university of groningen / faculty of spatial sciences

Understanding fertility differences across Muslim countries

A comparison between Egypt, Indonesia, Nigeria and Pakistan

Anne Abbing

S2035480

Master's thesis Population Studies

University of Groningen, Faculty of Spatial Sciences

Groningen, Netherlands

July 25, 2017

Supervised by:

Dr. J.A.A. (Joop) de Beer &

Dr. W.G.F. (George) Groenewold

Netherlands Interdisciplinary Demographic Institute

The Hague, Netherlands

Index

Figures

Tables

Maps

Definitions

TFR : The average number of children that would be born (per woman) among women progressing from age 15 to age 50 subject to the birth rates at each age in the population in question (Coale, 1989, p.16) 1

Acknowledgements

This thesis *'Understanding fertility differences across Muslim'* has been written for the master Population Studies at the University of Groningen, Netherlands. This study would not have been possible and could not have achieved this level without my enthusiastic supervisors dr. Joop de Beer and dr. George Groenewold. Joop and George helped me to find an interesting subject for the thesis and gave me very useful suggestions about what to add, change or delete in the text. Thank you very much for your supervision during the whole research process!

Anne Abbing
Groningen, July 2017

Abstract

How can fertility differences - by level and pace of change - across the Muslim countries Egypt, Indonesia, Nigeria and Pakistan in 1990-1995 and 2010-2015 be explained? Bongaarts' framework for analyzing the proximate determinants (PD) of fertility was applied to provide an answer to this question, thereby using Demographic and Health Survey (DHS) data. Findings show that variations in both the level and pace of change of fertility between the selected countries can mainly be attributed to differences in contraceptive use practices, followed by postpartum infecundability, induced abortion, and less so by differences in marriage customs and pathological sterility. More specifically, age at marriage differentials explains only a minor share part of the variation, whereas differences in pathological sterility appear negligibly small. Differences in contraception across the 4 Muslim countries are plausibly due to women's education and income, religious attitudes and opposition of husbands towards contraception, and to and family planning program efforts. Due to the decisive impact of religion and patriarchy on contraceptive use in the 4 Muslim countries, it is highly questionable whether a Total Fertility Rate (TFR) at replacement level will be reached in the future in all selected countries, as these factors can probably hardly be changed through taking measures. For future research, it is recommended to further search for plausible explanations for differences in postpartum infecundability, induced abortion and marriage customs between the selected Muslim countries.

Key words: *Fertility level; Fertility change; Muslim countries; projections; Egypt; Indonesia; Nigeria; Pakistan*

1. Introduction

This thesis is about the determinants of fertility differences across four Muslim nations over time. Below, I introduce the subject matter, I motivate the relevance and study objective, and I specify the research questions and criteria to select study countries.

1.1 Study background

The population size of a country is influenced by fertility, mortality, in-migration and out-migration (Preston et al., 2000). Of these demographic variables, fertility often has the most effect on the population size, particularly in developing countries with high birth rates and relatively low mortality rates (Kaneda et al., 2014). The TFR is the most often used indicator to measure fertility in demographic papers (Bongaarts & Feeney, 1998). The TFR is "the average number of children that would be born (per woman) among women progressing from age 15 to age 50 subject to the birth rates at each age in the population in question" (Coale, 1989, p.16). According to the World Bank data for 2013, the country with the lowest period TFR[1] in the world is South Korea with a TFR of 1.19 and the country with the highest TFR in the world is Niger with a TFR of 7.62 (World Bank, 2017a). Under the assumption that there is no migration to and from a country, a TFR between the 2.05 and 3.43 is needed to replace the population in a country. The replacement level is the lowest (TFR = 2.05) when practically all women survive to the age of 25 and is the highest (TFR = 3.43) when the probability to survive to the age of 25 is close to 0.60 (Espenshade et al., 2003). With zero migration and a higher TFR than the replacement level in a country, the population of a country will grow. The population will decline with zero migration and a lower TFR than the TFR at replacement level.

The United Nations (UN) classifies countries based on the fertility level into 3 categories; high-fertility countries, medium-fertility countries and low-fertility countries. High-fertility countries are countries with a TFR higher than approximately 5.8 and where ongoing fertility decline has not occurred yet. A medium-fertility country has a TFR above 2.1 and fertility levels that have been declining over time. The UN projects that all countries in the world will eventually become low-fertility countries, with a TFR lower than or equal to 2.1. They base their assumption on a combination of country's historical fertility trends and the variability of fertility trends across all countries that have already experienced a fertility decline. However, some medium-fertility countries in Africa show a slower pace of fertility decline compared to historical fertility trends in other countries in the world, or fertility stalls[2]. Even fertility increases have been observed (UN,

[1] The period TFR is the "average number of children who would be born to a hypothetical cohort of women who are *assumed* to survive at least up to the end of their reproductive period and who bear children at each age at the rate observed during a particular period" (Lundquist et al., 2015, p.230), whereas the cohort TFR concerns the fertility experience of an actual cohort of women and is defined as "the average number of children who would be born to a hypothetical cohort of women who survive to the end of their reproductive period and who bear children at each age at the rate observed during a particular period" (Preston et al., 2000, p.101-102). In this paper, the TFR should be read as the period TFR.

[2] Fertility stalls occur when downward fertility trends change to flat- or even slightly rising- trends (Garenne, 2013)

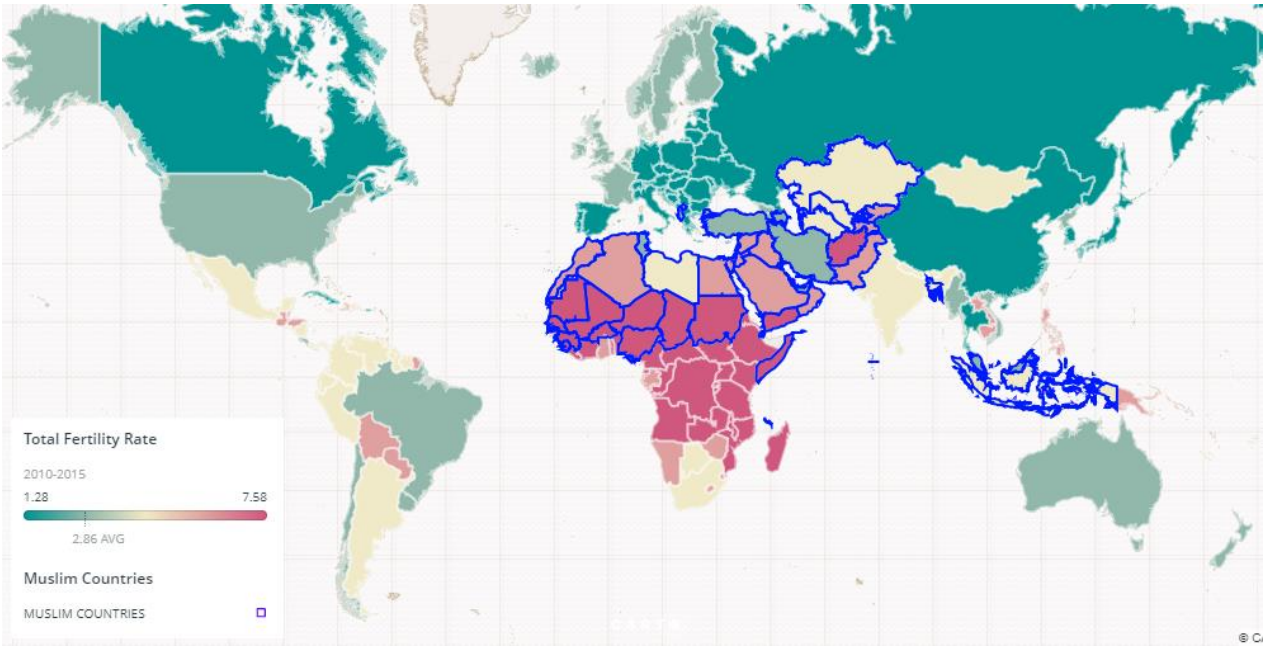
2015a). Is the UN assumption of a TFR equal to or lower than 2.1 on the long run therefore a reasonable assumption and may steep declines in fertility rates in all medium-fertility countries still be expected?[3]

This study focuses on fertility differences across Muslim countries. Muslims are expected to be the largest religious group from 2075 onwards, thereby overtaking the position of Christians (Pew Research Center, 2017). Many differences in the pace of change and the level of the TFR are observed in Muslim countries[4]. A couple of Muslim countries are classified as high-fertility countries, such as Niger, Somalia and Nigeria. Most Muslim countries are medium-fertility countries that experience a fertility transition. The pace of change of the TFR is very fast in some medium-fertility Muslim countries, such as in Bangladesh and Pakistan, whereas in other Muslim countries the pace of fertility change is almost stalling, e.g. in Senegal and Indonesia. Of all Muslim countries, Iran is only classified as a low-fertility country (UN, 2013; UN, 2015a). It is not known why large fertility differences in Muslim countries across the world are found. Determinants of fertility, which are among others socio-economic factors (education, income), cultural factors (religion and gender role traditions) and political factors (family planning policies and programs) may give a better insight in the reasons behind the differences in fertility across Muslim countries (see section 2.3).

Map 1 clarifies that the average TFR in Muslim countries is higher than the average TFR in countries which are not classified as Muslim countries. In the Western world (often interpreted as the majority of countries in Europe, Oceania and North America), where Christianity is the dominant religion and where roots are found in the Greco-Roman civilization, the average number of live births per woman is below replacement level (Dallmayr, 2002; Hayes, 1954; Thompson et al., 2016; UN, 2013). Culturally and politically, Muslim countries differ a lot from countries with another dominant religion and yet, the UN assumes that Muslim countries will follow the same TFR pattern as most countries in the Western world have experienced (Hayes, 1954; Salamé, 1994; UN, 2015a). However, can it even be possible that almost the same TFR pattern – by pace of change and level of the TFR - will be observed in all Muslim countries while keeping in mind that cultural and political factors have an influence on the TFR and that these factors cannot always be changed easily? (see section 2.3)

[3] The fertility projections of the UN are the most often used worldwide (Population Reference Bureau, 2001).
[4] Muslim countries are countries with a Muslim population of 50% or more. A full list of Muslim countries can be found in Table 1 on page 5.

Map 1 – Estimated TFR across the world in 2010-2015



Source: UN, 2013; Pew Research Center, 2009, 2011

According to the UN population projections (medium variant), Muslim countries show the largest population growth as compared to countries grouped by another major religion today and in the upcoming decades; in 2010-2015 and in 2045-2050, 6 out of 10 countries and respectively 5 out of 10 countries with the greatest population increase in the world are expected to be Muslim countries. In Nigeria, the greatest population growth is even expected of all countries in the world in 2045-2050 (UN, 2015a). The greatest uncertainties in the population projections are also found in the countries where the highest population increase is expected according to the UN (UN, 2015b). Therefore, it is relevant to understand the factors which have an influence on the fertility level and pattern over time in Muslim countries in order to make better estimations about the future TFR for these countries. Consequently, it is better possible to assess whether a TFR equal to or lower than 2.1 is a reasonable level to achieve for a country.

1.2 Relevance

Various studies have been conducted to the determinants of fertility across the world (Diamond et al., 1999; Martine, 1996; Neyer et al., 2013). There are only a few studies conducted to the factors influencing the differences in the pace of fertility decline and the results of these studies differ from each other (Bongaarts, 2002a; Casterline, 2001). Recently, factors influencing fertility stalls have also been researched. In these studies, the relationship between fertility stalls and socio-economic variables were examined, but the influence of the cultural and political context on fertility stalls received no attention (Bongaarts, 2006; Shapiro & Gebreselassie, 2009). A better insight in the factors influencing the pace of fertility change in countries – which may be linked to the level of the TFR as Bongaarts (2002a) indicates – is therefore needed. Muslim

countries are especially of importance for this research, as Islam is world's fastest growing religion (Pew Research Center, 2017). Moreover, it is unclear why many Muslim countries have very high fertility rates as compared to other countries in the world, whereas a few Muslim countries have a TFR just above or even below replacement level. In addition, the pace of fertility decline between Muslim countries differs a lot and an explanation for this difference is lacking (UN, 2013). A better insight in the differences in fertility across Muslim countries is thus needed. This information contributes to better a better understanding of population changes in the past and future in these countries as well.

This research is in particular relevant for stakeholders who are involved in family planning policies and programs (e.g. international organizations, national and regional governments, NGO's, elite groups) (Cleland et al., 2006; Tsui et al., 2011; Kesterton & De Mello, 2010). Some interventions have more impact on changing the TFR in Muslim countries than others. In order to identify potentially effective and efficient measures, it is important to understand the significance of the associations between the fertility level, the pace of fertility and the determinants of fertility in Muslim countries in the past and present. The relationships between the fertility level, the pace of fertility change and the determinants of fertility might differ per Muslim country and the effectiveness of potentially appropriate interventions might therefore depend on the context. Furthermore, my findings contribute to the formulation of realistic assumptions for population projections for the study countries.

1.3 Objective and research questions

In this thesis, 4 Muslim countries are compared: Egypt, Indonesia, Nigeria and Pakistan. The objective of this study is twofold: (a) to have a better understanding of the factors which have an influence on the differences in the pace of change and level of the TFR in the selected Muslim countries; and (b) to describe, based on these outcomes, its consequences for the population projections of the selected Muslim countries. The general research question of my study is: *'What are plausible explanations for the differences in the pace of change and level of the TFR between the selected Muslim countries and what are the implications of these findings for the population projections of the selected Muslim countries?'* This question can be decomposed into the following three research questions:

1. What are the differences in the speed of change and level of the TFR between the selected Muslim countries?
2. How can differences in the pace of change and level of the TFR between the selected Muslim countries be explained?
3. What are the implications of these research outcomes for the population projections of the selected Muslim countries?

1.4 Selection of study countries

I used the following criteria to select Muslim countries for my study: (1) >= 50% of a country's population must be Muslim; (2) at least 2 DHS must have been conducted in a country within a particular time-frame; (3) population size; and (4) observed level and pace of change of fertility.

Regarding the first criterion, Table 1 classifies Muslim countries by share of the Muslim population in the total populations.

Table 1 – Muslim countries across the world

% Muslim per country	Africa	Asia	Europe
90% or more	Algeria	Afghanistan	
	Comoros	Azerbaijan	
	Djibouti	Bangladesh	
	Egypt	Iran	
	Gambia	Iraq	
	Libya	Jordan	
	Mali	Maldives	
	Mauritania	Palestine	
	Mayotte	Pakistan	
	Morocco	Saudi Arabia	
	Niger	Syria	
	Senegal	Turkey	
	Somalia	Turkmenistan	
	Tunisia	Uzbekistan	
		Western Sahara	
		Yemen	
70-89%	Guinea	Bahrain	Albania
	Sierra Leone	Indonesia	Kosovo
	Sudan	Kuwait	
		Kyrgyzstan	
		Oman	
		Qatar	
		United Arab	
		Emirates	
		Tajikistan	
50% - 69%	Burkina Faso	Brunei	
	Chad	Kazakhstan	
		Lebanon	
		Malaysia	
		Nigeria	

Source: Pew Research Center, 2009, 2011

Regarding the second criterion, Table 2 list the number of DHS surveys that have been conducted in the Muslim countries listed in Table 1. To permit analysis of fertility change, a country is eligible only if more than one DHS per country has been conducted. Based on this criterion, 33 countries are deleted from the selection list. The remaining countries are shown in the left side of Table 2.

As I am interested in studying recent change in fertility in countries, it is important to know *when* all DHS are conducted in the potential study countries. To obtain a variety of study options, 2 time frames are selected wherein many DHS are conducted. Each 'x' in Table 2 stands for one conducted standard DHS in the time frame shown on top of this Table. As illustrated, most of the standard DHS are conducted between 2010-2014, followed by 1995-1999 and 1990-1994. The data for the time frames 1990-1994 and 2010-2014 are compared in this study. The DHS data for 1995-1999 is not used, as the TFR between 1995-1999 and 2010-2014 do not differ as much as the TFR between 1990-1994 and 2010-2014 in the potential study countries (UN, 2013). When DHS data are not available in 1990-1994 and 2010-2014 in a country mentioned in Table 2, this country is deleted from the selection list.

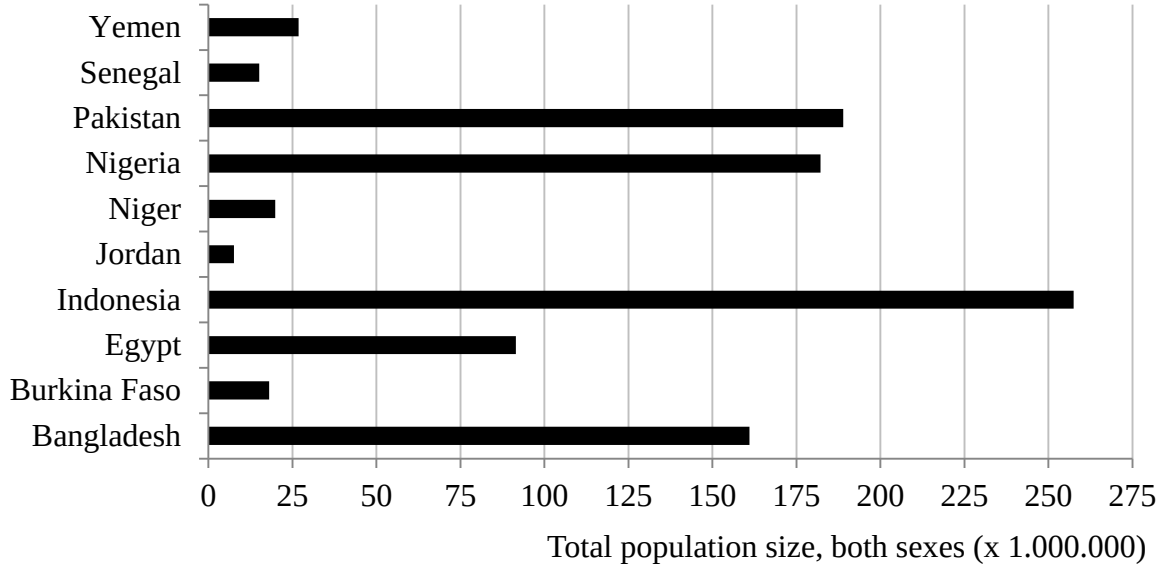
Table 2 – Number of DHS conducted, by 5-year period

Countries with >2 standard DHS	<1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009	2010-2014	2015-2019
Bangladesh			x	xx	x	x	xx	
Burkina Faso			x	x	x		x	
Chad				x	x		x	
Comoros				x			x	
Egypt		x	x	x	x	xx	x	
Indonesia		x	xx	x	x	x	x	
Jordan			x	x	x	x	x	
Kazachstan				xx				
Kyrgyzstan				x			x	
Mali		x		x	x	x	x	
Morocco		x	x		x			
Niger			x	x		x	x	
Nigeria			x	x	x	x	x	
Pakistan			x			x	x	
Senegal		x	x	xx		x	x	x
Sierra Leone						x	x	
Turkey			x	x	x			
Yemen			x				x	
Total number of surveys	*0*	*5*	*13*	*17*	*10*	*11*	*16*	*1*

Source: DHS, 2017

Regarding the third criterion, Figure 1 illustrates the current population size of potential Muslim study countries that complied with the first two criteria. Future's population size turns out to be the most uncertain for the remaining countries with the biggest population size and more accurate estimations may in particular be needed for these countries (UN, 2017). Therefore, I decided to select the remaining countries that stand out in terms of total population size: Pakistan, Nigeria, Indonesia, Egypt and Bangladesh.

Figure 1 – Total population size in the potential study countries in 2015

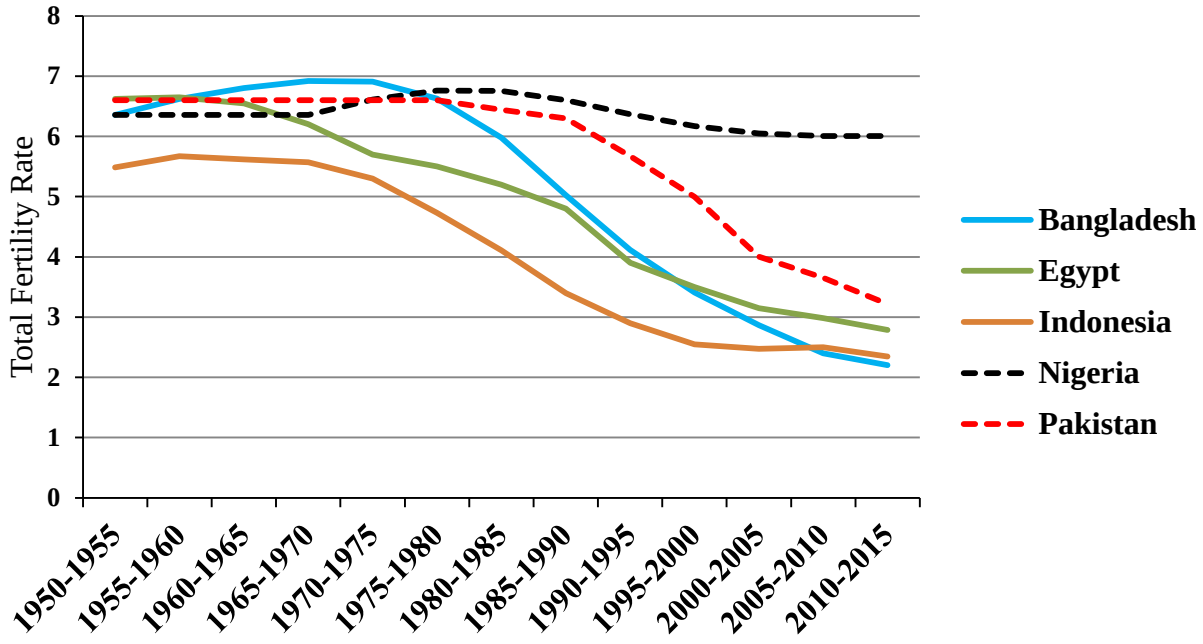


Source: UN, 2017

Regarding the fourth criterion, I plotted in Figure 2 the five remaining countries in terms of level *and* pace of change in TFR between 1990-1995 and 2010-2015. I expect that the larger the differences between countries in terms of levels and pace of change in TFR, the better I am able to identify causes of country-differences.

Table 3 classifies countries in terms of quantitative criteria regarding level and pace of change in TFR in our selected time-frame. Three countries (Nigeria, Pakistan and Bangladesh) exhibit a relatively high TFR in 1990-1995 (i.e. TFR $\geq$ 5) but they differ in terms of pace of decline in TFR (i.e. <20% decline (Nigeria) versus >25% decline in TFR (Pakistan, Bangladesh). Bangladesh was not selected because Pakistan and Bangladesh (i.e. former East-Pakistan) are quite similar in terms of cultural and economic characteristics due to their shared history (Hathaway, 2004). Conversely, the remaining two other countries (Indonesia and Egypt) exhibit relatively low TFR's in the 1990-1995 period (i.e. TFR <5), of which one country (Indonesia) had a relatively slow TFR decline of less than 20% between 1990-1995 and 2010-2015 and the other country (Egypt) showed a fast decline of more than 25% in these years. Thus, the countries selected for this study are: Egypt, Indonesia, Nigeria and Pakistan.

Fig. 2 – Estimated TFRs in the potential study countries from 1950-1955 until 2010-2015



Source: UN, 2013

Table 3 - Selected countries by pace of change and level of the TFR between 1990-1995 and 2010-2015

	< 20% TFR decline between 1990-1995 and 2010-2015	> 25% TFR decline between 1990-1995 and 2010-2015
TFR ≥5 in 1990-1995	Nigeria	Pakistan
TFR <5 in 1990-1995	Indonesia	Egypt

Source: UN, 2013

1.5 Structure of the thesis

This thesis comprises 5 chapters. Following this introductory chapter, I describe the theoretical framework for my study in chapter 2, including a literature review leading to a conceptual model and research question-related propositions. Chapter 3 describes the data and methods used for my study. In chapter 4, findings regarding the research questions are presented. In the final chapter of this thesis I draw conclusions and discuss the implications.

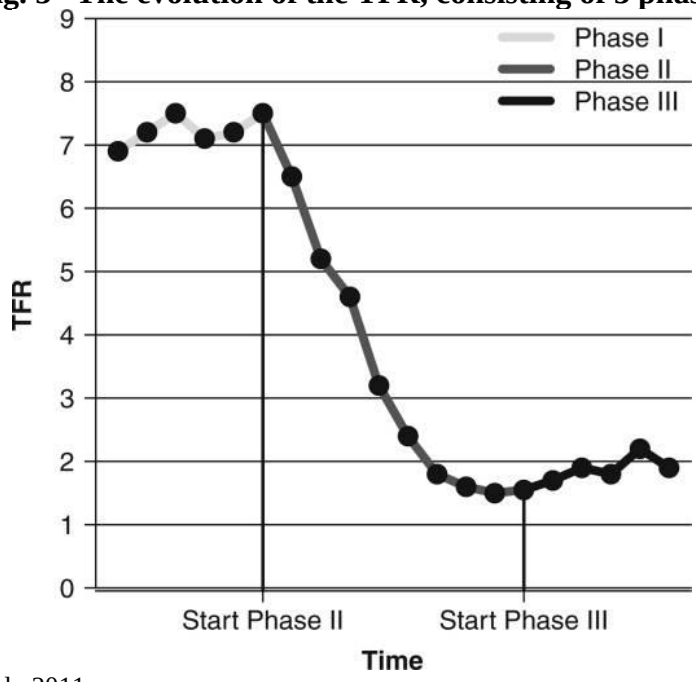
2. Theoretical framework

Below, in subsection 2.1, I describe the evolution of the TFR. In section 2.2, the direct determinants of fertility are presented, followed by a description of important underlying factors of fertility in the selected Muslim countries (section 2.3). Section 2.4 gives an insight into factors explaining the fertility change. The factors described in section 2.3 and 2.4 are relevant in order to understand the variations in fertility across the selected countries. Based on the literature review, a conceptual model is made (section 2.5) and propositions are formulated (section 2.6).

2.1 The evolution of the TFR

The TFR of a country changes over time, as illustrated in Figure 3. The evolution of the TFR can be divided into 3 phases. In the first phase, the fertility level is high (i.e. a TFR exceeding 5 children per woman) and this level is stable or increasing over time. Phase 2 is the fertility transition from high fertility to replacement-level fertility or below. In phase 3 – which is called the post-transition fertility period – the TFR recovers from below-replacement fertility to a TFR at replacement level (that is, 2.1 children per woman) (Alkema et al., 2011; Raftery et al., 2014).

Fig. 3 –The evolution of the TFR, consisting of 3 phases



Source data: Alkema et al., 2011

The majority of the Muslim countries fall in phase 2, i.e. the fertility transition. The pace of decline in this phase is usually faster in the early phase than in the later phase. (Alkema et al., 2011; Bongaarts, 2002a). The level, timing and pace of fertility decline vary across countries (Alkema et al., 2011; Bongaarts, 2002a). Bongaarts (2002a) found that the later in time a fertility transition begins, the lower the pace of initial fertility decline between the 1960s to 1980s.

Moreover, a stall in fertility transition occurred in some countries (e.g. Kenya, Ghana) (Shapiro & Gebreselassie, 2009; Westoff & Cross, 2006). Furthermore, it is observed that the TFR at which the fertility transition ends is in some countries lower than 2.1 (Goldstein et al., 2009). Whether all countries with TFR levels below 2.1 rebound to replacement level remains unsure (Bongaarts, 2002b; Goldstein et al., 2009; Lutz et al., 2003). It may also be questioned whether all countries with a higher TFR than 2.1 will reach phase 3, as long fertility stalls have been observed in some countries (UN, 2015a). Moreover, the model of the evolution of the TFR is based on the fertility levels which are observed in Western countries over time. Some of the countries with a TFR above replacement level differ culturally, economically and politically a lot from Western countries – such as Muslim countries (Hayes, 1954; Salamé, 1994; UN, 2015a) - while socio-economic, cultural and political factors have an impact on the TFR (see section 2.3). Thus, why should we assume that phase 3 of the evolution of the TFR will be reached by all countries?

2.2 PD of fertility framework

In 1956, Davis and Blake presented a framework of intermediate determinants of fertility (Davis & Blake, 1956). Based on this framework, Bongaarts (1978) derived a reduced number of main PD.

Bongaarts' analytical framework consists of 8 proximate (i.e. direct) determinants of fertility: (1) proportion of women living in sexual unions; (2) prevalence of contraceptive use ; (3) prevalence of abortion practices; (4) duration of lactational infecundity (i.e. breastfeeding); (5) frequency of sexual intercourse; (6) prevalence of permanent sterility; (7) prevalence of spontaneous intrauterine mortality; and (8) estimate of the length of the fertile period in a woman's life. Evidence is provided that the first four PD are the ones most important to the explanation of variation of fertility levels in the world (Bongaarts, 1978). Therefore, only the first four PD are included Bongaarts' model (1978). A few years after the PD of fertility model was developed, Bongaarts added the proximate determinant 'pathological sterility' to this model, since differences in the fertility level between some populations in sub-Saharan Africa are primarily caused by the proportion of childless women as a result of high prevalence of STD, notably syphilis and gonorrhea (Bongaarts et al., 1984; Frank, 1983). Moreover, Bongaarts combined the duration of lactational infecundability and postpartum abstinence into the new determinant 'postpartum infecundability' to be more specific about the influence of the postpartum period on a subsequent pregnancy (Bongaarts, 1982). The newer version of the PD of model – is summarized by the following multiplicative model (Bongaarts, 1978; Bongaarts, 1982; Bongaarts et al., 1984; Hasen et al., 1994; Kalule-Sabiti, 1984):

$$[1] \quad TFR = C_m * C_i * C_a * C_p * C_c * TF$$

Where:
C_m = Index of proportion married
C_i = Index of postpartum infecundability
C_a = Index of abortion
C_p = Index of pathological sterility
C_c = Index of contraception
TF = Total fecundity rate

The indexes all have values ranging from 0 to 1, each conveying a particular fertility-reducing effect. The first index in the model shows that, the lower the proportion of married women in their reproductive age in a population, the lower the TFR; C_m equals 0 if no women in their reproductive age are married and C_m has a value of 1 when all women are married during the entire reproductive period in a population. This means that actual fertility levels are represented by fertility levels of married people. Marriage should be interpreted as people who are formally married or who are living in a consensual union (Bongaarts, 1978). The second index is C_i. This index declines toward 0 the longer women lactate and refrain from sexual intercourse following a birth and is equal to 1 without lactation and postpartum abstinence (Bongaarts, 1982). The third index in the model – i.e. C_a - becomes closer to 0 when the incidence of induced abortion increases and has the value of 1 in the absence of induced abortion (Bongaarts, 1978). The fourth index is C_p. This index is 1 if (less than) 3% of the women at age 45 to 49 are childless and declines toward 0 when the percentage of women who remain childless increase (Bongaarts et al., 1984; Stover, 1998). The last index is C_c. This index is 0 when all nonsterile women in their reproductive years in the population are protected by 100% effective contraception and 1 when no contraception is practiced. The TF is also mentioned in the model. The TF is the maximum number of births a woman would have if she lived throughout the reproductive period and remained married during the entire reproductive period, and uses no contraception, induced abortion or breastfeeding practices, and does not refrain from sexual intercourse after birth. This TF is estimated to be between 13.5 and 17 births per woman, based on calculations of Bongaarts (1978). According to Bongaarts' model, the TFR of a population thus declines if women enter a sexual union (e.g. marriage) at a later age, more women start using (effective) contraceptive methods and more often induce abortions, if more women become sterile due to sexually-transmitted diseases (STD) and if women adopt intensive and long breastfeeding practices, and abstain more frequently and longer from sexual intercourse (e.g. after delivery of a new-born child, or before marriage).

The calculation of each separate index included in the model of Bongaarts has slightly been revised by Stover in 1998 and by Bongaarts in 2015, based on new theoretical and empirical evidence. Moreover, C_m is changed to index of sexual exposure, as research findings show that

"extramarital sex and pregnancy are becoming more prevalent in developed and developing countries" (Bongaarts, 2015, p.539). Equation 1 remains the same.

2.3 Underlying factors of fertility in the selected Muslim countries

The age of marriage, contraceptive use, abortion, pathological sterility and postpartum infecundability are influenced by the underlying factors of fertility (Bongaarts, 1978). There are many indirect factors of fertility and a few of these determinants - which are often mentioned in academic papers as important underlying factors of fertility and, in particular, in research papers which are about the selected Muslim countries - are described in this section in the following order:

- **Socio-economic factors –** education, income
- **Cultural factors –** tradition, religion
- **Political factors –** population policies and programs with respect to fertility

2.3.1 Socio-economic factors

- **Education**

According to multiple studies, women's education (in years of education) shows a reverse relationship with fertility in general, such as in Egypt, Indonesia, Nigeria and Pakistan (Hakim & Mahmood, 1994; Martin, 1995; Osili & Long, 2008). Schooling has positive effects on women's autonomy and on the exposure to new ideas, attitudes and opinions, as well as on the costs of having children (Ainsworth et al., 1996; Pritchett, 1994; Cleland, 2002). Education empowers women and provides them greater autonomy (Jejeebhoy, 1995). By having greater autonomy, women have more freedom to act according to their own needs and they have to listen less to their husbands who tend to want more children than their wives in developing countries (Abadian, 1996; Bankole & Singh, 1998).The exposure to new ideas, attitudes and opinions leads to more knowledge and acceptance of effective contraceptive use, which consequently reduces the fertility level (Ainsworth et al., 1996; Pritchett, 1994; Cleland, 2002). The relationship between the costs of having children and fertility is explained in the following section concerning income.

The effects of women's education, through the PD of fertility, on fertility are both positive and negative. Women's schooling (in years of schooling) is positively related to a higher age at first marriage and contraceptive use and negatively related to the duration of lactation and sexual abstinence. Moreover, women's education is expected to increase the number of abortions, although reliable data is lacking to confirm this relationship (Cleland, 2002). The age at first marriage is perhaps negatively related to proportion of women of reproductive age married (Goldstein & Kenney, 2001; Shapiro & Gebreselassie, 2014).

- **Income**

Empirical findings reveal that fertility is negatively associated with income in a lot of countries and areas in the world, e.g. in Lagos, Nigeria and in Indonesia (Ewer & Crimmins-Gardner, 1978; Jones et al., 2008; Gertler & Molyneaux, 1994; Knowles, 1999). According to Becker´s economic theory of fertility, the price of children is time and this explains why children are more expensive for couples who earn more money. It may also be that higher-wage couples regard child quality as more important, making child quantity more costly and, subsequently, those parents want to have fewer children (Becker, 1960; Jones et al., 2008). Another theory is that lower-wage couples perceive children more as social status and critical for their economic survival than higher-wage couples and therefore, they may desire more children than higher-wage couples (Abadian, 1996). Income also increases the empowerment of women according to several studies and this can lead to a lower fertility level (Amin et al., 1995; Grasmuck & Espinal, 2000; Visaria, 2000). The increase of women's earnings has more impact on the fertility level than an increase in men's wages in general. This is probably the consequence of the division of child-rearing responsibility; mothers usually spend more time on rearing a child as compared to fathers (Schultz, 1997).

Male and female wages show a positive relationship with contraceptive use according to several studies, among others in Pakistan and in Indonesia, which subsequently contributes to a lower fertility level (Agha, 2000; Amin et al., 1995; Gakidou & Vayena, 2007; Gertler & Molyneaux, 1994).

2.3.2 Cultural factors

- **Tradition**

Traditional beliefs can be barriers to changes in the fertility level in societies. In pre-transitional societies with natural fertility, fertility levels initially do not change due to "traditional norms and values [which] tend to support large families and discourage the deliberate limitation of family size through contraception" (Bongaarts, 2002a, p.279). In societies with a lower fertility level, similar and a variety of other traditional norms and values are observed which can make a further reduction of the fertility level more difficult (Burbank, 1995; Amin & Lloyd, 1998). For instance, patriarchal structures in Egypt, Indonesia, Nigeria and Pakistan have dire consequences for the status of women, their life chances and safe sex (Izugbara, 2004; Mahmood & Ringheim, 1996; Moghadam, 2007; Nilan & Demartoto, 2012). Moreover, the desire for sons in patriarchal societies is a major obstacle to a low fertility rate; sons carry on the family name and line, enhance the power of the family and can help out in the family business (Arnold, 1997; Dalla Zuanna & Leone, 2001). Patriarchy in the Arab context is defined as "the prioritizing of the rights of males and elders (including elder women) and the justification of those rights with kinship values which are usually supported by religion" (Joseph, 1996, p.14).

- **Religion**

The Islam and other religions tend to be pronatalist according to many scholars (e.g. Adsera, 2006; Adongo et al., 1998; McQuillan, 2004; Sufian & Johnson, 1989). Verses in the Qur'an with regard to contraceptive use are interpreted in various ways by Muslims (conservative or progressive). In Nigeria for example, the local perception of many Muslims is that the will of God regarding childbearing should not be overridden through making use of contraceptives and this perception may have contributed to a low contraceptive use of 15% in Nigeria in 2013 (National Population Commission & ICF International, 2014a; Renne, 1996). Muslim opponents also argue that contraceptive use is a Western plot to reduce the number of Muslims and thereby their power and that the coitus interruptus is infanticide according to one verse the Qur'an. Muslim proponents believe that contraceptive use is in line with the teachings of the Islam as childbearing is still in the hands of God and that contraception is just a means. Moreover, in one verse the Fourth Caliph denied that coitus interruptus is genocide (McQuillan, 2004). Besides, induced abortions are usually prohibited by Muslims except to save the life of the mother based on the Qur'an. This view on abortions has been turned into an abortion law in most Muslim countries, e.g. in Egypt, Indonesia, Nigeria and Pakistan (Guttmacher Institute, 2015a, 2015b; Hessini, 2007; Sedgh & Ball, 2008). As a consequence of these legal barriers towards induced abortions, the fertility rate may also not reduce a lot. Furthermore, the Qur'an allows different types of marriages; monogamous and polygamous marriages are possible (Jaalar-Mohammad & Lehmann, 2011). In some Muslim countries, polygamous marriages are also quite common. In Nigeria for example, 33% of the married women are in polygynous unions in 2013 (National Population Commission, 2014). A study of Larsen (1995) reveals that women in polygamous marriages are more likely to become pathological infertile as compared to women in monogamous unions due to a higher likelihood of having a STD, which subsequently leads to a lower fertility level in a population. Most Muslim children are probably born inside marriage, since children who are born out of wedlock are declared as illegitimate according to the Islamic Law and these children and their parents are often stigmatized by the Muslim society (Palamuleni & Adebowale, 2013; Khan & Pine, 2003).

Finally, the status of Muslim women is influenced by the Islam and this affects the fertility level. In the Qur'an, men are described as the custodians of women. The role of women is in the domestic sphere and other roles are also acceptable as long as these roles do not conflict with family duties. This role division makes it difficult, if not impossible, for Muslim women to improve their socio-economic position (which makes a decline in the fertility level also more difficult). When Muslims are married, the wife should meet the sexual needs of her husband (Baden, 1992; Yefet, 2009). Consequently, wives cannot control their fertility when husbands decide when to have sexual intercourses or when they disapprove the use of contraceptives during sexual intercourse (Isiugo-Abanihe, 1994; Kamal, 2000; Yefet, 2009). It is remarkable that women are much more egalitarian to men in other major world religions. Subsequently, these

women have more opportunities to acquire a higher socio-economic position and a lower fertility level as compared to Muslim women (Brown, 1990; Greenberg, 1981; Gross, 1993; Küng, 2005).

2.3.3 Political factors

- **Family planning programs and policies**

In this century, most Muslim countries had policies to lower the fertility level (e.g. in Egypt, Indonesia, Nigeria and Pakistan) (Hull, 2005; Obono, 2003; Refaat, 2010; UN, 2008). Policies to modify fertility levels consist of aims regarding the number of children and the spacing between children and direct measures (incentives and disincentives) in order to achieve these norms. Examples of incentives are free or cheap contraceptives and services and disincentives are among others the payment of extra taxes and a limitation of paid maternity leave (Population Division, 2002). Besides, family planning population programs are made. According to Cleland et al. (2006), family planning programs are effective and have played an important role in reducing the number of children from 6 to almost 3 births per woman in most developing countries in the past decades.

The effectiveness of family planning programs and policies partly depends on the way they are implemented, the context in which they are implemented and whether there is a demand for contraceptives in the population (Cleland et al., 2006; Tsui et al., 2011). Successful family planning programmes are programmes with commitment of the government on different levels, contributions from the private sector and civil society, approval from elite groups (i.e. 'important others', 'role models' such as religious leaders to legitimize use of contraceptives), sufficient funding, high quality of promotion of use of modern contraception in the media, social marketing, outreach services, access to different modern contraceptives through medical facilities and support for smaller families (Cleland et al., 2006; IRIN, 2011; Tsui et al., 2011). The bottom line though is that family planning policies and progammes must be successful in generating feelings in the population of an unmet need of contractive methods (Kesterton & De Mello, 2010). Cleland et al. (2006) mentioned that the family planning programs which have showed the best results in practice draw on indigenous cultural knowledge and creativity. Thus, there is not one standard effective way in order to obtain the family planning targets (Cleland et al., 2006).

2.4 Factors explaining the pace of fertility change

According to Bongaarts (2002) and Casterline (2001), only a few studies have been conducted about the factors which are likely to accelerate or slow down fertility decline. These studies show contradicting results and more research is often needed to confirm its validity. Casterline (2001) assumes that changes in the outcomes on the factors influencing the fertility rate have an impact on the pace of fertility decline. This implies that the faster a score on a determinant changes, the more rapid the fertility level changes in case the scores on the other determinants remain the

same (Casterline, 2001). Based on this assumption, a positive relationship between the pace of development in countries (Human Development Index) and the pace of fertility should among others be expected. However, several studies show that the rapidity of fertility decline is not associated with the pace of development at the time of the onset of the fertility transition (Bongaarts, 2002a; Knodel, 1977; Watkins, 1987). This example shows that the assumption of Casterline does not (completely) hold. However, changes in the outcomes on the PD are probably reflected in the rapidity of fertility decline or growth, as these PD show a direct relationship with fertility. For instance, a rapid increase in the use of contraceptives is associated with a fast fertility decline according to a study of the Population Division (2002). They found a negative pattern between the change in contraceptive use and the change in the number of children per woman for the decades 1970 until 2000 in countries with a TFR between 2.1 and 5 in 1995-2000, although there are a few countries which do not comply with this pattern. In 5 out of 7 countries with an increase in contraceptive use of 2% or more annually between 1990-2000, the TFR decreased with 2% or more per decade over the period 1970-2000. Twenty-six out of twenty-eight countries that experienced an increase in the use of contraceptives of less than 2% annually between 1990-2000 showed a decline in the TFR of 1.4 children or less per decade for the period 1970-2000. This study therefore indicates that an increase in contraceptive prevalence over time may have an important influence on the pace of fertility decline in a country. It should be noted that these outcomes do not show the effects of other, possibly interacting, PD. Therefore, it difficult to interpret effects of dynamics in contraceptive prevalence on the pace of fertility change.

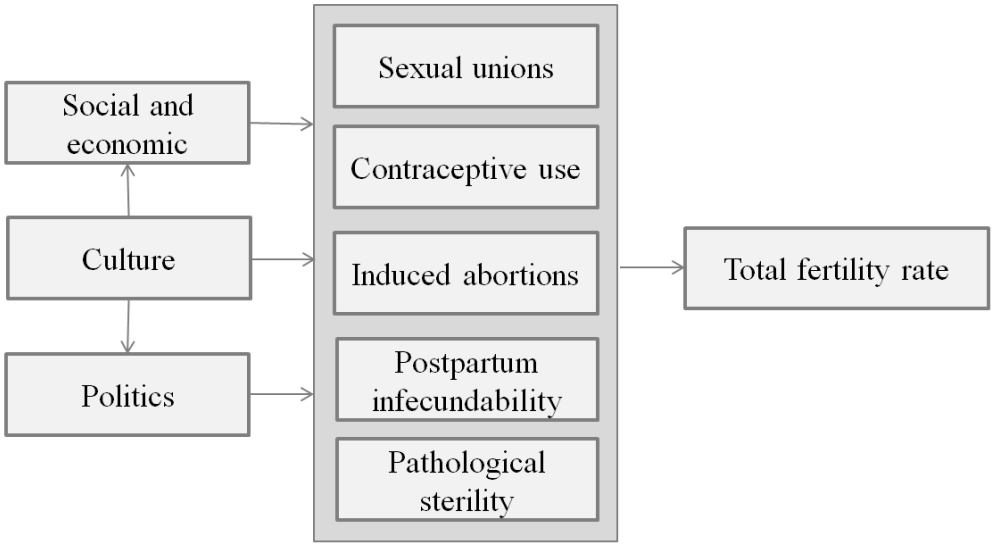
Besides, the rapidity of change of an underlying factor of fertility is likely to be reflected in the pace of change of a proximate determinant when there is a direct relationship between these factors. Shapiro and Gebreselassie (2014) also found evidence that the faster women's educational attainment increased, the higher the increase of the age at first union in sub-Saharan Africa from the late 1980s onwards. Yet, for the PD which are affected by multiple underlying factors – i.e. contraception, and perhaps other PD as well – it may be questioned to what extent the pace of changes of the underlying factors (which have an effect on contraception) are related to the pace of change of contraception.

2.5 Conceptual model

The main components of the conceptual model (Figure 4) are derived of the literature review. As described in section 2.1 and displayed in the conceptual model, the TFR differs over time due to different factors. In section 2.2 and 2.4, it was mentioned that the TFR in a country and the changes in the TFR are influenced by the PD of fertility, that is, the proportion of women living in sexual unions, contraceptive prevalence, the level of induced abortions, the duration of postpartum infecundability and pathological sterility. The PD of fertility are on its turn influenced by the underlying factors of fertility, which are mainly socio-economic, cultural and political factors in the selected countries (i.e. education, religion and population policies and programs, as described in section 2.3). Cultural factors also have an effect on the socio-economic and political

factors (section 2.3). It is yet unclear what combination of factors has an impact on the TFR and on the speed of change in the TFR in each country and on differences in the (pace of change in the) TFR between countries. A better insight in factors influencing the differences in the TFR may also reveal to a limited extent whether a TFR will become one at replacement level in the future in all countries, as was questioned in section 2.1.

Fig. 4 – Conceptual model



It should be noted that the ´black box´ in Figure 4 does not show interactions between the PD of fertility. Yet, interactions between PD have been found. According to Marston and Cleland (2006), an increase in contraceptive use leads to less induced abortions when fertility itself is constant. A rise in both contraception and abortion sometimes occur when the growing need for fertility reduction cannot be met with contraception solely. Moreover, contraceptive use and postpartum infecundability have been found to be negatively correlated over time. The use of modern contraception is often associated by users with following a modern western life-style. A western life-style is associated with breastfeeding practices that are short or even absent. In countries with a tradition of long and intense breastfeeding practices, an increase in use of modern contraceptives has led to an erosion of such traditional practices. In such kind contexts, such as in various Sub-Saharan African countries, the net effect might even be that, over time, fertility decline seem to stalls or even (temporarily) increase somewhat, in spite of a continuous increase in use of modern and effective contraceptives (Jayachandran, 2014; Krasny, 2012; Wilmoth & Elder, 1995). Besides, a negative association between condom use - which prevents STDs - and pathological sterility is found in Nigeria (Omo-Aghoja et al., 2007; Wilmoth & Elder, 1995). Higher rates of condom use may be reflected in higher rates of contraceptive use.

2.6 Propositions

From the literature review and conceptual model, the following propositions – related to the research objective - are implied:

1. Variations in the level of the TFR between the selected Muslim countries are caused by differences in the PD of fertility between the selected countries (i.e. marriage, induced abortion, contraceptive use, postpartum infecundability and pathological sterility). Differences in these PD are primarily caused by differences in education, income, traditions and religion (beliefs and practices) and family planning policies and programs, as well as by differences in the interactions between the PD of fertility between the selected countries.
2. Differences in the pace of changes in the TFR between the selected Muslim countries are the consequence of variations in the pace of changes in the PD of fertility between the selected countries, which are on their turn mainly influenced by differences in the pace of changes in education, income, religion and traditions (beliefs and practices) and family planning policies and programs, and also by differences in the pace of changes in the interactions between the PD of fertility between the selected countries.
3. The TFR does not have to become 2.1 (that is, replacement level) in all selected Muslim countries eventually; lower and higher levels than 2.1 are possible.

3. Data and method

3.1 Data

This analysis primarily relies on DHS data. In Table 4, an overview is given of the characteristics of respondents and the sample size for each selected DHS.

Table 4 – Characteristics of respondents, by selected DHS

	Females			Males			Household
Selected surveys	Respondents	Age	Sample	Respondents	Age	Sample	sample
Egypt							
EDHS 1992	Ever married women	15-49	9,864	Husbands	NA	2,466	10,760
EDHS 2014	Ever married women	15-49	21,762	NA	NA	NA	28,175
Indonesia							
IDHS 1991	Ever married women	15-49	22,909	NA	NA	NA	26,858
IDHS 2012	All women	15-49	45,607	Ever married men	15-54	9,306	43,852
Nigeria							
NDHS 1990	All women	15-49	8,781	NA	NA	NA	8,999
NDHS 2013	All women	15-49	38,948	All men	15-49	17,359	38,522
Pakistan							
PDHS 1990-91	Ever married women	15-49	6,611	Husbands	NA	1,354	7,193
PDHS 2012-13	Ever married women	15-49	13,558	Ever married men	15-49	12,943	12,943

Source: Central Bureau of Statistics, 1991a; El-Zanaty et al., 1993a; Federal Office of Statistics & Institute for Resource Development, 1992a; Ministry of Health and Population et al., 2015a; National Institute of Population Studies & ICF International, 2013a; National Institute of Population Studies & Institute for Resource Development, 1992a; National Population Commission & ICF International, 2014a; Statistics Indonesia et al., 2013a

In order to make the DHS data nationally representative, sampling weights have been applied to the datasets and weighted data were taken from DHS final reports (see also Appendix 1). Detailed information regarding the sample design and data quality is described in the DHS final reports for the countries and periods concerned: http://www.measuredhs.com/.

Besides, information about the performance on a variety of family planning aspects in Egypt, Indonesia, Nigeria and Pakistan in 1994 and in 2014 were taken from a database of family planning efforts scores (Track20 & Avenir Health, 2017). The family planning effort scores were given by 10-15 invited experts in the field of family planning. For the merits and pitfalls of this approach, see Ross & Smith (2011) and Measure Evaluation (2017).

Data on the TFRs in Egypt, Indonesia, Nigeria and Pakistan from 1950-1955 onwards were also applied for this study (UN, 2013). The TFR data are derived from census and a variety of survey data (UN, 2015a). Today's fertility data for the selected countries may be more reliable than data from the past, as more data is available and the data is of a better quality in general (Aluko, 1965; DHS, 2017; Muhidin, 2010).

Also, data on the average contraceptive effectiveness (*e*) were obtained from The Policy Project (1997). These data have its shortcomings, as described by Stover et al. (2006).

Furthermore, income trends between 1990-1995 and 2010-2015 were analyzed, thereby making use of 5 indicators: Gross National Income (GNI) per capita (PPP), Gini index[5], poverty headcount ratio and labor force participation rate of men and women[6] (World Bank, 2017b, 2017c, 2017d, 2017e, 2017f). I acknowledge that such kind of data have certain shortcomings, see World Bank (2017c; 2017d, 2017e), which impinge on comparability of results between countries.

Finally, a variety of literature sources – mostly academic articles - were used for this study.

3.2 Method and model variables

Bongaarts' PD model – which accurately represents reality - was applied for this study (Bongaarts & Potter, 1983). Competing models have been criticized for being oversimplified and for giving no satisfactory explanation of observed fertility differentials, see: Becker (1960), De Bruijn (2006), Greenhalgh (1990), Davis (1945), Howell (1986) and Notestein (1945). The equations and variables to calculate each PD index are shown in Table 5.

Table 5 – PD of fertility indices, equations and variables

PD indices	Equations	Variables
Marriage	[2] $C_m = (M / 100)$	M = percentage of women age 15-49 who are married
Postpartum infecundability	[3] $C_i = 20 / (18.5 + i)$	i = average period in months of postpartum infecundability
Abortion	[4] $C_a = TFR / (TFR + 0.4(1 + u) * A)$	u = contraceptive prevalence among married women age 15-49 A = total abortion rate
Pathological sterility	[5] $C_p = (7.63 – 0.11 * s) / 7.3$	s = percentage of women age 45-49 who remain childless
Contraception	[6] $C_c = 1 – 1.18 * u * e$ [7] $e = (\sum_m u_m * e_m) / u$	e = average contraceptive effectiveness subscript m = method m

Source: Bongaarts, 2015

[5] The GNI per capita (PPP) in dollars is the "sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad" per capita, converted into U.S. dollars using PPP rates (World Bank, 2017b). "Purchasing Power Parities (PPP) are the rates of currency conversion that equalize the purchasing power of different currencies by eliminating the differences in price levels between countries" (OECD, 2017), and can therefore be used to compare the GNI per capita across countries. The Gini index measures "the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution. An index of 0 represents perfect equality, while an index of 100 implies perfect inequality" (World Bank, 2017c).

[6] Data regarding the labor force participation of women instead of their income was used, since comparable data about their income is lacking.

Next, the effect of each PD on the reduction of the TFR was calculated with the equations mentioned in Table 6 (these equations are derived from equation 1).

Table 6 – The effects of the PD on the TFR

PD indices	Equations
Marriage	[8] $TF * (1 - C_m)$
Postpartum infecundability	[9] $TF * C_m - TF * C_m * C_i$
Abortion	[10] $TF * C_m * C_i - TF * C_m * C_i * C_a$
Pathological sterility	[11] $TF * C_m * C_i * C_a - TF * C_m * C_i * C_a * C_p$
Contraception	[12] $TF * C_m * C_i * C_a * C_p - TF * C_m * C_i * C_a * C_p * C_c$

Source: Bongaarts, 2015

For the calculations of the influence of each PD index on the TFR, the TF was set at a level of 15.3 (i.e. the average estimate of the TF) (Bongaarts, 1978). Data on the total abortion rate[7] (*A*) (equation 4) had to be obtained indirectly. Therefore, the following equation was used (see Westoff, 2008, p. 1-6):

$$[13]\ A = 4.09 - 0.037 * MOD - 0.386 * TFR$$

Where:
MOD = percentage of women age 15-49 using modern methods of contraception

This equation shows a strong correlation (R=0.83) with the most reliable abortion rates for 34 developing countries (mainly countries where abortion is free of social stigma). See Attachment 2 for the data used for MOD.

[7] The total abortion rate is "the average number of induced abortions per woman at the end of the reproductive period if induced abortion rates remain at prevailing levels throughout the reproductive period" (Bongaarts, 1978, p.114). Thus, it is assumed that period-age-specific abortion rates are representative for cohort-specific abortion rates.

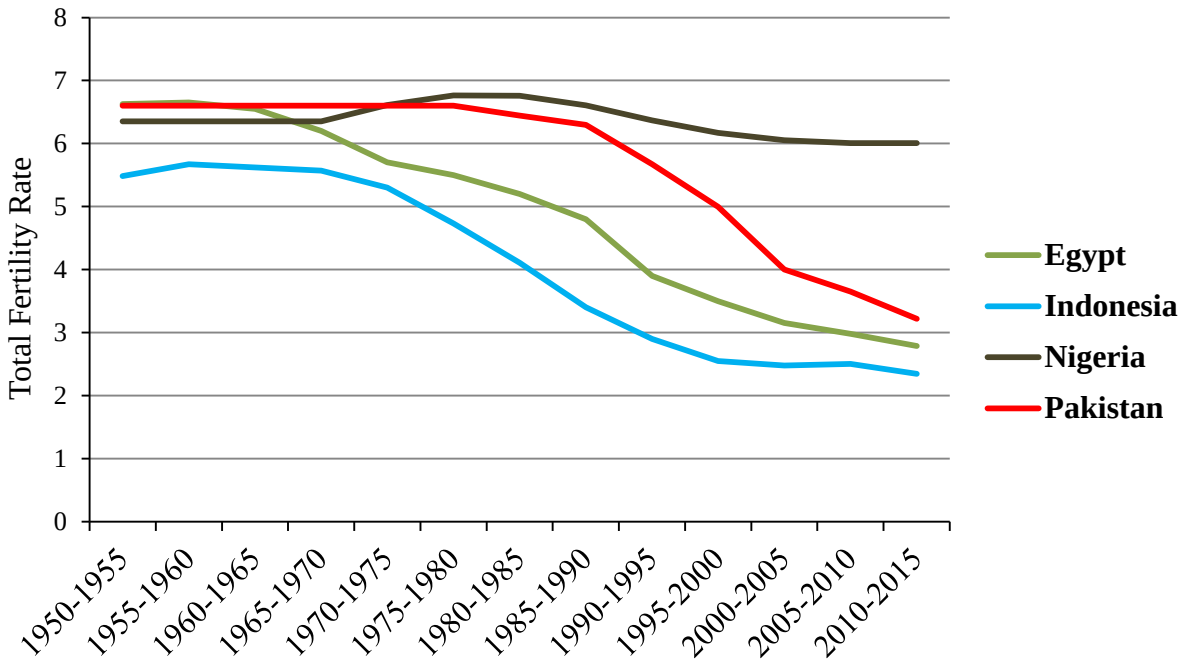
4. Results

In this chapter, the variations in fertility across the selected Muslim countries are described first (section 4.1). In section 4.2, explanations are given for the variations in fertility between Egypt, Indonesia, Nigeria and Pakistan. In the last section (section 4.3), the consequences of these findings for the future of fertility are presented.

4.1 Fertility differences between the selected Muslim countries

Regarding research question 1, Figure 5 shows how the estimated levels of TFR's have changed since 1950 in Egypt, Indonesia, Nigeria and Pakistan.

Fig. 5 – Estimated TFRs from 1950-1955 until 2010-2015



Source: UN, 2013

Figure 5 shows a couple of striking differences in the level and speed of change in the TFR between the selected countries over time. First of all, the level of the TFR just before the onset of the fertility transition varies; in Egypt, Pakistan and Nigeria, this level was 6.0-6.6, whereas this level was approximately 5.5 in Indonesia. Second, the point in time at which the transition onset occurs, differs in the selected countries. In Egypt, the transition onset started in the early 1960s and was followed by Indonesia in the early 1970s and Pakistan in 1985-1990. In Nigeria, the fertility transition seems not to have started yet, as the TFR is 6 in 2010-2015 and a break from the past with a much higher pace of fertility decline has not been observed (Bongaarts, 2002a). Third, the pace of fertility decline varies to quite some extent in the selected countries in the 2 decades after the beginning of the fertility transition; in Pakistan, the TFR declined the most as compared to Indonesia and Egypt. Consequently, the TFR reached a level of 3.7 in Pakistan in

2005-2010, 2.9 in Indonesia in 1990-1995 and 5.2 in Egypt in 1980-1985. Fourth, the pace of fertility decline reduced in all countries in later phases of the fertility transition, although the pace of fertility decline was still the highest in Pakistan, followed by Egypt. Indonesia had the slowest decline in the TFR and has experienced a fertility stall from 1995-2000 onwards.

Between 1990-1995 and 2010-2015 (i.e. the researched period), differences in the TFR declined from 5.6 in Pakistan, 3.9 in Egypt and 2.9 in Indonesia in 1990-1995 to 3.2 in Pakistan, 2.8 in Egypt and 2.4 in Indonesia in 2010-2015. In Nigeria, the TFR remained at a high level of 6.4 in 1990-1995 and 6.0 in 2010-2015.

4.2 Explanation of fertility differences between the selected Muslim countries

4.2.1 PD of fertility

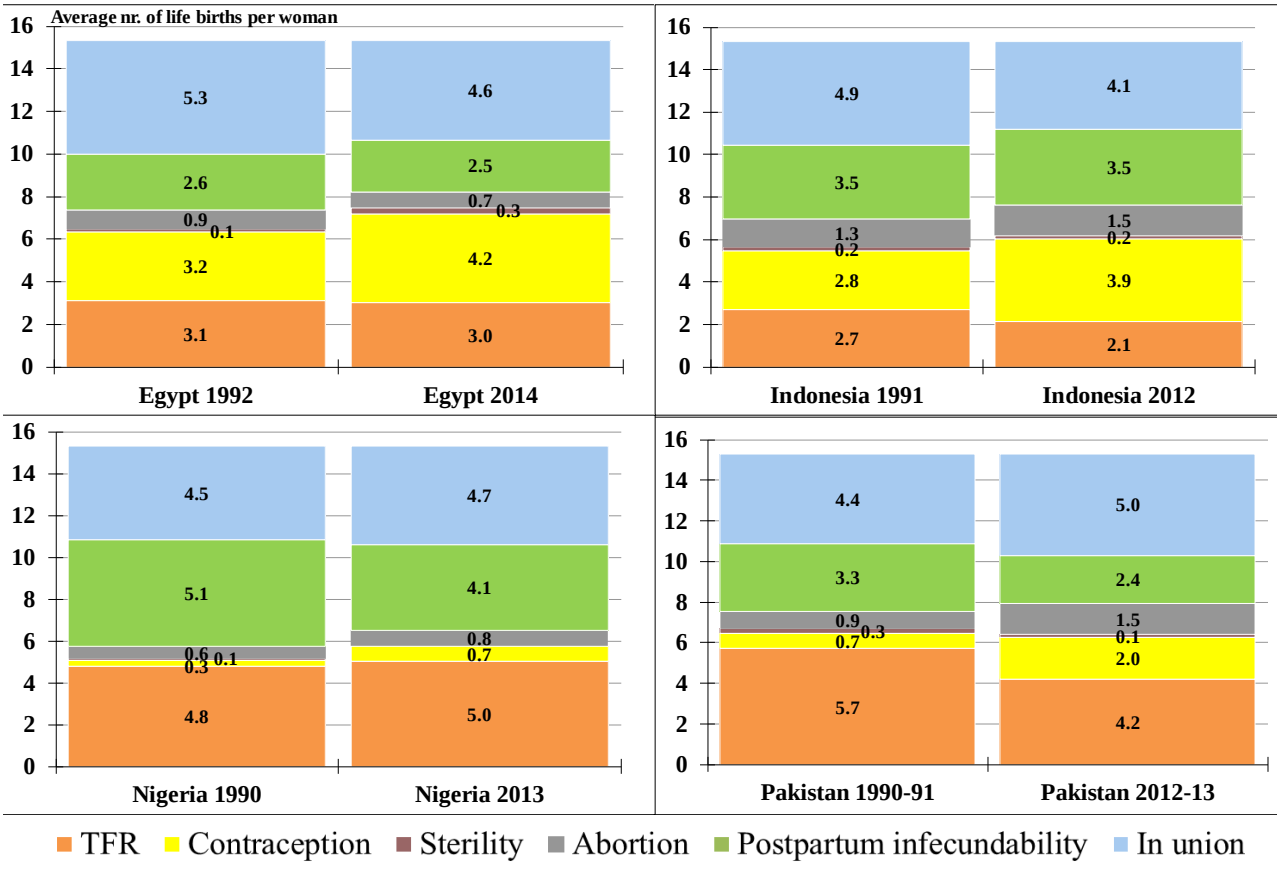
In Table 7, the PD of fertility indices for Egypt, Indonesia, Nigeria and Pakistan in the periods 1990-1995 and 2010-2015 are shown. The effects of all PD on the TFR in Egypt, Indonesia, Nigeria and Pakistan in 1990-1995 and 2010-2015 are displayed in Figure 6. As for Table 7, the symbols have the following meaning:

C_m *:* Index of proportion married
C_i *:* Index of postpartum infecundability
C_a *:* Index of abortion
C_p *:* Index of sterility
C_c *:* Index of contraception

Table 7 – PD of fertility indices

Proximate Determinants of Fertility Indices	C_m	C_i	C_a	C_p	C_c
Egypt					
1992	0.65	0.74	0.88	0.98	0.49
2014	0.70	0.77	0.91	0.96	0.42
Indonesia					
1991	0.68	0.67	0.81	0.97	0.49
2012	0.73	0.68	0.81	0.97	0.35
Nigeria					
1990	0.71	0.53	0.90	0.98	0.95
2013	0.69	0.61	0.88	1	0.87
Pakistan					
1990-91	0.71	0.69	0.89	0.96	0.88
2012-13	0.67	0.77	0.81	0.98	0.67

Fig. 6 – Effects of the PD on the TFR



Sources: Bongaarts, 2015; Central Bureau of Statistics, 1991a; El-Zanaty et al., 1993a; Federal Office of Statistics & Institute for Resource Development, 1992a; Ministry of Health and Population et al., 2015a; National Institute of Population Studies & ICF International, 2013a; National Institute of Population Studies & Institute for Resource Development, 1992a; National Population Commission and ICF International, 2014a; Statistics Indonesia et al., 2013a

Regarding research question 2, regarding the explanation of differences in fertility levels between study countries, Table 7 shows that, of all PD, contraceptive use PD had the largest influence on differences in the level of the TFR between the selected countries in 1990-1995 and 2010-2015. As can be derived from Table 7 and 8, high differences in contraceptive use (6-62%) and some differences in contraceptive effectiveness (72- 94%) lead to wide variations in C_c in the selected countries in 1990-1995 and 2010-2015 (C_c: 0.35-0.95).

Postpartum infecundability had the second-largest effect on variations in the fertility levels between the selected countries in 1990-1995 and 2010-2015 (C_i: 0.53-0.77). The period of postpartum infecundability differed a lot between the selected countries as the period of postpartum amenorrhea varied considerably - from 6.2 to 15.8 months - and the period of postpartum abstinence varied greatly, from 3.6 to 14.4 months (see Table 9).

Induced abortion had the third-most effect on differences in the fertility levels between the selected countries in the selected years (C_a: 0.81-0.91).

Marriage only explains a smaller part of the variations in the fertility level between the selected countries in 1990-1995 and 2010-2015, with a C_m ranging between 0.65-0.73.

The least part of the variation in the TFR between the selected countries in 1990-1995 and 2010-2015 is explained by pathological sterility (C_p: 0.96-1).

Differences in the fertility levels can thus be explained by the combined effects of the PD on the TFR (see Figure 6 and Table 7). In Nigeria, high estimated TFR levels of 4.8 in 1990 and 5.0 in 2013 as compared to the other selected countries are in particular explained by very low effects of contraception on the TFR compared to the other selected countries.

The estimated TFR levels in Pakistan were also high compared to the other countries: 5.7 in 1990-91 and 4.2 in 2012-13. This is primarily caused by quite a low effect of contraception on the TFRs and a somewhat low effect of postpartum infecundability on TFRs as compared to the other countries.

In Egypt, relatively low estimated TFR levels – i.e. 3.1 in 1992 and 3.0 in 2014 – can mostly be attributed to very high effects of contraception on the TFRs. However, in Egypt, postpartum infecundability had a low effect on the TFR levels on average compared to other selected countries.

The estimated TFR levels in Indonesia – that are, 2.7 in 1991 and 2.1 in 2012 - were the lowest of all selected countries. This was mainly the consequence of high effects of contraception and postpartum infecundability on the TFR levels as compared to other selected countries.

Table 8 – Percentage of currently married women age 15-49 using contraceptives and the average effectiveness of the contraceptives used

	Contraceptive use (%)	Contraceptive effectivenss (%)
Egypt		
1992	47	92
2014	59	94
Indonesia		
1991	50	86
2012	62	89
Nigeria		
1990	6	74
2013	15	72
Pakistan		
1990-91	12	83
2012-13	35	78

Source: Central Bureau of Statistics, 1991a; El-Zanaty et al., 1993a; Federal Office of Statistics & Institute for Resource Development, 1992a; Ministry of Health and Population et al., 2015a; National Institute of Population Studies & ICF International, 2013a; National Institute of Population Studies & Institute for Resource Development, 1992a; National Population Commission & ICF International, 2014a; Statistics Indonesia et al., 2013a; The Policy Project, 1997

Table 9 - Percentage of births in the three years preceding the survey for which mothers are postpartum amenorrheic, abstaining, and infecundable, by mean durations in months

	Postartum anenorrhea period (months)	Postartum abstinence period (months)	Postpartum infecundability period (months)
Egypt			
1992	8.2	3	8.7
2014	6.2	2.9	7.5
Indonesia			
1991	10.6	4.7	11.5
2012	8.6	6.1	10.8
Nigeria			
1990	15.8	14.4	19.3
2013	12.7	6.1	14.1
Pakistan			
1990-91	8.9	4.7	10.3
2012-13	6.5	3.6	7.5

Source: Central Bureau of Statistics, 1991a; El-Zanaty et al., 1993a; Federal Office of Statistics & Institute for Resource Development, 1992a; Ministry of Health and Population et al., 2015a; National Institute of Population Studies & ICF International, 2013a; National Institute of Population Studies & Institute for Resource Development, 1992a; National Population Commission & ICF International, 2014a; Statistics Indonesia et al., 2013a

Regarding the explanation of pace of change-differences in fertility between study-countries, Table 7 shows that between 1990-1995 and 2010-2015, pace of change-differences can to a large extent be attributed to changes in contraception (C_c changed by 0.07 to 0.21 between 1990-1995 and 2010-2015). In Table 8, it is demonstrated that these changes in contraception mainly consist of increases in contraceptive use among married women aged 15-49, contributing to a decrease in the TFR between the selected periods.

Variations in the pace of change of the TFR across the selected Muslim countries can to some extent be explained by changes of postpartum infecundability; C_i increased by 0.01-0.08. Thus, postpartum infecundability contributed to an increase in the TFR in all 4 countries between 1990-1995 and 2010-2015.

The index of induced abortion changed by 0.00 to 0.08 between 1990-1995 and 2010-2015, which implies that this factor contributed somewhat to differences in the pace of change in the estimated TFR between the selected countries. Whereas induced abortion contributed to an increase in the TFR in Egypt, induced abortion contributed a decrease in the TFR in Nigeria and Pakistan between 1990-1995 and 2010-2015. In Indonesia, the effect of induced abortion on the TFR was the same in Indonesia in both selected time-frames.

Marriage only contributed a little to variations in the pace of change in the estimated TFR across the selected countries between 1990-1995 and 2010-2015, as C_m changed by 0.02 to 0.05 between the selected years. An increase in the proportion of married women aged 15-49 in Egypt and Indonesia between 1990-1995 and 2010-2015, lead to an increase in the TFR levels. In Nigeria and in Pakistan, a decrease in the proportion of married women aged 15-49 contributed to an decrease in the TFR between the selected periods.

Differences in the pace of change in the TFR across the selected Muslim countries can to a minor extent be explained by pathological sterility, as the change in C_p was no more than 0.00-0.02 between 1990-1995 and 2010-2015. In Egypt, pathological sterility contributed to a downwards trend in the TFR between 1990-1995 and 2010-2015 and in Nigeria and in Pakistan, this effect on the TFR was vice versa.

The pace of change in the TFR in each selected country can be explained through comparing the aggregated effects of the PD on the TFR in 1990-1995 and in 2010-2015.

In Egypt, the pace of change in the estimated TFR between 1992 and 2014 was minor (est. change in the TFR: -0.1) even though contraception increased (see Figure 6 and Table 7). This is because changes in marriage, postpartum infecundability and induced abortion contributed to an increase in the TFR between 1992 and 2014. These factors more or less neutralized the effects of changes in contraceptive use and pathological sterility on the TFR.

In Indonesia, the estimated change in TFR was quite high (i.e. -0.6) between 1991 and 2012 due to a high increase in contraception, which contributed more to a change in the TFR than changes in marriage and postpartum infecundability together (changes in contraception contributed to a decline in the TFR between 1991 and 2012 while changes in marriage and postpartum infecundability caused an increase in the TFR between 1991 and 2012). Both induced

abortion and pathological sterility did not show a change in the effect on the TFR in Indonesia between 1991 and 2012.

In Pakistan, the estimated TFR declined a lot (est. change in TFR: -1.5) between 1990-91 and 2012-13 because of high changes in contraception and some changes in marriage and induced abortion which all contributed to a decline in the TFR between 1990-91 and 2012-13. Postpartum infecundability and pathological sterility only contributed to some increase in the TFR in Pakistan between 1990-91 and 2012-13.

In Nigeria, the estimated TFR even increased a little bit between 1990 and 2013 (est. change in TFR: +0.2) as a consequence of a high decrease in the period of postpartum infecundability and a small decrease in pathological sterility. Changes in marriage, induced abortion and contraception contributed only to some more decrease in the TFR between 1990 and 2013.

4.2.2 Underlying factors of fertility

4.2.2.1 Socio-economic factors

- **Education**

In this subsection I examine how educational attainment impinges on each of the PD. Table 10 shows the average years of education of women of reproductive age in the selected countries in 1990-1995 and 2010-2015. In line with Cleland's findings (2002), a positive relationship between the years of schooling of females aged 15-49 and contraceptive prevalence in the selected countries is mainly observed[8] (see Table 8 and 10). Differences in contraceptive prevalence between the selected countries may thus be explained by women's years of education. However, a higher contraceptive prevalence in Pakistan compared to Nigeria cannot be attributed to women's years of education.

Table 10 - Average years of education of women aged 15-49

Egypt	
1992	5.5
2014	8.6
Indonesia	
1991	5.7
2012	8.9
Nigeria	
1990	3.2
2013	6.1
Pakistan	
1990-91	2.3
2012-13	4.5

Source: Central Bureau of Statistics, 1991a; El-Zanaty et al., 1993a; Federal Office of Statistics & Institute for Resource Development, 1992a; Ministry of Health and Population et al., 2015a; National Institute of Population Studies & ICF International, 2013a; National Institute of Population Studies & Institute for Resource Development, 1992a; National Population Commission & ICF International, 2014a; Statistics Indonesia et al., 2013a

Somewhat surprisingly, differences in postpartum infecundability and induced abortion between the selected countries in 1990-1995 and 2010-2015 cannot be explained by (solely) women's education, as neither a negative association between the years of schooling of women and the period of postpartum infecundability, nor a positive relationship between the years of schooling of females and can be found (Cleland, 2002) (see Table 7 and 10).

Furthermore, a positive relationship between the average years of women's schooling and the age at first marriage

[8] The findings in section 4.2.2 are not based on a regression analysis, but on the observed associations between the data shown in the Tables and Figures in this chapter.

among ever married women aged 25-49 is to some extent observed in the selected countries in 1990-1995 and in 2010-2015. Thus, women's years of education may to some extent explain the observed variations in the age at first marriage between the selected countries (Cleland, 2002). Contrary to the assumption of Shapiro and Gebreselassie (2014), the findings do not show a negative relationship between the age at first marriage and the proportion of married women aged 15-49 in the 4 Muslim countries (see Table 7 and 11).

Educational attainment also seems to have an influence on differences in the pace of changes in contraceptive use practices between Egypt, Indonesia and Nigeria between 1990-1995 and 2010-2015, and this corresponds to Cleland's findings (2002) (see also Table 8 and 10). However, remarkable increases in contraceptive use are observed in Pakistan, whereas the years of education increased the least as compared to the other countries between 1990-1995 and 2010-2015. Factors other than women's years of education probably provide a better insight in this strikingly high increase contraceptive prevalence in Pakistan.

I find that educational attainment does not contribute to the explanation of differences in postpartum infecundability and the age at first marriage between the four countries between 1990-1995 and 2010-2015, as relationships corresponding to Cleland's findings (2002), have not been observed (see Table 7, 10 and 11).

Furthermore, differences in the pace of changes in induced abortion between the 4 Muslim countries between 1990-1995 and 2010-2015 do not seem to be explained by women's years of schooling, since an increase in the average years of women's education only lead to a minor increase in induced abortion in Egypt (Cleland, 2002).

Table 11 - Age at first marriage among ever-married women aged 25-49

Egypt	
1992	19.2
2014	20.8
Indonesia	
1991	17.7
2012	20.1
Nigeria	
1990	16.9
2013	18.1
Pakistan	
1990-91	18.9
2012-13	19.5

Source: Central Bureau of Statistics, 1991a; El-Zanaty et al., 1993a; Federal Office of Statistics & Institute for Resource Development, 1992a; Ministry of Health and Population et al., 2015a; National Institute of Population Studies & ICF International, 2013a; National Institute of Population Studies & Institute for Resource Development, 1992a; National Population Commission & ICF International, 2014a; Statistics Indonesia et al., 2013a

- **Income**

Below, I examine the effects of income on the PD. In Table 12, the income distribution and the participation of females and males in the labor force in the selected countries are presented.

Table 12 – Income distribution and labor force participation

	GNI per capita (PPP) in $	GINI index	Poverty headcount ratio at $1.90 a day (2011 PPP) (% of population)	Labor force participation rate, male (% of male population ages +15)	Labor force participation rate, female (% of female population ages 15+)
Egypt					
1992	4,120	NA	NA	71	22
2014	10,330	31 (2013)	NA	76	24
Indonesia					
1991	3,090	NA	57 (1990)	81	49
2012	9,190	40 (2013)	12 (2009)	84	51
Nigeria					
1990	1,770	45 (1992)	57 (1992)	75	39
2013	5,360	43 (2009)	53 (2009)	64	48
Pakistan					
1990-91	1,775	33 (1990)	59 (1990)	84	14
2012-13	4,780	31 (2013)	6 (2013)	83	24

Source: World Bank, 2017b, 2017c, 2017d, 2017e, 2017f

Findings in Table 8 and 12 reveal that differences in the GNI per capita (PPP) may have contributed somewhat to variations in contraceptive use between the 4 Muslim countries in 1990-1995 and in 2010-2015, since the GNI per capita (PPP) and contraceptive prevalence show a negative relationship in general in the selected countries and periods (Agha, 2000; Amin et al., 1995; Gakidou & Vayena, 2007; Gertler & Molyneaux, 1994). However, it is remarkable that contraceptive use is much lower in Nigeria than in Pakistan, whereas the GNI per capita (PPP) is a bit higher in Nigeria than in Pakistan. The much more skewed distribution of earnings in Nigeria compared to Pakistan might be one of the reasons behind the lower contraceptive prevalence in Nigeria than in Pakistan. Besides, contraceptive prevalence appeared to be lower in Pakistan in 2012-13 than in Egypt in 1992 and in Indonesia in 1991, even though the GNI per capita (PPP) was the highest in Pakistan of these 3 countries. This finding might be explained by a lower autonomy of women and less knowledge among females about contraceptives in Pakistan in 2012-13 as compared to Egypt in 1992 and Indonesia in 1991: (1) females aged 15 and over participated less in the labor force in Pakistan in 2012-13 as compared to females in Indonesia in 1991; and (2) Pakistani women aged 15-49 had less years of schooling on average in 2012-13 compared to women aged 15-49 in Egypt in 1992 and in Indonesia in 1991(see Table 10 and 12). These reasons might also clarify why a lower contraceptive prevalence is found in Egypt than in Indonesia, despite the higher GNI per capita (PPP) in Egypt than in Indonesia in 1990-1995 and 2010-2015.

Between 1990-1995 and 2010-2015, I find that the faster the GNI per capita (PPP) increased, the faster contraceptive prevalence increased in the selected countries except from Pakistan (see

Table 8 and 12). Variations in the pace of increase in contraceptive use between the 4 Muslim countries may therefore be explained by the GNI per capita (PPP) (Agha, 2000; Amin et al., 1995; Gakidou & Vayena, 2007; Gertler & Molyneaux, 1994). Perhaps, the remarkable increase in contraceptive use in Pakistan might to some extent be explained by a very fast decrease of the proportion of the population living below the poverty line.

4.2.2.2 Cultural factors

In this subsection, I describe the influences of tradition and religion on each of the PD respectively, thereby making use of Table 13. Table 13 presents (cultural) reasons for not intending to use contraceptives in the future among married women of reproductive age who do not use contraceptives in 1990-1995. Each respondent could cite no more than 1 reason. Of all married women aged 15-49 who do not use contraceptives, high percentages mentioned that they do not intend to use contraceptives in the future, being 46.2% in Egypt, 51.4% in Indonesia, 68.2% in Nigeria and 71.4% in Pakistan.

Table 13 - Reasons that married women aged 15-49, who do not use contraceptives, do not intend to use a contraceptive method in the future

	Egypt 1992	Indonesia 1991	Nigeria 1990	Pakistan 1990-91
wants children	19.8	21.1	44.7	35.8
lack of knowledge	0.4	7.7	13.0	12.0
partner opposed	4.0	6.2	2.8	7.4
cost too much	0.1	0.7	0.4	0.7
side effects / health concerns	13.1	11.5	4.1	5.1
hard to get methods	0.1	0.3	0.6	1.0
religion / fatalistic	11.7	5.2	19.0	18.9
opposed to FP	0.3	2.7	4.2	1.9
other people opposed	0.2	1.1	0.4	0.2
infrequent sex	8.3	3.5	1.0	1.0
difficult to get pregnant / menopausal	39.7	26.2	7.8	13.7
other	2.4	13.7	2.1	2.4

Source: Central Bureau of Statistics, 1991b; El-Zanaty et al., 1993b; Federal Office of Statistics & Institute for Resource Development, 1992b; National Institute of Population Studies & Institute for Resource Development, 1992b

- **Tradition**

From Table 13, it can be derived that partner opposition to contraceptives was one of the reasons for married women aged 15-49 not to use contraceptives now and in the future in the selected countries in 1990-1995. Of all married women aged 15-49, 1.0%, 1.6%, 1.8% and 4.6%[9] cited 'partner opposition' as a reason for not using contraceptives today and in the future in respectively Egypt, Indonesia, Nigeria and Pakistan. Variations in contraceptive prevalence between 4 Muslim countries are thus to some extent attributable to partner opposition in 1990-1995, and perhaps in 2010-2015 as well.

Table 13 furthermore shows that in 1990-1995, the desire for children - which could be related to difficulties to get pregnant - was often cited as a reason to use no contraceptives in the future. Due to possible relationships with other reasons and a lack of data for 2010-2015, it is not known how the desire for children may have contributed to differences in contraception between the 4 Muslim countries in/between 1990-1995 and 2010-2015. The desire for children appears to be positively influenced by son preference in Egypt, Nigeria and Pakistan (El-Zeini, 2008; Isiugo-Abanihe, 1994; Nag, 1991). Probably consequently, less women (intend to) use contraceptives in these countries. Surprisingly, daughters are slightly preferred over sons among women aged 15-49 in Indonesia despite patriarchal structures (Nilan & Demartoto, 2012). Gender preference may therefore not have resulted in a lower contraceptive usage in Indonesia (Fuse, 2010).

Partner opposition towards contraception might have decreased in all 4 Muslim countries between 1990-1995 and 2010-2015, because (1) the socio-economic position of women improved, which may have lead to more autonomy for women in making family planning decisions; (2) men may have shown more interests in contraceptives due to the increasing costs of having children (Kamran et al., 2014); and (3) measures are taken to involve men in reproductive health programs in Egypt and Indonesia from the 1990s onwards (CATALIST Consortium, 2000; UNFPA, 2015; Reproductive Health Promotion Working Group, 2004). Subsequently, contraceptive prevalence may have increased somewhat in all selected countries, although the pace of increase in contraceptive prevalence as a consequence of changes in the opposition of partners towards contraceptives in each selected country is unknown.

- **Religion**

Table 13 reveals that differences in religious views towards contraception between the selected countries lead to some differences in contraceptive use between the 4 Muslim countries in 1990-1995, and perhaps in 2010-2015 as well. Especially in Nigeria and Pakistan in 1990-1995, religion was mentioned as a reason for not intending to use contraceptives now and in the future; this reason was cited by 12.2% and 11.9% of all married women of reproductive age respectively.

[9] These percentages are calculated with data presented in Table 8, Table 12 and just above Table 12

In Egypt and Indonesia, only 2.9% and 1.3% of the married women aged 15-49[10] reported that they do not intend to use contraceptives now and in the future because of their religious beliefs.

Table 14 - Percentage of married women aged 15-49 in a polygynous union

Egypt	
1992	NA
2014	2.6
Indonesia	
1991	NA
2012	NA
Nigeria	
1990	40.9
2013	32.5
Pakistan	
1990-91	4.5
2012-13	3.7

Source: Central Bureau of Statistics, 1991a; El-Zanaty et al., 1993a; Federal Office of Statistics & Institute for Resource Development, 1992a; Ministry of Health and Population et al., 2015a; National Institute of Population Studies & ICF International, 2013a; National Institute of Population Studies & Institute for Resource Development, 1992a; National Population Commission & ICF International, 2014a; Statistics Indonesia et al., 2013a

High estimated induced abortion rates in all 4 Muslim countries, in particular in Indonesia in 1991 and 2012 and in Pakistan in 2012-13 (see Table 7), do not seem to be well explained by Islam, since abortions laws which are based on this religion are highly restrictive (Guttmacher Institute, 2015a, 2015b; Hessini, 2007; Sedgh & Ball, 2008). Reasons for a higher level of induced abortion in Indonesia and Pakistan compared to Nigeria and Egypt might among others be (1) a higher unmet need for contraceptives in Pakistan than in Egypt, Indonesia and Nigeria (see Table 16) and (2) a possible higher rate of unsafe premarital sex and more acceptance of induced abortions in Indonesia compared to the other selected countries (Amazigo et al., 1997; Omo-Aghoja et al., 2009; Situmorang, 2003; World Bank, 2017e, 2017h).

Table 7 and 14[11] clarify that differences in pathological sterility between the selected countries can probably not be explained by the incidence of polygyny (which is allowed in Islam) in 1990-1995 and in 2010-2015, as the incidence of polygyny is not positively related to the proportion of women aged 15-49 who are pathological sterile in the selected countries in 1990-1995 and 2010-2015 (Larsen, 1995).

Between 1990-1995 and 2010-2015, changing attitudes of religious leaders have been one of the most important reasons for a rise in contraceptive use in Nigeria (Costa, 2009; IRIN, 2011). In Pakistan, on the other hand, religious opposition towards contraceptives may have increased as a consequence of rising religious conservatism and extremism and Shia-Sunni conflicts (Ahmad et al., 2006; Varley, 2012). In Egypt and Indonesia, the combination of Westernization and the "resurgence of radical fundamentalist thought and politics" may have lead to minor changes in the religious views towards contraceptive use (Moussa, 2011, p.253; Utomo & McDonald, 2009). Variations in the pace of change in contraceptive prevalence between the selected countries might thus to some extent be explained by changes in religious views towards contraception.

Differences in the pace of change in induced abortion between the selected countries and periods cannot be explained by religion. Other factors, such as a presumed increase in premarital sex in all 4 countries, Westernization in Indonesia and Egypt which has made abortion less of a

[10] See footnote 9

[11] In Indonesia, the percentage of currently married women who are in a polygynous union has always been low and the percentage of currently married men who are in a polygynous union in 2012 was 0.7% (McNicoll, 2011; Statistics Indonesia et al., 2013a).

taboo, and changes in the proportion of married women aged 15-49 with unwanted births – which especially reduced in Egypt and in Indonesia (see Table 15) – might have lead to differences in the pace of change in induced abortions between 1990-1995 and 2010-2015 (Amazigo et al., 1997; Bankole et al., 1998; Fischer & Seidman, 2016; Haider, 2016; Omo-Aghoja et al., 2009; Shalaby, 2013; Situmorang, 2003).

Findings in Table 7 and 14 suggest that declines in pathological sterility in Nigeria and Pakistan between 1990-1995 and 2010-2015 might be explained by the reduction of proportion of women in polygynous unions (Larsen, 1995). For Egypt and Indonesia, it is not known whether changes in polygynous unions might have contributed to changes in pathological sterility.

Furthermore, religion seems to explain to some extent the low socio-economic position of women compared to men and compared to most Western countries in all 4 Muslim countries in 1990-1995 and 2010-2015 (World Bank, 2017e; World Bank, 2017f; World Bank, 2017g). Their role in the domestic sphere - as mentioned in the Qu'ran – can hardly, if at all, be combined with work in the workforce in the selected countries (Begum Sadaquat, 2011; El-Naggar, 2010; Tri, 2013; World Bank, 2015).

The results in this subsection clarify that cultural factors have a decisive impact on contraceptive use in the selected countries, both directly, but also indirectly through influencing the socio-economic and political factors of fertility. Cultural factors might also have an impact on induced abortion in all 4 countries. It is therefore concluded that cultural factors can be seen as the most important factors of fertility in the selected countries.

Table 15 – Percent distribution of unwanted births to women age 15-49 in the five years preceding the survey (including current pregnancies)

	Wanted children later (%)	Wanted no more children (%)
Egypt		
1992	9.0	25.9
2014	7.4	8.3
Indonesia		
1991	15.8	6.5
2012	6.5	7.1
Nigeria		
1990	8.1	2.3
2013	6.6	1.7
Pakistan		
1990-91	8.4	13.0
2012-13	7.1	7.1

Source: Central Bureau of Statistics, 1991a; El-Zanaty et al., 1993a; Federal Office of Statistics & Institute for Resource Development, 1992a; Ministry of Health and Population et al., 2015a; National Institute of Population Studies & ICF International, 2013a; National Institute of Population Studies & Institute for Resource Development, 1992a; National Population Commission & ICF International, 2014a; Statistics Indonesia et al., 2013a

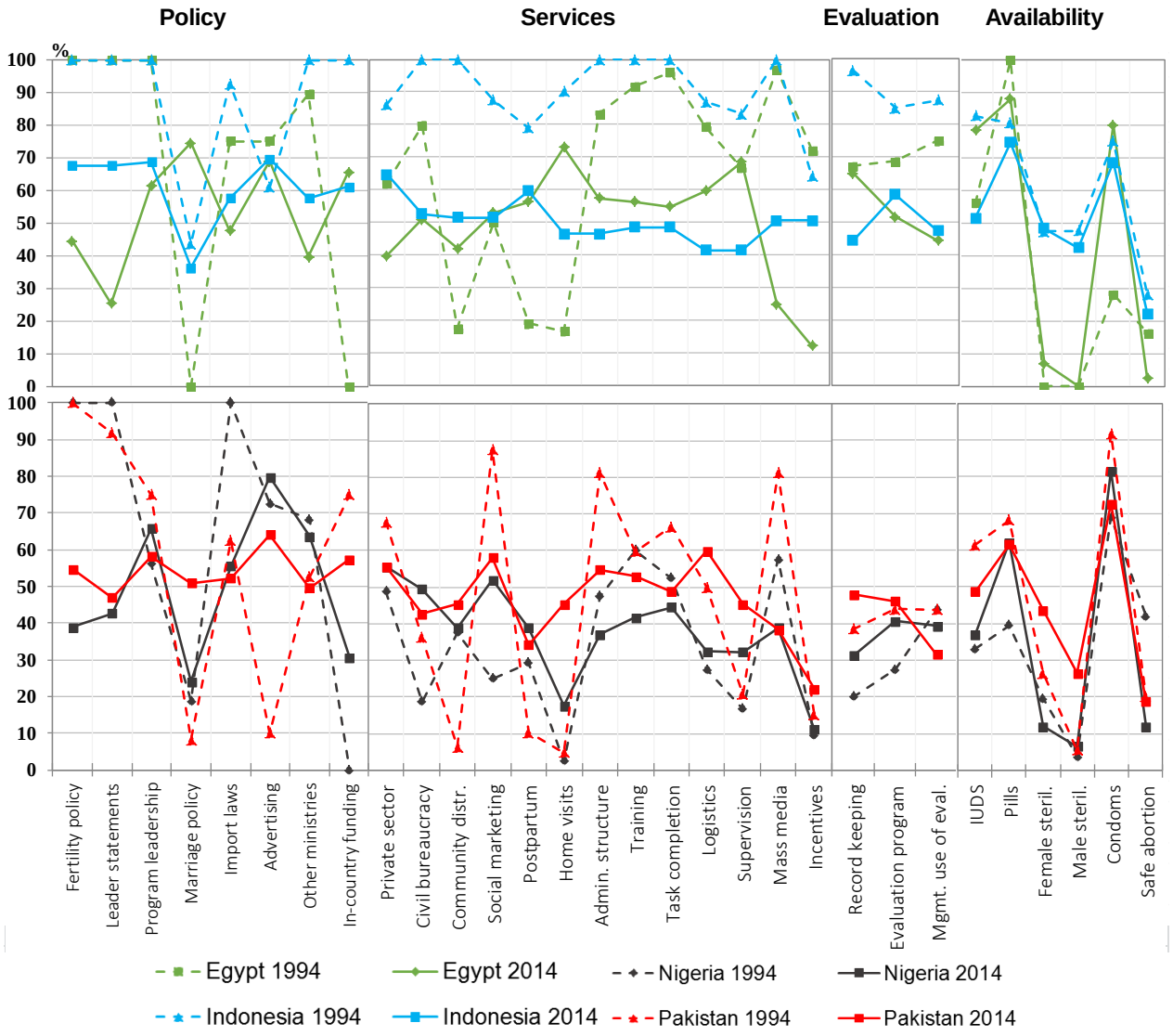
4.2.2.3 Political factors

- **Family planning policies and programs**

In this subsection, I examine the relationships between the family planning program and the PD of fertility, based the family planning program effort scores for Egypt, Indonesia, Nigeria and Pakistan in 1994 and 2014 (see Figure 7).

Figure 7, combined with Table 8, reveal a positive relationship between the average family planning program effort scores and contraceptive prevalence in the selected countries in 1990-1995 and 2010-2015. This observed association may be in accordance with the findings of Cleland et al. (2006) and Tsui et al. (2011), implying that differences in family planning policy and program efforts between the 4 Muslim countries may have contributed to variations in contraceptive prevalence between the selected countries. The countries with the highest family planning effort scores in 1990-1995 and 2010-2015 – i.e. Indonesia and Egypt - also had the lowest unmet need for contraceptives among married women ages 15-49 and this could be the result of family planning policies and programs that better meet the demand for contraceptives in Egypt and Indonesia compared to Nigeria and Pakistan (see Table 16). However, it is difficult to assess the impact of family planning policies and programs on an increase in contraceptive use, as successful family planning programs can also generate feelings of an unmet demand for contraceptive use and socio-economic and cultural factors also have an influence on contraceptive prevalence (Kesterton & De Mello, 2010).

Fig. 7 – Family planning program effort scores



Source: Track 20 & Avenir Health, 2017

Interestingly, findings show that declines in the overall family planning effort scores in Egypt, Indonesia and Nigeria between 1990-1995 and 2010-2015 did not lead to a decrease in contraceptive prevalence in these countries. In Pakistan, this score remained at the same level (see Figure 7). These outcomes do not seem to be in accordance with the findings of Cleland et al. (2006) and Tsui et al. (2011). Plausible explanations might be that (1) knowledge about family planning among women aged 15-49 increased throughout the last decades, e.g. due to schooling (see Table 10) and information provided by others; (2) the availability of a variety of contraceptive methods – which probably increased in all countries except from Indonesia (see Figure 7) – is a more decisive factor in order to increase contraceptive use than family planning policies, services and evaluations (Freedman & Freedman, 1992; Jain, 1989; Philips et al., 1988);

and (3) socio-economic progress and cultural changes had more impact on contraceptive prevalence than changes in family planning policies and programs between 1994 and 2014.

Table 16 – Unmet need for contraceptives among married women aged 15-49

	Unmet need for contraceptives (%)
Egypt	
1992	20.1
2014	12.6
Indonesia	
1991	17.0
2012	11.4
Nigeria	
1990	20.8
2013	16.1
Pakistan	
1990-91	28.0
2012-13	20.1

Source: Central Bureau of Statistics, 1991a; El-Zanaty et al., 1993a; Federal Office of Statistics & Institute for Resource Development, 1992a; Ministry of Health and Population et al., 2015a; National Institute of Population Studies & ICF International, 2013a; National Institute of Population Studies & Institute for Resource Development, 1992a; National Population Commission & ICF International, 2014a; Statistics Indonesia et al., 2013a

4.3 The future of fertility in the selected Muslim countries

Regarding my third research question, findings demonstrate that a TFR at replacement level – as the UN projects for all countries - is difficult, if not impossible, to reach in all 4 Muslim countries due to multiple decisive cultural factors that limit a decline in the TFR and which are probably very difficult to change through taking measures[12]. These cultural factors are: (1) patriarchal social structures and religious interpretations about the role of women that put constraints on the socio-economic possibilities of women and on their power to make their own decisions regarding family planning; and (2) (a growing) Muslim conservatism and extremism which is among others reflected in a lack of priority given to the family planning program in Egypt and in (more) negative religious interpretations about contraceptive use and abortion (Fahim, 2013; Kingsley, 2014). Other major obstacles to socio-economic progress and to family planning program improvements may also limit a fertility decline in the future, i.e. corruption and negligence of natural resources in Nigeria, political unrest in Pakistan, weak governance, a lack of funding for the family planning program and a lack of access to family planning methods in all selected countries, as well as a poor understanding of the side effects of contraceptive use in all 4 Muslim countries (Agbiboa, 2012; Ahrari, 2000; Fahim, 2013; Herarti, 2008; Federal Government of Nigeria, 2014; Hull & Mosley, 2009; Kingsley, 2014; Sathar & Zaidi, 2010; Sodipe &

[12] For sources, see section 4.2. Sources are only mentioned in section 4.3 when new information – which is not provided in section 4.2 – is given.

Ogunrinola, 2011). Nevertheless, measures may more easily be taken to reduce or overcome these barriers as compared to the previously mentioned cultural barriers.

Yet, there are also trends observed in the underlying factors of fertility which may be seen as opportunities to achieve a lower TFR in the selected Muslim countries in case these trends continue in the future. These are the following trends: (1) Westernization in Egypt and Indonesia, which may lead to more positive ideas about contraceptive use, abortion, premarital sex and equal gender roles; (2) a higher school attendance and labor force participation of women which may empower women to further increase the socio-economic status of female children; and (3) a higher income per capita, which makes it more expensive to have a high number of children. Furthermore, there is a high unmet need for family planning among married women aged 15-49 in the selected countries in 2010-2015. This unmet need for family planning indicates that contraceptive use may increase somewhat when the supply of family planning commodities meets the unmet demand. However, meeting the current unmet need for family planning services may only reduce the TFR to a level of 2.1 in Indonesia, assuming that the TF is 15.3.

As a consequence of all barriers to a further TFR decline in the selected countries – of which some may be very difficult to overcome – and some opportunities for a decline in the TFR, the UN uncertainty intervals for the TFR for Egypt, Indonesia, Nigeria and Pakistan may need to expand to anticipate on these uncertainties.

5. Conclusions and discussion

5.1 Conclusions

The general question of my research is: *'What are plausible explanations for the differences in the (1) level and (2) pace of change of the Total Fertility Rate between the selected Muslim countries and (3) what are the implications of these findings for the population projections of the selected Muslim countries?'.* An answer to this question is relevant, as differences between Muslim countries regarding level and pace of change-differences are not well understood. Furthermore, an answer to this question is important to the formulation of fertility assumptions for population projections as often the assumption is made that fertility change in Muslim countries will follow the same evolutionary trajectory as in western countries, eventually leading to replacement-level fertility or lower. However, as I demonstrate, Muslim countries differ to a great extent from each other (e.g. culturally, socio-economically and politically) and it may therefore be questioned whether and, if so, when replacement-level fertility will ever be reached in Muslim countries in the future. The selected Muslim countries for this study are Egypt, Indonesia, Nigeria and Pakistan and the selected period is between 1990-1995 and 2010-2015. The selection of these countries and periods is based on available data, population size and differences in the pace of fertility change and the fertility level.

Findings on the first research question demonstrate that the TFR in Nigeria has remained a high level of 6 children without signs of change between 1990-1995 and 2010-2015. In Pakistan, the TFR was high and showed the most decrease of all selected countries; from 5.6 in 1990-1995 to 3.2 in 2010-2015. In Egypt and in Indonesia, the TFR was already lower compared to Nigeria and Pakistan in 1990-1995. In Egypt, the TFR declined quite fast; from 3.9 in 1990-1995 to 2.9 in 2010-2015. In Indonesia, the TFR did not show much change, since the TFR was 2.9 in 1990-1995 and 2.4 in 2010-2015. The pace of change and level of the TFR between the 4 Muslim countries thus differ greatly from each other. Yet, one remarkable similarity is observed, that is, none of these countries have reached a TFR at replacement level.

The second sub-question was researched by examining the effects of the PD on the TFR and by examining the effects of the underlying socio-economic, cultural and political factors on the PD of fertility. Of all PD, differences in the level and pace of change of fertility between the selected countries and periods can mostly be attributed to contraceptive use differences, followed by, respectively, differences in postpartum infecundability, abortion practices, proportion of married women and prevalence of pathological sterility (pathological sterility had a negligibly small impact on the TFR). Patterns and levels of contraceptive use among married women aged 15-49 in the selected countries and periods may among others be explained by women's average years of education and the GNI per capita (PPP adjusted), and might be explained by the distribution of earnings in the population and the labor force participation rate of females as well. Besides, differences in religious opposition towards contraceptive use and the opposition of husbands towards contraceptives between the selected countries may have contributed to variations in

contraceptive use in 1990-1995 and 2010-2015. Family planning program efforts may also explain variations in the percentage of contraceptive prevalence among married women of reproductive age between the selected countries in the selected period, although it is unsure whether family planning efforts also had an influence on changes in contraceptive use in each selected country between 1990-1995 and 2010-2015. The research findings do not explain variations in the levels and patterns in induced abortions, marriage, pathological sterility and postpartum infecundability between the selected countries and periods (well). The research findings thus reveal that a combination of cultural factors (tradition and religion), socio-economic factors (education and income) and political factors (family planning programs and policies) plausibly affected both the fertility level and pace of change across the selected Muslim countries.

Regarding the third sub-question, I conclude that the TFR will not necessarily reach a level of 2.1 or below in all selected countries – as the UN projects – since cultural determinants of fertility are pervasive in the sense that they are firm barriers to fertility decline. Conventional family planning and population policy measures and measures to improve the social and economic conditions may not enable populations in these Muslim countries to adopt smaller family size norms and reduce numbers of offspring to replacement level.

5.2 Discussion

This study focuses on the relationships between fertility and the PD of fertility, as well as on associations between the PD of fertility and a broad spectrum of indirect determinants of fertility (socio-economic, cultural and political determinants) in Muslim countries. Taking into account a broad spectrum of indirect determinants of fertility makes it more plausible to find satisfactory explanations for the observed fertility patterns, which is needed as "there seem to be many roads to lower fertility" (De Bruijn, 2006, p.553). A link between the factors explaining the fertility patterns in the selected Muslim countries and the future TFR is also made in this study. Usually, population projections are based on a statistical approach, without taking into account behavioral factors which are correlated to the fertility level (Alkema et al., 2011; O'Neill et al., 2001). My approach gives more insight in the mechanisms behind (future) fertility, and subsequently, in possible future fertility patterns in the selected countries which do not seem to be as straight forward as the UN and other institutions project through making use of statistical procedures.

There are several limitations to this study. First, the culture and the economic and political situation in selected country Nigeria is very diverse (Moore, 2016). As a consequence, the research findings for Nigeria may not always be fully representative for the situation for the Muslim part of Nigeria. Second, not all underlying factors of fertility could be mentioned in the theoretical framework as there are too many. Yet, the underlying factors of fertility which are not included in this study may also have an important influence on fertility in the selected countries. Third, the estimated total abortion rates in the selected countries may not be very accurate. The

scores on two indicators of possibly induced abortions[13] show trends which correspond to the calculated trends in the total abortion rates in Egypt, Indonesia and Nigeria between 1990-1995 and 2010-2015. Based on these indicators, more certainty about the trends in the estimated total abortion rates in 3 out of 4 selected countries is given, but the full picture is not provided. Fourth, the calculated TFR with Bongaarts' PD model sometimes differ quite a lot from the estimated TFR by the UN. These differences may be due to inaccurate estimations of the TF, induced abortions and contraceptive effectiveness and to under- or overestimations of the TFR by the UN among others. Fifth, the reasons behind the scores on the effectiveness of contraceptives are not researched. It is important to understand trends in this aspect as well in order to get a better insight in possible future fertility trends. Furthermore, the relative impact of the indirect determinants on the PD of fertility is not determined and subsequently, it is difficult to understand which measures are needed the most in order to further reduce the TFR in the selected countries in the future. Finally, due to a lack of comparable quantitative and qualitative data on the underlying cultural factors of fertility, it is not exactly clear how trends in these cultural factors have developed in the selected countries from 1990-1995 onwards.

For future research, it is recommended to search for explanations for the observed levels and patterns in postpartum infecundability, induced abortion and marriage in the selected countries in the selected years, as the contribution of (some) of these factors to fertility differences between the selected Muslim countries is quite large. For a deeper insight in the impact of the underlying factors of fertility on the TFR in the selected countries, focus-group discussions and in-depth interviews are advised to be conducted in these countries (Babbie, 2013). Other Muslim countries may be taken into account in further research as well. In this way, variations in fertility across Muslim countries can be better understood.

To conclude, the following policy recommendations are made to possibly come closer to a TFR at replacement level in all 4 Muslim countries. First of all, it is recommended to make education for (female) children compulsory by law and free of charge, as female education is a means to empower them. For a better understanding of family planning, courses about the use and side effects of family planning methods are recommended to be incorporated in school curricula. A second recommendation is to change the desire for large families and the preference for sons over daughters – which contributes to high fertility rates - through emphasizing the advantages of small families and the value of daughters, bottom-up as well as top-down. Third, it is advised to increase the legal age at marriage in all areas of the 4 Muslim countries to 18, so that women can finish high school and have more of a say regarding family planning. Finally, it is recommended to improve the quality of family planning programs, by increasing the availability of various contraceptive methods, reducing the price of contraceptives, and providing information to both women and men about contraceptive methods.

[13] These indicators include the percent distribution of unwanted births to women age 15-49 in the 5 years preceding the survey (including current pregnancies) and the unmet need for family planning services among currently married women age 15-49 (Sing et al., 2010; World Health Organization, 1996)

References

Abadian, S. (1996). Women's autonomy and its impact on fertility. *World development*, *24*(12), 1793-1809.

Adsera, A. (2006). Marital fertility and religion in Spain, 1985 and 1999. *Population Studies*, *60*(2), 205-221.

Adongo, P.B., Phillips, J.F., & Binka, F.N. (1998). The influence of traditional religion on fertility regulation among the Kassena-Nankana of northern Ghana. *Studies in Family Planning*, *29*(1), 23-40.

Agbiboa, D.E. (2012). Between corruption and development: The political economy of state robbery in Nigeria. *Journal of business ethics*, *108*(3), 325-345.

Agha, S. (2000). Is low income a constraint to contraceptive use among the Pakistani poor?. *Journal of Biosocial Science*, *32*(02), 161-175.

Ahmad, F., Hanif, M., & Zafar, M.I. (2006). Attitude of religious leaders (Imam masjid) towards family planning. *Journal of Agriculture and Social Sciences (Pakistan)*.

Ahrari, M.E. (2000). China, Pakistan, and the" Taliban Syndrome". *Asian Survey*, *40*(4), 658-671.

Ainsworth, M., Beegle, K., & Nyamete, A. (1996). The impact of women's schooling on fertility and contraceptive use: A study of fourteen sub-Saharan African countries. *The World Bank Economic Review*, *10*(1), 85-122.

Ali, K.A. (2002). *Planning the family in Egypt: New bodies, new selves* (Vol. 21). University of Texas Press.

Alkema, L., Raftery, A.E., Gerland, P., Clark, S.J., Pelletier, F., Buettner, T., & Heilig, G.K. (2011). Probabilistic projections of the total fertility rate for all countries. *Demography*, *48*(3), 815-839.

Aluko, S.A. (1965). How many Nigerians? an analysis of Nigeria's Census problems, 1901–63. *The Journal of Modern African Studies*, *3*(03), 371-392.

Amazigo, U., Silva, N., Kaufman, J., & Obikeze, D.S. (1997). Sexual activity and contraceptive knowledge and use among in-school adolescents in Nigeria. *International Family Planning Perspectives*, 28-33.

Amin, R., Hill, R.B., & Li, Y. (1995). Poor women's participation in credit-based self-employment: the impact on their empowerment, fertility, contraceptive use, and fertility desire in rural Bangladesh. *The Pakistan Development Review*, 93-119.

Amin, S., & Lloyd, C.B. (1998). *Women's lives and rapid fertility decline: Some lessons from Bangladesh and Egypt* (Vol. 117). New York: Population Council.

Arnold, F. (1997). *Gender preferences for children.* No.23. Calverton: Demographic and Health Surveys Comparative Studies.

Babbie, E. (2013). *The Practice of Social Research.* Boston: Wadsworth Cengage Learning.

Baden, S. (1992). *The position of women in Islamic countries: possibilities, constraints and strategies for change*. University of Sussex. IDS.

Bankole, A., Singh, S., & Haas, T. (1998). Reasons why women have induced abortions: evidence from 27 countries. *International Family Planning Perspectives*, 117-152.

Bankole, A., & Singh, S. (1998). Couples' fertility and contraceptive decision-making in developing countries: hearing the man's voice. *International family planning perspectives*, 15-24.

Becker, G.S. (1960). An economic analysis of fertility. In *Demographic and economic change in developed countries* (pp. 209-240). Columbia University Press.

Begum Sadaquat, M., & Sheikh, Q.T.A.A. (2011). Employment situation of women in Pakistan. *International journal of social economics*, *38*(2), 98-113.

Bennett, L. R. (2001). Single women's experiences of premarital pregnancy and induced abortion in Lombok, Eastern Indonesia. *Reproductive Health Matters*, *9*(17), 37-43.

Bongaarts, J. (1978). A framework for analyzing the Proximate Determinants of fertility. *Population and development review*, 4(1), 105-132.

Bongaarts, J. (1982). The fertility-inhibiting effects of the intermediate fertility variables. *Studies in family planning*, 179-189.

Bongaarts, J. (2002a). The end of fertility in the developing world. In United Nations (Eds.), *Completing the Fertility Transition* (pp. 271-286). New York: United Nations.

Bongaarts, J. (2002b). The end of the fertility transition in the developed world. *Population and development review*, *28*(3), 419-443.

Bongaarts, J. (2015). Modeling the fertility impact of the Proximate Determinants: Time for a tune-up. *Demographic Research*, *33*(19), 535-560.

Bongaarts, J. (2006). The causes of stalling fertility transitions. *Studies in family planning*, *37*(1), 1-16.

Bongaarts, J., & Feeney, G. (1998). On the quantum and tempo of fertility. *Population and development review*, 24(2), 271-291.

Bongaarts, J., Frank, O., & Lesthaeghe, R. (1984). The Proximate Determinants of fertility in sub-Saharan Africa. *Population and Development Review*, *10*(3), 511-537.

Bongaarts, J., & Potter, R.E. (2013). *Fertility, biology, and behavior: An analysis of the Proximate Determinants*. New York: Academic Press.

Brown, C.M. (1990). *The Triumph of the Goddess: the canonical models and theological visions of the Devi-Bhagavata Purana*. New York: SUNY Press.

Burbank, V.K. (1995). Gender hierarchy and adolescent sexuality: the control of female reproduction in an Australian Aboriginal community. *Ethos*, *23*(1), 33-46.

Casterline, J.B. (2001). The pace of fertility transition: national patterns in the second half of the twentieth century. *Population and Development Review*, *27*, 17-52.

CATALIST Consortium (2000). Best Practices in Egypt: Involving Men in Reproductive Health and Family Planning Programs. The Minia Experience. Available at: http://pdf.usaid.gov/pdf_docs/Pnadf253.pdf [Accessed 29-06-2017].

Central Bureau of Statistics, State Ministry of Population/National Family Planning Coordinating Board, Ministry of Health & Macro International (1991a). *Indonesia Demographic and Health Survey 1991*. Calverton: CBS and Macro International.

Central Bureau of Statistics, State Ministry of Population/National Family Planning Coordinating Board, Ministry of Health & Macro International (1991b). *Indonesia Demographic and Health Survey 1991* [Datasets]. IDPR21FL.SAV and IDIR21FL.SAV. Calverton: CBS and Macro International [Producers]. ICF International [Distributor], 1991.

Coale, A.J. (1989). Demographic transition. In Eatwell, J., Milgate, M. & Newman, P. (Eds.), *Social Economics* (pp. 16-23). London: Palgrave Macmillan UK.

Cleland, J. (2002). Education and future fertility trends, with special reference to mid-transitional countries. In United Nations (Eds.), *Completing the Fertility Transition* (pp. 183-194). New York: United Nations.

Cleland, J., Bernstein, S., Ezeh, A., Faundes, A., Glasier, A., & Innis, J. (2006). Family planning: the unfinished agenda. *The Lancet*, *368*(9549), 1810-1827.

Costa, G. da (2009). Contraceptive Use Increases in Muslim-Dominated Northern Nigeria. Available at: https://www.voanews.com [Accessed 29-06-2017].

Dalla Zuanna, G., & Leone, T. (2001). A gender preference measure: the sex-ratio at last birth. *Genus*, *57*(1), 33-56.

Dallmayr, F. (2002). Dialogue among civilizations: Some Exemplary Voices. New York: Palgrave Macmillan.

Davis, K. (1945). The world demographic transition. *The Annals of the American Academy of Political and Social Science*, *237*(1), 1-11.

Davis, K., & Blake, J. (1956). Social structure and fertility: An analytic framework. *Economic development and cultural change*, *4*(3), 211-235.

De Bruijn, B.J. (2006). Fertility: Theories, Frameworks, Models, Concepts. *Demography: Analysis and Synthesis,* Chapter 39, 549-569.

DHS (2017). *Available Datasets.* Available at: http://dhsprogram.com/data/available-datasets.cfm [Accessed 25-06-2017].

Diamond, I., Newby, M., & Varle, S. (1999). Female education and fertility: examining the links. In Bledsoe, C.H., Casterline, J.B., Johnson-Kuhn, J.A. & Haaga, J.G. (Eds.), *Critical perspectives on schooling and fertility in the developing world* (pp. 23-48). Washington, D.C.: National Academy Press.

El-Naggar, M. (2010). In Egypt, Women have Burdens but no Privileges. *The New York Times,* 13-07-2010.

El-Zanaty, F.H., Sayed, H.A.A., Zaky, H.H.M., & Way, A.A.W. (1993a). *Egypt Demographic and Health Survey 1992.* Cairo, Egypt and Rockville, Maryland, USA: National Population Council and Macro International.

El-Zanaty, F.H., Sayed, H.A.A., Zaky, H.H.M., & Way, A.A.W. (1993b). *Egypt Demographic and Health Survey 1992* [Datasets]. EGIR21FL.SAV and EGPR21FL.SAV. Cairo and Rockville: National Population Council and Macro International [Producers]. ICF International [Distributor], 1993.

El-Zeini, L.O. (2008). The path to replacement fertility in Egypt: acceptance, preference, and achievement. *Studies in family planning*, *39*(3), 161-176.

Ewer, P.A., & Crimmins-Gardner, E. (1978). Income in the income and fertility relationship. *Journal of Marriage and Family*, *40*(2), 291-299.

Fahim, K. (2013). Egypt´s Birthrate Rises as Population Control Policies Vanish. *New York Times*, 02-05-2013.

Federal Government of Nigeria (2014). Nigeria Family Planning Blueprint (Scale-Up Plan). Available at: https://www.healthpolicyproject.com/ns/docs/CIP_Nigeria.pdf [Accessed 28-06-2017].

Federal Office of Statistics & Institute for Resource Development (1992a). *Nigeria Demographic and Health Survey 1990.* Columbia: Federal Office of Statistics/Nigeria and IRD/Macro International.

Federal Office of Statistics & Institute for Resource Development (1992b). *Nigeria Demographic and Health Survey 1990* [Datasets]. NGIR21FL.SAV and NGPR21FL.SAV. Columbia: Federal Office of Statistics/Nigeria and IRD/Macro International [Producers]. ICF International [Distributor], 1992.

Fischer, N.L., & Seidman, S. (Eds.)(2016). *Introducing the New Sexuality Studies*. Abingdon and New York: Routledge.

Frank, O. (1983). Infertility in sub-Saharan Africa: estimates and implications. *Population and development review*, 137-144.

Freedman, R. & Freedman, D. (1992). "The role of family planning programmes as a fertility determinant." In Philips, J.F. and Ross, J.A. (Eds.), *Family Planning Programmes and Fertility*. Oxford: Oxford University Press.

Fuse, K. (2010). Variations in attitudinal gender preferences for children across 50 less-developed countries. *Demographic Research*, *23*, 1031-1048.

Gakidou, E., & Vayena, E. (2007). Use of modern contraception by the poor is falling behind. *PLoS Med*, *4*(2), e31.

Garenne, M. (2013). Situations of fertility stall in sub-Saharan Africa. *African Population Studies*, *23*(2), 1-16.

Gertler, P.J., & Molyneaux, J.W. (1994). How economic development and family planning programs combined to reduce Indonesian fertility. *Demography*, *31*(1), 33-63.

Goldstein, J.R., & Kenney, C.T. (2001). Marriage delayed or marriage forgone? New cohort forecasts of first marriage for US women. *American Sociological Review*, 66(4), 506-519.

Goldstein, J.R., Sobotka, T., & Jasilioniene, A. (2009). The End of "Lowest-Low" Fertility?. *Population and development review*, *35*(4), 663-699.

Grasmuck, S., & Espinal, R. (2000). Market success or female autonomy? Income, ideology, and empowerment among microentrepreneurs in the Dominican Republic. *Gender & society*, *14*(2), 231-255.

Greenberg, B. (1981). *On Women & Judaism.* Philadelphia, PA: Jewish Publication Society of America.

Greenhalgh, S. (1990). Toward a political economy of fertility: Anthropological contributions. *Population and Development review*, *16*(1), 85-106.

Gross, R.M. (1993). *Buddhism after patriarchy: A feminist history, analysis, and reconstruction of Buddhism*. Suny Press.

Guttmacher Institute (2015a). Unintended Pregnancy and Induced Abortion in Pakistan. Available at: https://www.guttmacher.org/sites [Accessed 28-06-2017].

Guttmacher Institute (2015b). *Abortion in Nigeria.* Available at: https://www.guttmacher.org/sites [Accessed 28-06-2017].

Hafez, S. (2014). The revolution shall not pass through women's bodies: Egypt, uprising and gender politics. *The Journal of North African Studies*, *19*(2), 172-185.

Haider, Z. (2016). What I learned Having Sex as a Young Woman in Pakistan. Available at: https://www.vice.com/en_us/article [Accessed 28-06-2017].

Hakim, A., & Mahmood, N. (1994). Factors Affecting Fertility in Pakistan [with Comments]. *The Pakistan Development Review*, *33*(4), 685-709.

Hasen, A., Assefa, H., & Yacob, Z. (1994). *Proximate Determinants of fertility in Ethiopia: An application of the Bongaarts Model.* Addis Ababa: Demographic Training and Research Center.

Hathaway, R.M. (2004). Pakistan and Bangladesh: Comparing Development Trajectories. Available at: https://www.wilsoncenter.org [Accessed 28-06-2017].

Hayes, C.J.H. (1954). *Christianity and Western Civilization*. Stanford: Stanford University Press.

Henry, A., & Piotrow, P.T. (1979). Age at marriage and fertility. *Population Reports. Series M: Special Topics*, 4, 55.

Herartri, R. (2008). 'Decentralization policy and sustainability of the family planning program in 10 districts in Indonesia', *paper presented at the 2nd International Conference on Reproductive Health Management (ICRHM)*, Bali, 6-8 May.

Hessini, L. (2007). Abortion and Islam: policies and practice in the Middle East and North Africa. *Reproductive health matters*, *15*(29), 75-84.

Hull, T.H. (2005). *People, population, and policy in Indonesia*. Jakarta: Equinox Publishing.

Hull, T.H. & Mosley, H. (2009). *Revitalization of family planning in Indonesia.* Jakarta: Bappenas and BKKBN.

IRIN (2011). *Changing attitudes to contraception.* Report 93340. Dakar: IRIN.

Isiugo-Abanihe, U.C. (1994). Reproductive motivation and family-size preferences among Nigerian men. *Studies in family planning*, *25*(3), 149-161.

Izugbara, C.O. (2004). *Patriarchal Ideology and Discourses of Sexuality in Nigeria.* Lagos: Africa Regional Sexuality Resource Centre.

Jain, A.K. (1989). Fertility reduction and the quality of family planning services. *Studies in family planning*, *20*(1), 1-16.

Jayachandran, S. (2014). Does contraceptive use always reduce breast-feeding? Demgraphy, 51(3), 917-937.

Jejeebhoy, S.J. (1995). *Women's education, autonomy, and reproductive behaviour: Experience from developing countries.* Oxford: Claredon Press.

Joseph, S. (1996). Patriarchy and development in the Arab world. *Gender & Development*, *4*(2), 14-19.

Jones, L.E., Schoonbroodt, A., & Tertilt, M. (2008). *Fertility theories: can they explain the negative fertility-income relationship?* NBER Working Paper No. 14266. Cambridge: National Bureau of Economic Research.

Kallmuss, D. (2004). Nonvolitional sex and sexual health. *Archives of Sexual Behavior,* 33, 197–209.

Kalule-Sabiti, I. (1984). Bongaarts' Proximate Determinants of fertility applied to group data from the Kenya Fertility Survey 1977/78. *Journal of biosocial science*, *16*(02), 205-218.

Kamal, N. (2000). The influence of husbands on contraceptive use by Bangladeshi women. *Health Policy and Planning*, *15*(1), 43-51.

Kamran, I., Khan, M., & Tasneem, Z. (2014). *Involving men in reproductive and fertility issues: insights from Punjab*. No. 85062. Geneva: The World Bank.

Kaneda, T., Clifton, D. & Bremner, J. (2014). *Understanding population projections: assumptions behind the numbers.* Policy Brief. Washington, D.C.: Population Reference Bureau.

Kesterton, A.J., & de Mello, M.C. (2010). Generating demand and community support for sexual and reproductive health services for young people: A review of the Literature and Programs. *Reproductive health*, *7*(25), 1-12.

Khan, A., & Pine, P. (2003). *Adolescent and Youth Reproductive Health in Pakistan: Status, Issues, Policies and Programs.* March 2013. Washington, D.C.: POLICY Project.

Kingsley, P. (2014). Egyptian population explosion worsens social unrest. *The Guardian,* 16-02-2014.

Knodel, J. (1977). Family limitation and the fertility transition: Evidence from the age patterns of fertility in Europe and Asia. *Population Studies*, *31*(2), 219-249.

Knowles, J.A. (1999). Parental Decisions and Equilibrium Inequality. Doctoral dissertation, University of Rochester, Rochester.

Krasny, Y. (2012). Every Parent Should Know The Scandalous History of Infant Formula. Available at: http://www.businessinsider.com [Accessed 27-07-2017].

Küng, H. (2005). *Women in Christianity*. London: Continuum.

Larsen, U. (1995). Differentials in infertility in Cameroon and Nigeria. *Population Studies*, *49*(2), 329-346.

Lundquist, J.H., Anderton, D.L., & Yaukey, D. (2015). *Demography: the study of human population*. Fourth Edition. Long Grove: Waveland Press.

Lutz, W., O'Neill, B.C., & Scherbov, S. (2003). Europe's population at a turning point. *Science*, *299*(5615), 1991-1992.

Mahmood, N., & Ringheim, K. (1996). Factors affecting contraceptive use in Pakistan. *The Pakistan Development Review*, 35(1), 1-22.

Marston, C., & Cleland, J. (2003). Relationships between contraception and abortion: a review of the evidence. *International family planning perspectives*, 6-13.

Martine, G. (1996). Brazil's fertility decline, 1965-95: a fresh look at key factors. *Population and development review*, 47-75.

McQuillan, K. (2004). When does religion influence fertility?. *Population and Development Review*, *30*(1), 25-56.

Measure Evaluation (2017). Family Planning Program Effort Index. Available at: https://www.measureevaluation.org/prh/rh_indicators [Accessed 22-06-2017].

Millman, S. (1985). Breastfeeding and contraception: Why the inverse association?. *Studies in Family Planning*, *16*(2), 61-75.

Ministry of Health and Population, El-Zanaty, F.H. and Associates & ICF International (2015a). *Egypt Demographic and Health Survey 2014*. Cairo and Rockville: Ministry of Health and Population and ICF International.

Ministry of Health and Population, El-Zanaty, F.H. and Associates & ICF International (2015b). *Egypt Demographic and Health Survey 2014* [Datasets]. EGIR61FL.SAV and EGPRFL.SAV. Cairo and Rockville: Ministry of Health and Population and ICF International [Producers]. ICF International [Distributor], 2015.

Moghadam, V.M. (2007). *From patriarchy to empowerment: women's participation, movements, and rights in the Middle East, North Africa, and South Asia*. New York: Syracuse University Press.

Moore, D.L. (2016). *Country profile: Nigeria.* Cambridge: Harvard Divinity School.

Moussa, J. (2011). *Competing Fundamentalisms and Egyptian Women's Family Rights.* Leiden: Brill.

Muhidin, S. (2010). 'Indonesian Demographic Data', *paper presented at a session on Strengths and Weaknesses of Asian Demographic Data at the 2010 Meeting of the Population Association of America (PAA)*, Dallas, 15-17 April.

Nag, M. (1991). Sex preference in Bangladesh India and Pakistan and its effect on fertility. *Demography India*, *20*(2), 163-85.

National Institute of Population Studies & ICF International (2013a). *Pakistan Demographic and Health Survey 2012-13.* Islamabad and Calverton: NIPS and ICF International.

National Institute of Population Studies & ICF International (2013b). *Pakistan Demographic and Health Survey 2012-13* [Datasets]. PKIR61FL.SAV and PKPR61FL.SAV. Islamabad and Calverton: NIPS and ICF International [Producers]. ICF International [Distributor], 2013.

National Institute of Population Studies & Institute for Resource Development (1992a). *Pakistan Demographic and Health Survey 1990/1991.* Islamabad: NIPS/Pakistan and IRD/Macro International.

National Institute of Population Studies & Institute for Resource Development (1992b). *Pakistan Demographic and Health Survey 1990/1991* [Datasets]. PKIR21FL.SAV and PKPR21FL.SAV. Islamabad, Pakistan: NIPS/Pakistan and IRD/Macro International [Producers]. ICF International [Distributor], 1992.

National Population Commission & ICF International (2014a). *Nigeria Demographic and Health Survey 2013.* Abuja and Rockville: NPC and ICF International.

National Population Commission & ICF International (2014b). *Nigeria Demographic and Health Survey 2013* [Datasets]. NGIR6AFL.SAV and NGPR6AFL.SAV. Abuja and Rockville: NPC and ICF International [Producers]. ICF International [Distributor], 2014.

National Research Council (1993). *Factors affecting contraceptive use in Sub-Saharan Africa*. Washington D.C.: National Academy Press.

Neyer, G., Lappegård, T., & Vignoli, D. (2013). Gender equality and fertility: Which equality matters?. *European Journal of Population/Revue européenne de Démographie*, *29*(3), 245-272.

Nilan, P., & Demartoto, A. (2012). Patriarchal residues in Indonesia: respect accorded senior men by junior men. *European Journal of Social Sciences*, *31*(2), 279-293.

Notestein, F. (1945). Population: the long view. In: Theodore W. Schultz (Eds.), *Food for the world* (pp. 36–57). Chicago: Chicago University Press.

Obono, O. (2003). Cultural diversity and population policy in Nigeria. *Population and Development Review*, *29*(1), 103-111.

OECD (2017). Purchasing Power Parities – Frequently Asked Questions (FAQs). Available at: http://www.oecd.org/std/prices-ppp [Accessed 22-6-2017].

Omo-Aghoja, L.O., Okonofua, F.E., Onemu, S.O., Larsen, U., & Bergstrom, S. (2007). Association of Chlamydia trachomatis serology with tubal infertility in Nigerian women. *Journal of Obstetrics and Gynaecology Research*, *33*(5), 688-695.

Omo-Aghoja, L.O., Omo-Aghoja, W.V., Okonofua, F.E., Aghedo, O., Umueri, C., Otayohwo, R., ... & Esume, C.O. (2009). Perceptions and attitudes of a rural community to abortion in the Niger-delta region of Nigeria. *Nigerian journal of clinical practice*, *12*(4), 443-449.

O'neill, B.C., Balk, D., Brickman, M., & Ezra, M. (2001). A guide to global population projections. *Demographic research*, *4*(8), 203-288.

Osili, U.O., & Long, B.T. (2008). Does female schooling reduce fertility? Evidence from Nigeria. *Journal of development Economics*, *87*(1), 57-75.

Palamuleni, M. E., & Adebowale, A.S. (2013). Patterns of premarital childbearing among unmarried female youths in sub-Saharan Africa: Evidence from demographic health survey. *Scientific Research and Essays*, *9*(10), 421-430.

Pew Research Center (2009). *Mapping the global Muslim population: A Report on the size and distribution of the world's Muslim population.* October 2009. Washington, D.C.: Pew Forum on Religion & Public Life.

Pew Research Center (2011). *The Future of the Global Muslim Population, Projections for 2010-2030.* January 2011. Washington, D.C.: Pew Research Center's Forum on Religion and Public Life.

Pew Research Center (2017). *The Changing Global Religious Landscape.* April 5. Washington, D.C.: Pew Research Center.

Population Division (2002). Views and policies concerning population growth and fertility among Governments in intermediate-fertility countries. In United Nations (Eds.), *Completing the Fertility Transition* (pp. 213-250). New York: United Nations.

Population Reference Bureau (2001). *Understanding and using population projections.* Policy Brief. Washington, D.C.: MEASURE Communication.

Preston, S., Heuveline, P., & Guillot, M. (2000). Demography: measuring and modeling population processes. Hoboken: Wiley-Blackwell.

Pritchett, L.H. (1994). Desired fertility and the impact of population policies. *Population and Development Review*, 20(1), 1-55.

Raftery, A.E., Alkema, L., & Gerland, P. (2014). Bayesian population projections for the United Nations. *Statistical science: a review journal of the Institute of Mathematical Statistics*, *29*(1), 58-68.

Refaat, O. (2010). *Population Stabilization Policies and Programs.* Available at: http://gillespiefoundation.org [Accessed 29-06-2017].

Renne, E.P. (1996). Perceptions of population policy, development, and family planning programs in northern Nigeria. *Studies in Family Planning*, 27(3), 127-136.

Reproductive Health Promotion Working Group (2004). *Male Involvement is Key to Reproductive Health.* Available at: http://www.policyproject.com/pubs [Accessed 29-06-2017].

Ross, J., & Smith, E. (2011). Trends in national family planning programs, 1999, 2004 and 2009. *International Perspectives on Sexual and Reproductive Health*, 37(3), 125-133.

Sathar, Z., & Zaidi, B. (2010). *Status of Family Planning in Pakistan.* Bangkok: UNFPA.

Schultz, T.P. (1997). Demand for children in low income countries. *Handbook of population and family economics*, *1*(A), 349-430.

Sedgh, G. & Ball, H. (2008). *Abortion in Indonesia.* In Brief - No.2, New York: Guttmacher Institute

Shalaby, E. (2013). Abortion in Egypt: Whose choice? *Daily News Egypt*, 28-06-2017.

Shapiro, D., & Gebreselassie, T. (2009). Fertility transition in sub-Saharan Africa: falling and stalling, *African Population Studies*, *22*(2), 1-23.

Shapiro, D., & Gebreselassie, T. (2014). Marriage in sub-Saharan Africa: Trends, determinants, and consequences. *Population Research and Policy Review*, *33*(2), 229-255.

Situmorang, A. (2003). *Adolescent reproductive health in Indonesia.* STARH Program. Jakarta: Johns Hopkins University.

Sodipe, O.A., & Ogunrinola, O.I. (2011). Employment and economic growth nexus in Nigeria. *International Journal of Business and Social Science*, *2*(11), 232-239.

Statistics Indonesia, National Population and Family Planning Board, Kementerian Kesehatan & ICF International (2013a). *Indonesia Demographic and Health Survey 2012.* Jakarta, Indonesia: BPS, BKKBN, Kemenkes, and ICF International.

Statistics Indonesia, National Population and Family Planning Board, Kementerian Kesehatan & ICF International (2013b). *Indonesia Demographic and Health Survey 2012* [Datasets]. IDPR63FL.SAV and IDIR63FL.SAV. Jakarta, Indonesia: BPS, BKKBN, Kemenkes, and ICF International [Producers]. ICF International [Distributor], 1991.

Stover, J. (1998). Revising the Proximate Determinants of fertility framework: What have we learned in the past 20 years? *Studies in family planning*, 29(3), 255-267.

Stover, J., Heaton, L., & Ross, J. (2006). *FamPlan Version 4: A Computer Program for Family Planning Requirements.* Futures Group.

Sufian, A.J.M., & Johnson, N.E. (1989). Son preference and child replacement in Bangladesh: A new look at the child survival hypothesis. *Journal of biosocial science*, *21*(2), 207-216.

Susiloretni, K.A., Hadi, H., Prabandari, Y.S., Soenarto, Y.S., & Wilopo, S.A. (2015). What works to improve duration of exclusive breastfeeding: lessons from the exclusive breastfeeding promotion program in rural Indonesia. *Maternal and child health journal*, *19*(7), 1515-1525.

The POLICY Project (1997). Proximate Determinants of Fertility: Demonstration Worksheet. Prepared by the POLICY Project.

Thompson, W.E., Hickey, J.V., & Thompson, M.L. (2016). *Society in focus: An introduction to sociology*. Lanham: Rowman & Littlefield.

Track20, & Avenir Health (2017). Family Planning Effort Index: Scores from 1972 to 2014. Available at: http://www.track20.org/pages/data/FPE [Accessed 22-06-2017].

Tri, D. (2013). Indonesia's Working Women Struggle to Succeed. *Jakarta Globe,* 27-03-2013.

Tsui, A.O., Casterline, J., Singh, S., Bankole, A., Moore, A.M., Omideyi, A.K., ... & Shellenberg, K.M. (2011). Managing unplanned pregnancies in five countries: Perspectives on contraception and abortion decisions. *Global public health*, *6*(sup1), S1-S24.

UNFPA (2015). *Men's Engagement in UNFPA Indonesia Programming*. Jakarta: UNFPA.

UN (2008). *World Population Policies 2007.* New Delhi: Academic Foundation.

UN (2013). *World Population Prospects: The 2012 Revision*, New York: Department of Economic and Social Affairs, Population Division.

UN (2015a). *World Population Prospects: The 2015 Revision, Methodology of the United Nations Population Estimates and Projections.* Working Paper No. ESA/P/WP.242.

UN (2015b). *Probablistic Population Projections based on the World Population Prospects: The 2015 Revision.* New York: Population Division, DESA, United Nations.

UN (2017). *World Population Prospects: The 2017 Revision*, New York: Department of Economic and Social Affairs, Population Division, United Nations.

Utomo, I. D., & McDonald, P. (2009). Adolescent reproductive health in Indonesia: contested values and policy inaction. *Studies in family planning*, *40*(2), 133-146.

Varley, E. (2012). Islamic logics, reproductive rationalities: Family planning in northern Pakistan. *Anthropology & medicine*, *19*(2), 189-206.

Westoff, C.H. (2008). *A New Approach to Estimating abortion Rates.* DHS Analytical Studies No.13. Calverton: Macro International Inc.

Watkins, S. C. (1987, September). The fertility transition: Europe and the Third World compared. *Sociological Forum*, *2*(4), 645-673.

Westoff, C.F., & Cross, A.R. (2006). The stall in the fertility transition in Kenya, *DHS Analytical Studies, 9*, 1-41.

World Health Organization (1996). *Studying unsafe abortion: a practical guide.* WHO/RHT/MSM/96.25. Geneva: WHO.

Wilmoth, T.A., & Elder, J.P. (1995). An assessment of research on breastfeeding promotion strategies in developing countries. *Social science & medicine, 41*(4), 579-594.

World Bank (2015). *More, and More Productive, Jobs for Nigeria: A Profile of Work and Workers.* Washington, D.C.: The World Bank.

World Bank (2017a). *Fertility Rate, total (births per woman).* Available at: http://data.worldbank.org/indicator/SP.DYN.TFRT.IN [Accessed 28-06-2017].

World Bank (2017b). *GNI per capita, PPP (current international $).* Available at: http://data.worldbank.org/indicator/NY.GNP.PCAP.PP.CD [Accessed 22-06-2017].

World Bank (2017c). *GINI (World Bank estimate (2017b).* Available at: http://data.worldbank.org/indicator/SI.POV.GINI [Accessed 22-06-2017].

World Bank (2017d). *Poverty headcount ratio at $1.90 a day (2011 PPP)(% of population).* Available at: http://data.worldbank.org/indicator/SI.POV.DDAY [Accessed 22-06-2017].

World Bank (2017e). *Labor force participation rate, female (% of female population ages 15+)(modeled ILO estimate).* Available at: http://data.worldbank.org/indicator/SL.TLF.CACT.FE.ZS [Accessed 22-06-2017].

World Bank (2017f). *Labor force participation rate, male (% of male population ages 15+)(modeled ILO estimate).* Available at: http://data.worldbank.org/indicator/SL.TLF.CACT.MA.ZS [Accessed 22-06-2017].

World Bank (2017g). *School enrollment, primary and secondary (gross), gender parity index (GPI).* Available at: http://data.worldbank.org/indicator/SE.ENR.PRSC.FM.ZS [Accessed 27-06-2017].

World Bank (2017h). *Foreign Direct Investment, net inflows (% of GDP).* Available at: http://data.worldbank.org/indicator/BX.KLT.DINV.WD.GD.ZS [Accessed 17-07-2017].

World Economic Forum (2017). *Competitivenss Rankings.* Global Competitiveness Report 2015-2016. Cologny: World Economic Forum.

Yefet, K. C. (2009). What's the Constitution Got to Do With It-Regulating Marriage in Pakistan. Journal of Gender Law & Policy, *16*(2), 347.

Appendix 1 –SPSS procedure for education, tradition and religion

Below, an explanation is given of the commands carried out in SPSS and why these commands were executed for this study. Quantitative information regarding the average years of education (of women) and reasons for not intending to use a method of contraception in the future was used.

- **SPSS procedure for education**

DHS household member recode files (=PR files) have been used in order to analyze the educational attainment of all women aged 15-49 in the selected countries, because this file also contains data about all women (thus, also those who have never been married are included).

First, I selected de facto women aged 15-49, using variable v105 (the age of household members) and hv104(the sex of the household member).

Second, the analyzed variable education in single years (h108) was checked for nonresponse and invalid codes. For the variable h108, the codes 97 (=inconsistent), 98 (=don't know) and 99 (=missing) were listwise deleted from the dataset and not imputed as there are only a few missing cases (it is more appropriate to delete these cases as these cases do not affect the data too much and the cases are missing for a reason).

Third, the weights were applied to the household data (hv005). These weights have to be divided by 1,000,000 before they can be used to approximate the number of cases.

After the right cases were selected. The mean was calculated for the education in single years (h108) in SPSS.

- **SPSS procedure for tradition and religion**

DHS individual recode files (=IR files) have been used in order to analyze the reasons for not intending to use a method of contraception in the future among women who do not currently use a contraceptive method and do not intend to use a method in the future (v376, base: v362=5). In IR files, all women or ever-married women aged 15-49 years are included (see Table 4).

First, all duplicated cases - which have the same CASEID - were not selected in the IR files. These cases are duplicated in order to give detailed information about each child of a woman who participated in the survey, but this information is not needed in order to obtain information about

V376. In SPSS, the data > identify duplicate cases was used. Next, only the cases which were not duplicated, were selected.

Second, some values for v376 were merged, because there are many answer categories and some of these answer categories are not filled out often and do not really relate to the research topic. Three times, two answer categories are quite similar and are therefore merged: that is, side effects (5) and health concerns (6), as well as religion (8) and fatalistic (10), and difficult to get pregnant (13) and menopausal (14). In the Indonesia, 1991 IR file: value 18 was also merged with value 15 and in the Nigeria, 1990 IR file: value 18 and 19 were merged with value 15 (values differ a little bit per dataset).

Third, missing and invalid values were filtered from the dataset (98 and 99), as well as all respondents who did not comply to the precondition : all women not currently using a contraceptive method and not intending to use a method in the future (v362 = 5).

Fourth, only currently married women were selected, as they are only perceived as being at risk of getting pregnant (v502 = 1)

Fifth, the female sample weigths (v005) were applied to the dataset.

Last, the frequency that each value was filled out was calculated in SPSS.

Appendix 2 – Calculation of the Total Abortion Rate

For the calculations the total abortion rate (*A*) (equation 13), the data used for MOD is the percentage of *currently married* women aged 15-49 using any modern family planning method, instead of the percentage of *all women* aged 15-49 using any modern method of contraception. Only married women are included in equation 13, as they are perceived as only being a risk of childbearing in Bongaarts' equations (1978). In the selected Muslim countries, it is also very likely that babies are primarily born in wedlock, because births outside marriage are prohibited by Islamic law, cause social stigma and can even lead to honor killings in Pakistan (Bennett, 2001; Fischer & Seidman, 2016; Haider, 2016; Kallmuss, 2004).