THE CAUSES OF INDONESIA'S LATE FERTILITY TRANSITION STALL

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ABSTRACT

Indonesia’s stalled fertility transition presents researchers with an empirical conundrum. While Southeast Asian countries that began their transition around the same time as Indonesia are now struggling to revive fertility from below replacement levels, Indonesia has seen fertility stall around 2.6 since 2002/03. Using data from seven rounds of the Indonesian Demographic and Health Surveys, I use decomposition techniques to examine competing explanations for this stall. I find that the stall is not spurious, and that it is not associated with low levels of female schooling or halts in urbanization. Instead, the stall is associated with increasing marital exposure among women with education, and women in Bali, and increasing wanted marital fertility among women with no education and women in rural areas. These findings raise questions about the effect of changing cultural and religious politics in the region, and the implications of this fertility trend for realizing a demographic dividend.

BIOGRAPHICAL SKETCH

Sneha Kumar grew up in Kuwait City, Kuwait. She has earned a Bachelors' degree in Economics and Economic History, and Masters' degree in Economic History (with Distinction), both from the London School of Economics and Political Science, U.K. Prior to joining Cornell, she worked at the Center for Microfinance in Chennai, India as a Research Assistant on the *Yale Economic Growth Center – Center for Microfinance Tamil Nadu Socioeconomic Mobility Survey*.

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CHAPTER 1

INTRODUCTION

Fertility reduction was a central component of the Southeast Asian[1] development agenda in the late twentieth century. As population growth rates peaked in the late 1960s, governments in the region, concerned with the economic ramifications of a growing population, actively pursued fertility reduction policies. These policies were financially supported by multilateral agencies and private foundations at the time (Mason 2003). The adoption of fertility reduction policies to achieve economic growth was not unique to the developing countries of Southeast Asia. The period between the late 1950s and the early 1970s was marked by a global push to reduce population in developing countries as governments, intellectuals and policy-makers around the world were growing increasingly concerned about the possibility of a pernicious Malthusian scenario (Ayala and Caradon 1968; Niehof and Lubis 2003b). Triggered by these coordinated efforts, but not solely determined by them, fertility rates in Southeast Asian declined over the following decades (Rele and Alam 1993). While the onset and pace of the decline varied across the different countries in the region - given the varying degrees of vigor with which respective governments pursued the broader social development agenda - the general trajectory in their fertility trend was similar (Hull 2012).

The primary justification for the push to reduce fertility in the 1960s and 1970s was that reductions in fertility would lower the number of young dependents to care for, and concentrate the population among the working age group. With a lower dependency ratio, governments and families could focus resources on productive investments rather than consumption, and thereby

[1] Southeast Asia comprises of Brunei Darussalam, Cambodia, Indonesia, Lao people's Democratic Republic, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Timor-Leste, Viet Nam (United Nations Statistics Division 2013)

increase income per capita (Coale and Hoover 1958). This approach is often referred to as the demographic dividend or bonus. For three decades until the 1997 financial crisis, several countries in Southeast Asia witnessed steady improvements in economic growth. The World Bank (1994), in their review of East and Southeast Asian economies in the post-war era, identified four Southeast Asian countries (Singapore, Indonesia, Malaysia, and Thailand) as High Performing Asian Economies or HPAEs given the 'miraculous' economic success they had achieved between 1960 and 1990. Various studies (Bloom, Canning, and Malaney 2000; Bloom and Williamson 1998; Kelley and Schmidt 1996; Mason 2001) argue that part of the success of these HPAEs can be explained by the fact that these countries harnessed their demographic dividend. Not only did these countries succeed in lowering fertility rates and increasing the size of working population, they ensured that this working population was endowed with high levels of education and opportunities to participate in the workforce (Bloom, Canning, and Sevilla 2003). Bloom and Williamson (1998) attribute almost half of South-East Asian growth between 1960 and 1990 to the actualized demographic dividends of these countries. Estimates from Mason's (2001) growth-accounting model confirm this as well.

Since the late 1980s and early 1990s, however, continued declines in fertility below an average of just over two births per woman has been a matter of concern for countries like Singapore and Thailand[2]. A fertility rate of two births per woman represents replacement, that is, the level of fertility needed to produce zero population growth in the long term. As fertility falls below two births per woman, and mortality improvements continue to spur the growth of the elderly population, concerns about population ageing arise. The immediate macroeconomic concerns

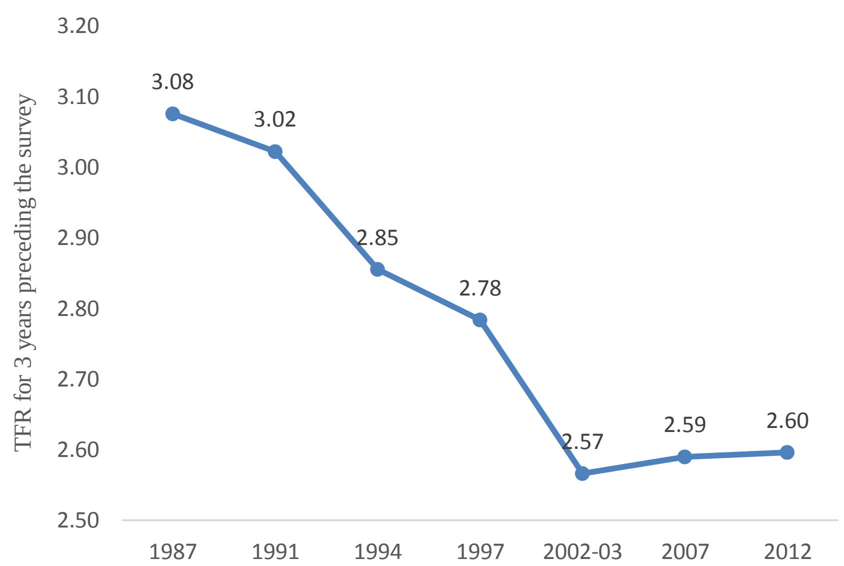
[2] This is a concern among their East Asian neighbors as well, especially those countries that saw unprecedented declines in fertility since the mid twentieth century (Japan, the Republic of Korea, Hong Kong, Taiwan). Recently, Viet Nam's fertility has also intermittently dipped below two births per woman, but it has yet to go as low as Singapore or Thailand's.

with population ageing are about ensuring adequate labor supply to sustain the economic growth witnessed over the last few decades, and maintaining the liquidity of social support programs for the elderly. However, the challenges of population ageing do not end there. There are also concerns about the provision of long-term physical and emotional care for the elderly in a context of changing familial support arrangements, and availability of meaningful employment opportunities for older persons particularly in situations where they are branded as a burden (Knodel and Chayovan 2008; Mujahid 2006). Singapore and Thailand have the highest proportion of older persons in their population: in 2014, the percentage of the Singaporean and Thai population in the 65 or older age group was 11.1% and 10.1% respectively (The World Bank 2014). Like their East Asian neighbors, the governments of Singapore and Thailand, have reversed their population policy positions since the 1960s and 1970s, and are now adopting a more pronatalist stance in a bid to avert some of socioeconomic implications of ageing. A variety of financial and non-financial incentives have been used to coax (certain) couples to bear more children (Jones, Straughan, and Chan 2009; Westley, Choe, and Retherford 2010). However, these attempts to revive fertility have been unsuccessful so far.

The Case of Indonesia

Contemporary fertility patterns in Indonesia represent somewhat of an anomaly. Like many of its neighboring countries, Indonesia began its fertility transition in the late 1960s. Over the next four decades, Indonesia witnessed a steady reduction in fertility: the total fertility rate (TFR) declined from 5.6 children per woman in 1967-70 to 4.1 in 1981-84, and then to 3.0 in 1987-1990. By 1995-97, Indonesia had halved its fertility rate from the 1967-70 level (Jones 2003). However, unlike its neighbors who have seen fertility reach replacement or fall below replacement in recent years, Indonesia has seen fertility stagnate around the 2.6 level since the turn of the century.

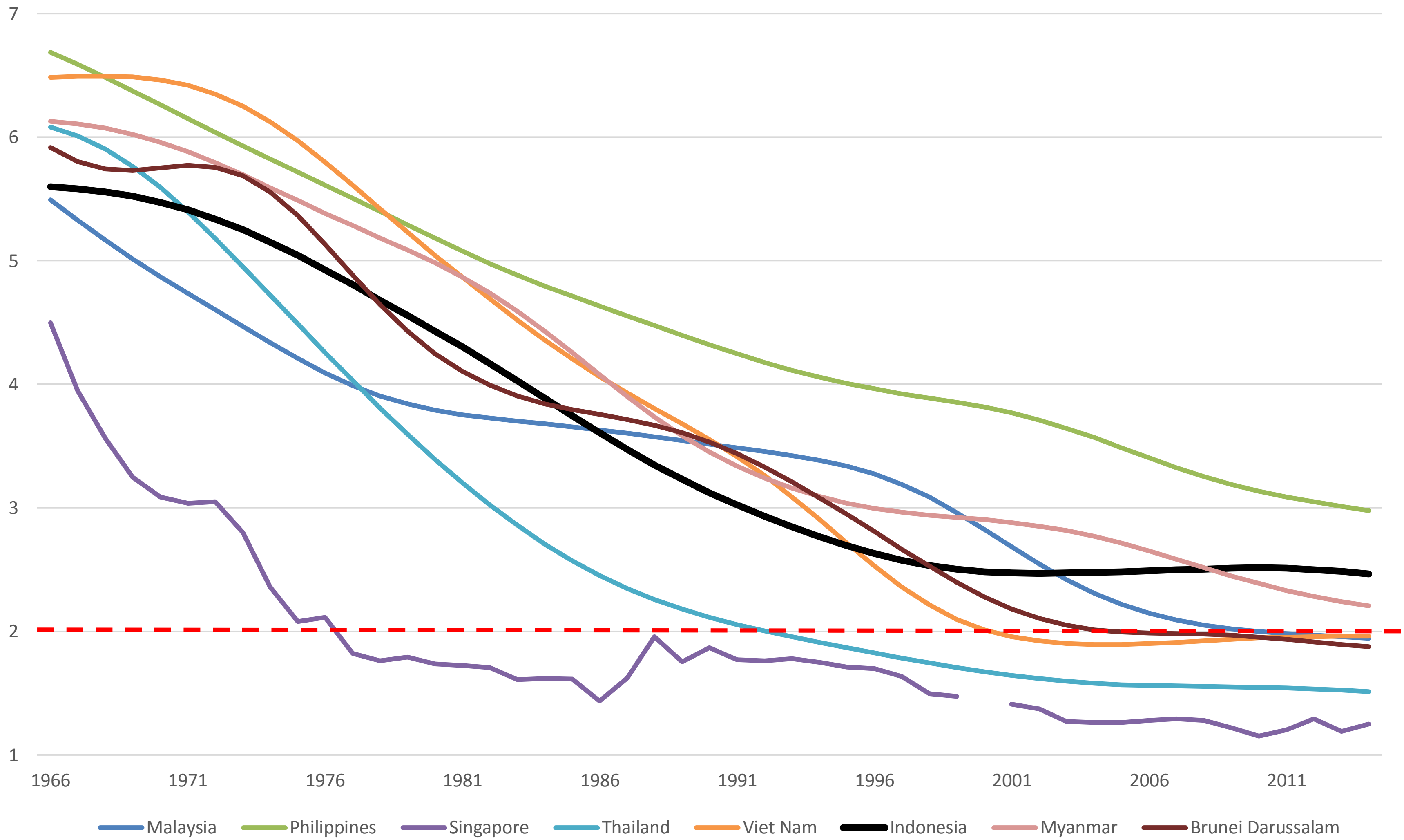
Figure 1.1: Total Fertility Rate (1987 to 2012)



Source: Authors' calculations using individual level DHS files

Figure 1.1, which plots Indonesian fertility rates using seven rounds of the Demographic and Health Surveys (DHS), depicts a stall, and possible reversal, in Indonesian fertility since the 2002/03 DHS. In this analysis, a country is classified as stalling if it is in mid-transition (TFR between 2.5 and 5 children per woman) and if it failed to see a TFR decline between two consecutive DHS surveys (see Bongaarts 2006). Figure 1.2, below, puts the Indonesian fertility transition in comparative perspective with other countries in the Southeast Asia region that began their transition around the same time as Indonesia.

Figure 1.2: Indonesia's Fertility Transition in Comparative Perspective



Source: World Development Indicators, World Bank (2014)
Note: The gap in the Singapore trend line is due to missing data for the year 2000. Cambodia, Timor-Leste and Laos have been excluded as the general course of their transition has been markedly different due to social disruptions in these countries.

Even if we ignore the Singaporean case, we can see that in comparison with the majority of other countries that also began their transition in the late 1960s and early 1970s (Thailand, Viet Nam, Brunei, Malaysia), Indonesian fertility has not reached or gone below replacement. Currently, the only country in the region with a higher fertility rate than Indonesia is the Philippines, a country whose fertility transition has, on the whole, been much slower than its neighbors given the struggles it has faced with family-planning policy (Hull 2012).

According to Niehof and Lubis (2003a), the reasons for this stall in Indonesian fertility remain unclear. Is the stall real or is it a reflection of data quality issues? If it is real, is it associated with a change in the composition of the population? Or is it associated with independent changes in reproductive behavior across different subgroups? This thesis seeks to answer these questions.

The causes of Indonesia's late transition stall are interesting from both a theoretical and policy perspective. The current literature on fertility stalls focuses primarily on stalling fertility in the early and mid-transition countries of Sub-Saharan Africa. Understanding why Indonesia, a country where family planning practices have relatively high acceptance across various subgroups (Karra and Lee 2012), has not continued to replacement fertility would advance our understanding of stalls. From a domestic policy perspective, it is important to examine why family size is not declining, and the broader implications this trend poses. On the one hand, the delayed transition to replacement fertility would extend Indonesia's window of opportunity to reap the potential benefits of a demographic dividend. On the other hand, the resource dilution perspective would caution against the possibility of harnessing this dividend as large family size would add to the strain on resources at both the micro level and macro level. This is particularly the case in a country as populous as Indonesia where small changes in individual fertility would aggregate to a large number of births. From an international policy perspective, understanding the specific social and cultural context in which the Indonesian stall is occurring would help inform the possible lessons there are for countries who are now struggling to revive fertility. The structure of this thesis is as follows – Chapter 2 provides an overview of the political, economic and social context in which the Indonesian fertility transition occurred. This would provide the necessary historical perspective to analyze contemporary fertility patterns. Chapter 3 is a literature review on the causes of stalling fertility transitions. In this chapter, findings from previous studies on stalling fertility are gleaned to determine possible hypotheses for the Indonesian fertility stall. Chapters 4 and 5 detail the data and methodological approach used in this analysis, and Chapter 6 and 7 highlight the results and general conclusion.

CHAPTER 2

BACKGROUND

Indonesia's steady decline in fertility from the mid-1960s to the mid-1990s reflects several political, economic and social shifts within Indonesian society. The change from the Old Order to the New Order in 1966 marked a "rearrangement of political power such that the major inhibitions to family planning (political Islam and nationalistic economic planning) were replaced by forces supporting birth control (secularist authoritarianism and modernizing technocratic planning)" (Hull 2002:376). The Suharto administration strengthened links with local governments to ensure the implementation of a common development agenda that included the reduction of fertility rates. As highlighted in the introductory chapter, this ideological shift within the Indonesia political system coincided with the neo-Malthusian phase of the global population debate (Niehof and Lubis 2003b). The Indonesian government was one of the 30 signatories of the Declaration on Population in 1967. The sentiment expressed in this Declaration (see excerpt below) anchored the Suharto administration's population and development policy in the 1960s and 1970s.

> "As Heads of Governments actively concerned with the population problem, we share these convictions: We believe that the population problem must be recognized as a principal element in long-range national planning if governments are to achieve their economic goals and fulfill the aspirations of their people. We believe that the great majority of parents desire to have the knowledge and the means to plan their families; that the opportunity to decide the number and spacing of children is a basic human right. We believe that lasting and meaningful peace will depend to a considerable measure upon how the challenge of population growth is met. We believe the objective of family planning is the enrichment of human life, not its restriction; that family planning, by assuring greater opportunity to each person, frees man to attain his individual dignity and reach his full potential." (Ayala and Caradon 1968:3)

Apart from the political commitment to lowering birth rates, the oil boom of the 1970s and its accompanying social changes also created an environment conducive to fertility decline. The oil boom provided a monetary windfall that allowed the expansion of educational infrastructure across Indonesia: between 1973-74 and 1978-79, nearly 62,000 new schools were constructed. At least up until 1990, this marked the fastest primary school construction program to be implemented in the world (Duflo 2001). Furthermore, tuition fee requirements were waived in public primary schools. Between 1974 and 1984, primary school enrollments rose from 60% to 94%, and between 1970 and 1980, female literacy increased from 47% to 66% (Jones and Hull 1997; Maralani 2008). The nature of employment was also changing in Indonesia at the time: by the early 1980s, only 55% of the working population was engaged in agricultural work. Urbanization rates were increasing as well. In 1966, only 16% of the population was living in urban areas, but this figure rose to 20% in 1976, and then 27% in 1986 (The World Bank 2014). Other socioeconomic developments in this period included improvements in infant and child survival, and improvements in life expectancy.

The combination of these factors effectively altered the context in which marital and childbearing decisions were being made. With greater access to educational and employment opportunities, women began to delay entry into marital unions. In 1960, the mean age at marriage for women in Indonesia was 18.7. This increased to 19.3 in 1970, 20.0 in 1980 and 21.7 in 1990 (Hull 2012). Fertility preferences in marital unions were changing as well. As the importance of child labor in agriculture diminished, and the returns to formal education increased, parents no longer saw the quantity of children as something to be taken for granted. They began to place greater value on educating their children. This shift in the valuation of children was not just a function of changing economic conditions. The government mounted an extensive information campaign propagating the benefits of small family size, and mobilized local community groups to apply informal pressures on families to lower fertility as well

(McNicoll and Singarimbun 1983). Within three decades, the once popular saying *banyak anak, banyak rezeki* (many children, much good fortune) was replaced by *dua anak cukup* (two children are enough). Couples were able to implement these new preferences as the national family planning program (BKKBN) was effectively structured to ensure both availability and accessibility of contraceptive means (Gertler and Molyneaux 1994; Hugo et al. 1987; Hull 1987; Molyneaux and Gertler 2000; Niehof and Lubis 2003b; Permana and Westoff 1999).

There was regional variation in the initiation of family planning services across Indonesia. In 1967, the 'Jakarta Pilot Project' was the first family planning program to be set up. Following the success of this pilot project, similar programs were implemented in the 1970s across other parts of Java and Bali. The Outer Islands were the last to be covered, with the outermost provinces achieving coverage only in 1980s – nearly a decade after Java-Bali. Part of the regional differentials in the onset, pace, and levels of fertility (Java-Bali generally had lower levels of fertility than the outer islands) can be explained by the lag in the availability of contraception in the outer islands. However, the regional variation is not that easily interpretable. In the late 1980s, for example, West Java had higher fertility levels than provinces in other islands. The generalization we can make is that provinces that most completely embraced modernization forces – Bali, East Java, Yogyakarta, North Sulawesi - were the ones that saw the earliest and fastest declines in fertility (Hull and Hatmadji 1990; McNicoll and Singarimbun 1983).

As Indonesia entered the 1990s, there were stronger calls for pluralization of power, and privatization of various government enterprises including the family planning program. In addition, there was mounting pressure from domestic and international organizations post the 1994 Cairo conference to refocus family planning policy away from targets and towards improved reproductive health services. However, the push towards ending the authoritarian structure of the New Order did not materialize until the financial crisis of 1997 (Hull 2007). The 1997 crisis brought along with it fears of a reversal in fertility decline, as the economic decline led to a reorganization of political forces and budget cuts for family planning. However, the BKKBN, with the support of international donors, was swift in responding to any shortages in availability of contraception in the immediate aftermath of the crisis. Moreover, at this point in time, demand for contraception had been well-established in Indonesia (Karra and Lee 2012), and Suharto's successors continued to resist religious politics that targeted the family planning program. With that being said, the political uncertainty with various short-term appointments following the end of the Suharto administration made it difficult for the country as a whole to focus on issues such as reproductive health of women (Hull 2002, 2007). The observed fertility stall in Figure 1.1 occurred during this period of uncertainty, and the following analysis seeks to uncover some of the socioeconomic and behavioral trends associated with it.

CHAPTER 3

CAUSES OF FERTILITY STALLS

The causes of stalling fertility remain varied and debated. In his early work on the subject, Gendell (1989) compared the persistent decade-long fertility stall in Costa Rica between 1976 and 1985 to the relatively brief lulls seen in South Korea. He argues that South Korean stalls were brief because unlike Costa Rica, South Korea saw a decline in desired family size, had a stronger family planning program, and greater availability of sterilization and abortion methods. Ezeh et al. (2009), examining fertility patterns in Kenya, Tanzania, Uganda and Zimbabwe, find that stalls in subgroup fertility were associated with declines in contraceptive prevalence, rising unmet need for family planning, increases in fertility preferences and increases in adolescent fertility. Westoff and Cross' (2006) analysis of the Kenyan fertility stall reveal stalling contraceptive use among younger women and women with lower levels of education, and more fundamentally, rising fertility preferences among Muslim women and women with no education. Aghajanian's (1991) study of stalled fertility in Iran in the 1980s also points to the importance of strong family planning programs for continued fertility decline.

However, fertility stalls are not always associated with stalling or declining contraceptive use (see Ishida et al.'s (2009) analysis of the fertility stall in Ecuador), and deteriorating family planning efforts (see Bongaarts' (2006) multi-country analysis). The other proximate determinant that is often associated with fertility stalls is changing marriage patterns. For example, Garenne (2008) finds stalling fertility in rural Rwanda and rural Tanzania to be associated with falling mean age at marriage (with rural Tanzania actually seeing an increase in contraceptive use during the period). Similarly, Khawaja et al. (2009) find stalling fertility in the

Gaza strip to be associated with rising proportions of women married, not stalling or declining contraceptive use.

In terms of the socioeconomic determinants, trends in female education often emerge as an important factor in explaining stalling fertility. Gendell (1989) argues that one of the reasons South Korea had a shorter fertility stall than Costa Rica was due to faster growth in female schooling rates. Shapiro and Gebreselassie (2008) find that for Sub-Saharan African countries, improvements in women's educational attainment was associated with continued fertility decline. Ezeh et al. (2009) also find that fertility stalls are positively correlated with the proportion of women with no education. These findings are in keeping with Bongaarts' (2003) conclusion that the combination of educational differentials in fertility and low levels of female schooling can cause fertility to stall. Other important socioeconomic factors typically associated with stalling fertility include increases in infant and child morality and halts in urbanization rates (see Gendell (1989) and Shapiro and Gebreselassie (2008)).

The link between socioeconomic development and continued fertility decline is not always clear though. For example, Eltigani's (2003) study of the fertility stall in Egypt in the mid to late 1990s brings into question the premise that lack of improvements in the conditions of lower socioeconomic groups will cause national TFR to decelerate or stall. Eltigani finds that women from middle and high socioeconomic groups who initially led the fertility decline, saw a stall in the decrease in their desired fertility at three births per woman. This stall in desired fertility among middle and high socioeconomic groups can explain most of the national TFR stall. He argues that once behavioral convergence between socioeconomic groups is achieved, fertility cannot be expected to continue its decline until one segment of the population serves as the new vanguard and expresses a desired fertility below 3 children per woman.

Another study that questions the link between socioeconomic development and continued fertility decline is Leete's (1996) study on the causes of the Malay fertility stall between 1977 and 1991. Leete argues that despite the spread of education and economic opportunities within the Malay community, fertility rates among this population did not continue to decline after the mid-1970s. In comparison, fertility rates among the Chinese and Indian communities in Malaysia continued to fall. Leete concludes that the Malay fertility stall in this period was primarily caused by the resurgence of fundamental Islam within the political arena and that with this resurgence came the spread and reinforcement of pronatalist values. The Malay population, given their adherence to the Islamic faith, responded to these calls of the government. As evidence of this, Leete shows that between 1975 and 1984/5, the use of modern contraceptive methods among the Malay population declined. Furthermore, he argues that this was a time of growing cognizance about how population size translates into political power, and the Islamic movement's pronatalist stance amplified the importance of maintaining the Malay identity.

While Leete makes an interesting and compelling case about how cultural norms can shape the course of the fertility transition, it must be noted that his interpretation of the Malay stall has come under some criticism. In his review of Leete's (1996) study, Hirschman (1997) argues that there has been evidence of Malay women basing marital and childbearing decisions on their socioeconomic circumstances. Hirschman's (1986) own work on the subject is an example of this. Hirschman (1986) argues that the Malay fertility stall is explained by the slower rate of decline in higher-order births among the Malay population in the late 1970s compared to fifteen years earlier. The Malay population was not as strongly incentivized to lower family size as the Chinese and Indian population because the cost of extra children was lower for Malays than non-Malays. Unlike the non-Malay population, the Malay population had easier access to child care services and subsidized education for their children. The second criticism of Leete's argument comes from a comparative analysis. The variations in levels and trends of Malay fertility across states of Malaysia, and between the Malay populations of Singapore and Malaysia, draw skepticism about whether religious adherence serves as a viable explanation for the stall (Hirschman 2001).

Schoumaker's (2009) recent work adds another dimension to the literature on fertility stalls by calling for an examination of data quality. He argues that underreporting of births during a specific period (due to birth omissions or displacement) can explain some apparent stalls observed in Sub-Saharan Africa. Births may be omitted or displaced back in time because the extended child health module of the DHS is applied to births that occurred five years before the survey, and interviewers may be tempted to omit or displace recent births in order to reduce their workload when administering that module. The omissions and/or displacement of births leads to the underestimation of recent fertility. If the extent of this underestimation is more prevalent in the next to last survey than the last survey, then it can give appearance of a fertility stall. After conducting data quality tests, Schoumaker finds that the fertility stalls seen in Cameroon, Ghana, Nigeria, and Tanzania are spurious. In Benin, Guinea, Mozambique, and Rwanda, he argues, the extent of underestimation was the same in the last and next to last survey, however, since the level of underestimation was so high, these countries cannot be considered as having started their fertility transition. Kenya is the only country that passes Schoumaker's test for a genuine fertility stall.

Drawing on this literature, I identify three possible hypotheses for stalling fertility in Indonesia:

Hypothesis 1: The stall is spurious

Hypothesis 2: If the stall is real, it is associated with a change in the composition of the population. A change in the composition of the population can be measured across various dimensions. Based on historically predominant factors associated with fertility change and patterns in Indonesia, the four dimensions across which I'm going to examine compositional change are:

- Change in the proportion of ever-married women with education
- Change in the proportion of ever-married women living in urban areas
- Change in the proportion of ever-married women living in Java and Bali
- Change in the proportion of all women aged 15-49 who are currently married

Hypothesis 3: If that stall is not associated with a change in the composition of the population, then it must be associated with a change in group specific reproductive behavior. Since reproductive behavior is a function of fertility preferences and access to contraceptive methods to implement those preferences, it follows that any change in reproductive behavior must be related to a change in its two components.

CHAPTER 4

DATA

This analyses uses data from the Indonesian Demographic and Health Surveys (DHS). The DHS is a nationally representative household survey that collects information relating to population, health and nutrition. The replication of the DHS across countries, and within a country over time, makes it appropriate for any cross-country and country-specific historical analysis[3]. In the case of Indonesia, the DHS has on average, been fielded every 4-5 years since 1987. In total, there are seven rounds of DHS data available for Indonesia: 1987, 1991, 1994, 1997, 2002/03, 2007, and 2012.

The DHS collects information using four types of questionnaires:

(1) Household questionnaire: collects information on the characteristics of the household, and the characteristics of the members who usually live in the household;

(2) Women's questionnaire: the household member roster is used to identify eligible women (women between ages 15 to 49) for the individual questionnaire. For these eligible women, data on marriage, fertility and mortality histories, reproductive preferences, family planning, reproductive and child health, nutrition, and HIV/AIDS is collected. In the case of the 1987, 1991, 1994, 1997, 2002/03, and 2007 Indonesian DHS rounds, only ever-married women between ages 15 to 49 were deemed eligible for the individual questionnaire. The rationale for this was that sexual relationships and childbearing typically occur within marriage in this context, and if pre-martial pregnancy were to occur, it would lead to marriage in a short amount of time (Hull and Hartanto 2009). In 2012, however, the individual questionnaire was administered to all women aged 15 to 49.

[3] The DHS is a repeated cross-sectional data set not a panel data set analyzing the same individuals over time.

(3) Men's Individual Questionnaire: the household member roster is used to identify eligible men (men between ages 15 to 49) for the individual questionnaire. This questionnaire is similar to but shorter than that administered to the eligible women.

(4) Biomarker Questionnaire: collects data on anthropometrics, anemia levels, and HIV status.

While DHS data is not without its problems, it is widely regarded as the gold standard in data collection on important demographic indicators. Assessments of DHS data quality have shown that that the quality of birth history data has been particularly good, and estimates of lifetime fertility from DHS birth history data was mostly superior to those obtained from other sources (Cleland 1996).

In this analysis, I will specifically be using data from the individual women's questionnaire (sample size shown below). Women's individual data contain the two primary types of information needed for this analysis: women's birth histories, and women's background characteristics.

Table 4.1: Number of Eligible Women Interviewed (Unweighted N)	
DHS 1987	11, 884
DHS 1991	22, 909
DHS 1994	28, 168
DHS 1997	28, 810
DHS 2002/03	29, 483
DHS 2007	32, 895
DHS 2012	45, 607

Data Quality: Testing the Genuineness of the Fertility Stall

Before analyzing the possible compositional and behavioral factors associated with the fertility trends in Indonesia, it is important to rule out the possibility that the fertility stall seen in Figure

1.1 is not a result of data quality issues. In other words, we need to determine if the stall is real or spurious.

As highlighted in the review of Schoumaker's (2009) study, interviewers may be motivated to omit or displace recent births back in time in order to avoid the child health module. This omission and/or backward displacement of births can result in the underestimation of recent fertility, and in the case of displacements, overestimation of past fertility. If this underestimation of recent fertility is more severe in the next to last survey than in the last survey, it can give the appearance of a stalling fertility trend. Estimation problems in recent fertility are examined since the TFR estimates from the DHS are a function of births that occurred three years prior to the survey.

In the case of Indonesia, the fertility rate has stalled between the 2002/03, 2007, and 2012 survey. In order to assess whether patterns in birth underestimation explain this fertility stall, I quantify and compare the extent of TFR underestimation for these three surveys. I use Schoumaker's (2009) approach to quantify the underestimation. For each survey, I implement the following steps:

(1) Using the birth history data, I reconstruct trends in fertility by calculating annual TFRs for 15 years preceding the survey. For more information on how retrospective annual TFRs are calculated, see Schoumaker (2013).

(2) I then estimate a Poisson regression model, with the retrospective annual TFRs as my outcome variable, and the linear trend in the logarithm of the retrospective annual TFRs as my predictor variable. A linear trend is fitted to the logarithm of fertility rates so that the resulting fitted values show a smooth trend in fertility. Essentially, this model uses historical data going back 15 years to generate a predicted value of TFR not affected by omissions or

displacements. This allows us to compare the observed fertility trend and the predicted fertility trend. Figure 4.1 provides a graphical illustration.

Figure 4.1: Comparison of observed and predicted TFRs (DHS 2002/03)

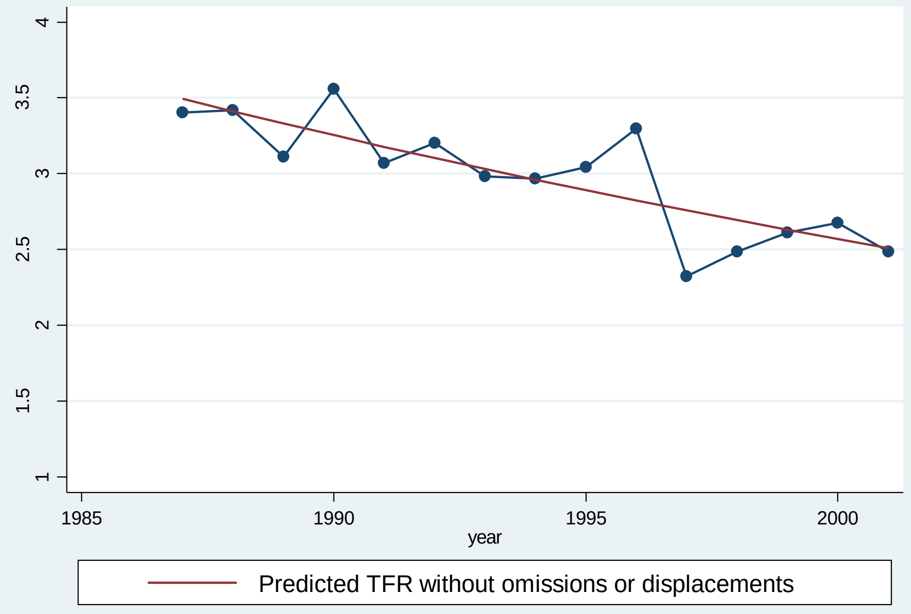


Figure 4.1 suggests some displacement of births around the cut-off point for the health module: TFR in the fourth and fifth year before survey (1998 and 1997) is lower than predicted TFR, and TFR in the sixth year before the survey (1996) is higher than predicted TFR. The TFRs for three years before the survey, however, are not underestimated (observed TFR was not lower than predicted TFR).

(3) The extent of underestimation in TFR is computed as the average difference between the predicted TFR and the observed TFR for the last three years before the survey. A positive value indicates that fertility was underestimated (predicted TFR was greater than the observed TFR). Table 4.2 compares the extent of underestimation across the 2002/03, 2007, and 2012 surveys. The figure for the 2007 DHS is positive, however, it represents a marginal underestimation of 0.005 births. Even if we adjust the 2007 fertility estimate by these 0.005

births, the fertility trend between 2007 and 2012 would have stayed relatively flat. Overall, the Indonesian DHS surveys do not seem to suffer from differential levels of underestimation, allowing us to conclude that the stall is not spurious.

Table 4.2: Underestimation of TFR in the three year period before the survey	
2002/03 DHS	-0.021
2007 DHS	0.005
2012 DHS	-0.043
Source: Authors' calculations using individual women's DHS data	

See Appendix for further discussion on DHS data quality.

CHAPTER 5

METHODS

Having rejected the hypotheses that the Indonesian stall is spurious, we now have to examine whether the stall is associated with a shift in the composition of the female population, or whether it is associated with behavioral change across different subgroups. A demographic decomposition approach can be used to parse out change in TFR into these two effects. While a decomposition approach cannot establish the *causes* of change, and nor does it claim to, it can help identify the *sources* of changes. For example, if TFR increases, we can parse out this TFR increase to see whether the change was primarily driven by a change in the relative size of subgroups in the population (increase in the proportion of women with no schooling relative to the proportion of women with schooling[4]), or whether it was driven by change in education group specific fertility. This breakdown would not tell us why the proportion of women with no schooling increased, or why fertility behavior across groups changed, but it does tell us whether educational group size change or behavioral change was the dominant process driving overall TFR change, and in doing so, it can help focus policy response.

I use the decomposition approach proposed by Kitagawa (1955) to breakdown change in TFR in the pre-stall period (between 1991 and 2002/03), and the stalling period (between 2002/03 and 2012). What this essentially does is provide historical perspective on the drivers of fertility change in Indonesia. It identifies which factors were important for TFR decline in the 1990s, whether these factors continue to have a fertility inhibiting effect, or whether other factors have played a more important part in shaping contemporary fertility trends. I have chosen to look at overall TFR change in the period between 2002/03 and 2012, instead of TFR change in the two

[4] Assuming there is a fertility differential between women with no schooling and women with schooling, i.e. women with no schooling display higher fertility than women with schooling.

inter-survey periods between 2002/03 and 2007, and 2007 and 2012, because the overall change in TFR between 2002/03 and 2012 is greater. The inter-survey increase in TFR is too marginal to decompose. While the overall TFR increase between 2002/03 and 2012 is not high either, it does provide relatively more room to breakdown change. The choice of 1991-2002/03 as the pre-stall period is to ensure that the pre-stall and stalling period time frames are of equal length. This way any differences seen between the two time periods is not just a function of how long fertility has had to evolve.

I intend to examine the effect of compositional change by looking at what percentage of TFR change in the pre-stall period versus the stalling period is driven by:

- Change in the proportion of ever-married women with education
- Change in the proportion of ever-married women living in urban areas
- Change in the proportion of ever-married women living in Java and Bali
- Change in the proportion of women aged 15-49 currently married

One of the key assumptions here is that all fertility occurs within marriage. In the Indonesian context, this is a reasonable assumption given that (a) the median age first sexual intercourse is almost identical to the median age at first marriage for women (see Table 5.1 on the next page), (b) the overall rates of spousal separation are low (see Table 5.2 on the next page), and (c) there are taboos surrounding non-marital sexual activity in Indonesia (Amensty International 2010).

Table 5.1: Median age at first marriage and first sex		
	Age at first marriage (25 - 49 year olds)	Age at first sexual intercourse (25 - 49 year olds)
1987	17.2	17.5
1991	17.7	17.8
1994	18.1	18.1
1997	18.6	18.6
2002-03	19.2	19.5
2007	19.8	20.1
2012	20.4	20.6

Table 5.2: % Women who are divorced or separated	
1987	3.0
1991	3.1
1994	2.6
1997	2.5
2002-03	2.2
2007	2.4
2012	2.9

Source for Table 5.1 and 5.2: The DHS Program STATcompiler

The formula below outlines the decomposition of TFR change by education:

$$\Delta TFR = F_a - F_b = \sum_{i=1}^{k} C_{i,a} F_{i,a} - \sum_{i=1}^{k} C_{i,b} F_{i,b}$$

$$= \sum_{i=1}^{k} (C_{i,a} - C_{i,b}) \frac{(F_{i,a} + F_{i,b})}{2} + \sum_{i=1}^{k} (F_{i,a} - F_{i,b}) \frac{(C_{i,a} + C_{i,b})}{2}$$

$C_{i,a}$ and $C_{i,b}$ refer to the proportion of ever-women in education category *i* at time *a* and time *b*, respectively. $F_{i,a}$ and $F_{i,b}$ is the fertility rate of women in education category *i* at time *a* and time *b*, respectively. There are three categories expressing the highest level of educational attainment (no education, primary education, secondary education or higher) achieved by ever-married women. In the above formulation, change in TFR has been decomposed into two additive terms. The first term (on the left) represents the amount of TFR change that can be attributed to a change in the educational composition of the population. The second term (on the right) represents the amount of TFR change that can be attributed to changes in education-specific fertility rates.

A similar method is used to decompose TFR change by ever-married women's place of residence (urban/rural), and region of residence (Java/Bali/Outer Java Bali).

To test what proportion of TFR change was due to increased proportions of women married, I use variation of the Kitagawa (1955) decomposition advanced by Retherford and Ogawa (1978) and Retherford and Rele (1989):

$$TFR = 5\sum F_x$$

F_x refers to the age-specific fertility rates. Since all fertility is assumed to occur within marriage, the above equation can be written as follows:

$$TFR = 5\sum P_x F_{mx}$$

P_x refers to the age specific proportion of all women aged 15-49 currently married[5], and F_{mx} refers to the age specific marital fertility rate. Change in TFR over time can be decomposed as follows:

$$\Delta TFR = 5\sum \Delta P_x \bar{F}_{mx} + 5\sum \Delta F_{mx} \bar{P}_x$$

$\bar{F}_{mx}$ is the average age specific fertility rate and $\bar{P}_x$ is the average age specific proportions currently married. The first term (on the left) is the amount of change in TFR that can be attributed to change in the proportion of women currently married (marital composition change).

[5] For DHS prior to 2012, the individual women's files only contain data for ever-married women. However, the individual files also provide a way to adjust the ever-married women samples to estimate statistics based on all women aged 15-49. The individual files contain 'all women factors' which essentially are ratio variables where the numerator equals the number of all de facto women, and the denominator equals the number of de facto ever-married women. These 'all women factors' can be applied to make any adjustments necessary to base statistics on all women.

The second term (on the right) is the amount of change in TFR that can be attributed to change in marital fertility.

Decomposing Behavioral Change

If we find that fertility change in the stalling period is not primarily driven by compositional change, but by changes in subgroup specific reproductive behavior, then it would be interesting to understand what factors are shaping these changes in reproductive behavior. Are increases in group specific fertility rates driven by changes in fertility preferences (and therefore the demand for contraception), or by changes in the supply of contraception?

In order to determine which of the two above factors are the most important in shaping group specific fertility rates, we can break down change in group specific fertility into change in its two additive components: wanted fertility and unwanted fertility. A birth is considered wanted if the number of living children at the time of conception of the birth is less than the ideal number of children a woman reports. The wanted fertility rate is computed similarly to the total fertility rate, except that the births tallied are those considered wanted (Rutstein and Rojas 2006). This measure does not account for mistimed births, and since it uses ideal number of children in its computation, it is also suspect to post-birth rationalization. The unwanted fertility rate is computed as the difference between the observed fertility rate and the wanted fertility rate. Unwanted fertility can increase if women's access to contraception and/or use of effective contraception declines - these two factors alter the ability to maintain desired family size.

The formula below shows how group specific fertility change can be decomposed into wanted fertility change and unwanted fertility change:

$$TFR_j = WFR_j + UFR_j$$

$$\Delta TFR_j = \Delta WFR_j + \Delta UFR_j$$

TFR_j is the group specific fertility rate, WFR_j is the group specific wanted fertility rate, and UFR_j is the group specific unwanted fertility rate. So $\frac{\Delta WFR_j}{\Delta TFR_j}$ represents the amount of total fertility change attributable to change in wanted fertility, and $\frac{\Delta UFR_j}{\Delta TFR_j}$ represents the amount of total fertility change attributable to change in unwanted fertility.

CHAPTER 6

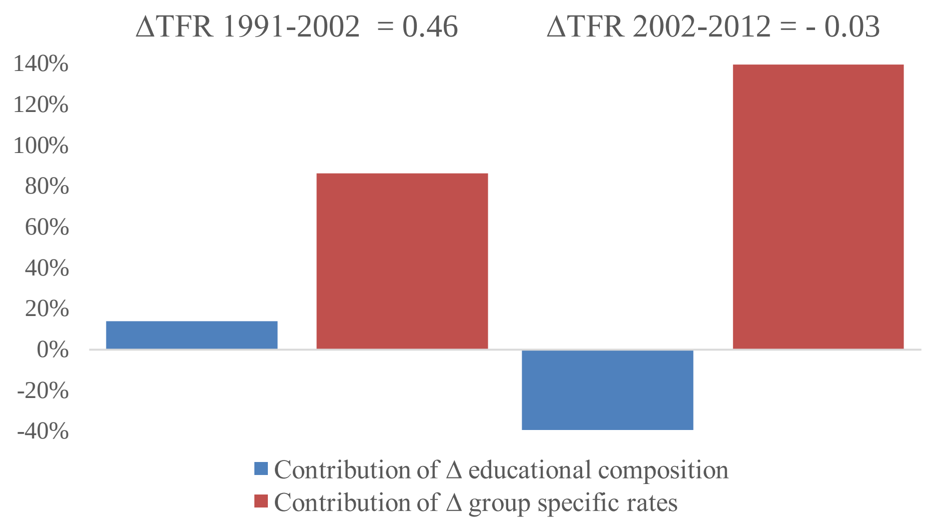
RESULTS

Compositional Change

The results of the decomposition by ever-married women's education are shown below:

Table 6.1: Decomposition of TFR change by education						
	% Ever Married Women (15-49)			TFR		
	1991	2002/03	2012	1991	2002/03	2012
No Education	19.14	7.92	3.93	3.28	2.54	2.79
Primary Education	60.86	53.92	40.01	3.29	2.71	2.92
Secondary Education or more	19.99	38.16	56.06	2.58	2.52	2.59

Figure 6.1: Decomposition of TFR change by education



The fertility decline between 1991 and 2002/03 was predominantly driven by declines in education group specific fertility rates. Furthermore, declines in fertility among women with less than secondary education contributed the most to the overall decline in the pre-stall period. Between 2002/03 and 2012, the trend of declining fertility was interrupted, however, this interruption was not driven by compositional factors, i.e. declines in the percentage of women with education. In fact, the 2002/03 to 2012 period saw upward shifts in the educational composition of women that countered some of the stalling fertility trend. Stalling fertility was primarily a function of the slight rise in education group specific fertility rates.

Similarly, Table 6.2 and Figure 6.2 confirm that the interruption in TFR decline between 2002/03 and 2012 was not due a halt in urbanization. The percentage of ever-married women living in urban areas actually increased between 2002/03 and 2012, and worked to mitigate some of the rising fertility trend. The TFR change in the stalling period was due to the rise in residence specific fertility rates, namely rural fertility rates.

Table 6.2 : Decomposition of TFR change by place of residence

	% Ever Married Women (15-49)			TFR		
	1991	2002/03	2012	1991	2002/03	2012
Rural	70.79	54.22	50.50	3.24	2.70	2.77
Urban	29.21	45.78	49.50	2.60	2.45	2.44

Figure 6.2: Decomposition of TFR change by place of residence

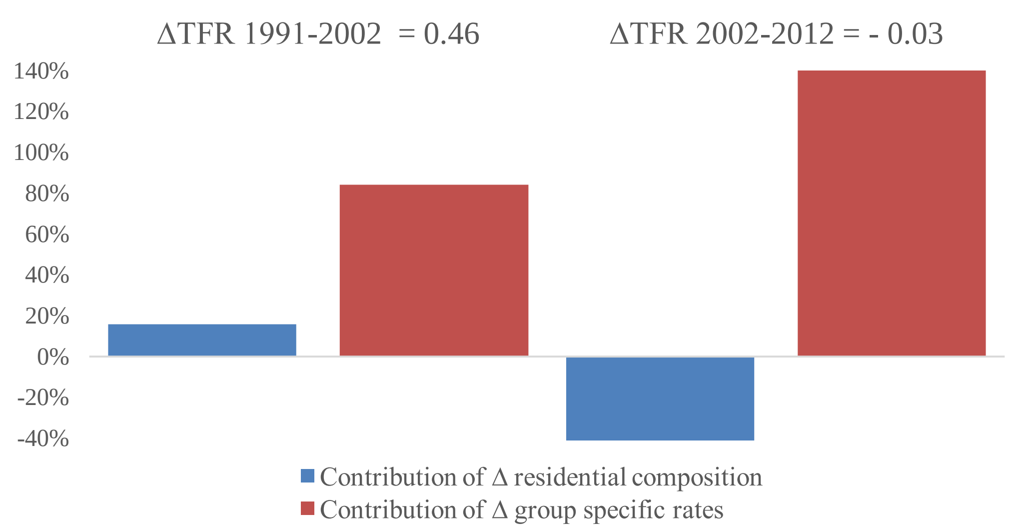


Table 6.3 and Figure 6.3 show the decomposition results by region. In the pre-stall period, TFR decline was primarily associated with a reduction in group specific fertility – all three regions saw a decline in fertility rates. In the stalling period, however, both Java and Bali saw an increase

in fertility rates. This increase in fertility in Java and Bali drove overall TFR up between 2002/03 and 2012.

Table 6.3: Decomposition of TFR change by region						
	% Ever Married Women (15-49)			TFR		
	1991	2002/03	2012	1991	2002/03	2012
Java	62.52	61.68	59.36	2.68	2.35	2.43
Bali	1.37	1.58	1.72	2.85	2.11	2.31
Outer Java-Bali	36.11	36.74	38.92	3.58	2.91	2.85

Figure 6.3: Decomposition of TFR change by region

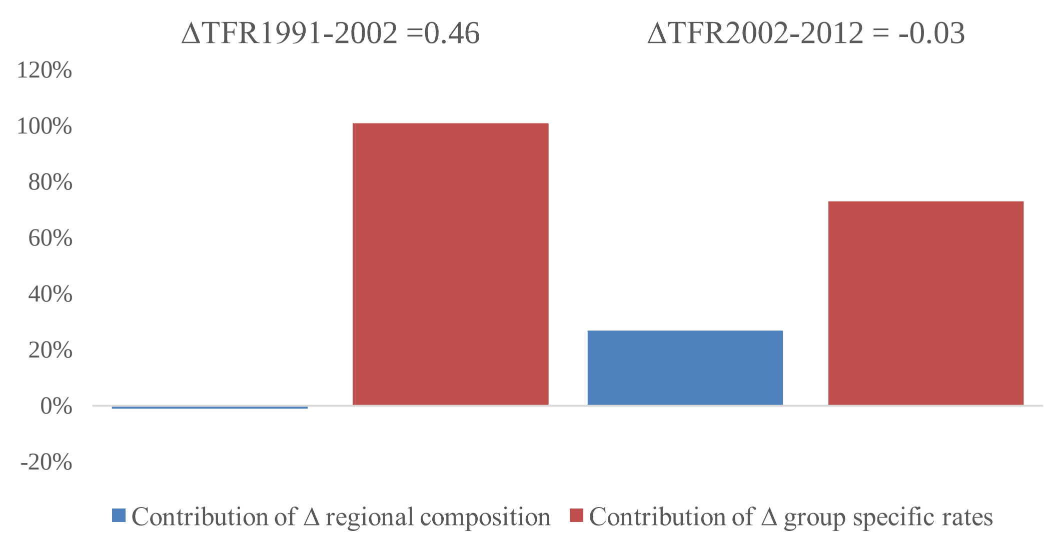
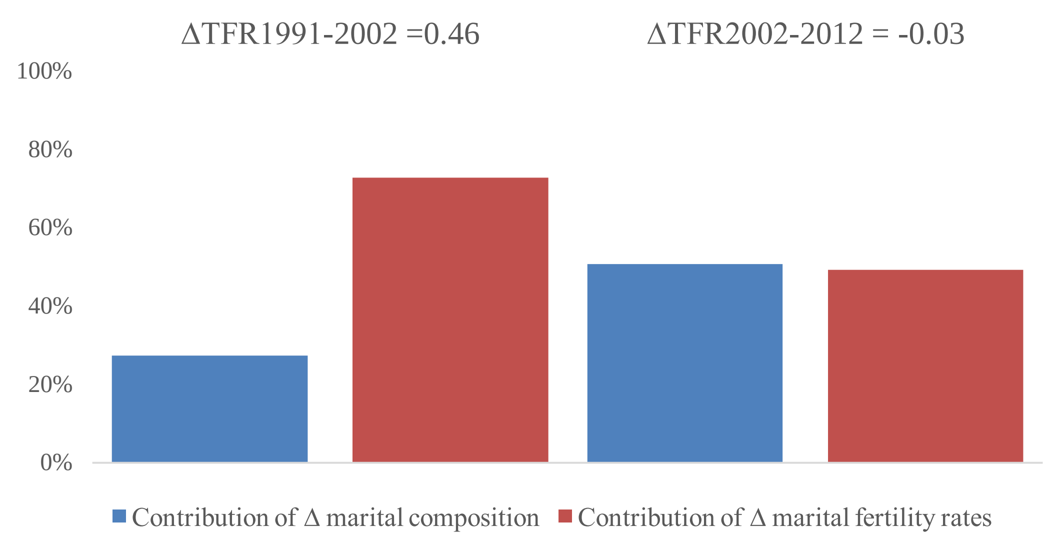


Figure 6.4 displays the decomposition results by proportions married. Between 1991 and 2002/03, the nearly 73% of the TFR decrease was associated with a reduction in marital fertility, and 27% of the decline was associated with lower proportions married. In the stalling period, however, these trends in proportions married and marital fertility had reversed. The increase in TFR between 2002/03 and 2012 was associated with both an increase in marital exposure (% of 20-24 year olds currently married increased from 57% to 59%; % of 25-29 year olds currently married increased and 84% to 86%), and an increase in marital fertility rates.

Figure 6.4: Decomposition of TFR change by proportions married



In other words, the stalling period saw a change in the composition of the population (a greater % of women in their 20s, and early 30s were married), and the reproductive behavior of those married had changed as well (those within unions were having more children), causing a bump in overall TFR.

The question that then arises is whether this increase in marital exposure occurred evenly across all subgroups of the population, or whether it was phenomenon witnessed only among certain groups of the population. The following figures explore this. Figure 6.5 to Figure 6.8 displays decomposition by proportions married for different subgroups of women aged 15-49.

Change in Marital Composition across Education Groups

From Figure 6.5 we can see that in the pre-stall period women in all education groups saw a decrease in TFR. For women with no education, the decrease in TFR was primarily a result of lower proportions of them getting married. For women with education, the decrease in TFR was primarily due to decreased fertility within marriage.

Figure 6.5:
Decomposition of education group specific TFR by proportions married
(1991 to 2002/03)

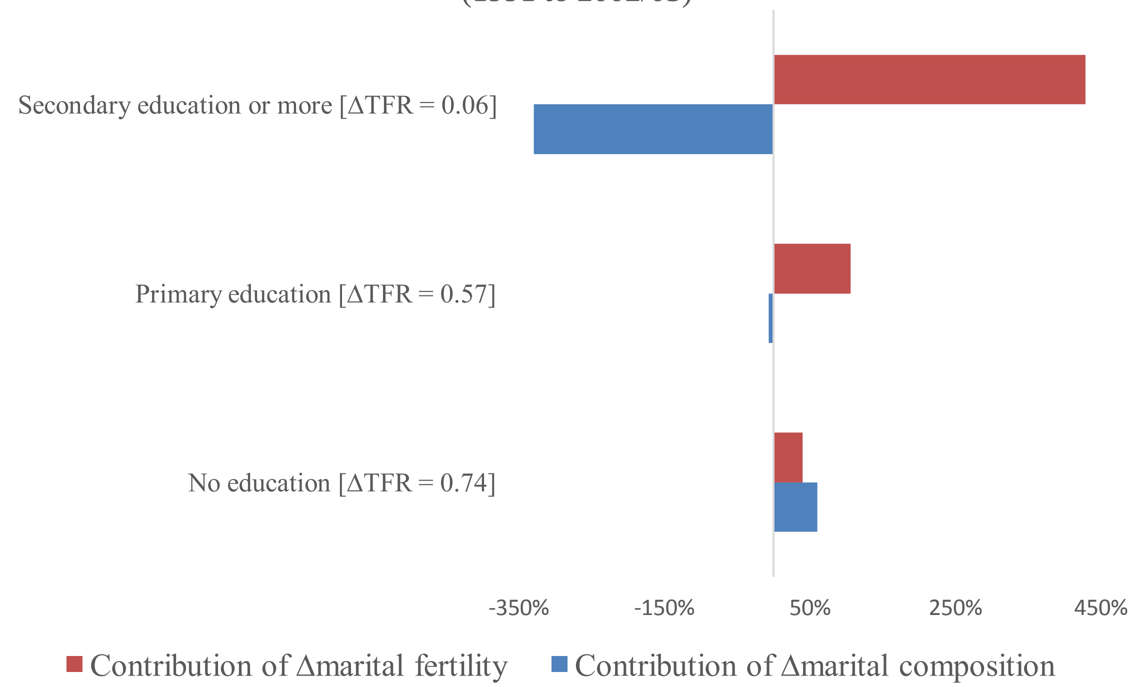
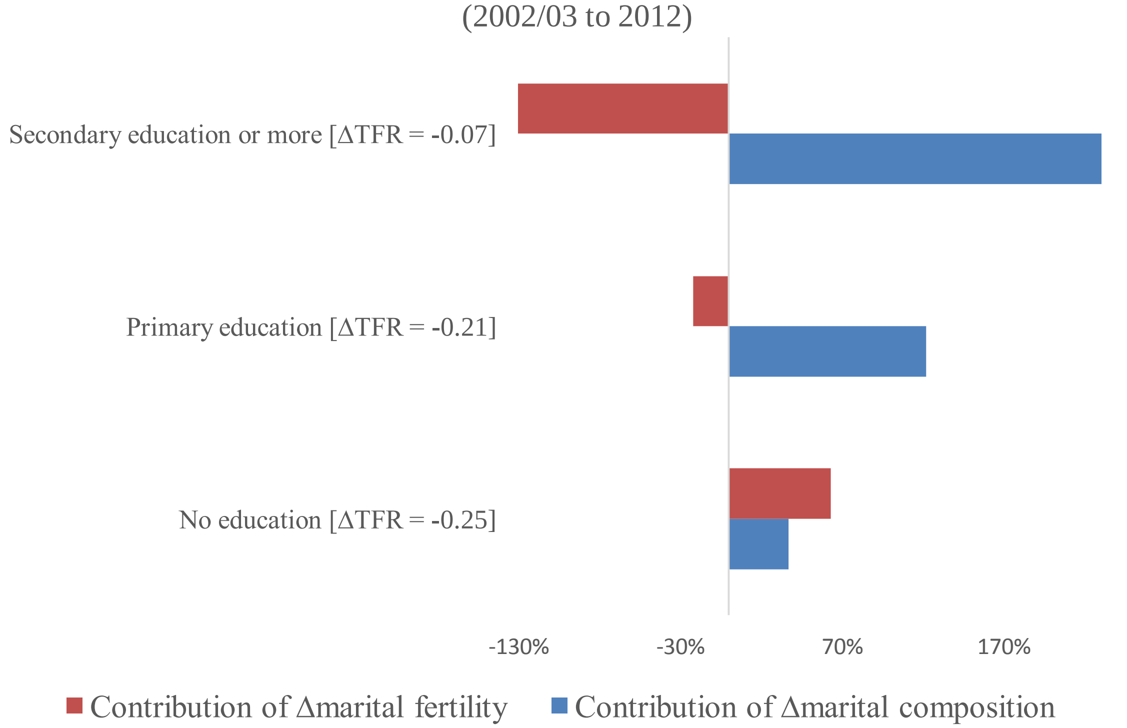


Figure 6.6:
Decomposition of education group specific TFR by proportions married
(2002/03 to 2012)



From Figure 6.6, we can see that in the stalling period, fertility increased for women in all education groups. The primary driver for the fertility increase among women without education was increased marital fertility, while the primary driver for the fertility increase among women with education was increased marital exposure.

Change in Marital Composition across Residence and Region

Figure 6.7 shows the decomposition of residence specific and region specific fertility rates in the pre-stall period. In this period, fertility decreased across all groups. In rural Indonesia, the decrease was primarily due to reduced marital fertility. In Java and the outer islands, the decrease was primarily due to a decrease in marital fertility as well. In Bali, however, the decrease was primarily due to lower proportions of women getting married.

Figure 6.7:
Decomposition of residence specific TFR by proportions married
(1991 to 2002/03)

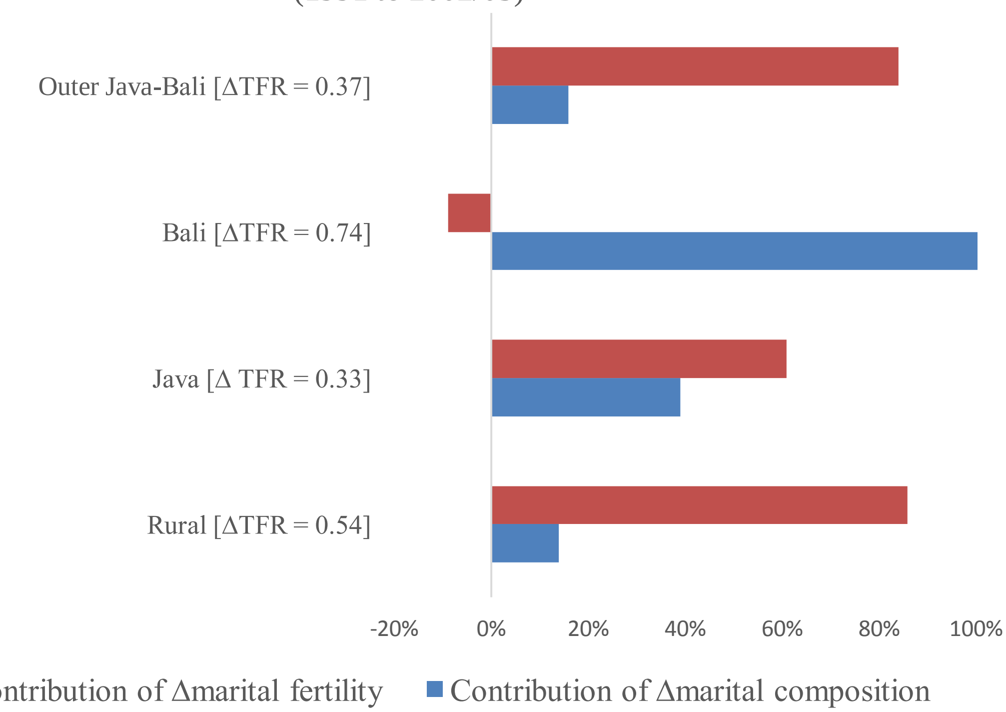
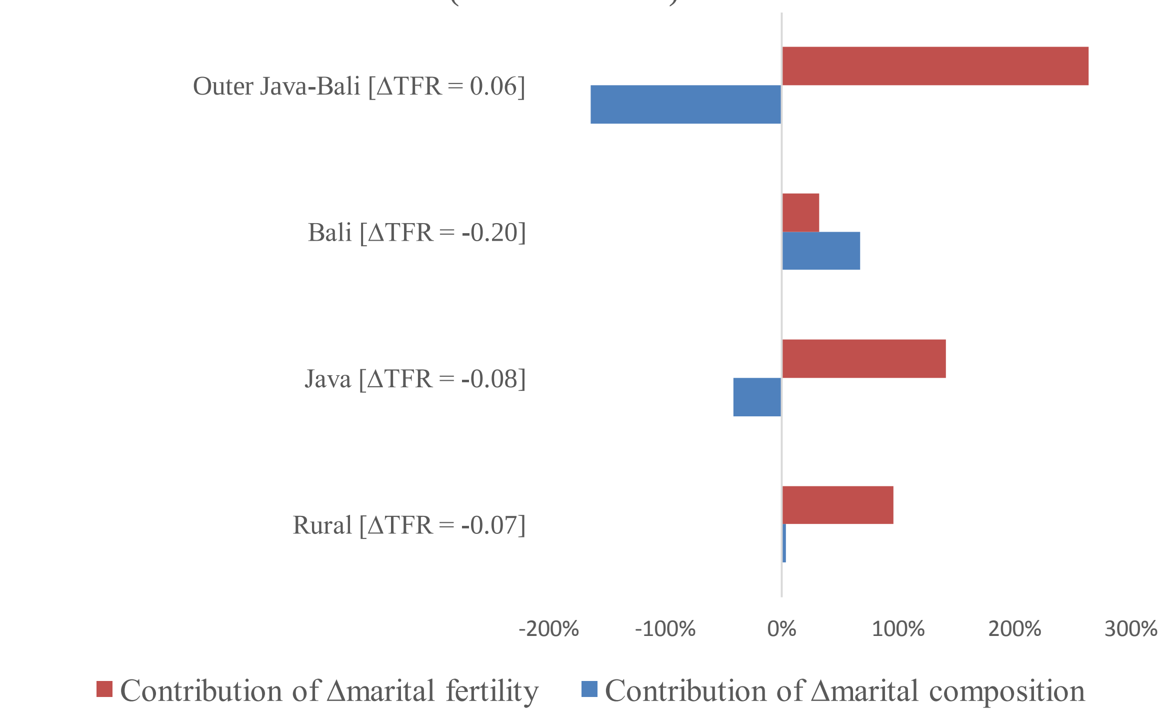


Figure 6.8 conducts a similar decomposition for the stalling period. In rural Indonesia, fertility rates increased during the stalling period. This increase was primarily due to an increase in marital fertility. The same is the case for Java. In Bali, the TFR increase was primarily due to increased proportions married. What is noteworthy is that the very factors that were shaping declining fertility in these subgroups in the pre-stall period, were now shaping the uptick in fertility in these sub-groups.

Figure 6.8:
Decomposition of residence specific TFR by proportions married
(2002/03 to 2012)



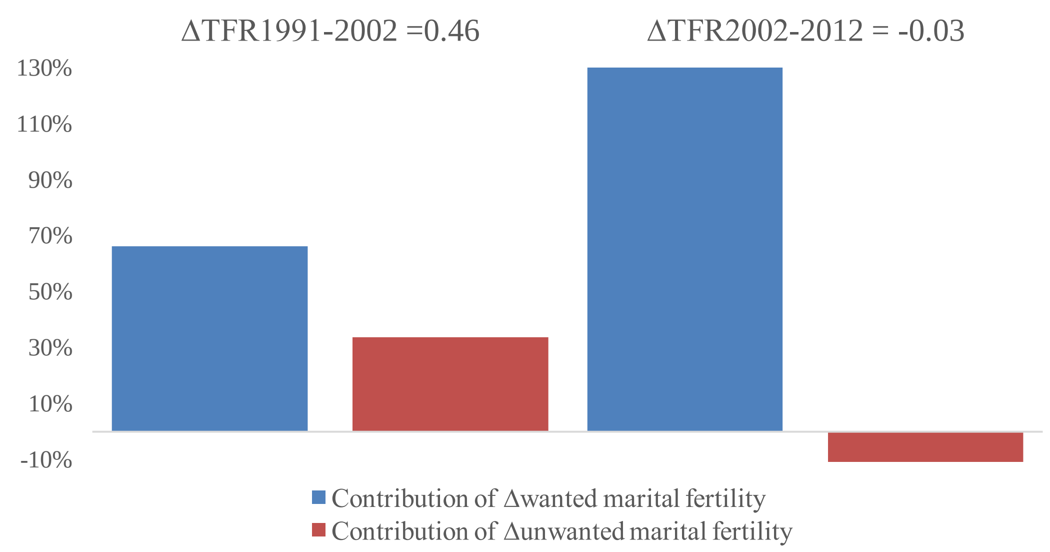
Fertility continued to decline in the outer islands during the stalling period, and like the decade prior, this decline was driven by falling marital fertility. The decomposition results for urban areas is not shown since there is no difference in fertility between 2002/03 and 2012 for urban areas. It must be noted, however, that this lack of difference is more a function of the choice of beginning and end points for the time periods. Fertility in urban Indonesia, actually decreased between 2002/03 and 2007, and then saw an uptick back to 2002/03 levels between 2007 and 2012.

Overall, we find that while almost all groups saw an increase in fertility in the stalling periods, not all of them saw this increase due to a change in proportions of women married. The only discernable pattern is that women with no education and women who live in rural areas saw a fertility increase due to an increase in marital fertility, while women with education saw a fertility increase due to greater marital exposure.

Behavioral Change

To recount, the results from Figure 6.4 confirm that the TFR increase in the stalling period was a result of both an increase in proportions married, and an increase in marital fertility. Figure 6.9 below shows the results of decomposing the marital fertility increase into change in wanted fertility, and change in unwanted fertility.

Figure 6.9: Decomposition of marital fertility change



In the pre-stall period, the marital fertility decrease was primarily driven by a decrease in wanted marital fertility. In the stalling period, the trend in wanted fertility had reversed, causing an increase in overall fertility. Moreover, the increase in marital fertility was not associated with an increase in infant and child mortality rates (see Table 6.4 below)

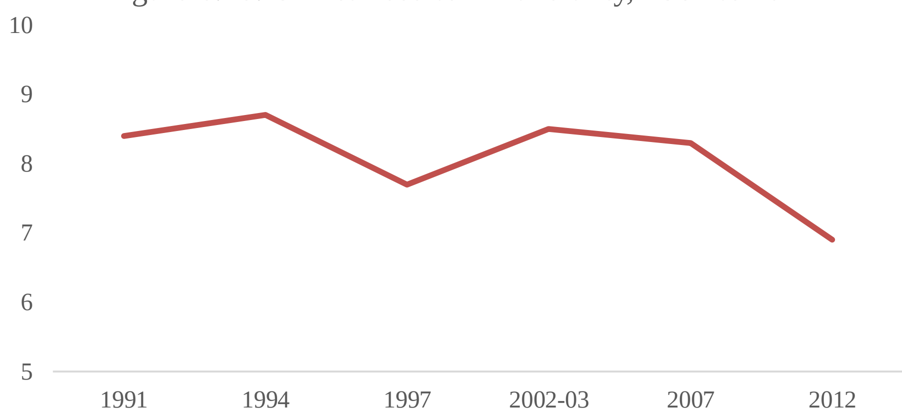
Table 6.4 : Infant and Child Mortality Rate, DHS1987 to DHS2012

	1987	1991	1994	1997	2002-03	2007	2012
Infant Mortality Rate	74	74	66	52	43	39	34
Child Mortality Rate	110	107	93	71	54	51	43

Source: The DHS Program STATcompiler

What is rather surprising is that unwanted fertility actually decreased between 2002/03 and 2012. As noted in the Background chapter, the change in administration and the privatization of contraceptive supplies following the 1997 financial crisis had raised concerns about a crisis is contraceptive access. However, that does not seem to be the case here. Figure 6.10 shows that unmet need to limit fertility declined during the stalling period. This finding is in keeping with Karra and Lee (2012) and McKelvey et al. (2012), who note that despite the reduction in government subsidies for family planning, contraceptive choice have remained relatively income and price inelastic.

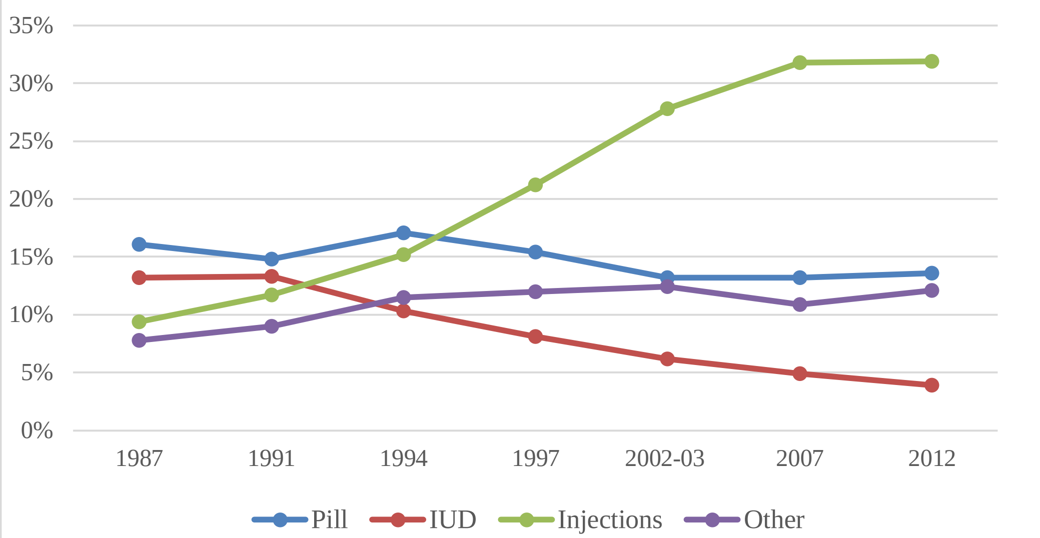
Figure 6.10: Unmet need to limit fertility, 1987 to 2012



Source: The DHS Program STATCompiler

Furthermore, trends in the contraceptive method mix do not show a move towards less effective methods of contraception either. While there has been a general shift away from IUDs to injections, injections have just as high an effectiveness rate as IUDs (Trussell 2011).

Figure 6.11: Percentage of currently married women using the pill, IUDs, injections, and other modern methods



Other modern methods = condoms, sterilization, implants, diagraphm/foam/jelly
Source: The DHS Program STATCompiler

All the subgroups whose fertility increase in the stalling period was primarily driven by an increase in marital fertility, saw an increase in wanted fertility as well. None of these subgroups saw an increase in unwanted fertility: their increase in marital fertility was solely driven by changing fertility preferences (see Figure 6.12 and 6.13 on the next page).

Figure 6.12: Decomposition of marital fertility change for different subgroups
(1991 to 2002/03)

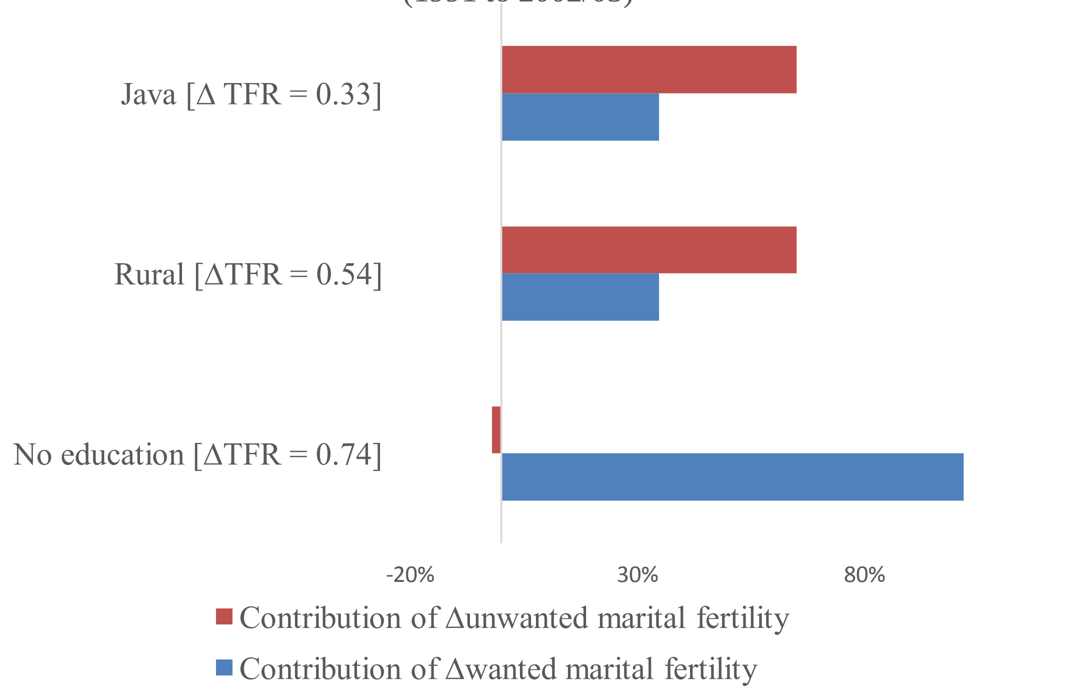
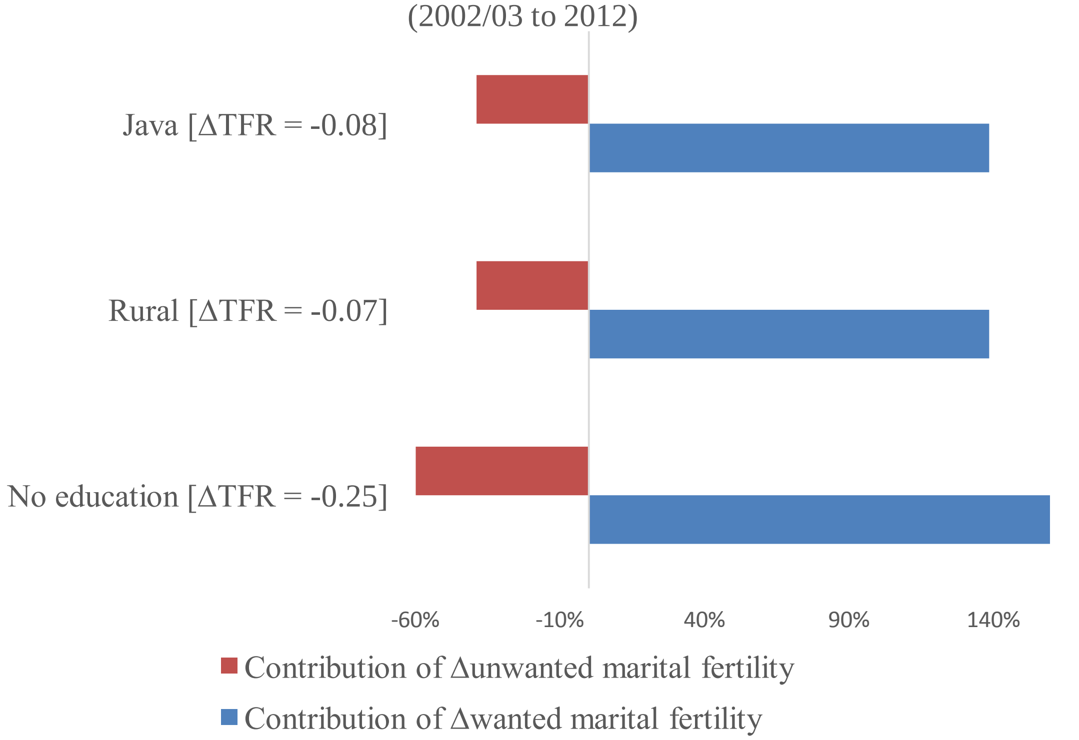


Figure 6.13: Decomposition of marital fertility change for different subgroups
(2002/03 to 2012)



CHAPTER 7

CONCLUSION

Indonesia's steady decline in total fertility since the mid-1960s halted around the 2.6 level since 2002/03. This thesis seeks to unpack the causes of this late transition stall in fertility by examining a series of competing explanations:

(1) Is the stall spurious, i.e. is it due to data quality issues?

(2) If the stall is real, is it due to changes in the composition of the population? More specifically, is it due to declines in the proportion of women with schooling, proportion of women who live in urban areas, proportion of women who in Java and Bali, and/or proportion of women who are currently married?

(3) If the stall is not associated with a change in the composition of population, is it associated with a change in reproductive behavior, namely a change in demand for contraception or a change in supply of contraception?

Data quality checks assure us that the stall is not spurious: the 2002/03, 2007, and 2012 DHS do not show differential levels of underestimation in births (due to possible omissions and/or displacements) three years prior to the survey.

An examination of the compositional effects shows us that the stall was not associated with a halt in the transition of women into higher levels of schooling, a halt in urbanization, or a change in the proportion of women who live in the central islands (given that the central islands have historically had a stronger presence of family planning services). In the stalling years, fertility increased across all the education groups, in rural areas (and urban areas between 2007 and 2012), and in Java and Bali. Outer Java and Bali was the only subgroup to see a decline in TFR during the stalling period. This marks a historical shift as it was inner provinces of East Java and

Bali that led the fertility decline in the 1970s. This finding is worth further examination in future research.

The compositional effect that appears to matter most in explaining the Indonesian stall is marital composition. Decomposition results show that 51% of the increase in TFR between 2002/03 and 2012 was driven by increased marital exposure among women. The remaining 49% of the TFR increase was driven by increased fertility within marriage. The increased fertility within marriage was a function of increased wanted fertility; there was not an increase in unmet need or a switch to ineffective methods of contraception that was preventing women from achieving their desired family size during the time period of interest.

Across subgroups, we find that the increased fertility among women with no education and women living in rural areas was primarily driven by an increase in marital fertility. My intuition was that marital fertility among these groups would have increased due to disrupted access to contraception, as these groups would have been most vulnerable to the switch to private sector contraceptive supplies post 1997. However, what I find is that increased marital fertility among these groups was primarily a function of increased wanted fertility. Among women with education, I find that the primary driver of increased fertility between 2002/03 and 2012 was increased marital exposure.

One possible explanation for the rising proportions of women married is the increasing participation of young adults in religious groups, and the growing religious institutional support for early marriage. A popular phrase, *lebih baik kawin daripada dosa* (it is better to be married than sinful), has entered the public discourse and reflects the push toward getting young adults married before they enter any premarital relationships (Hull 2016). Savitri and Faturochman (2011) write about the growth of religious activism in Indonesia, marked by the emergence of the

Tarbiyah movement in secular colleges in 1999. One of the fundamental goals of this movement is to ensure the establishment of Muslim families who can maintain and practice Islamic customs. In order to achieve this goal, *Tarbiyah* activists actively participate in the process of matchmaking between like-minded individuals. Unfortunately, the DHS does not have data of religious affiliation that makes it possible to test this hypothesis. The Indonesian Census does not have consistent information on religious affiliation either.

In terms of policy implications, the fact that Indonesian fertility has not reached replacement can be both advantageous and disadvantageous. On the one hand, Indonesia has a longer window of opportunity than some of the neighboring countries in the region to capture a demographic dividend. On the other hand, the demographic dividend is not automatic – it requires, among other things, vocational training for the young population, opportunities for them to participate in the workforce, financial policy reform to ensure accumulation of savings for government investments in future projects, etc. With an increasing number of children and elderly to care for, the necessary resources to convert the demographic dividend into an economic dividend may be stretched thin in Indonesia. For example, one of the areas in which Indonesian children face a challenge is in terms of the quality of education they receive. On the Third International Mathematics and Science Study (TIMSS), Indonesia ranked 36^{th} out of 48 countries on mathematics and science achievement (Hendayana et al. 2010). With fertility showing signs of stagnating and possibly reversing, the Indonesian government has to manage the tradeoff between making significant investments in improving teaching quality and ensuring that all the additional children born are cared for.

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APPENDIX

Further Discussion on DHS Data Quality

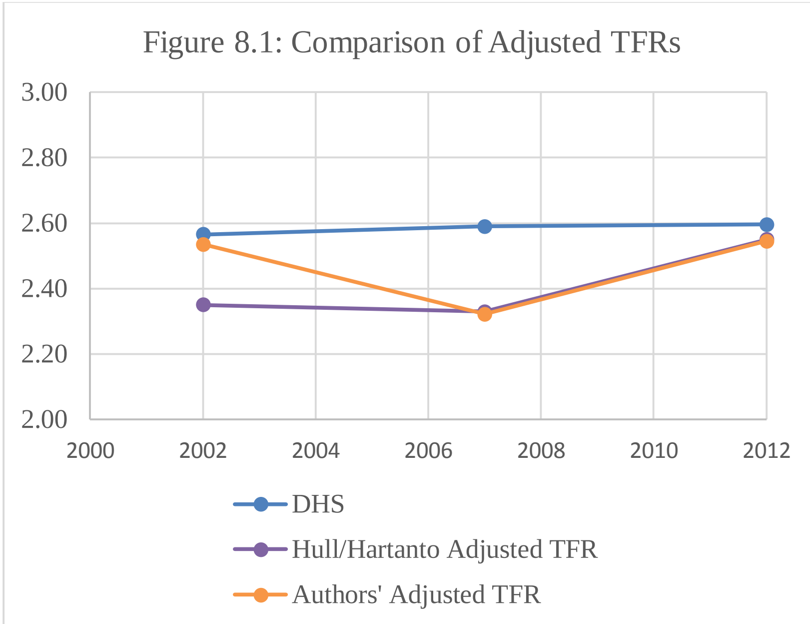
Hull and Hartanto (2009) raise a data quality issue with the DHS that I did not delve into in the main body of my thesis. They argue that the DHS sample survey design is flawed as it places extra emphasis on ever-married women as the main respondent. Other single female household members may not be captured by household listings as they might not be considered members who regularly live in the household, or because they might live in institutional housing or collective living units such as dormitories, prisons, religious group housing, army camps etc. Even if these never-married women live in "households" as defined by the DHS, they might be passed over by DHS interviewers and field staff who focus on household units that are more likely to generate eligible female respondents for the individual women survey. In Indonesia, this under-enumeration of never married women may be particularly problematic as the country has seen a dramatic change in opportunities for women since the 1970s and 1980s. Women are increasingly more likely to pursue tertiary education, and seek industrial and service jobs, that may lead them to live in the kind of institutional settings typically ignored by the DHS.

Even if we were to argue that all fertility occurs within marriage, the 'missing' single women from household listings can create problems in the calculation of demographic measures such as the total fertility rate. While the numerator of the total fertility rate equals the number of births, the denominator of the total fertility rate is the number of women in each 5-year age group. It is important to have an accurate counting of all women, regardless of marital status, for the denominator of the TFR. If the denominator is under-estimated, the TFR will be over-estimated. Hull and Hartanto (2009) carry out an adjustment of DHS fertility, using census data, to return the 'missing' single women to the population. They argue that the census can be used to get a more accurate enumeration of young unmarried adults because, unlike the DHS, it is designed to capture all individuals living in all types of households and institutional settings. The adjustment process is defined below:

- Calculate the proportion of single women in the DHS in each age group: Ds/Dw = ds
- Calculate the proportion of single women in the census in each age group: cs
- Adjust the proportion of single women in the DHS by adding the missing single women (M) to both the numerator and denominator to achieve the same proportion of single women as the most recent census: cs = (Ds + M)/(Dw + M)
- Solve for M, and generate the adjusted total number of women, i.e. Dw +M
- Recalculate TFR using this adjusted total number of women

Following these adjustments for the 2002/03, and 2007 surveys, they find that fertility was over-estimated in the DHS. For 2002/03, their adjusted TFR was 2.35 (versus the DHS TFR of 2.57), and for 2007, their adjusted TFR was 2.33 versus the DHS TFR of 2.59). Hull (2016) calculates the adjusted TFR for 2012, and finds that the adjusted TFR is much closer to the DHS estimate for that year. He argues that the adjustment was minor the 2012 survey because the 2012 individual survey was targeted at all women aged 15-49, not just ever-married women aged 15-49.

I tried to replicate Hull and Hartanto's adjusted TFR figures but my adjusted TFR figures for 2002/03 did not match theirs. My adjusted TFR figure for 2007 and 2012, however, did (see Figure 8.1 on the next page). One possible explanation for the discrepancy between my calculation and their calculation is that they used the full sample from the Census data, while I used the 10% sample data that is publicly available (Statistics Indonesia and IPUMS International).



The discrepancies aside, my primary skepticism with following this approach of adjusting TFRs stems from the data quality issues in the 2000 Census (which ironically have been reported by Hull (2001) himself). Hull argues that since the 2000 Census was conducted right after the 1997 crisis, the Census operations were severely hampered by the budget cuts that followed the crisis, and the decentralization of core information delivery units. He notes that the problems with the 2000 Census included poor interviewer training, insufficient coverage of certain regions due to political unrest, and deficiencies in technology that created problems in the digitization process. How would the results of this thesis change if I adjusted the DHS data? Even if fertility in the DHS was overestimated in 2002/03 and 2007, the fact that it was not overestimated in 2012, means that my observation of a stall would still stand. In fact, my estimates of the extent of the stall would be conservative. What is not as clear, however, is how the decomposition results would vary if I adjusted the data.