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THE ELDERLY MISSING WOMEN PHENOMENON

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Abstract

This research examines the elderly missing women phenomenon – masculinized sex ratios in the elderly population from a fourfold approach. First, it systematizes the causal factors responsible for missing women according to different stages of the female life course (before/at birth, childhood, young adulthood, adulthood and old age) to reveal an elderly missing women phenomenon. This categorization emphasizes that the majority of literature to date has focused on the first two stages while neglecting the cumulative impact of factors affecting missing women at later stages and especially old age. Second, it evaluates the elderly missing women phenomenon in all countries across Asia. It shows that while the missing women phenomenon is well researched in specific countries of East/Southeast Asia and South Asia, it is mostly ignored in the Middle Eastern region of Western Asia where the extent of the female deficit is worse. Further, even in the former regions the issue is mostly addressed at young ages. In light of the rapid ageing of Asia, this points to the necessity of changing the geographical focus of literature on missing women from younger to older age groups in East/Southeast and South Asia and place a greater emphasis on the Middle Eastern region as a whole. Third, using Pakistan as a case study, it considers whether the elderly missing women phenomenon observable in the elderly populations of some Asian countries may be the result of a second set of possible group effects, namely demographic shocks. An evaluation of conflicts and natural disasters throughout the history of Pakistan, however, reveals that the first set of group effects (i.e. factors across the life course) need to be given greater weightage in explaining the phenomenon. Finally, it examines the empirical strength of the factors, forces and exogenous shocks responsible for missing women by assigning variables to these causal mechanisms and testing their strength at the cross national level. The results reveal that, when evaluated in an ordinary least squares framework, the number of variables that are significant increases when the elderly population versus the total population is used as the dependent variable. This shows that the true severity of the missing women phenomenon only becomes evident when evaluating the elderly missing women phenomenon because the latter considers the consequences of a female deficit from all life stages. By analyzing the elderly missing women phenomenon in this manner, this research shows that the life course perspective is the ideal framework to analyze the missing women phenomenon in general and the elderly missing women phenomenon in particular.

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Chapter 1 - Introduction

The female survival advantage, as measured by higher female vis-a-vis male life expectancy, persists across all countries worldwide and may have appeared, at least in developed nations, centuries beforehand (Boldsen and Paine 1995, Thorslund et al. 2013). Using paleo-demographic data from skeletons excavated in Europe, Boldsen and Paine (1995) trace the trajectory of gender gap in life expectancy and find that in the earliest hunting-gathering communities' male-female life expectancies were roughly equal. However, the advent of agriculture together with the formation of villages led to male advantage in life expectancy due to rising levels of fertility in the population and higher prevalence of infectious diseases which led to a disproportionately high reduction in female vis a vis male life expectancy (Boldsen and Paine 1995). It was only after trade started to flourish in the Iron Age (1500 -2000 years ago), that women experienced a relative improvement in their life expectancy as a result of which for the past 500 years' female life expectancy, in Northern Europe at least, has exceeded that of males (Boldsen and Pain 1995, Alberts et al. 2014). John Graunt was the first to chronicle this relative female longevity in 1662 by observing that women in London parishes had higher life expectancies than their male counterparts (Bernin, Stolnitz and Tenenbein 1989). Thereafter, throughout the 19th and early 20th century, the female survival advantage in life expectancy is well documented in developed countries (Alberts et al. 2014). For example, Alberts et al. (2014) find evidence of female life expectancy exceeding that of males in France, Netherlands, Belgium, Russia and Japan that continues to this day. They contend that these results persist in sub populations where male behavior is less risky than their counterparts in other subpopulations (Alberts et al. 2014). For example, they find the gender gap in life expectancy in favor of females to persist in Mormon populations of the United States where males are less likely to be exposed to the dangers of alcoholism and females continue to be exposed to the dangers of reproduction (Alberts et al. 2014). Through most of the 20th Century, until 1970-1990, developed countries witnessed a substantial increase in the gender gap in life expectancy in favor of females (Nathanson 1983, Thorslund et al. 2013). Before the 1950's these gains in life expectancy have resulted from improvements in life expectancy at younger age groups but in the latter half gains were made through improvements in life expectancy in later life (Oeppen and Vaupel 2002). Two main explanations have been offered for this increasing gender gap between male and female life expectancies: the biological explanation that women are more "fit" and the social/lifestyle explanation that men engage in more damaging ways to health than women (Wingard 1984). However, as the Mormon example shows, even in societies where men adopt less risky lifestyles, women appear to have a survival advantage. Nevertheless, in more recent years, a reduction in gender gap in life expectancy in some developed countries has been observed (Meslé 2004). Explanations for this reduction focus on the improvement of medical technology that allows men and women to achieve relatively equal mortality and the adoption of approximately similar lifestyle habits by men and women (e.g. in the case of smoking with an increasing number of women taking up the habit; Meslé 2004). Hence, explanations for a narrowing of this gender gap are both biologically and socially rooted.

The general gains in longevity and the female survival advantage extend beyond developed countries. Clark and Peck (2012) conduct a cross-national analysis for 195 countries worldwide from 1985 to 2005 and find that in 2005 there are only eight

countries in the world in which the life expectancy for males is higher than that for females: Afghanistan, Bangladesh, India, Nepal, Pakistan, Nepal, Niger and Zimbabwe. However, by 2006, Barford et al. (2006) using life expectancy data from WHO and the US Central Intelligence Agency, find that for the first time in human history female life expectancy for all countries in the world has exceeded that for males. They report that WHO data from 2001 suggested male advantage in life expectancy for six countries i.e. Bangladesh, Botswana, Lesotho, Nepal, Swaziland and Zimbabwe. While life expectancies had reversed in these countries by 2002, two other countries Qatar and Maldives had higher male than female life expectancies in the year, a trend which continued till 2004. However, in 2005, the CIA reported women gained advantage in Qatar and Maldives as a result of which in all countries of the world, females had higher life expectancy than males. Of course this is not to say that the gender gap in life expectancy in favor of females in developing countries has reached the level of developed countries. Clark and Peck (2012) find that this gender gap in life expectancy is largest in Eastern Europe followed by Western Countries (Western Europe and North America) then Latina America, East Asia and the Pacific and finally Middle East and Africa, the latter two having the lowest gender gap in life expectancy. Different factors play a role in determining the gender gap (Nathanson 1983). Nevertheless, in all countries of the world, the life expectancy of women today exceeds that of men (Barford et al. 2006, Throslund et al. 2013).

The higher life expectancy of women would suggest that the number of women exceeds the number of men (Hazzard and Bowden 1990). Using data from the United Nations Population Division (UNDESA, "custom data"[1] 2015) for the year 2015, Table 1-1 calculates sex ratios (male/female) for the world and different regions therein to show that regardless of the level of development, the number of women exceeds the number of men in the 60+ population in all regions of the world and this excess of women becomes more pronounced as the population ages (i.e. from 60+ to 80+).

Table 1–1

Sex ratios (male/female) for world regions in 2015		
Region/Country	60+	80+
World	0.86	0.63
More developed regions	0.77	0.55
Less developed regions	0.90	0.71
Least developed regions	0.88	0.81

These ratios translate into women accounting for 54% of the world population aged 60+ and 61% of the population aged 80+ in 2015 (UNDESA, "Ageing" 2015). By 2050, the comparative estimates are projected to be 53% and 58% (UNDESA, "Ageing" 2015) respectively with the lower percentages resulting from male gains in life expectancy in

[1] This text uses the MLA citation format. For in text citations, this format requires the first word of the title of a work in parenthesis to follow the author's name for multiple works cited by the same author (published in a given year).

developed countries (UNDESA, "Ageing" 2015). Nevertheless, the female advantage at older ages till 2050 is substantial enough for some authors to dub it as the feminization of later age at the global level (e.g. Davidson, DiGiacomo and McGrath. 2011), both in developed countries (e.g. Peace et al. 2007) and in developing countries (e.g. UN-INSTRAW 1999).

However, this seemingly universal phenomenon appears to evade some countries, i.e. in some countries the number of elderly men exceeds the number of elderly women despite the female advantage in life expectancy, creating a contradiction between life expectancy and female preponderance in old age. Using the same data from UNDESA ("custom data" 2015), Table 1-2 provides some examples of countries where this contradiction persists.

Table 1–2

Sex ratios (male/female) and life expectancy (female-male) for selected countries in 2015

Country	L.E. gap	S.R. 60+	S.R. 80+
Iran	2.24	1.03	1.10
Pakistan	1.85	1.04	1.10
Qatar	2.58	2.30	1.00
Malaysia	4.67	0.96	1.24
Afghanistan	2.39	0.92	0.77
China	6.02	0.96	0.74
India	2.80	0.95	0.81

Table 1-2 illustrates the gender gap in life expectancy (female – male) and the sex ratio (male/female) in the 60+ and 80+ age categories for selected countries. It is immediately evident that despite the female advantage in life expectancy in all countries, the preponderance of women observed in table 1-1 across different regions of the world is either non-existent or less noticeable in these countries. In Iran and Pakistan, it is clear that the pattern is reversed for both elderly categories: not only is there a preponderance of men in the elderly population but also this preponderance increases as the population ages (i.e. from 60+ to 80+). In Qatar, the situation for the 60+ population is even worse than the former two countries with the number of men being twice that of women. However, it seems to improve as the population ages as sex ratios in the 80+ category indicate an equal proportion of men and women in the population. In Malaysia, although the sex ratios in the 60+ population don't appear to deviate as dramatically as the first three countries, in the 80+ category they supersede the sex ratios for all countries, presented in table 1-2, of the same category. In the remaining countries – Afghanistan, China and India – the general trend of a reduction in the share of men with the ageing of the population is evident however with the proportion of women in the elderly population is far below the world or less developed region average. This contradiction between the gender gap and life expectancy entreats an explanation.

Over two decades ago Amartya Sen (1990, 1992) introduced the term Missing Women to refer to the number of women who should be alive at a given point of observation but are not. He estimated that, in the 1990's, over a 100 million women were missing in parts of Asia and Africa (Sen 1990). Since then several authors have attempted to refine the methodology used to calculate the number of missing women (e.g. Coale 1991, Klasen 1994), update the number of missing women (e.g. Klasen and Wink 2003, Bongaarts and Guilmoto 2015), identify the causes (e.g. Park and Cho 1995, Das Gupta and Shuzhuo 1999) and consequences (e.g. Hudson and Den Boer 2005, Ebenstein and Sharygin 2009) of missing women, outline future policy implications that might overcome the problem of missing women (e.g. Chung and Das Gupta 2007) and even calculate the expected number of missing women in the future (e.g. Attané 2006). However, the majority of studies that attempt to explain the phenomenon do so at the time of birth and early childhood with a few recent studies addressing the phenomenon in adulthood. There are only three papers to date that address the existence of the phenomenon in the elderly (60+) population. The first paper, Anderson and Ray (2010) restricts its analysis of the missing women phenomenon by age group to three regions: China India and Sub-Saharan Africa while the second paper, Anderson and Ray (2012), addresses the age distribution of the female deficit across the different states in India. The final paper, Bongaarts and Guilmoto (2015), shows that at the global level, missing women exist in the elderly population but the bulk of the paper is devoted to a discussion of the phenomenon in China and India with occasional reference to some other countries (e.g. Pakistan, Bangladesh).

The dearth of literature addressing missing women in the elderly category becomes increasingly striking with the passage of time. Given that, the majority of countries that experience a female deficit in their total population are located in Asia (Klasen and Wink 2003, Bongaarts and Guilmoto 2015), the demographic changes taking place on the continent are of increasing relevance. While substantial academic debate so far has concentrated on the consequences of ageing for Europe, Asia is currently the most rapidly ageing region in the world and is expected to host two-third of the world's two billion elderly by 2050. Following Harper (2006), the speed at which Asia is ageing is a cause for further alarm: while it took average European countries 120 years to transform from young to mature societies, the comparative time frame for Asian countries is expected to be 25 years. Embedded in this is not only Asia's lack of institutional preparedness to cater or its elderly (Chiu 2008) but also the fact that by 2040 there will be more elderly (60+) people than younger (0-59) people in Asia (see Harper 2006).

In light of Sen's writings, subsequent literature and the rapid transformation of Asian countries, the deficit of women in old age (as presented in table 1-2) should come as no surprise as it is continuous and contingent upon a lifetime of cumulative disadvantages and would be (and to some extent has already been) revealed by a comparative analysis of younger and middle aged men and women (Gibson 1996). Furthermore, the disadvantaged position of elderly women in society is well established. For example, Bennett and Zaidi (2016) show that in low income countries women face vulnerabilities across multiple life domains (e.g. education, family care obligations) that accumulate into severe disadvantages in old age and result in women spending a greater proportion of their increased longevity in poorer health. Davidson, DiGiacomo and McGrath. (2011) argue that despite the increased longevity of women, their challenging socio-economic position exposes them to several vulnerabilities in old age – poverty,

widowhood, financial instability – that generally translate into poor health outcomes for women and can be ameliorated by addressing the needs of women in a time appropriate manner. The over-emphasis of literature and policy in addressing the plight of elderly women is critiqued by Knodel and Ofstedal (2003) who argue that in developing countries, an increasing number of elderly men are faced by vulnerabilities (e.g. widowhood/being single) that are often solely attributed to elderly women so academic and policy attention should also be diverted to addressing the needs of the former.

The discussion to this point makes two things evident: First, literature documents the existence of a female deficit in the population of selected countries across Asia but mostly discusses it in the context of younger age categories. Second, literature recognizes the vulnerable position of elderly women and the possibility of an increase in this susceptibility due to the rapid ageing of Asia. However, it fails to address the blatant female deficit in the elderly population depicted in table 1-2 that contradicts the global female advantage in life expectancy. Following from the writings of Sen (1990), I term this female deficit in the elderly (60+) population the elderly missing women phenomenon and adopt a life course perspective to explain its pervasiveness.

The life course perspective postulates that experiences in later life are linked to choices and events in earlier life (Elder Jr. 1994) and provides a framework for examining phenomena at the confluence of developmental trajectories, social pathways and social change (Elder Jr., Johnson and Crusnoe 2003). Trajectories are sequences of roles and experiences that are made up of transitions – i.e. changes in states or roles (Elder Jr., Johnson and Crusnoe 2003). Examining life trajectories across multiple stages of life recognizes that development extends beyond childhood and explores issues of behavioral continuity and change (Elder, Johnson and Crusnoe 2003). Social pathways are trajectories followed by individuals and groups in a society and are shaped by historical forces and societal institutions (Elder Jr., Johnson and Crusnoe 2003). Hence, while individuals may choose their social pathways, their choices are contingent upon the constraints imposed by society and culture (Elder Jr, Johnson and Crusnoe 2003). Social change represents a range of transitional phenomenon like change of school or residence (Elder Jr., Shanahan and Jennings 2015). Historical comparisons lend credence to the argument that life transitions are embedded in social trajectories and are powerfully regulated and constrained by social contexts (Elder Jr. 1998, Mayer, "Whose" 2004). The impact of historical change on life trajectories may be understood in the form of cohort or period effects (Elder Jr., Shanahan and Jennings 2015). A cohort is an aggregate of individuals within the same population who experience the same event in the same time interval (Ryder 1965). All members of a given birth cohort are exposed to the same historical experiences and a cohort effect occurs when historical change differentiates between the lives of different birth cohorts (Elder Jr., Johnson, Crusnoe 2003, Elder Jr., Shanahan and Jennings 2015). A period effect occurs when the effect of a social change is relatively uniform across successive birth cohorts. Within each cohort social forces may generate differential activities and unequal rewards that distinguish cohort members from one another in terms of resources, health and well-being and these distinctions may become more pronounced as members age (Dannefer 1987). This variability in inequality can be understood within the cumulative advantage/disadvantage perspective. Dannefer (2003) defines cumulative advantage/disadvantage as "the systematic tendency for inter-individual divergence in a given characteristic with the passage of time" where inter-individual divergence implies that cumulative disadvantage is not a property of individuals but of collectivities (such

as cohorts), for which an identifiable set of members can be ranked. However, this does not preclude the manifestation of inequality over the individual life course (Ferrarro and Shippee 2009). This idea is captured by the cumulative inequality theory which specifies that early disadvantages increase the risk of future disadvantages and uses basic life stages as a frame for understanding accumulation processes involving structural disadvantages, exposure to risk and mobilization of resources to the extent that these accumulation processes may lead to premature mortality. There is considerable evidence to suggest that gender, ethnic group and class based inequalities operate to produce cumulative disadvantage in old age (O'Rand 1996). Gender especially is a deterministic characteristic fixed early in life with important implications for the status of the elderly (Hermalin 2000).

In the context of the elderly missing women phenomenon, gender may be viewed as the primary source of inequalities that generates premature mortality across successive life stages contingent upon the historical, social and cultural institutions in a given country. When the elderly missing women phenomenon is viewed from this perspective, three things are noteworthy. First, being female generates inequalities at each life stage that either leads to premature mortality at that life stage or cumulates into a higher mortality risk for women at subsequent life stages (Ferraro and Shippee 2009). Second, the inequalities (and cumulative disadvantage) faced by women may differ by birth cohort (Ryder 1965) or by cohort and/or period effects (Mayer, "Whose" 2004). The inequalities/cumulative disadvantage faced by women and birth cohorts may vary at the cross-national level (Settersten and Mayer 1997, Mayer, "Whose" 2004). The remainder of this monograph is organized to address these concerns.

Given the fundamental position of age in the life course theory and the multifaceted dimensions along which it can be measured – chronological (the individual life span from birth to death), social (i.e. the social timetable embedded in norms and social roles – e.g. time of marriage) and historical (i.e. entry into the system as an index of historical location) – Chapter 2 divides the female life course into five distinct stages: before/at birth, childhood, young adulthood, adulthood and old age. These life stages embed the chronological and social dimension of age and capture how the missing women phenomenon at each stage and especially in old age may be the result of the simultaneous interaction of micro, and macro level processes in a given country (Elder Jr. 1975, Komp and Johansson 2016). Micro level processes define the behavior of individual actors (Coleman 1986) and within the life course perspective capture the notion of life course effects and social inequalities in the life course (Komp and Johansson 2016). Life course effects imply that individual experiences may affect the individual life course years into the future and may in turn affect the progression of further life courses (Komp and Johansson 2016). Moreover, the effect of these experiences is contingent upon the time at which they occur in the life course so that the same experience at an earlier or later stage of life may have a different developmental impact than at later stages in life (Elder Jr. 1998). Chapter 2 describes how the inequality that results from gender exposes women to factors (i.e. disadvantages) from the earliest stages of life (before/at birth) that either lead to premature mortality at that stage or cumulate to erode the female survival advantage at subsequent stages. The idea that disadvantages beget disadvantages (Ferraro and Shippee 2009) is relevant here bringing to the fore the magnitude, onset and duration of factor in question i.e. the greater the severity of the disadvantage, the earlier the onset and the longer the

duration, the worse the potential impact of that factor on subsequent stages (O'Rand 1996, Ferraro and Shippee 2009).

The relevance of macro level process hinges on the fact that the factors across the life course do not develop in a vacuum. Macro level processes refer to the functioning of social systems like communities (Coleman 1986) and are captured in the life course perspective through the application of the lives in time and place paradigm (Komp and Johansson 2016). This paradigm entails that the life course of individuals is embedded in and shaped by the historical times and places they experience over their life course (Elder Jr. 1994). This implies that social context such as norms, culture and institutions affect the progression of the life course (Komp and Johansson 2016). As social structures shape human behavior, inequality is not primarily the result of individual choices and actions but rather structurally generated as a product of the social system to which people belong (Ferraro and Shippee 2009). In the context of the missing women phenomenon social institutions such as dowry, patrilocality and patrilineality may be governing social norms centered around son preference (the inclination towards having a son due to the expected benefits its entails; Guilmoto 2009), daughter devaluation (the disinclination towards having a daughter due to the expected costs it entails, independent of son preference; Guilmoto 2009) and female subordination (inferior position of women in society). The micro and the macro level are further tied together by the principle of linked lives. The idea of linked lives postulates that individual lives are lived interdependently and individual experiences are connected to the linked fates of family and society members (Elder Jr. 1998). People evaluate their life trajectories in comparison to others in the social group and modify their actions to overcome any deficits thereby influencing future life trajectories (Ferraro and Shippee 2009). Hence, the disadvantages faced by women at each life stage are a product of the inferior manner in which women are viewed by members of their family and society and the actions against them (i.e. factors/disadvantages) are family/society's attempt to compensate for the "burden" imposed by these women. For example, in societies where son preference and daughter devaluation is prevalent, couples who have too many daughters and no sons may perceive themselves to be at a disadvantage compared to other members in the social group and may find it acceptable to neglect their daughters to compensate for the burden of having to care for all the daughters.

The social context entails a geographical and temporal element so that individuals and birth cohorts born at different times and places in different life stages and locations may be exposed to different varieties of disadvantages (Ryder 1965, Mayer, "Whose" 2004). Hence, in addition to factors across the life course that lead to elderly missing women, Chapter 2 discusses the role of intermediary variables that may affect the missing women phenomenon independently or by reinforcing the factors across the life stage. Lives are overlain by multiple trajectories and earlier trajectories may be deflected by historical or life course or both experiences altering their direction and introducing more or less inequality (O'Rand 1996). Hence, intermediary variables account for the of social inequalities other than gender (e.g. education, income) or other forces like religion and legislation that may influence the number of missing women.

The individual life course may be influenced by a series of economic, political and social developments that alter social institutions over time (Neugartan and Datan 1996). To assess how factors across the life course and intermediary forces may vary across time, chapter 2 incorporates the historical dimension of age. Therefore, it takes account

of the role of social change in influencing the elderly missing women phenomenon by showing how factors at each life stage and intermediary force may differ by birth cohort.

The cumulative impact of factors and intermediary forces has the potential to lead to premature mortality of the female birth cohort at each life stage so that by the time this birth cohort reaches the elderly life stage a significant fraction of the female cohort has eroded thereby creating a female deficit in the elderly population (Dannefer 2003, Ferraro and Shippee 2009). This deficit may be aggregated at each life stage by birth cohort to present the missing women phenomenon for that life stage with the elderly life stage presenting the culmination of the female deficit for a given birth cohort (Coleman 1986). The summation of the missing women phenomenon across all life stages would present the missing women phenomenon in the total population. Therefore, Chapter 2 shows how micro and macro interactions reinforce gender induced factors/disadvantages at the individual level that cumulatively (by inducing mortality at each stage and/or disadvantages at subsequent stages) lead to an elderly missing women phenomenon at the cohort level.

The individual life course is a function of the society/country in which individual belongs and is not indelible across time or geography (Mayer, "Whose" 2004). The life course in modern societies has deeply entrenched cultural roots that penetrate every element - from the state to the family - and defines people's activities and choices (Meyer 1988). Hence, even countries with similar levels of economic and social development may present variations in life course patterns which are rooted in a country's institutions and public policy (Mayer, "Whose" 2004). These cross-national differences represent diverse macro (social) contexts that may be linked to micro (individual) level processes not only in the way individuals shape themselves (i.e. adapt and develop traits) according to these social contexts but also in how they superimpose their own values and preferences upon the social contexts to which they are exposed (Mayer, "Whose" 2004). Hence the factors and intermediary forces that affect individuals and, in their aggregate, the birth cohort at each life stage may vary across countries. As a result, the cumulative disadvantage that accrues to each birth cohort at each life stage, the resulting cumulative disadvantage in old age and the consequent impact on female deficit in old age may also vary across countries (O'Rand 1996). Chapter 3 examines cross-national variations in the elderly missing women phenomenon in countries of Asia. Asia is ideally poised for such an analysis for three reasons. First, as already mentioned, the majority of countries/regions that have been identified to date as presenting the missing women phenomenon lie within the Asian continent. Second, Asia represents not only the demographic bulk of the world's total population but also of the world's elderly population (60+) with the share of the worlds elderly population in Asia expected to grow rapidly in the decades to come (Bloom, Canning and Sevilla 2003). It would therefore be expected that at least the countries that already present the missing women phenomenon in their population would show some impact of this female deficit in old age. Third, Asia consists of countries that are very homogenous in terms of social and cultural institutions and at the same time very heterogeneous other sets of countries (Menon and Melandez 2009). For example, the majority of countries in East and Southeast Asia are culturally homogenous but contrast sharply with countries of Western Asia (Menon and Melandez 2009). This allows for an assessment of the variable nature of the elderly missing women phenomenon across countries that are homogenous and heterogeneous in their social context. Hence, in

making cross-national comparisons of the elderly missing women phenomenon, Chapter 3 may allow an improved understanding of the causes behind the female deficit in old age and provide a better assessment of the specific timing, turning points and direction of change (Mayer, "Whose" 2004). For example, Chapter 3 considers how migration affects the elderly missing women phenomenon across countries. Migration, alongside fertility and mortality changes, introduces size variations (at times abrupt) in cohorts and any extraordinary variations are likely to alter the trajectory of cohorts and society (Ryder 1965). Heterogeneity of characteristics within a birth cohort usually has a fixed distribution (that may differ from that of preceding and succeeding birth cohort) but within a cohort, is alterable by immigration (Ryder 1965). An analysis of the variable patterns of migration across countries (e.g. immigrant receiving countries, immigrant sex structure by age) may elucidate the existence the female deficit in old age. The chapter further projects (to 2030 and 2050) how trends in elderly missing women would differ from the trends observed today. The rapid social and economic development in most of the Asian countries over the past 30-40 years would suggest that the life trajectories of elderly today (most of whom were exposed to predominantly rural backgrounds in their youth with relatively little education and low income) are quite different from the life trajectories of those who will form the elderly population in 2030 and 2050 (Hemalin 2000). Consequently, the forces that accumulate to create a disadvantage or generate premature mortality would differ for the 2015 versus 2030 and 2050 birth cohorts and an analysis of these projections may reveal how these differences affect the female deficit in old age. Therefore, Chapter 3 not only allows a cross-national analysis of female deficit in the elderly population but also shows how this deficit is affected by migration and how it varies across time.

Chapters 2 and 3 describe the elderly missing women phenomenon as the accumulation of disadvantages across life stages in relatively stable societies where the continuity of regular transitions prevails over disorderly turning points and irregularity in lives does not come about in unpredictable ways (Diewald, Goedicke and Mayer 2006). However, discrete historical events that create a system upheaval may channel lives into a new direction by possibly altering patterns of continuity and creating change for specific groups of the population and therefore affecting existing configurations of social inequalities (Neugartan and Datan 1996, Diewald, Goedicke and Mayer 2006). The tracking of cohorts across eras of social upheavals allows an analysis of historical experience and an examination of how individuals and cohorts respond to dislocations (Elder 1975). Chapter 3 examines system upheavals in the context of the elderly missing women phenomenon. Taking conflict and natural disaster to be the two exogenous shocks to the system, the chapter uses the special case of Pakistan to consider whether these forces may have led to a female deficit in the birth cohorts that form the elderly population of the country today. Therefore, it considers whether the system upheavals created by these two shocks may have been massive enough to impact the mortality of women in the elderly population of Pakistan today and distort the ratios in favor of men. There is evidence from literature to suggest that conflicts and natural disaster have different effects on the mortality of men and women at least in the long run (e.g. Plumper and Neumayer 2006, Neumayer and Plümper 2007). Pakistan provides an interesting country to study this because other confounding forces that may have affected birth cohorts in other countries are not present therein (e.g. rapid fertility decline, imposition of one child policy; Sathar and Karim 1996, Klasen 2008) so the effect of these exogenous shocks in isolation from those confounding forces may be evaluated and their future impact on elderly missing women may be assessed. Chapter 3

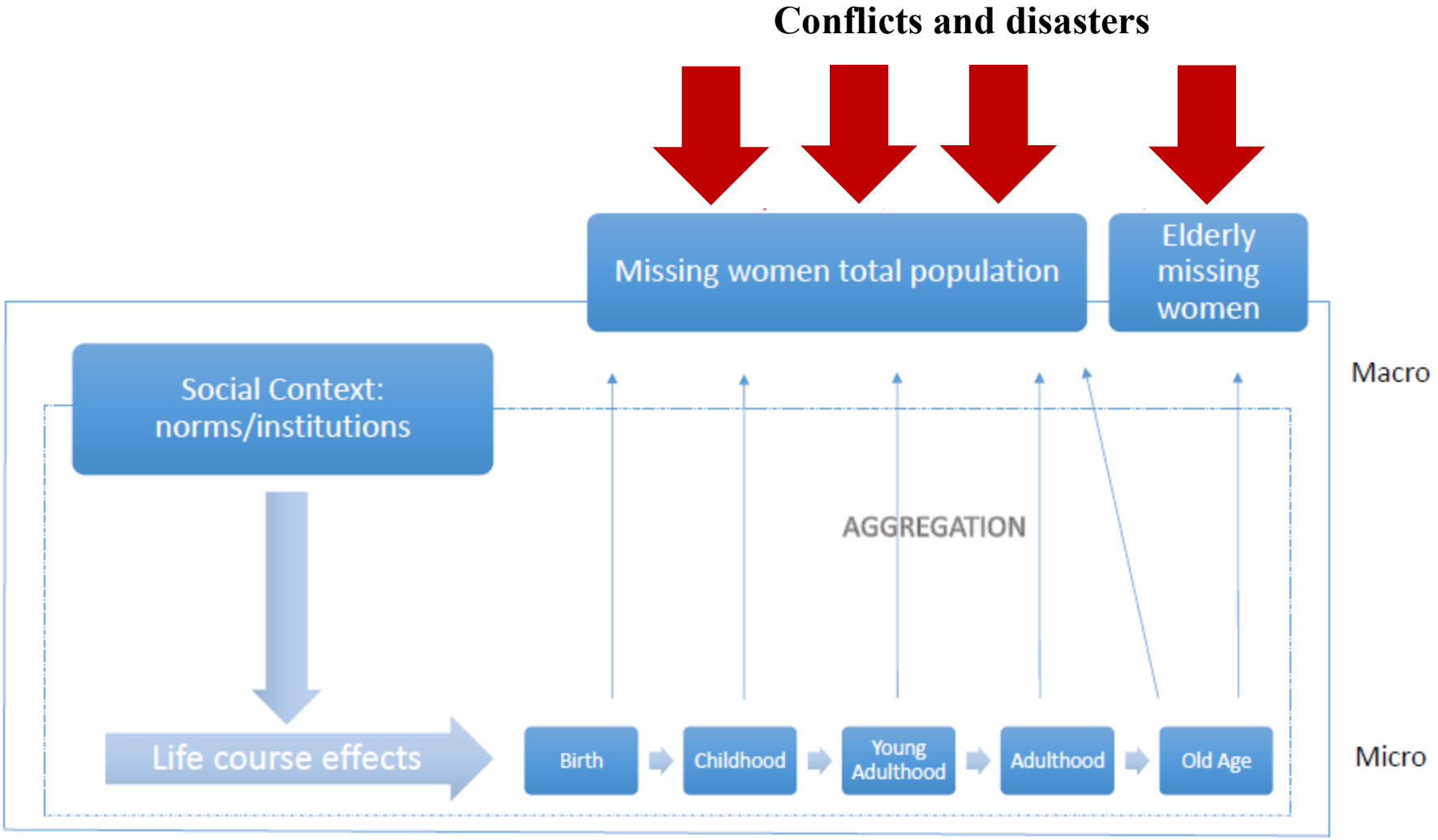
therefore allows for an evaluation of the period effect of historical change on the elderly missing women phenomenon. Period effects occur when social change have a relatively similar influence across successive birth cohorts (Elder Jr. 1994). In the case of the elderly missing women phenomenon, conflict and natural disaster would be expected to have some effect on disadvantages and mortality of women of all birth cohorts regardless of the life stage at which they are in. The exact influence of historical change however depends on the age at which individuals and families experience the event (Pavalko and Elder Jr. 1990). Therefore, the effect of discrete historical events is variable by birth cohorts (Neugartan and Datan 1996). For example, evidence from the five major famines in the Subcontinent (Pakistan, India and Bangladesh) shows that mortality of female infants relative to male infants had been relatively elevated during all five natural disasters but mortality of women in the reproductive age groups had been relatively lower than mortality of men in the same age group (Dyson, "Part I" 1991, Dyson, "Part II" 1991). Hence, the effect on the cohort of elderly who were infants during the famine would be different than the effect on those who were in their reproductive age during the famine (a lower preponderance of women in the former compared to the latter).

Chapters 2 and 3 elucidate that the elderly missing women phenomenon is driven by factors and forces that may differ by social context while chapter 4 introduces the possibility of exogenous demographic shocks that may also differ by country. What is however missing from the analysis is an explanation of the generative mechanisms behind the factors and forces that may lead to marked differences in the elderly missing women phenomenon across countries and hence provide some explanation of the social context behind life courses (Mayer, "Life" 2004). Chapter 5 attempts to unearth these generative mechanisms by assigning variables to the factors, forces and exogenous shocks identified in the preceding chapters and testing their relevance for the sex ratios of the population (total/elderly) at the world level (i.e. including countries that do not present the elderly missing women phenomenon because these countries also display variabilities in their total and elderly sex ratios). Cross-national comparisons are the most suitable method for evaluating the manner in which patterns in life course behaviors and outcomes vary systematically between societies as an observation of inequality generating processes across countries allows greater variations to be identified than inequality generating processes within countries and may therefore allow clearer patterns to be identified (Mayer, "Life" 2004). Such a comparison is especially useful with issues related to gender research because it allows institutions across different countries to be compared (Drobnic1998). Further, cross-national comparisons partly overcome the drawbacks of both inter-cohort comparisons and longitudinal research: the former allows historical differences in life courses to be evident but does not unearth the reasons behind these differences while the latter does not allow a comparison of different life stages at the same point of time which precludes generalizations about the specific timing, turning points and directions of change (Mayer, "Life" 2004). Therefore, the aim of the cross-national comparison in Chapter 5 is not to identify how a particular variable affects sex ratios in a particular country but to evaluate the general mechanism whereby these variables operate on the sex ratios of the population (total/elderly) and hence interpret how the micro and macro processes in society interact to affect the elderly missing women phenomenon (Drobnic 1998). By incorporating this cross-national comparison, Chapters 2 through 5 allow a hierarchical development of the elderly missing women phenomenon in the life course framework. The most basic level examines the individual life course (Mayer, "Life"

2004) and how gender distinguishes not only the life courses of men and women but also how the disadvantages faced by women at each life stage distinguish their life course from other women. The subsequent level evaluates historical variability (Mayer, "Life" 2004). This is captured by the cohort differences observable in the missing women phenomenon also explained in chapter 2. Thereafter, at each level of historical development, some country differences are evident (Mayer, "Life" 2004). These country differences are first explored in terms of differences in social context as described in chapter 3, differences in exogenous demographic shocks as evaluated in chapter 4 (for the special case of Pakistan only) and differences in all factors, forces and exogenous shocks across countries of the world to allow the mechanism behind these differences to emerge.

The idea of the elderly missing women phenomenon within the life course framework may be represented by figure 1.1. The analysis starts at the micro level, i.e. the level of the individual. The individual life course can be divided into five distinct stages (before/at birth, childhood, young adulthood, adulthood and old age) and these stages are tied together by the principle of life course effects. The principle of life course effect implies that what happens to individuals at an earlier point in life affects them at a later point in life. Chapter 2 describes how social context at the macro level differentiates the life courses of men and women by conceptualizing factors and intermediary forces in the individual life courses of women. The repercussions of these factors and forces (i.e. female deficit) can be aggregated at the macro level to present the missing women phenomenon at each life stage or amassed to present the deficit in the total population. Chapter 3 examines how the missing women phenomenon in the total and elderly population changes when the social context changes as this would lead to a different combination of factors and forces that may affect women in the given country. Both Chapters 2 and 3 evaluate the endogenous mechanism driving the elderly missing women phenomenon. Chapter 4 considers the possibility of exogenous shocks in the form of conflict and disasters (at the example of Pakistan only) to the endogenous mechanism. Finally, chapter 5 unearths the generative mechanism behind the social context that allows the factors and forces to develop and the exogenous shocks to have such an extreme impact on female versus male mortality.

Figure 1.1: Elderly missing women in the life course framework



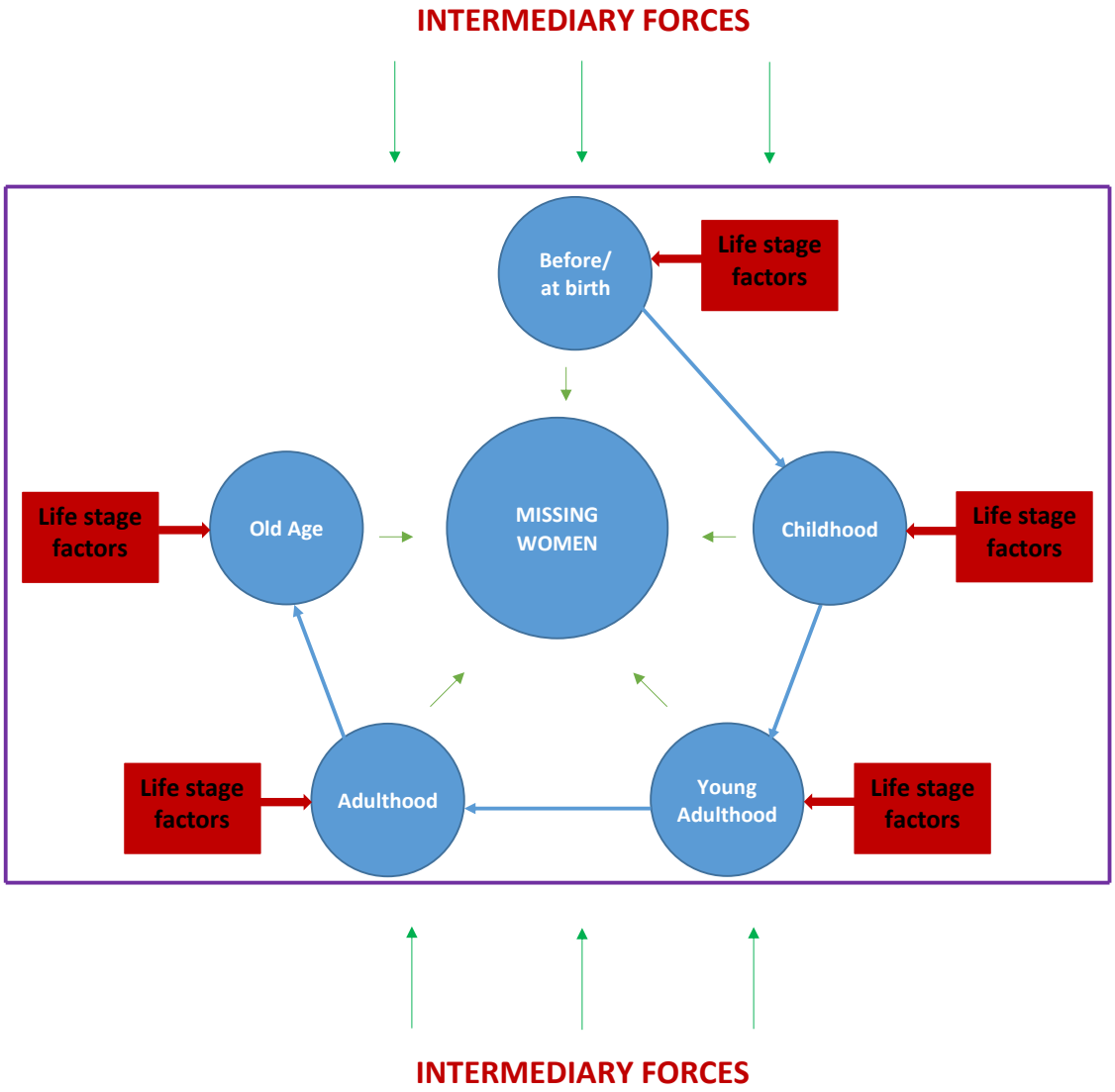
Chapter 2 - Elderly Missing Women: Account and explanations

2.1. Introduction

Incidences of excess female mortality have been recorded since the latter half of the 19th Century (Das Gupta 2005) and may have persisted for eons before that (Chung and Das Gupta 2007). A wider audience for the phenomenon resulted from the writings of Amartya Sen (1990, 1992) who adopted the term "missing women" to capture unnaturally high levels of female mortality prevailing in parts of Asia and Africa. He estimated a number of 100 million missing women in the 1990's. In reaction, burgeoning literature has examined the numbers, causes, consequences and the geography of missing women worldwide. For example, Coale (1991) and Klasen (1994) use alternate methods to calculate figures of 60 million and 92 million missing women respectively. Park and Cho (1995) and Das Gupta and Mari Bhat (1997) assess the factors that exacerbate gender discrimination of female children in South Korea and India respectively. Ebenstein and Sharygin (2009) predict the consequences of missing women for the marriage market in China. Klasen and Wink (2003) discuss the geographical distribution of missing women among (and in some cases within) countries. Das Gupta and Shuzhuo (1999) evaluate how unexpected historical events (1920-1990) affect sex ratios in China, South Korea and India. Furthermore, there are often competing views on how a particular factor affects the missing women problem. For example, Klasen and Wink (2003) use data from India (1961-2001) to show that urbanization may exacerbate the sex ratios at birth, whereas Chung and Das Gupta (2007) show that educated women living in urban areas exhibit lower son preference than their less well educated rural counterparts.

This chapter first briefly summarizes the original account and discussions. In order to disentangle data problems and the various explanatory arguments, this chapter systematizes the existing factors mentioned in the literature by making pragmatic use of the life course approach in two ways: First, to classify the causal factors across the life course (e.g., reasons for women missing already at time of birth, in young and childbearing ages up to phenomena like ritual burning of widows), see figure 2.1 below as an overview. Second social change is taken into account by applying the cohort perspective to data and explanations. As a result, the lifelong and cumulative effects of son preference and female devaluation over the life course are systematically uncovered to not only allow for the recognition of the elderly missing women phenomenon as a neglected issue in population research but also the necessity to bring the topic to scientific and political agenda.

Figure 2.1: Missing Women by life stage



2.2. A systematized review of the literature: Numbers and trends

2.2.1. Original concepts and estimates

By introducing the concept of missing women, Sen (1990, 1992) provided a method to quantify the female deficit. Prior to Sen (1990, 1992) several studies had analyzed some of the reasons for unusual sex ratios (male/female). For example, the Matlab project (introduced in rural Bangladesh in the 1980s) assesses several facets of female neglect and the geographical distribution of this neglect (Chen, Huq and D'Souza 1981). However, Sen seems to have been the first to quantify the magnitude of this inequality. Sen's method of estimation required calculating the number of extra women who would have been alive in a given country if men and women in this country received equal treatment and, hence, women had a survival advantage. The calculation of this figure requires the use of an ideal sex ratio that would hypothetically prevail in these countries in the absence of discrimination. Sen (1990, 1992) took this ratio to be 1.02 (the sex

ratio prevailing in Sub-Saharan Africa as it is also a developing region but has favorable gender ratios) and later 1.05 (the sex ratio prevailing in Europe and North America as he assumes no mortality inducing gender bias against women in these regions).

Sen limits the scope of causal factors to gender discrimination in health and nutrition. Many later papers address the limits of this definition as excess female mortality may result from a variety of other causes which may not necessarily fall under the aegis of discrimination and – even if so – cannot be limited to discrimination in nutrition and health. Also, the method used to calculate missing women has been debated by several authors. The main point of contention is the ideal hypothetical sex ratio used by Sen. Other points of contention emerge when deciding the relationship between sex ratio at birth and life expectancy and the relationship between sex ratio at birth and sex ratio in the population.

Coale (1991) has been the first to address these issues. He uses alternative assumptions (for age and sex specific mortality patterns) to calculate a much lower figure of 60 million missing women worldwide. He asserts that whilst females outnumber males at all ages (except at birth where he assumes the biologically normal sex ratio is 1.05 but rapidly erodes in favor of females) younger populations have a more masculinized sex ratio than older populations because male mortality (vis-à-vis female mortality) increases steeply as populations get older. To delineate the sex specific mortality patterns, Coale (1991) uses the sex specific mortality patterns delineated by model life tables West[2] to show that in populations with normal mortality women outnumber men at all ages. He calculates the expected sex ratios using the life expectancy and fertility levels prevailing in the respective countries from ten years earlier (1970) and a sex ratio at birth of 1.059, and compared the result to actual sex ratios of populations from censuses conducted in the 1990s to come up with the figure of 60 million missing women.

Like Sen, Coale (1991) uses existing literature on gender discrimination to explain the prevalence of this problem. He asserts that traditional differences in the treatment of girls and women leads to excess female mortality and uses the relationship between the state wise variation in sex ratio and tradition in India to further develop his hypothesis. The appropriateness of the sex ratios used by Coale (1991) have been further discussed by Klasen (1994). He compares the methods of Sen (1990) and Coale (1991) and concludes that Sen overestimated the number of missing women whilst Coale (1991) underestimated it. Sen's overestimated figures are a result of using Sub-Saharan Africa as the hypothetical reference point for sex ratios as these have a biologically low sex ratio at birth that cannot be expected to prevail in populations of non-African descent. Coale's (1991) underestimated figure result from two peculiarities in model life tables West that reduce the survival advantage of girls thereby underestimating the number of missing women. To overcome this problem, Klasen (1994) uses model life tables East[3] instead of West.

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[2] Model life tables based on the mortality experience of Western European countries, Japan, Taiwan, New Zealand, Australia, Israel, South Africa and North America (Murray et al. 2002).

[3] Model life tables based on experience of Eastern European countries (Murray et al. 2002).

Klasen (1994) further contends that increasing life expectancy of the population is accompanied by rising sex ratios at birth because factors that expand the former also improve the survival rate of male babies. He argues that Coale's (1991) sex ratio at birth is based on populations with life expectancies beyond 70 years and hence is inaccurate for the countries affected by the missing women phenomenon (which have much lower life expectancies). To correct for the sex ratios at birth Klasen (1994) uses cross-sectional evidence for 62 countries[4] from the 1970's and 1980's to regress male to female sex ratios at birth against average life expectancy in the country. He finds a highly statistically significant correlation suggesting that a 13-year increase in life expectancy is correlated with a one percentage point rise in the sex ratio at birth. He then uses this regression to estimate the hypothetical sex ratio at birth that should prevail in each country contingent on its average life expectancy. By incorporating these changes into Coale's (1991) methodology, Klasen (1994) calculates a figure of 92 million missing women.

2.2.2. Updated estimates

Sen (1990, 1992), Coale (1991) and Klasen (1994) estimated the number of missing women using census data from the early 1990s. Their estimates are therefore a reflection of the number of missing women in the 1980s. Almost a decade later, Klasen and Wink (2002, 2003) re-calculated the numbers using updated demographic information to assess the missing women situation in the 1990s. They use the method employed by Klasen (1994) and find that the number of missing women has increased in absolute terms but decreased in relative terms, indicating an overall improvement in the missing women problem. The authors provide hypothetical explanations for this improvement. These include: better enumeration of women, improvements in education and quality of life, increase in female labor force participation and change in government policy.

The aforementioned authors calculate the number of missing women for the entire population in a country regardless of age group, so that cohort effects and variations in discrimination over the life course remained largely unobserved. Klasen (1994) points to the possibility of calculating missing women at each age but dismisses the idea because data requirements (accurate count of males and females at each age) for such an exercise are unlikely to be met by the poor vital registration systems in most of the affected countries. Nevertheless, Anderson and Ray (2010) use data from population Censuses (for 2000) in selected countries (China, India and Sub-Saharan Africa) to calculate the number of missing women by age. Their results drastically differ from earlier calculations of missing women as they show that the majority of missing women in India and a significant portion in China are of adult age. Further, they find that on a relative basis, the number of missing women in Sub- Saharan Africa is comparable to that of India and China. However, Klasen and Vollmer (2013) contend that the calculations of Anderson and Ray are based on faulty assumptions.

Nevertheless, Bongaarts and Guilmoto (2015) use data from the United Nations to estimate the number of missing women by age (five-year age groups from 0-4 to 85+)

[4] Considered reliable by the United Nations Population Division and not including populations of African descent (Klasen 1994).

in 2010. They calculate the difference between the expected and actual sex ratio (at birth and by life expectancy for each age interval) in 2010. For the expected sex ratio they use a set of reference countries[5] from all continents and conduct a linear regression analysis to correlate the sex ratio with life expectancy. They find that there are approximately 125.6[6] million missing women worldwide in 2010 distributed across all age groups from 0-4 to 85+ with the majority concentrated under the age of 60. Further, under the age of 60, they find the largest number of missing women to be in the 40-59 category with each five-year interval containing a deficit of 10 million women. They attribute this large female deficit to the cumulative impact of prenatal and post-natal factors and discuss how these may differ by birth cohort. They highlight that the majority of missing women are concentrated in China and India followed by Pakistan, Bangladesh, Nigeria and Indonesia. They also find evidence of excess female mortality in Sub-Saharan Africa at the post-natal stage thereby lending support to the results of the study by Anderson and Ray (2010).

The arguments presented so far agree on the existence of the missing women phenomenon and debate the magnitude and complexity of the phenomenon. Causes, however, have not been systematically discussed and evaluated. Sen (1990, 1992) assumes that the problem was concentrated at birth and in early childhood. Some authors have confirmed this view, for example, Coale and Bannister (1996) follow Chinese birth cohorts from 1930's to the present and show that the majority of women go missing at early stages of life with negligible female deficit thereafter. Other authors, have shown that sex ratios at birth are beginning to normalize (e.g. Guilmoto 2009), while still others discuss reasons behind the missing women problem in the adult population (e.g. Milazzo 2014). In the remained of this chapter, I summarize how gender discrimination at each phase of female life course (before/at birth, childhood, young adulthood, adulthood and old age) may lead either to excess female mortality at that phase or to missed opportunities that create disadvantages in subsequent phases of the life. I therefore adopt a life course perspective to assess how gender discrimination throughout the life course creates a baggage of disadvantages that may lead to an even more pronounced missing women problem in the elderly population.

2.3. Systematizing factors in a life course perspective

This chapter systematizes causal factors mentioned in the literature that are responsible for missing women at each phase of the female life span (before/at birth, childhood, young adulthood, adulthood old age). These factors are either assumed to be the result of (predominantly) biological differences between men and women (hereafter referred to as sex related factors) or (predominantly) social and behavioral differences in the treatment of men and women in society (hereafter referred to as gender related factors). Table 2-1 provides an overview of these factors by life stage.

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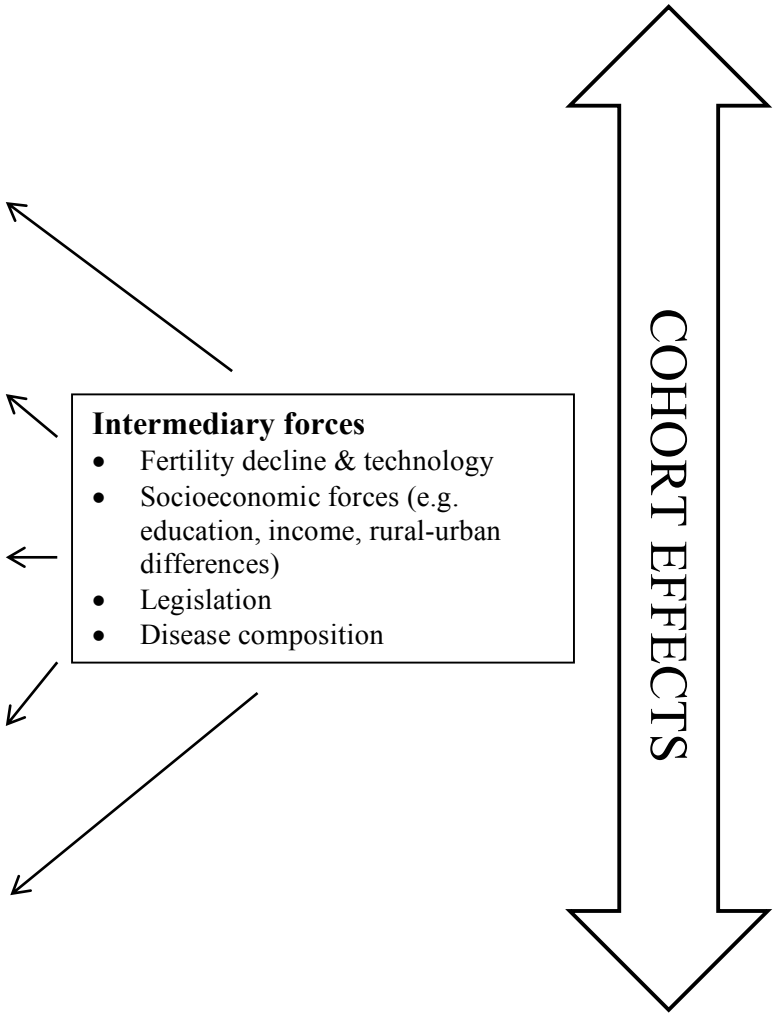
[5] Reference countries meet four criteria: have populations above 5 million in 2010, do not include Eastern European countries (due to their high male mortality rates), do not include Saudi Arabia and United Arab Emirates (due to the presence of large number of male immigrants), do not include countries that are known to practice prenatal sex selection or exhibit post-natal excess female mortality (Bongaarts and Guilmoto 2015).

[6] Or 121 million missing women, depending on direct or indirect method of estimation (Bongaarts and Guilmoto 2015).

Table 2–1: Factors and intermediary forces responsible for missing women by life stage

Life stage		Factors
Before/at birth	Sex related	• Parent carrier of Hepatitis B virus • Heterogeneous probability of having sons
	Gender related	Son preference and daughter devaluation: • Infanticide/neglect at the time of birth • Prenatal sex selection • Birth order & gender composition effects
Childhood	Sex related	-
	Gender related	Son preference & daughter devaluation: • Neglect in health & nutrition • Birth order & gender composition effects • Trade-off with sex ratios at birth • Adoption
Young adulthood	Sex related	Reproductive role
	Gender related	Female subordination: • Mortality risks of reproduction • No access to health care • HIV/AIDS • Violence Son preference & daughter devaluation • Direct impact on female mortality
Adulthood	Sex related	-
	Gender related	Female subordination: • Lack of preventive care Son preference and daughter devaluation • Repercussions of failure to have a son • Possible negative consequences of female labor force participation
Old age	Sex related	-
	Gender related	Female subordination: • Widowhood • Absent property rights • Financial vulnerability • Changing household structures • Violence



2.3.1. Before/at time of birth

The ideal sex ratio at birth in human populations has been the subject of much debate. According to Hamilton (1967), Ronald Fisher, in his 1958 book – A Genetical Theory of Natural Selection, is the first to assert that following Darwin's Theory of Natural Selection the sex ratio at birth in human populations should be 1:1. A plethora of literature has examined factors that may cause it to deviate. James (1987) summarizes this literature and outlines some factors that may cause substantial variation from unity for individual parents: age of parents, time of insemination in the cycle, specific parental diseases, hormonal treatment of parents for specific illnesses or infertility and exposure to harmful chemicals. However, he concludes that research on the effect of these factors on sex ratios is severely limited. In a recent paper Orzack et al. (2015) probably use the largest and most comprehensive dataset for a study of this sort to date to assess the trend in sex ratios from conception to birth. They find that the biologically normal sex ratio at conception is 1:1 but during pregnancy total female mortality biologically exceeds total male mortality as a result of which the sex ratio at birth becomes male biased. Following from this study, Austad (2015) approximates the biologically normal sex ratio (male/female) at birth to be 1.05. However, this only holds for non-black populations as sex ratios at birth tend to be more feminized for black populations worldwide – in the Sub-Saharan Africa region, in specific Caribbean countries and amongst African-Americans in the United States (James 1984, Kaba 2008, Garenne 2009). Reasons for this may be biological (James 1984) or non-biological (e.g. some of the reasons described earlier in the paragraph may be accentuated in specific subgroups of black populations; Garenne 2009).

Nevertheless, some authors continue to explain abnormally masculinized sex ratios at birth in
populations by purely sex related explanations. Oster (2005) is probably one of the first to do so in the context of missing women. She postulates that mothers who are carriers of the *Hepatitis B* virus have more masculinized sex ratios at birth (1.5 boys for every girl). She therefore concludes that the high Hepatitis B prevalence rate across many Asian countries like China could account for 45% of missing women worldwide. Oster's (2005) findings raise a debate in academia about the link between the virus and missing women. Oster et al. (2010) end this debate by showing that the findings of Oster (2005) have been obviously incorrect.[7]

Ellis (2008) provides another sex related explanation for masculinized sex ratios at birth, although combined with gender related behavior. She asserts that if women within a population have *heterogeneous probabilities of having sons* (i.e. some women have a high probability of having a son while other women have a low probability of having a son at any given birth order) then son preferring behavior may lead to an excess of girls and drive the sex ratios down. She provides the theoretical reasoning

[7] Das Gupta (2005) and Ebenstein (2007) show that the relationship depicted by Oster (2005) only holds for births of higher level. Lin and Luoh (2008), using data from Taiwan, find a very small effect of maternal carriers of Hepatitis B virus and elevated sex ratios at birth (0.25 percentage points effect versus 9 percentage points effect found by Oster). Chen, Oster and Yu (2008) shows that the relationship between the virus and masculinized sex ratios at birth is a result of the father (rather than the mother) being the carrier. Finally, Oster et al. (2010) find no correlation between either parent being a carrier of the virus and masculinized sex ratios at birth.

behind this as follows: when women continue to have children until the birth of a son (the so called son-preferring-fertility-stopping rule) then the reduction in the number of girls born to women who have a first son (women with a higher probability of having a son) is less than the increase in the number of girls born to women who have a first daughter (women with a lower probability of having sons). This will lead to an overall increase in the number of girls and lower the sex ratios at birth (males/females). Hence, she concludes, that current figures even underestimate the number of missing women because they are based on a hypothetical ratio that is higher than one that should prevail in societies practicing son preference. If this hypothesis were true, countries with large numbers of families following the son- preferring-fertility-stopping rule should have even more men than women.

Guilmoto (2009) asserts that gender related factors resulting in skewed sex ratios at birth are a result of two independent preferences: *son preference and daughter devaluation*. Son preference is rooted in patriarchal and patrilocal family and social arrangements. Sons most frequently are assumed to preserve the family power and property (through inheritance), carry on the family lineage and care for elderly parents and relatives. Daughter devaluation is an aversion to daughters which results from their role in preserving the family honor, the social responsibility of getting them married and the costs associated with their marriage, dowry and post marriage transfers. Money spent on sons is regarded as an investment whilst on daughters an expenditure because sons stay with the natal family forever whereas daughters become members of their husband's family upon marriage. Guilmoto (2009) contends that parents may exercise their preference before/at birth through traditional and/or modern methods of sex selection. Traditional methods are *infanticide* or *neglect at time of birth*. Modern methods include *sex selection technology at the prenatal stage*. The cheapest method of sex selection (available in most Asian countries) is ultrasound technology followed by a possible abortion.

Son preference and daughter devaluation may result in two effects before/at the time of birth: *birth order effect* and the *gender composition effect*. The birth order effect means that the sex ratio at birth is an increasing function of the number of children that a couple has so that sex ratios at birth are higher for higher level births. This is because in a son preferring society the goal of parents is to have at least one son and there is a limit to the number of daughters parents allow to be born in order to achieve this goal. The gender composition effect implies that parents' decision to sex select is determined by whether their surviving children reflect their gender preferences. Together these effects translate into higher sex ratios at birth for higher level births especially when preceded by surviving children of the undesirable gender (girls in this case; Das Gupta and Mari Bhatt 1997). For example, using data from the 1984 Population Census of India, Das Gupta (1987) shows that in Indian Punjab female infant mortality at birth is normal at the first three birth levels but significantly higher at the fourth birth level and starts to correlate with the gender composition of existing children at this level.

According to Sen (1990, 1992), gender related factors are shaped by economic and social factors. It would therefore be interesting to assess how gender related factors differ by social and economic milieus, for example in case of migration. Some authors have analyzed how son preferring behavior among immigrants may affect their sex selection behavior. These analyses cover immigrant communities in United Kingdom, United States and Canada. Dubuc and Coleman (2007) assess the behavior of Indian

immigrants in the United Kingdom by using data on live births in England and Wales from 1969 to 2005. Their analysis shows that the trend in sex ratios at birth of Indian born mothers in England and Wales is similar to that in India with sex ratios at birth noticeably increasing after 1980's and further accelerating in the 1990s. These results allow them to calculate 1480 missing women of Indian origin in the United Kingdom between 1990 and 2005. Further, Gill and Mitra-Kahn (2009) argue that the largest imbalances in sex ratios at birth in the United Kingdom (2001) occurred among the Asian (Chinese included) populations. The recent study by Adamou, Drako and Iyer.(2013) uses data from 1971 to 2006 to also assesses the missing women situation in the United Kingdom. Their most relevant result is a disaggregation of the motivation behind sex ratios at birth into two components: an ethnicity effect and an attribute effect. They use the term ethnicity effect to capture the extent to which the persistence of Indian cultural norms and son preference motivates Indian immigrants to undertake sex selection at birth. They use the term attribute effect to capture the extent to which difference in personal characteristics (independent of cultural norms) between Indian and English families motivates the former to sex select more than the latter. Their results show that 87% of missing women at birth are a result of the ethnicity effect whilst 13% are a result of the attribute effect. Upon applying these percentages to survey data, they find a figure of 914 missing women at birth of Indian origin in the UK between 1993 and 2006. Given this it is not surprising that they also find evidence of a birth order effect with Indian immigrants' sex selecting at a lower parity than Indians in India (i.e. second order birth rather than third order birth). The authors suggest that this may be due to lower fertility preferences of Indian immigrants.

In the case of United States, Abrevaya (2009), based on three independent datasets covering the period from 1970 to 2005, finds evidence of sex selection among Chinese and Indian (Asian) immigrant parents. Similar to Dubuc and Coleman (2007), the author finds that not only does migrant behavior mirror that in China and India but also coincides with the spread of sex selection technology. Further, he finds the birth order effect to be operative amongst Chinese and Indian parents at the third and fourth order births respectively. He estimates that there are over 2000 missing women of Chinese and Asian Indian origin in the United States (900 of the former and 1300 of the latter). From a relative perspective, the estimate of 1300 Indian missing women is proportional to the 914 missing women in the United Kingdom calculated by Adamou, Drako and Iyer. (2013) because there are more Indian immigrants in the United States than in the United Kingdom.

Almond, Edlund and Milligan (2009), using the Canadian population censuses of 1991, 2001 and 2006, assess sex ratios at birth of South and East Asian immigrants in Canada and find two main patterns in terms of birth order and generation of immigrant. First, they find that on average (for all immigrants) the decision to have a third child and the gender of this child is contingent on the gender of existing children. Hence, providing evidence of the birth order and gender composition effects. Second, when disaggregating the results by generation of immigrant, they find that first generation immigrants are more likely to exhibit son preference through the fertility stopping rule whilst second generation immigrants are more likely to use sex selection methods.

2.3.2. Childhood

The majority of literature on missing women focuses on the 0-6 age groups. Therefore, some factors in the first two life stages may overlap. Son preference and daughter devaluation continue to deteriorate the female survival advantage. At this stage, Sen (1990, 1992) underscores the importance of gender bias in *health and nutrition* in elevating the mortality of girls vis-à-vis boys. This notion is supported by various authors before and after his publication.

For example, Chen, Huq and D'Souza. (1981) compare the male and female mortality rates from 1974 to 1977 in the Matlab region of rural Bangladesh and find that the highest difference in male-female mortality occurs between the ages of 1 and 4. They attribute this differential to higher incidence of malnutrition and lower rates of disease (infectious) recovery among girls compared to boys as girls are taken to hospitals less frequently and at more serious stages than boys.

Another example is Das Gupta's (1987) study of rural Punjab (in India). Based on data from the 1984 Indian Population Census, she finds that for all ages from 1 to 59 months' female mortality rates are higher than male mortality rates. Further, between 1 and 23 months, where the bulk of child mortality is concentrated, female mortality rates are almost twice as high as male mortality rates. Her results reveal that this can be explained through differences in nutrition and health care which are maximum in the first two years of life. She also finds evidence of the birth order and gender composition effects by showing that mortality rates for girls at the fourth level are elevated compared not only to boys of the same level but to girls of the preceding level as well.

Goodkind (1996) suggests a *trade-off* between sex ratios at birth and sex ratios during childhood. He argues that rising sex ratios at birth should reduce post-natal discrimination against girls as daughters who are born are intentionally wanted. To test his hypothesis, he uses several sources of data (vital registration data and surveys) from 1960 to 1990 to assess trends in sex ratios in both life stages for South Korea, China and Malaysia (Indians). His results show that the case of South Korea supports the idea of a trade-off, however the cases of China[8] and Malaysia (Indians) show the opposite with rising sex ratios at birth being accompanied by rising child sex ratios. Sen (2003) theoretically supports the trade-off argument by suggesting that female childhood mortality may be counterbalanced by sharply rising sex ratios at birth. Lin, Liu and Qian (2014), using data on birth and death registries from 1980 to 1996, evaluate this argument for Taiwan and find that for every 100 abortions, 15 girls at the post-natal stage survive. They apply these statistics to hypothetical scenarios in China and India and conclude that an enforceable abortion ban in these countries would increase the number of girls born by 1.6 million but reduce the number of girls who survive by 0.16 million. Although evidence for the trade-off argument is contradictory, it may explain why Sen and other authors often group the factors responsible for elevated sex ratios at birth and during childhood.

Johansson and Nygren (1991) assert that missing girls in China may partly be explained by *adoption.* Using population surveys from China they argue that half of the missing girls from 1980-1987 can be accounted for by adoption. Their contention is based on

[8] Goodkind (1996) argues that China presents a special case because of the imposition of the One Child Policy and therefore cannot be used as evidence that the trade-off is inoperative.

the logic that adopted children are often not included in the registration of live births because the adoption either takes place informally and/or birth parents avoid reporting births because of restrictions on family size. Since most of the adopted children in China are girls, it seems logical that including them in the birth data would improve child sex ratios. However, Bannister (2004) disproves their findings. She asserts that adopted children are listed as members` of the household of adoptive parents and hence are included in the Chinese census count.

2.3.3. Young adulthood

In young adulthood certain sex related factors may increase women's susceptibility to dangers that are nonexistent for men. For example, many authors have argued that women's reproductive role increases their mortality risk vis-à-vis men (c.f. Paolisso and Leslie 1995, Anderson and Ray 2010). Other sex related factors include higher incidence of anemia and iodine deficiency disorders among women at all ages after adolescence, greater prevalence (not necessarily incidence) of sexually transmitted diseases (STDs) amongst women and worse biological (e.g. possible infertility) and social consequences of STDs for women (Paolisso and Leslie 1995). Gender related factors may exploit and exacerbate the biological vulnerabilities of women at this stage contributing to a missing women problem in young adulthood. The example of anemia may help elaborate on this. The incidence of iron deficiency anemia among women in the reproductive age group may be an important indicator of the cumulative impact of childhood nutrition on adult health. Although the Global Burden of Disease study on the prevalence of anemia between 1990 and 2010 for 187 countries worldwide shows that the prevalence of anemia is most severe in the under 5 age group (both genders, with slightly higher prevalence amongst girls), it finds that after adolescence (i.e. after age 15) the prevalence of this disease is much higher amongst females than males with the gender differential continuing to increase with age (Kassebaum et al. 2014). Reasons for this increased risk amongst female may include faster growth, iron loss (the incidence of which is higher amongst women after puberty) and poor dietary habits (Milman 2011). Women suffering from anemia face greater susceptibility from various types of infections and may be exposed to negative outcomes during pregnancy (e.g. higher risk of early delivery; Milman 2011). Perhaps the most aggravating part is that women may be mostly aware of factors that increase the susceptibility to anemia in adulthood and yet do nothing to circumvent them. This is evident through Galloway et al.'s (2002) assessment of anemia perceptions amongst women in eight developing countries[9] which reveals that women are cognizant that anemia symptoms are a result of poor quality diet. For example, in India women mention dietary restrictions and eating last or eating leftovers as causes of anemia and in Pakistan women cite the allocation of the limited available meat (and other iron rich foods) in the household in favor of husbands and children only as a prime cause of anemia (Galloway et al. 2002).

Gender related factors that influence the survival of women in young adulthood can be classified into three categories: female subordination, son preference and daughter devaluation. *Female subordination* refers to the inferior position of women in society and for example may be manifested through their lack of decision making power.

[9] Countries include: Bolivia, Burkina Faso, Guatemala, Honduras, India, Indonesia, Malawi and Pakistan (Galloway et al. 2002).

Fikree and Pasha (2004) identify several factors in South Asia that may elevate *female reproductive mortality* through this channel. These include: pregnancy at an early age, frequent childbearing, poor antenatal care, unskilled birth attendants and unsafe abortions. Okojie (1994) asserts that early and excessive childbearing leads to weakness and exhaustion resulting in high levels of maternal mortality. She notes that this is exacerbated in countries where abortion is illegal or not easily available as untrained practitioners and unsanitary conditions significantly elevate the mortality of young women. Further, Ojangu and Gilbert (1992) contend that the low rates of hospital deliveries and high rates of maternal mortality in many developing countries indicate that pregnancy and childbirth are not considered health issues.

Some author's discuss how female subordination restrict women's *access to health care*. Paolisso and Leslie (1995) contend that women's subordinate position to her husband and his family implies that she often cannot seek health care without their permission which may not be granted unless the medical condition is considered severe. Ojangu and Gilbert (1992) assert that female deaths from diseases associated with malnutrition (e.g. gastroentitis, colitis, pneumonia) may provide one such example as they are frequently indicative of the late stage at which treatment is sought and thereby reflect the undervaluation of women in society. Women's seclusion to the household severely limits their capacity to seek health care (Ojangu and Gilbert 1992). The household chores assigned to women often cannot be delegated to other members so the time costs of traveling to medical facilities and waiting at clinics are very high. Restrictions on women's ability to move freely may also imply that they cannot travel long distances without a male companion further increasing the time costs of professional health. Women's financial dependence on their husbands could create complications as the latter may not want to allocate scarce resources to the well- being of their wives. However, even if women are free from all these constraints they may be reluctant to consult a professional if they perceive that traditional sources of medicine are more effective in alleviating symptoms (Ojangu and Gilbert 1992).

Child marriage may increase the number of missing women in young adulthood through the channels identified in the preceding paragraphs. The United Nations defines child marriage as a "formal marriage or informal union before the age of 18" and although this definition is applicable to both boys and girls, statistics reveal that more than 700 million women alive today were married before the age of 18 with 250 million of these women married by the age of 15 (UNICEF 2016). Nour (2006) lists some of the health consequences facing child brides in Africa. She contends that child brides are more vulnerable to HIV, other sexually transmitted diseases and cervical cancer. One of the reasons behind these increased vulnerabilities is the lower autonomy child brides have as they usually marry older men, become part of polygamous marriage arrangements and due to their generally lower education have limited knowledge of contraceptive techniques (Clark, Bruce and Dude 2013). Alongside this is the pressure to prove their fertility early in the marriage which leads to frequent intercourse and consequently premature childbearing (Nour 2006). Pregnancy and childbirth place additional health risks for these women whose bodies are not yet ready for this challenge. These present themselves not only in the form of infectious diseases such as malaria but complications during delivery which may lead to infertility and the associated social humiliation (Nour 2006). Child brides are also more likely to suffer the consequences of intimate partner violence. For example, using demographic and health surveys from 34 countries around the world, Kidman (2016) finds that women

aged 20-24 who were married as children reported higher rates of sexual intimate partner violence in the past year compared to women in the same age category who got married when they were older. She finds these results to hold when extending the age category to older age groups so that the results are not limited to the first few years of marriage, when the wife is young (Kidman 2016).

Son preference further increases pressure on these factors. Milazzo (2014), using data from the Indian National Family Health Survey (1992-1993, 1998-1999, 2005-2006) shows how son preference directly elevates the mortality of women (during reproductive ages and beyond). Her analysis reveals three main results. First, amongst women with at least one child born, the share of women with first born daughters decreases with mother's age. Second, women with first born daughters are more likely to be anemic when young (after the birth of their daughters) but are no different in terms of anemia as they age. Third compared to women with first born sons, women with first born daughters have more children, are more likely to have had a terminated pregnancy, desire more children, and are less likely to use contraceptives. Her results therefore show that the incidence of missing women is likely to be higher for women with first born daughters as these women are more susceptible to factors that increase the mortality risk of reproduction. She further finds that older women of a higher socioeconomic status are more likely to survive the birth of daughters. This may be because these women had better nutrition and healthcare when they were younger, they value daughters more equally than sons and/or they have better access to medical care whilst pregnant to ensure they remain healthy.

Anderson and Ray (2010), using WHO data for cause death by disease for the year 2000, find that *HIV/AIDs* is the dominant source of missing women in Sub-Saharan Africa and disproportionately affects women in the 15-44 age category. They hypothesize this to be due to gender bias in treatment, gender-based violence and/or differences in cultural and sexual norms between developed countries and Sub-Saharan Africa. Klasen and Vollmer (2013) agree that the proportion of missing women in the 15-44 category in Sub-Saharan Africa is increasing but contend that HIV/AIDs is less pervasive than argued by the former authors. Nevertheless, the trends in HIV/AIDS delineated by other researchers also support the argument of Anderson and Ray (2010). For example, using global data on HIV from WHO for the year 1995, Quinn (1996) finds almost half of the HIV infected population in sub-Saharan Africa and 30% to 65% of the infected population in Asia (predominantly India and Thailand) is female. In contrast, over 80% of the infected population in Australia, New Zealand and the Scandinavian countries is male. This is because the majority of infections in the latter set of countries are a result of male heterosexual behavior whereas in the former set of countries mother to child transmission and female prostitution play a prominent role. The results of Bongaarts and Guilmoto (2015) support the argument of Anderson and Ray (2010) about the burden of HIV on missing women in Sub-Saharan Africa.

Fikree and Pasha (2004) emphasize the role of *violence* in elevating the mortality of women. They argue that although in most parts of the world men bear the burden of violence, in South Asia, young women are more at risk of violence (especially when accompanied by dowry distress) and suicide. Okojie (1994) contends that South Asian women may be more susceptible to domestic violence (in the form of wife beating) but dowry murder is less common. Nevertheless, Babu and Babu (2011) find that in 2007 alone a total of 11,241 women died in India as a result of dowry related murders and

dowry related suicides. This figure represents a 74%[10] increase over its 1995 level. The figure however fails to capture the suffering of women who manage to evade dowry death but are unable to pay their dowries. Their suffering may manifest in the form of form of malnutrition, poor antenatal care, female foeticide, maternal mortality and family conflict (Babu and Babu 2011). Therefore, failure to pay dowry elevates exposure to all the factors that may lead to missing women at different life stages. Anderson and Ray (2010) find that violence/injuries against women is a formidable cause of missing women in India with the 15 to 29 age category standing out. Injuries are also a cause of missing women in China though to a lesser extent and at older ages (30-59). Nevertheless, they find that China is the only country in the world where female suicides outnumber male suicides.

Women in some parts of the world may also be subjected to *Female Genital Mutilation (FGM)*. The WHO (2016) defines FGM as "any procedure that involves partial or total removal of the external female genitalia, or other injury to the female genital organs for non-medical reasons." According to UNICEF (2016), at least 200 million girls and women worldwide have been subjected to this procedure with 44 million victims being under the age of 15. The practice cannot be traced to a specific religion but rather is the outcome of deeply embedded traditional belief[11] and prevails across African, Arabian and Malay countries and amongst immigrant communities from these regions in industrialized societies (Webb and Hartley 1994, Morrone, Hercogova and Lotti 2002). The practice may take place in a traditional setup without sterile equipment or by a medical practitioner with sterile equipment and with the victim under the influence of anesthesia (Braddy and Files 2007). Braddy and Files (2007) outline the short term and long term health implications for victims of FGM. Short term implications include infections, severe pain, bony fractures, hemorrhage, acute urinary retention and deaths. Morrone, Hercogova and Lotti. (2002) argue that although anecdotal evidence of deaths from FGM exists, there is no academic literature to date that assesses the proportion of female deaths attributable to FGM. They further contend that only 15-20% of FGM complications are treated by trained medical personnel due to distance of the victim from health care facilities, ignorance of practitioners and fear of retribution. Long term health complications of FGM include different types of infections, infertility, sexual dysfunction, post-traumatic stress disorder, increased risk of HIV and several types of obstetric complications. Adam et al. (2010) conducted a study across six African countries[12] in 2006 to estimate the annual costs and years of life lost by victims of FGM (aged 15-45) due to obstetric complications[13]. They find that on average, for all types[14] of FGM, obstetric complications led to an additional cost of $3.7 million dollars for the 2.8 million women aged 15-45 in these six countries who had undergone the procedure. In terms of years of life lost, they find that all 15 year olds who are expected to undergo

[10] Part of this increase however is attributed to a 31% increase in the reporting of dowry related suicides which form 3,148 of the 11,241 deaths (Babu and Babu 2011)

[11] Rational for FGM may include preservation of female purity, prevention of prostitution, mechanism to control women's sexuality and prerequisite for a good marriage (Webb and Harley 1994, Morrone et al 2002, Bradley and Files 2007).

[12] Countries include Burkina Faso, Ghana, Kenya, Nigeria, Senegal and Sudan (Adam et al. 2010).

[13] Obstetric complications included in the study are: Caesarian section, hemorrhaging, inpatient stay, inpatient perinatal death, infant resuscitation and episiotomy (Adam et al. 2010).

[14] The WHO classifies FGM into four categories: Type I, Type II, Type III and Type IV. The first three types represent increasing levels of severity of FGM while Type IV represents all types of FGM that cannot be classified under the first three types (WHO 2017).

any type of FGM procedure in the upcoming year will cumulatively loose 130,000 years of their life which amounts to half a month of life lost for each girl. If the FGM type is restricted to type III (the severest form of FGM; Braddy and Files 2007), the resulting life lost for each girl rises to three months. These years of life lost are associated with obstetric complications only. It may be surmised that if the other short and long term health implications listed in this paragraph alone are included, the years of life lost by each girl would rise significantly making FGM a gross contributor to the missing women phenomenon.

An extreme manifestation of violence against women are *honor killings*. According to Obberwittler and Kasselt (2011), honor killings can be defined as "intentionally committed or attempted homicides that are carried out predominantly by males against females in order to restore, from the perspective of the perpetrator, their family or personal honor." Reliable statistics on honor killings are difficult to attain. The United Nations Population Fund (2000) estimates that almost 5,000 women worldwide are killed yearly in the name of "honor." According to the Honor Based Violence Awareness Network (2016) this figure equals 1,000 women each in Pakistan and India. A study conducted amongst 856 ninth graders in Jordan revealed that approximately 40% of boys and 20% of girls considered it justifiable to kill a sister, wife or daughter who had dishonored the family (Eisner and Ghuneim 2013).[15] These high percentages reveal the extent to which extreme manifestations of violence against women may be considered acceptably by society.

Violence may also be a consequence of missing women when considering the long term demographic effects of a male surplus (Guilmoto 2009). Ebenstein and Sharygin (2009) argue that persistently masculinized sex ratios at birth for decades have led to the problem of bare branches in China. The term bare branches refers to a generation of young men of marriageable age who are unable to find wives due to a shortage of women. These men are expected to grow old without getting married or having a family. The failure to find wives is already creating many social problems that have exacerbated the quality of life of women through increased rates of kidnapping and prostitution, "importing" of wives from neighboring regions and sexual slavery. All these factors could further worsen the missing women problem in the future (Ebenstein and Sharygin 2009). This shows that whereas in all life stages discussed so far gender related factors resulted from external factors, the shortage of brides as a cause of the missing women problem is created by the internal mechanism of the missing women problem itself and is now an internal factor that is expected to stimulate the problem.

Anderson and Ray (2015), using various sources of data from the United Nations, find that approximately 0.62 million women of adult age are missing in South Asia, Sub-Saharan Africa and China in 2000 as a result of *being unmarried* (single, divorced or widowed). This figure accounts for 40% of the missing women in the given age category and may appear surprising as the many factors discussed in the young adulthood category would perhaps affect married women only as marriage for both men and women in the listed countries is almost universal (Anderson and Ray 2015). Nevertheless, upon further disaggregation by age group the authors find that

[15] Attitude of the respondents was shaped by traditionalism, perceptiveness of female chastity as a precious good and the tendency to morally justify honor killing as a response to shameful behavior (Eisner and Ghuneim 2013).

approximately 70% of the missing women due to being unmarried are in the reproductive age category (i.e. ages 20-45) with the remaining 30% in the non-reproductive category (i.e. ages 45-64). Geographically, the phenomenon is worst in India (and other parts of South and Southeast Asia) where 50% of adult women are missing due to being unmarried, followed by Africa and China with figures of 40% and 13% respectively. The authors argue that patrilocal and patrilineal norms in these regions may expose single women to several vulnerabilities that elevate their mortality compared to their married counterparts (some of the possible vulnerabilities faced by widows are discussed in the old age section later).

2.3.4. Adulthood

As women grow older, the role of preventive medicine increases. Paolisso and Leslie (1995) argue that increasing longevity in developing countries has led to the burden of chronic illnesses falling on women due to the gendered distribution in access to health care services. They contend that two diseases stand out in this regard: cerebrovascular diseases and certain types of cancers (cervical and breast cancer). In the case of the former, the authors emphasize the need to regularly monitor hypertension levels while in the case of the latter they advocate regular screening for both types of cancers to allow early detection and relatively low cost and effective treatment. Sherris, Herdman and Elias (2001) argue that cervical cancer is the most common type of cancer in the world with 80% of deaths occurring in developing countries. They argue that the lack of effective programs aimed at detecting this cancer at early stages is the key reason behind this high death rate and provide statistics to support their argument: the screening rate for cervical cancer diverges from 5% in developing countries to 40-50% in developed countries. Shulman et al. (2010) contend that more than half of all the worldwide cases in breast cancers today occur in developing countries and the resultant high mortality rates are a consequence of delayed detection. Some reasons for late detection may include social stigma associated with having breast cancer, societal implications of mastectomy, lack of knowledge about breast health, few opportunities for early detection (due to a lack of access to routine health care) and restrictive financial costs of mammography (Shulman et al. 2010). For both types of cancers, prognosis is good if detected early (Paolisso and Leslie 1995).

Although women's childbearing years have come to an end, they continue to suffer the effects of son preference. A woman's status in the household is contingent upon her having a son. The study by Milazzo (2014) discussed in the young adulthood section shows how son preference may increase the mortality risk of women. *Failure to have sons* may not only lead to domestic violence but also divorce or polygamous marriage arrangements on part of the husbands. The implications of divorce in some developing countries are disastrous for women especially if they do not have any male kin to care for them. Often, women seem to prefer violence or polygamy to being divorced (Williamson and Boehmer 1997).

The findings of some authors suggest that female labor force participation may not necessarily be beneficial for women. There are three reasons for this. First, female labor force participation may lead to a dual burden of care where women must simultaneously cater to the needs of their household and the demands of their workplace (Williamson and Boehmer 1997). For example, while the establishment of the garment industry in Bangladesh in the 1980s significantly increased the

employment opportunities for women (especially those from the poorest members of society) it also predisposed women to a more hectic routine than men (Kabeer and Mahmud 2004): findings from the Bangladesh Labor Force Survey (1990-1991) reveal that women spent a total of 84 hours per week on a combination of domestic and employment related activities whereas the same figure for men totaled 66 hours per week with the main different arising from lower male contribution to domestic chores (Elson 1999). Second, not only are the working conditions of women often less favorable than those of men but also women are often employed in the informal sectors of the economy (Williamson and Boehmer 1997). For example, Kazi and Raza (1991), using data from the Agriculture Census of Pakistan (1970 – 1982) and the Labor Force Surveys of Pakistan (1984-1985, 1987-1988) find that the increase in female labor force participation in Pakistan from 1970's to 1980's was mostly[16] concentrated in the agricultural sector where employment is informal. Paolisso and Leslie (1995) outline that some of the deleterious health effects of female labor force participation in agriculture are directly correlated with the types of jobs relegated to women in this field. For example, jobs like weeding, transplanting, threshing and post-harvest processing are almost exclusively undertaken by women and require women to work in uncomfortable positions for long hours which can lead to chronic back and leg problems (Paolisso and Leslie 1995). Further, with the introduction of cash crop agriculture, the exposure of women to pesticides is longer than that for men. Men may be exposed to high doses of pesticides for short interval because of inadequate protection during application of pesticides (for which they may use gloves for protection). However, women often do the hand labor in fields (weeding, picking and sorting) which have been sprayed with pesticides thus encountering prolonged exposure (Paolisso and Leslie 1995). These effects are evident not only on women's own health but also on the health of their unborn children (Paolisso and Leslie 1995). Third, women usually earn lower wages than men and often do not have control over their income (Winkvist and Akhtar 2010). In the event that they do have control, they are more likely than men to spend it on the well-being of their children and households as compared to men (Winkvist and Akhtar 2010). One of the reasons why many microfinance institutions (e.g. United States Agency for International Development) prefer female versus male clients may be due to the higher propensity of the former to invest their income in the nutrition, health and education of their family members (Cheston 2007). Nevertheless, studies from Bangladesh suggests that microfinance loans have the potential to increase the exploitation of women: men may use women to gain access to microfinance loans and leave women in the face of insurmountable debt or women's families may offer the possibility of a loan as a replacement for dowry in which case women's inability to obtain the loan may result in domestic violence (Hofman and Marius-Gnanou 2007).

2.3.5. Old Age

In old age the risk of *widowhood* increases for both men and women (Bennett 1997). However, both the incidence and the consequences of widowhood may be greater for women (Barrientos, Gorman and Heslop 2003). The former may be because women in developing countries marry men who are much older than them (Barrientos, Gorman and Heslop 2003) and the rate of remarriage amongst widows is lower than widowers

[16] Part of the increase was also concentrated in the professional category (especially teachers and doctors) but the benefits of this increase were limited to women of a higher socioeconomic status (Kazi and Raza 1991).

(Bennett 1997). The study by Anderson and Ray (2015) in the young adulthood section already depicts the large number of missing women attributable to widowhood between the ages of 20-64. There is reason to believe that the detrimental impact of widowhood may be even stronger for women in old age. Across many developing countries, old and widowed women are often defined as the poorest of the poor (Barrientos, Gorman and Heslop 2003). This is may not only be because of the vulnerability in their life time income stream (as a result of which they are continuously reliant on their husbands for support) but also their weak inheritance rights.

The lack of inheritance rights amongst widows in many countries where property is mostly inherited through the male line means that women without sons are deprived of any claims to assets upon the death of their spouses which leaves them financially vulnerable (Barrientos Gorman and Heslop 2003). This is because women's asset accumulation depends on three aspects: dowry, inheritance patterns and labor force participation and in many countries men not only bring more wealth to the marriage but also accumulate more wealth during marriage (Deere and Doss 2006). As a result, widow's contribution to intergenerational patterns of exchange are limited: in multigenerational households, the elderly may contribute to the general pool of resources through the assets they own (e.g. houses, land) to make up for their absence of cash flow (Lloyd-Sherlock 2000). However, this option becomes untenable for widows who neither own assets nor inherit their deceased husbands' assets. An example from Pakistan may shed light on this: using data from urban Lahore, Qureshi (2012) finds that motherhood is a crucial element of a woman's life and significantly elevates her status especially when it pertains to sons as responsibility for care usually falls upon sons and care received from daughters is considered shameful. However, he clarifies that care received by sons may not guarantee protection beyond co-residence as poverty in general guarantees that the elderly are provided health benefits commensurate with their economic contributions. He finds this to be especially problematic for elderly and widowed women who do not have the financial resources to ensure their position in the family. This is further compounded by the fact that elderly women see very little value in investing resources into their health and often prefer to suffer silently (Qureshi 2012).

The changing household structure may further strain the position of women as it accentuates their existing vulnerabilities. In developing countries households are the main providers of financial and non-financial support for the elderly with some countries such as China having drafted laws into their constitution which encourage intergenerational support (Bongaarts and Zimmer 2002). However, the traditional joint family system that extends horizontal and vertical forms of co-residential support to kin may be eroding in favor of the nuclear family where only parents and children reside in the same household (Bongaarts and Zimmer 2002). As a result, elderly women may not only be deprived of their venerated status but also of their limited financial support (Bongaarts and Zimmer 2002) with the former alone being enough to deteriorate their quality of life. For example, after interviewing elderly parents in India whose adult children reside in the United States, Miltiades (2002) finds that despite the generous financial support these elderly parents receive from their children thereby allowing them to live relatively comfortable lives, elderly parents may still be suffering from the psychological effects of loneliness and depression. Sabzwari and Azhar (2011), in addition to highlighting how the decline in the extended family system in Pakistan challenges the revered status and decision making power of the elderly, stress that it

raises the social and economic challenges for the increasing number of elderly who are being forced to live alone. This situation is aggravated by the fact that nursing homes in many developing countries such as Pakistan are virtually non-existent and the few that function are run by volunteer or religious organizations. For example, in Karachi there are three nursing homes that are run by the Catholic Church. These homes rely on the services of donors or volunteers as very few people admitted here can afford to pay on a regular basis. Such homes are probably unable to provide for the majority of the elderly population as living in an old age home is considered socially taboo and brings shame to the household of the elderly (Sabzwhari and Azhar 2011). However, in the long term, such norms may change as well.

Rahman, Foster and Menken (1992), use data from a study conducted in rural Bangladesh from 1974-1982, to assess how household composition affects the mortality of older female widows (aged 45 and above). Their study compares the mortality risk of elderly widowed women in three scenarios: widows heading their own household, widows living in households headed by their sons and widows living in households headed by other male kin. Upon controlling for age, household assets, disability status and exposure to famine, the authors find that only widows living in households not headed by themselves or by their sons have elevated mortality risks compared to their married counterparts. However, they contend that the mortality risk of women who head their own households is contingent upon having access to services provided by male kin so that widows who live alone not only have a higher mortality risk than their married counterparts but also than widows living in households headed by male kin other than their sons. Hence, they conclude that the mortality risk of women is negatively correlated with the presence of male kin in the house and is contingent upon the relationship of widows to these male kin.

Closely related to these findings is the study by Dreze and Srinivasan (1997) who use data from the Indian National Sample Survey (1986-1987) to compare male and female headed households in rural India. Contrary to the general perception, they find no evidence of male headed households being disproportionately richer than female headed households. However, they find a correlation between household size and economic well-being so that larger households are able to benefit from economies of scale and are therefore better off than smaller households. Since they show that male headed households tend to be larger than female headed households, they conclude that the latter are on average poorer than the former. This is related to the findings by Rehman, Foster and Menken (1992) who show that the relationship between widowhood and mortality is strongly correlated with poverty especially since it is likely that women will only head households if they are widowed.

The direct impact of HIV/AIDS mortality on missing women has already been explained in the young adulthood section. However, the AIDS pandemic may also disadvantage the quality of life of uninfected elderly women through the responsibility of caring for their infected children and their uninfected grandchildren (Ssengozi 2007). Despite the argument that elderly women are well equipped for caregiving in old age because it is a continuation of their role as mothers from earlier stages of life (Mudege and Ezeh 2009), there is reason to suspect that care responsibility makes them increasingly vulnerable. For example, Schatz (2007), based on 30 interviews of elderly (60+) women in rural South Africa, finds that grandmothers in rural South Africa who act as surrogate mothers to children of relatives orphaned by HIV shoulder all the

physical and financial responsibilities of raising these children which leads to a deleterious impact on their physical health. Nevertheless, these women are reluctant to recognize the vulnerabilities that this additional care burden exposes them to and willingly shoulder their responsibilities because not only are they caring for their family members but also as they expect these surrogate children to provide support in the future when grandmothers reach very old age. In contrast, Ssengozi (2007), based on interviews conducted by the elderly in Uganda, not only finds that the burden of care associated with HIV depreciates the economic, financial and physical well-being of the elderly in Uganda but also this depreciation in quality of life is perceived by the elderly. This is partly evident via the anxiety reported by the elderly about how assuming parental roles in late life may negatively affect their future. Hence, the author finds that the burden of providing care exacerbates the health conditions of the elderly who are already subjected to poverty and suffering from a poor health infrastructure.

Elderly women may also disproportionately suffer from violence. *Senicide* is an extreme form of abuse suffered by the elderly. Bhattacharya and Bhattacharya (2014) define it as the act of killing old people in the name of culture and point to a poor district in Tamil Nadu (India) where it is practiced. They list four ways in which Senicide is achieved: neglecting and not feeding the elderly, abandoning the elderly when the nomadic society moves on, assisting suicide of the elderly (e.g. slowly administer liquids that lead to organ failure) or actively killing the elderly (e.g. injecting poison). Although the authors contend that elderly males are more likely to be affected by this practice (as males are traditionally the inheritors of property so the death of a senior male would allow assets to flow through the family line), women may be equally victimized as the reason behind the act is to rid society of the old unproductive members who become too heavy a burden for their children.

Another extreme form of abuse that may disproportionately affect elderly women are *accusations of witchcraft*. Schnoebelen (2009) points to several incidents in 2008 in the Indian state of Bihar where such accusations resulted in violence against accused women and in some cases even death. Bhattacharya and Bhattacharya (2014) contend that in India poor, low caste, elderly women are often victimized as witches on account of being considered greedy for property. Especially in the event of a calamity these women are singled out, stripped publicly, humiliated and often beaten or burnt to death. The authors report that over a period of 15 years such accusations have resulted in a total of 2500 deaths. Similarly, for Nepal, Schnoebelen (2009) finds that elderly, widowed, destitute and low caste females are the most frequent targets. Here, the accusations are used as a tool to victimize female relatives, deprive women of their property or to settle personal vendettas. Accusations of witchcraft against women are also commonplace in several countries in Africa with Tanzania providing the best documentary evidence of such accusations (Schnoebelen 2009).[17] Accusations often increase with unexplainable adverse occurrences (e.g. sudden death of a community member or crop failure; Gorman 2000). The recent surge in AIDS related deaths in Africa has in some cases been attributed to witchcraft (Gorman 2000).

On extremely rare occasions, widowed women in certain parts of India may be subjected to the traditional *ritual of sati.* Stein (1988) defines this as the burning or

[17] Machangu (2015), Oestigaard (2015), Kibuga and Dianga (2000) and Mesaki (2009) provide a detailed discussion on the causes and consequences of accusations related to witchcraft in Tanzania.

burying alive of a widow alongside her deceased husband. Ahmad (2009) cites some recent instances in India (in 2008, 2006, 2002 and 1987) when the practice took place. However, he notes that despite a few incidents each year, the ritual has never been widespread in the country.

2.4. Social change and inequalities: intermediary forces

Several intermediary forces influence the social factors systematized along the life course in the last chapter. These include changing norms of family size (e.g. fertility decline) and technological progress that boost the opportunities for sex selection, social inequalities other than gender (namely education, income, rural-urban differentials), changing legislation, religion, disease composition and change over time. Taking into account these intermediary forces allows for consideration of cohort effects, speculation about future developments, and cautious policy recommendations that may help to overcome gender discrimination over the life course.

2.4.1. Fertility decline and sex selection technology

The rapid spread of prenatal sex selection technology (especially ultrasound technology for fetal sex determination followed by a possible abortion) in many of the countries experiencing the missing women problem and the inability to monitor their use led to highly masculinized sex ratios at birth immediately after the technology became available (Guilmoto 2009). In the case of South Korea, Park and Cho (1995), using various surveys from 1970 to 1990, find a high correlation between the availability of sex selection technology and the rise in sex ratios at birth. They show that after 1981 a birth order effect becomes evident at the third birth and after 1991 a gender composition effect becomes evident at the third birth if children of the first two births are daughters. In the case of China, Coale and Bannister (1996) use hospital records to show that the rise in sex ratios at the first birth in the 1970's and 1980's can largely be explained by the use of sex selection technology. In both South Korea and China, the use of sex selection technology became widespread in the 1980's (Das Gupta and Shuzhuo 1999).

Closely linked to sex selection technology, and perhaps an enabler of its popularity, is *fertility decline*. Guilmoto (2009) uses a numerical example to explain how fertility decline exacerbates son preference and daughter devaluation: As the desired number of children falls from 6 to 1, the probability of remaining sonless increases from 0.01 to 0.49. As a result, the acceptable percentage of daughters decreases from 83% to 0%. Hence, parents use whatever means at their disposable to ensure the birth of at least one son. Guilmoto (2009) uses the term fertility squeeze to describe the dual pressure of limiting the number of children whilst ensuring the birth of at least one son.

According to Das Gupta and Mari Bhat (1997) fertility decline may operate through two opposing channels. First, fertility decline may lead to a reduction in female child mortality due to a reduction in female births at higher levels (birth order effect). Second, fertility decline may lead to an increase in female child mortality at lower birth levels because the marginal cost of each additional daughter has increased. The net impact on female child mortality would therefore depend on which effect dominates. For India, based on data from the 1991 Indian Population Census, the authors find that

the second effect, on average, dominates leading to an increased gender bias in mortality. Similarly, for China and South Korea, Park and Cho (1995), using various surveys from 1970 to 1990, find that the second effect dominates so that fertility decline leads to worsening sex ratios at birth.

Klasen (2008) deviates from the contention that fertility decline necessarily leads to worsening sex ratios at birth. He asserts that fertility decline will only intensify gender bias in mortality if it is introduced as an exogenous shock. Under natural circumstances it behaves as an endogenous variable accompanied by a set of economic and social developments that increase the value of women and reduce son preference. He uses the examples of South Korea, China and India to differentiate between the endogenous and exogenous impacts of fertility decline. He notes that South Korea is the best example of endogenous fertility decline as the sudden rise in sex ratios at birth caused by technological innovation (exogenous shock) was counterbalanced by government policies that reinforced the endogenous nature of fertility decline and allowed sex ratios at birth to approach biologically normal levels. In the case of China two exogenous shocks (technological innovation and One Child Policy) deteriorated the sex ratios at birth without any force to counteract them hence deteriorating the sex ratios at birth. In India fertility decline deteriorated sex ratios (0 to 6 year olds) only after sex selection technology became widely available.

Chung and Das Gupta (2007) support Klasen's hypothesis by using the Korean National Fertility and Family Health Surveys (1991 and 2003) to show that *economic development* may reduce son preference in two ways. First, there is a reduction in son preference due to the increased education and urbanization of the population, allowing values like gender equality to become more widespread. Second, this reduction in son preference (i.e. due to education and urbanization) diffuses throughout the country and thereby benefits the majority of the population. The authors find that almost 75% of the fall in son preference in South Korea can be attributed to the second channel. However, the role of economic development even in South Korea must be interpreted with caution because despite South Koreas impressive feats in economic development from the 1960's to 1990's, sex ratios at birth continued to rise through the 1980's and the reversal only started when active government intervention to change social norms regarding son preference and daughter devaluation were put into action (Chung and Das Gupta 2007). The Indian State of Kerala provides a similar example, despite have a GDP level below the national average, it does exceptionally well on indicators such as female education and employment which alongside its matrilineal inheritance tradition may be one reason why the sex ratios in the state are significantly lower than the national average and thereby do not depict a missing women problem in the population of the state (Sen 1998). These results then do not raise the question whether economic development leads to a reduction in the missing women phenomenon but rather what aspects of economic development affect the missing women phenomenon because clearly economic growth alone cannot account for feminized sex ratios.

2.4.2. Socio-economic factors

The factors discussed in different life stages are shaped by socio economic factors and development, for example education, income, employment and infrastructure. Although country specific legislation will surly result in pure country differences, many other internal differentiations are existent, and some even can be discussed as similarities

across countries. This clearly is the case with gender, but also with these socio-economic factors.

There have been various studies assessing the effect of *education* and *income* on sex ratios, especially at birth and during childhood, but it is evident that education and income play an important role at later stages of life as well, for example in case of access to health information or medication. Education may work through the fertility decline channel and exacerbate or improve sex ratios whilst mother's income may raise the future value of daughters and improve child sex ratios. This can be seen through the following examples: Using data from the Population Census of India (1984), Das Gupta (1987) shows that in Khanna (India) daughters of younger and more educated mothers are likely to have higher mortality rates. She contends that this could be propelled by fertility decline as not only are educated mothers more likely to prefer smaller families but also have greater knowledge of childcare so she suspects there is a greater likelihood of neglect being intentional. Conversely, Bannister (2004), using survey and census data from China from 1950's to 1990's, argues that with regards to fertility decline in China, mother's education has no effect on female child mortality which is determined by the number and gender of existing children.

Some studies even suggest that the effect of parental education and income on child malnutrition is strong enough to overcome the effect of child's gender. For example, Mohsena, Mascie-Taylor and Goto (2010), using Bangladesh Demographic and Health Survey (2004), test the association between education, income and gender differential in malnutrition. They contend that the prevalence of malnutrition is not necessarily affected by the gender of the child but by the education level of the mother and ownership of certain durable goods at the household level (e.g. radio, television, motorcycle). Hence, children of more educated mothers and those belonging to households with more durable goods fare better on malnutrition indicators regardless of their gender. Similarly, Mahyar et al. (2010), using data from a community based survey in Qazvin Iran, find that stunting (one of the child malnutrition indicators) amongst children under the age of two is correlated with family size, birth order and parental level of education but not with gender of child. They further contend that the incidence of all malnutrition indicators disappears with improvements in family income and greater access to health care centers.

Qian (2008) assesses the relationship between mother's income and daughter's wellbeing in China's agricultural sector. She shows that an increase in mother's income raises the educational attainment of all children and improves the survival of daughters. Conversely, an increase in father's income only, worsens survival and educational attainment of daughters. The author gives three explanations for these results: First, an increase in mother's income only raises the future prospects of daughter's earning thereby raising the future value of daughters and making them more desirable. Second, it improves the bargaining position of mothers and, if they prefer daughters more than fathers, increases the welfare of daughters. Third, since prenatal sex determination technology was not available for the period and area of study, increasing the value of adult female labor increases the cost of sex selection as pregnancies must be carried to term before the gender of the child is revealed. Using these arguments, she contends that the increase in missing girls in China in the 1980s could in part be attributed to the increase in gender wage gap between 1978 and 1984. This gap is expected to have lowered the future value of daughters to parents and increased their propensity to select

sons especially in the face of strict family planning policies. This argument lends support to Klasen's (2008) hypothesis about the endogenous nature of fertility decline and shows how gender neutral social and economic policies may reduce the gender bias in mortality.

In young adulthood, Ojangu and Gilbert (1992) emphasize the importance of women's education in reducing their mortality. Educated women are better able to recognize the symptoms of their illness and more likely to opt for professional (rather than traditional) help. The authors further assert that education increases awareness about family planning thereby enhancing the positive effects of fertility decline on reproductive health (conversely, education may increase awareness and accessibility to sex selection methods which may lead to an increase in female deficit at birth and in female mortality in young adulthood when illegal or unsafe methods of sex selection are used). This obviously holds true for later stages in life as well. For example, Liu, Hermalin and Chuang (1998) use data from the Taiwan Survey of Health and Living Status of the Elderly (1989) to show that educational attainment reduces the mortality of older adults by its effect on health status, health behavior and social relationships: more educated elderly benefit from higher income, safer occupations, less environmental risks, better housing and better access to health care resources; have higher levels of social participation and receive greater emotional support from their family and community and are less likely to be current smokers. Benett and Zaidi (2016), based on data from the World Bank (2015), United Nations (2014) and Barro Lee educational indicators (2010) for 139 countries worldwide, find that globally, not only do elderly women have lower levels of educational attainment than elderly men but also the gender gap in educational attainment (in favor of elderly men) is more pronounced in low income countries versus high income countries. Their results show that on average an elderly woman in a low income country is approximately twenty-four times less likely to have completed secondary education than an elderly woman in a high income country. This may imply that the health implications of low educational attainment for the elderly, as revealed by the study in Taiwan, are worse for elderly women compared to elderly men and are especially adverse for elderly women in low income countries.

In old age, several authors discuss the role of income and *employment* in seeking health care and reducing the number of missing women. For e.g. Nawaz et al. (2012), based on interviews of elderly women (60+) residing in urban Punjab (Pakistan), show how income is correlated with health status of elderly women. They find a statistically significant relationship between income and health status so that as income category increases the proportion of women of high health status also increases. Ladha et al. (2009), based on interviews of elderly men and women (65+) in urban Pakistan, assess the factors that prevent the elderly from seeking healthcare in Karachi (Pakistan) and show that these factors are more pervasive among women. They find that financial constraint (including the desire to allocate scarce resources to the productive younger generation) is the primary deterrent in seeking healthcare. Other deterrents include illiteracy, unemployment and living alone. Although the authors find all deterrents to be more common among elderly women, they claim that once the latter three deterrents are controlled for, the gender element alone is not a significant deterrent in seeking health care. This may imply that the disadvantages created by discrimination in early life (e.g. lack of proper schooling) indirectly accumulate into higher mortality risk in old age.

Urbanization may affect the number of missing women in the population via several channels. First, it may lead to a worsening of sex ratios at birth. This worsening may be a direct result of greater access to sex selection technology (Klasen and Wink 2003) or the indirect result of urbanization offering greater employment opportunities to women which creates an incentive for fertility decline thereby motivating the use of sex selection technology (Klasen and Wink 2003, Almond Edlund and Miligan 2009). However, this argument precludes the fact that urbanization may lead to an overall reduction in son preference and daughter devaluation. Urban norms are very different from rural norms and the reasons for having a son in rural areas may not be as strong in the former (Das Gupta et al. 2003). For example, in urban areas parents in some countries (e.g. South Korea) working in the formal or government sector may have access to pension after retirement which may lessen the need to rely on sons in old age (Das Gupta et al. 2003). Further, education and employment opportunities may be more equitable so parents may be able to rely on both sons and daughters for support in old age (Das Gupta et al. 2003). Klasen and Wink (2003) attribute the overall reduction in the number of missing women in many countries like Pakistan to increased rates of female education and urbanization.

Urbanization may also directly improve the health of women in later stages of life by improving access to health *infrastructure.* For example, in the case of Pakistan, not only is access and quality of healthcare significantly better for women in large urban areas but also urban women have greater opportunities, if any, to participate in allocation of health resources (women in developing countries often do not participate in the allocation of health resources; Jejeebhoy and Sathar 2001). Further, as discussed in the young adulthood section inability to access hospitals in a timely manner may increase the number of missing women at this stage. For example, Powell-Jackson et al. (2015) find that the reduction in maternal mortality in China from 66 to 14 maternal deaths per 100,000 live births between 1996 and 2013 (making China one of the few countries that achieved the 5th Millennium Development Goal of improving maternal health) is attributable to the improved access to healthcare throughout the majority of the provinces in the country. The authors findings indicate that, amongst all improvements in access to health care, amelioration in hospital infrastructure had the greatest impact on this decline.

Poor infrastructure that lacks the ability to support an ageing population may also increase the mortality risk of elderly women. Several authors highlight the case of Pakistan, where insufficient resources are allocated to the health needs of the elderly (e.g. Sabzwari and Azhar 2011, Jalal and Younis 2014). These authors contend that geriatrics is yet to be recognized as a medical field with the ailments of the elderly being treated by general practitioners. They also point to the absent social security system with the bulk of health expenditure being paid out of pocket.[18] They further argue that although the government designed a National Policy to address the heath needs of the elderly in 1999, the program is yet to be implemented and the elderly continue to face barriers to health care in Pakistan.

[18] Although the authors recognize that government hospitals provide affordable treatment, they contend that the majority of elderly prefer private care (if they can so afford) due to better services in the latter.

Social norms of son preference and daughter devaluation may be clustered in specific regions, and lead to geographical variations in the missing women phenomenon in a given country as is the case in India and, to a lesser extent, China. In the case of India, the discrepancy in sex ratios between the Northern and Southern states of the country stands out in this regard. Das Gupta and Mari Bhat (1997), using data from the Population Census of India (1991), find that not only are sex ratios at birth and during childhood in the Northern States significantly more masculinized than in the Southern states but also specific Northern states such as Punjab and Haryana have drastically higher sex ratios than the rest of the Northern States. Similarly, in the case of China, Bannister (2004), using census and survey data from 1980 to 2000, finds highly masculinized sex ratios (ages 0-14) in Han dominated provinces of China proper and in Gaungxi and Guangdon provinces in the South, Shanxi in the North and Anhui and Zhejiang provinces in the east. For both India and China, the authors find no correlation between missing women and poverty. Rather, the richest provinces in Northern India suffer from the most severe shortage of girls. Similarly, in China some of the richest provinces suffer from a shortage of girls whereas the shortage in some poorer provinces is not as severe as the richer provinces.

2.4.3. Legislation

Perhaps the most blatant example of the effect of legislation is China's One Child Policy. The discussion already highlights that the imposition of the One Child Policy in the country in the 1970's served as an exogenous shock that, alongside fertility decline, precipitated the demographic masculinization of the country. Therefore, the amendment in Chinese laws, introduced in October 2015, which allows most couples to have two children can be expected to feminize the sex ratios at birth and perhaps allow them to return to normal in the future (Zeng and Hesketh 2016). Using Guilmoto's (2009) argument about how fertility decline increase the marginal cost of each additional daughter (with the sudden imposition of the one child policy making this marginal cost prohibitive), the relaxation of the One Child Policy to the Two Child Policy may be expected to reduce the marginal cost of daughters at the first parity as parents can now wait for the second parity to exercise their son preference. Therefore, factors before the time of birth may be less significant in distorting the sex ratios at birth for birth cohorts after 2015 as compared to birth cohorts before 2015 (especially for first births) purely as a result of amended legislation.

Legislation may impact the survival of women at later life stages as well. Sons are often desired for their primacy in inheritance and therefore maintaining wealth within the family (Guilmoto 2009). Therefore, a change in inheritance laws in favor of women may alter the position of daughters in the natal and marital household. The case of India may be used to shed light on this: The original Hindu inheritance law passed in 1956 substantially discriminates against daughters in the inheritance of joint family property and posits these rights in favor of sons (Roy 2008). However, starting in 1976, some states amended this law to allow, under certain conditions, daughters to inherit natal family property as well (see Roy 2008). Roy (2008) finds that in states that passed this amendment, daughters who benefitted from this law, enjoyed greater autonomy in their marital household thereby strengthening their bargaining position within said household in the sense that they had greater influence over the final consumption bundle of this household. The ability of these women to inherit may also reduce their risk of poverty in old age as they will have some accumulated wealth of their own in case they have no

source of income or savings and cannot rely on inheritance from their husbands in the event of widowhood (Deere and Doss 2006).

Change in legislation also has the ability to directly temper the impact of an adverse factor so that subsequent birth cohorts at a given life stage may be less affected by it. One example is the new honor killings bill passed in Pakistan which may reduce the number of missing women via this factor in the young adulthood stage. Previously, honor killings in Pakistan were treated as private matters as they were regarded as punishment for immoral behavior and perpetrators of honor crimes were not prosecuted by law if they were pardoned by the women's family[19] (Niaz 2003, Chen and Saifi 2016). However, in October 2016 the Pakistani government increased the sentence for perpetrators of honor crimes and closed the loophole that they would not face prison time if forgiven by family. Now, perpetrators must spend at least 25 years in prison, can be sentenced to life imprisonment and can only be forgiven by the victim's family members if the court sentences perpetrators to the death penalty (Chen and Saifi 2016, Masood 2016). The threat of stricter punishment for honor based crimes may reduce the incidence of these crimes and hence the number of missing women attributed to these crimes.

2.4.4. Religion

Existing literature on missing women allows a differentiation of the missing women phenomenon by religion. In particular, it allows for a distinction between elevated sex ratios at birth among Asian Muslim (and to some extent Christian) populations and Asian non-Muslim populations. The study by Almond, Edlund and Milligan (2009) discussed in the sex ratio at birth section of this chapter provides some evidence of this argument. The dataset used by these authors for examining immigrant sex ratios at birth in Canada provides information on immigrants by religions. An evaluation of sex ratios at birth by religion reveals that amongst all immigrants from Asian countries, only those who are followers of Islam or Christianity do not exhibit masculinized sex ratios at birth.

Evidence on the association between religion and missing women is also provided by the study of Borooah and Iyer (2004) for India. Using data from qualitative (i.e. analyzing holy scriptures of Islam and Hinduism for attitudes towards fertility and contraception use) and quantitative (i.e. data for 10,548 women in India who had terminated their pregnancy and thereby considered to have achieved their equilibrium family size and composition) sources, the authors compare the degree of son preference and daughter devaluation amongst Hindus and Muslims in the country. Their qualitative analysis reveals that while son preference is common to both religions, daughter devaluation is less intense in Islam as compared to Hinduism. Their quantitative findings support their qualitative results: After controlling for literacy rate, community, employment status of women, type of occupation of women (if employed) and state of residence, the authors find that compared to Hindu women, Muslim women have higher fertility, lower incidence of sex selective female abortion after the birth of a daughter and lower rates of infant mortality for both genders. Based on these results, the authors conclude that the better treatment of daughters in Muslim versus Hindu families is not

[19] The likelihood of the perpetrator of an honor crime to be pardoned by the victims family is quite high as these crimes are usually inflicted by male family members upon female family members (Obberwittler and Kasselt 2011) so family members have the proclivity to pardon each other.

merely the result of higher fertility amongst Muslim women but also due to lower daughter aversion amongst Muslims compared to Hindus. Similarly, Iyer and Joshi (2013) use data from the Indian National Family Heath Survey (2006) and find that, after controlling for parental age, parental education, family income, family wealth, caste membership and rural-urban residence, infant mortality amongst Muslim girls (especially first born Muslim girls) is lower than their Hindu counterparts. They take this to be a result of both higher fertility and lower daughter devaluation amongst Muslims as compared to Hindu families.

2.4.5. Disease composition

As many countries affected by the missing women phenomenon are facing a dual burden of disease, Anderson and Ray (2010) test whether the epidemiological transition may be driving the excess female mortality in China, India and Sub-Saharan Africa. The epidemiological transition is the long term shift in mortality patterns during which pandemics, acute infections, respiratory diseases and nutritional deficiencies characteristic of underdevelopment are replaced by manmade non communicable and degenerative diseases characteristic of modernization and development (Omran 1971, Wahdan 1996). The transition may take four or more phases (Caldwell 2001) and during this transition the population may be affected by both communicable diseases (i.e. nutritional and infectious diseases) and non-communicable diseases (i.e. degenerative diseases; Caldwell 2001). Anderson and Ray (2010) argue that in societies where the missing women phenomenon does not exist, communicable diseases are likely to affect men and women equally whereas women are expected to have a survival advantage with regards to non-communicable diseases. Therefore, they test whether the persistence of the missing women phenomenon in China, India and Sub-Sharan Africa may be a result of these countries suffering from both types of diseases as a result of which women are unable to benefit from the advantage they could obtain from the burden of non-communicable diseases only. However, the results for these three countries show that the epidemiological transition cannot explain the missing women phenomenon therein (Anderson and Ray 2010). Nevertheless, the discussion of factors across the life course shows that exposure to communicable diseases inevitably increases the mortality of women vis-á-vis men in some countries, especially those affected by the missing women phenomenon. For example, prevalence of infectious diseases in childhood may increase female versus male child mortality due to delay in seeking treatment. Therefore, although the prevalence of communicable diseases does not directly lead to an increase in missing women (as show by Anderson and Ray 2010), gender related factors across the life course accentuate the predisposition of women to suffer from mortality related to communicable diseases.

2.4.6. Social change and cohort differences

It is evident via the discussion in sections 4.1 to 4.5 that intermediary forces may vary substantially within countries but at the same time work very similarly across countries. It is perhaps important to see their development over time, and the impact that these changes have had and will have on different birth cohorts. Missing women do not only appear in different amounts at specific points in time at specific social and geographical regions: Imbalances (or coincidences) of technological progress, modernization and urbanization, secularization and norms of gender equality create the missing women phenomena observed – mainly using cross-sectional studies – today. For example, son preference may coincide with new technologies for sex selective abortion, one-child-

policies with a given set of son preference and economic need structures, state gender equality policies may improve education for girls and alter the otherwise expected trend of an increase of missing women over time, and improved income – for example by introduction of social pensions – may change these paths even in very old age. It has to be highlighted that these interactions need to be taken into account, as well as their varying impact on the life course of birth cohorts.

Some authors have discussed historical trends already. For example, Guilmoto (2009) finds that sex ratios at birth follow an inverted U-shaped trend. This trend has two phases. In the first phase, different intermediary forces (e.g. fertility decline and sex selection technology – discussed in section 4.1) interact leading to rising sex ratios at birth which eventually plateau at a maximum. In the second phase, sex ratios at birth are expected to decline and return to the biologically normal levels. Guilmoto (2009) asserts that this decline is spurred by two factors: economic development (and accompanying social change that elevates the position of women in society making daughters more desirable; Klasen 2008) and surplus of men of marriageable age (as the probability of finding a bride for sons' decreases, the prospect of having an unmarried son seems darker than that of having a daughter making daughters more acceptable at the time of birth). The author asserts these changes will take place over generations.

Similar to Guilmoto (2009) for trends in sex ratios at birth, Das Gupta, Chung and Shuzhuo (2009) study the patterns in child sex ratios in South Korea, China and India and outline expected future trends for the latter two countries. They find that South Korea and China experience a rise in child sex ratios (0-6 years) until the mid 1990s. Thereafter, South Korea experienced a steady decline whereas China a continued rise. India had lower sex ratios than South Korea and China which, nevertheless, started to rise significantly from the mid-1990s. The authors conclude that child sex ratios in both countries are peaking at the national level and beginning to decline at several subnational levels whilst rising at a slower pace at other levels. Extrapolating from the case in South Korea they conclude that the number of missing girls in both countries is falling and will continue on a downward trend.

Other authors hypothesize the expected future trends in the number of missing women. Attané (2006) uses data from the Chinese Population Census and estimations from the United Nations medium variant population projections to assess how the masculinized sex ratios at birth in China may affect population growth, age structure and sex structure of the country from 2000-2050. Her projections are based on three alternate assumptions on the trend that sex ratios at birth could be expected to take in the future: the first scenario considers constant sex ratios at birth (i.e. sex ratios remain at the 2000 level 1.16 till 2050), the second scenario considers rising sex ratios at birth (i.e. sex ratios rise above 2000 to a level of 1.25 by 2050 – a scenario of maximum gender bias), the third scenario considers falling sex ratios at birth (i.e. sex ratios at birth fall to 1.06 by 2030 and continue at this level thereafter). She finds that regardless of the trend assumed by the sex ratios at birth, total population growth and age structure of the population remain unperturbed. However, the sex structure of the population is contingent upon the sex ratio at birth trend with the rising sex ratio at birth scenario leading to the maximum number of missing women in the population followed by the falling sex ratio at birth and constant sex ratio at birth scenarios. Nevertheless, she argues, the impact of the dominant scenario on the sex structure, will only be felt after 2020 as the cohort that is to enter marriageable age and have children for the future has

already been born. Therefore, the future of China's missing women is contingent on the way the current generation of marriageable men fills the shortage of women and the way changing norms and policies influence the son-preferring of these couples and couples in the future (Attané 2006). The deficit of women in itself may make daughters more valuable for parents and reduce son preferring behavior (Attané 2006). The bulk of the impact may however come from the introduction of the two child policy (discussed in the legislation section) which would make it more likely for the falling sex ratio at birth scenario to dominate, which, as depicted by Attané (2006) is the best case scenario for China creating the inevitable female deficit in the population. It is to be noted that Attané's (2006) projections are based on the assumption that the missing women phenomenon in the population only arises from a female deficit at the time of birth which may not necessarily be the case as the discussion on factors across the life course has shown.

Bongaarts and Guilmoto (2015) use United Nations medium variant population estimates to project future trends in the number of missing women worldwide (i.e. Asia and Africa) from 2010 to 2050. They find that the total number of missing women is expected to rise from approximately 125.6 million in 2010 to a maximum to 150 million in 2035 before declining to 142 million in 2050. They further contend that while the increase in the number of missing women in the past (i.e. from 61 million in 1970 to 125.6 million in 2010) can mostly attributable to a rise in prenatal factors (i.e. factors before/at the time of birth), the majority of the rise in the subsequent decades is expected to be concentrated above the age of 40 and is perhaps a result of postnatal factors (i.e. factors at later stages of life). Given this future age distribution of missing women, the authors assert that China is expected to be the largest contributor to the increase in missing women as not only are missing women in India and Sub-Saharan Africa mostly concentrated in childhood and young adulthood but also, from the period 1970-2010, there has been a slight relative decline in the number of missing women (at the childhood life stage) in India whilst there has been a relative increase (in the before/at birth life stage) in China.

2.5. Conclusion

The analysis of Missing Women literature reveals three things: First, literature mostly focuses on missing women before/at the time of birth and childhood and largely neglect later stages especially missing women in the elderly life stage. This holds for the extent of the problem, a systematic account of the causes and their interactions as well as inferences to the problem as a result of this development. Second, the life course approach explains the existence of elderly missing women by not only highlighting the factors responsible at each stage of the female life course (before/at the time of birth, childhood, young adulthood, adulthood and old age) that accumulate into the elderly missing women phenomenon but also by accounting for social change evident through cohort differences across generations. Third, the elderly missing women phenomenon presents the culmination of the missing women phenomenon from all previous life stages in terms of the accumulation of not only the female deficit but also a female survival disadvantage both of which may be expected to be maximum at this age. Hence, while a female deficit in earlier life stages would be evident in both the earlier stage and in old age, a female deficit that originates in old age would only be evident by an evaluation of the elderly missing women phenomenon.

The discussion shows that the concept of missing women is very elusive not only because it is difficult to quantify but also there are a myriad of factors that have competing influences on the problem (for e.g. fertility decline when behaving exogenously may exacerbate sex ratios at birth but may reduce the number of missing women in young adulthood). Further, as the problem shifts to older age categories, especially to the elderly level, it becomes difficult to measure the extent to which female mortality falls under the aegis of discrimination. Nevertheless, the systematization allows for political, social, and legislative interventions in many ways, so that we do not have to simply complain about existing injustice, but actively support policies to change the situation. So far I have contributed to the missing women literature by systematizing the existing literature according to the life course perspective. This systematization allows for much more targeted policy recommendations namely to improve access to health care by increasing the number of fully equipped health facilities with adequately trained female medical staff, motivate parents to send their sons and daughters to school by providing free education and access to health care, set up a social pension system and invest resources in nursing homes that would at least be available for the poorest segments of society. As the case of South Korea demonstrates (the most successful example in tackling missing women before/at birth demonstrates), successfully overcoming this problem requires a multidimensional approach: the simultaneous weakening of patriarchal institutions (e.g. by introducing more equitable inheritance laws, allowing children to register under their mothers name, granting women the right to remain members of their natal households), higher levels of industrialization and urbanization (so daughters have greater employment opportunities and can also provide for parents in old age or parents may not require the assistance of children as they are more likely to benefit from pensions) and most importantly large scale media and awareness campaign to not only make the population realize the necessity of abandoning the archaic notions of son preference and daughter devaluation but to ensure that the desired changes reach the grass root level of society (Chung and Das Gupta 2007). All these measures point to one thing: the importance of altering existing social norms regarding the position and value of women in society in order to tackle the missing women phenomenon.

Effective policy implementation however first requires the identification of countries that exhibit an elderly missing women phenomenon. Given that this chapter is the first in academia to highlight the extent of the missing women problem in the elderly population by theorizing and analyzing causes and consequences from both cohort and life course perspectives, there is scant existing evidence about cross-country variations in the elderly missing women phenomenon. The subsequent chapter, therefore, explores the distribution of elderly missing women across the countries of Asia.

Chapter 3 - Changing sex ratios in old age across Asia

3.1. Introduction

It is evident from Chapter 2 that there is an age specificity to missing women literature so that despite the plethora of evidence suggesting the existence of missing women at all life stages, literature largely concentrates on the two youngest life stages. This chapter investigates whether there is also a geographical specificity to missing women literature by investigating the pervasiveness of the elderly missing women phenomenon across different countries in Asia. As elucidated in the introduction, the primary social inequality of concern with regards to the missing women phenomenon is that of gender as it differentiates the life courses of men and women and exposes women to the factors at each life stage and intermediary forces (described in chapter 2) that leading to a missing women and elderly missing women problem in the population. Gender inequalities, however, are generated by the social context (i.e. norms and institutions) to which individuals belong and the social context may or may not vary across countries or regions (Mayer, "Whose" 2004). Asia provides a fertile ground for exploring the extent to which variations in social norms affect the existence and magnitude of the elderly missing women phenomenon for two reasons: First, although Sen (1990) and subsequent authors identify the missing women phenomenon to persist in Asia and Africa, they find the bulk of the phenomenon to be concentrated in Asia. Second, the population in most countries of Asia is ageing very rapidly (especially when compared with the majority of countries in Africa, which remains the youngest continent of all; Bloom, Canning and Sevilla 2003) so the persistence of a female deficit in older age categories of Asia requires immediate investigation.

Two features characterize ageing in the world today: an unprecedentedly rapid pace and stark heterogeneity within and among regions (Heller 2006; Canning 2007). Asia is at the vanguard of both characteristics with no two regions making this more apparent than East Asia and the Middle Eastern part of Western Asia (Bloom, Cannning and Sevilla 2003). East Asia is oldest region on the continent and best prepared to cater to its rapidly ageing population (Menon and Melandez 2009). Southeast Asia is not far behind East Asia in that the majority of countries in the former having nearly exhausted their demographic dividend and their baby boom generation being at the brink of entering old age (Bloom, Canning and Sevilla 2003). South Asia, due to higher initial fertility and delayed fertility and mortality decline, has a relatively younger population than the former two regions giving it a time lag before entering old age (Bloom, Canning and Sevilla 2003, Mujahid and Siddhisena 2009). However, this time lag is fast eroding and consequently pushing the region into the elderly category in the decades to come (Mujahid and Siddhisena 2009). The post-Soviet states of Central and Western Asia present two distinct trends: The Central Asian states are ageing at rates equivalent to the Southeast Asian countries while the post-Soviet States of Western Asia are ageing more rapidly, equivalent to that of many Eastern European countries (Sidorenko 2016). Finally, the Middle Eastern region of Western Asia is the youngest on the continent as a result of which it not only experiences the youth bulge as in South Asia but also echo bulges (youth bulges followed by youth bulges) and faces the daunting challenge of productively employing its working age population to reap the benefits of the demographic dividend for its aged population in the future (Saxena

2008). These inter regional differences are further augmented by intra-regional diversities created by the individual countries forming these regions (Hayutin 2009). However, one feature that may be shared by the majority of the regions and thereby surpasses demographic boundaries is the missing women phenomenon in the elderly population of the countries therein.

Using data from the United Nations Department of Economic and Social Affairs (UNDESA, "custom data" 2015), the table 3-1 provides sex ratios of the elderly population in different regions across Asia and gives examples of countries within each region that present the elderly missing women phenomenon. When using the world as a reference standard, it is evident that both the East/Southeast Asian regions and the South Asian region present the elderly missing women phenomenon to some extent as their sex ratios in the 60+ and 75+ populations are higher than the world average. Upon examining the sex ratios of specific countries within these regions, i.e. China and Bhutan, it is not only evident that the masculinization is even worse but also that some countries (e.g. Bhutan) that are rarely mentioned in literature as presenting a missing women problem in the population appear to present a large female deficit in the 60+ population which worsens with age. In general, the lower regional versus country sex ratios points to the heterogeneity in the elderly missing women problem amongst the countries of Asia so that a higher female deficit in some countries is counterbalanced by lower female deficit in other countries resulting in lower regional sex ratios. For the remaining two regions of Asia, Central Asia and Western Asia, the sex ratios appear to present no female deficit, with ratios even below the world average in the case of the former. However, an assessment of specific countries in the region – i.e. Tajikistan and Qatar – reveals that the phenomenon may be pervasive therein. The case of Qatar is especially striking where the number of elderly men is more than twice the number of elderly women and although the pressure slightly abates in the 75+ population, men continue to outnumber women.

Table 3–1

Sex ratios (male/female) for regions and countries in 2015

Region/Country	60+	75+
World	0.86	0.70
East/Southeast Asia	0.90	0.74
China	0.96	0.83
South Asia	0.96	0.88
Bhutan	1.16	1.30
Central Asia	0.70	0.57
Tajikistan	0.96	0.91
West Asia	0.84	0.70
Qatar	2.33	2.00

This glimpse on the deficit of elderly women in some parts of Asia shows that – alongside the challenges of a rapidly ageing population – many countries in Asia may be facing the additional burden of a masculinization of old age. This chapter discusses and compares the extent of this masculinization in countries of the continent. After providing an overview of patterns already discussed by missing women literature, section 3.3 presents the data, section 3.4 describes the methods, section 3.5, 3.6 and 3.7 present and analyze the results. Finally, section 3.8 concludes.

3.2. Country specific patterns in literature

3.2.1. Missing women in the total population

When Sen (1990, 1992) estimated a figure of 100 million missing women worldwide he identified the excess female mortality to be concentrated in China, some countries of South Asia (India, Pakistan and Bangladesh) and the regional level, in West Asia and North Africa. Subsequently, when Coale (1991) and Klasen (1994) debated the appropriateness of the methodology to be used they identified the problem in the same geographical regions as Sen.[20] When updating the number of missing women, Klasen and Wink (2002, 2003) added a few countries to the original analysis and identified the missing women problem therein. These countries included: Iran, Afghanistan, Taiwan, South Korea, Algeria and Tunisia. Thereafter, a further update on the number of missing women was provided by Guilmoto (2012) who estimated that the following countries exhibit a missing women phenomenon in their total population in 2010: Afghanistan, Albania, Armenia, Azerbaijan, Bangladesh, China, Hong Kong, Georgia, India, Montenegro, Nepal, Pakistan, South Korea, Singapore and Vietnam. Finally, Bongaarts and Guilmoto (2015) when estimating the total number of missing women in the population from 1970 to 2010 and in their projections from 2010 to 2050 included China, India, Pakistan, Bangladesh, Nigeria, Indonesia, Sub-Saharan Africa and a rest of the world category in their calculations. The authors contend that the majority of women are missing below the age of 60 (with the highest proportion in the 40-59 age category) and their geographical clustering is apparent in East and South Asia although countries of Southeast Europe and South Caucasus also present an excess of male (at younger ages than 40) due to a rise in sex selection in the 1990s (Bongaarts and Guilmoto 2015).

Two things are to be noted from the academic literature on missing women that attempts to estimate the female deficit in the total population. First, many Asian countries are excluded from an analysis of missing women in the total population (e.g. Thailand, Bhutan, Jordan, Middle Eastern countries of Western Asia) Second, existing studies that attempt to estimate missing women in the total population do not take account of the effect of immigration. Coale (1991) highlights that migration is one of the four ways in which the sex ratios of a population can be affected with the effect depending on the age structure and gender composition of the migrant population. It may therefore be useful to assess the impact of migration on the elderly missing women phenomenon.

[20] Although Coale (1991) and Klasen (1994) leave out some countries from South Asia and the only country included in their analysis from North Africa is Egypt.

3.2.2. Missing women in specific age groups

As already identified in chapter 2, the most frequently discussed age category in missing women literature is the before/at birth category followed by the childhood category with some later age categories only recently being emphasized. The study by Guilmoto (2009) provides an exhaustive list of countries that are analyzed in the before/at birth category. These countries include: Albania, Armenia, Azerbaijan, Bangladesh, China, Georgia, India, Nepal, Pakistan, Singapore, South Korea, Taiwan, Nepal and Vietnam. By far, the most frequently discussed countries are China and India in terms of the effect of fertility decline and sex selection technology (e.g. Das Gupta and Shuzhuo 1999), the role of birth parity and gender composition effects (e.g. Bannister 2004 in the case of China & Das Gupta and Mari Bhatt 1997 in the case of India), possible regional variations (e.g. Hull 1990 for China and Mari Bhat and Zavier 2007 for India), elevated sex ratios at birth amongst Indian and Chinese migrant communities (e.g. Dubuc and Coleman 2007) and future projections (e.g. Attané 2006 for China). Another country that is frequently discussed, though to a lesser extent is South Korea. Although some of the same features as China and India are also highlighted in South Korea (e.g. the same literature highlights the effects of sex selection technology and fertility decline and Park and Cho 1995 evaluate the role of the birth parity and gender composition effects), the country is notable for its role in reversing the missing women phenomenon at birth and literature either directly highlights the exemplary role of South Korean government in managing the missing women problem at birth (e.g. Kim 2004) or indirectly discusses the applicability of South Korean solutions in the context of China or India (e.g. Chung and Das Gupta 2007). Pakistan and Bangladesh are less frequently examined at the time of birth and when discussed are attributed as having relatively normal sex ratios at birth due to higher fertility and lower practice of sex selective abortion (e.g. Bongaarts and Guilmoto 2015). In the case of the former, the sex selection behavior of Pakistani migrants is often compared to that of Indian migrants (e.g. Adamou, Drakos and Iyer 2013).

The four post-Soviet countries, Albania, Armenia, Georgia and Azerbaijan, were introduced to missing women literature by Guilmoto (2009) and have benefitted from some research on rising sex ratios at birth since then. Most research focuses on the correlation between the breakup of the Soviet Union and sex selective abortions at higher birth levels (e.g. Duthé et al. 2012) and the fact that this increase in sex ratios is limited to only a few countries of the Soviet bloc despite similar sociocultural patterns across post-Soviet States (e.g. Michael et al. 2013). Vietnam is another country that was identified by Guilmoto (2009) as exhibiting the missing women phenomenon at birth. The majority of existing literature on the country emphasizes that although sex ratios at birth started to rise later in the country, they are expected to exhibit the same U-shaped sex ratio patterns (described in chapter 2) that other countries experiencing a sex ratio at birth deficit exhibit (Guilmoto 2012).

Literature on the missing women phenomenon at birth for the remaining countries in Guilmoto's (2009) paper is not very detailed but may be referred to occasionally as in for example by Lin and Luoh (2008) in Chapter 2 to test the hypothesis on the link between parental carriers of the Hepatitis B virus and the missing women phenomenon.

In the childhood category the main focus of the literature is the neglect of girls in health and nutrition and in this regard three countries feature prominently – Bangladesh, India and Pakistan. Even before the introduction of the term missing women, the neglect of girls in these countries was highlighted (e.g. Chen, Huq and D'Souza 1981 for Bangladesh and Das Gupta 1987 for India). In the post 1990 era India predominates the literature on missing girls where again the gender composition effect is often assessed (e.g. Kulkarni 2007). In India studies also compare the effect of religion and fertility on missing women in early childhood (e.g. Iyer and Joshi 2013). Of course substantial research also evaluates the existence of missing girls in China (e.g. Qian 2008) and the impact of resource constraints on girls (e.g. Jiang, Feldman and Jin 2005). The trend departs from discussing these traditional countries when talking about the tradeoff effect i.e. the extent to which sex selection at birth has counterbalanced discrimination against young girls (e.g. Goodkind 1996, Lin, Liu and Qian 2014) when data is used from different countries (China, South Korea, Malaysia and Taiwan) to evaluate the validity of the argument.

In the young adulthood and adulthood categories there are two papers that directly address the existence of the missing women phenomenon. The first paper addresses it in the context of India only (i.e. Milazzo 2014). The second paper examines the existence of adult missing women (20-64) due to not being married (described in chapter 2) in China, India, Southeast Asia, South Asia, West Asia and Africa (i.e. Anderson and Ray 2015). Furthermore, over the past decade there has been a growing body of literature that evaluates the consequences of missing women phenomenon for marriage markets in countries like China and India and how the deficit of brides can be filled by importing from countries with similar cultural ties, especially in the context of China (e.g. Hudson and Den Boer 2002, Ebenstein and Sharygin 2009).

Finally, there are three papers that examine the missing women phenomenon in the elderly category. The first paper disaggregates the missing women phenomenon by age and disease for China, India and Sub-Saharan Africa and finds that a substantial proportion of missing women in the former two countries are concentrated in the elderly age group (Anderson and Ray 2010). The second paper concentrates on the age distribution of missing women across different states in India and finds evidence of elderly missing women therein (Anderson and Ray 2012). The third paper by Bongaarts and Guilmoto (2015) calculates the total number of missing women worldwide for each age category and finds that missing women exist in the elderly category as well but focuses its discussion mainly on how the missing women trend of China and India has developed in the past and how it will develop in the future, alongside the rest of the world.

The discussion on literature by age group makes it clear that not only is there an overabundance of research on missing women at the time of birth (as already apparent in chapter 2) but also budding research on the effects of a female birth deficit at some later stages of life. This is especially true for China and India. For example, at the childhood stage some authors examine whether higher prenatal sex selection may increase female chances of survival during childhood. This trend is especially apparent in young adulthood when young men born in cohorts in China and India when prenatal sex selection was practiced very widely are now facing difficulties finding wives and hence have a lot of literature and media attention oriented their way. This may reflect the tendency of literature to focus on the deficit of women at the stage when the

problem is most apparent in society. The relative neglect of the elderly missing women phenomenon may therefore be the result of ageing being a recent phenomenon in Asia (i.e. restricted to a few countries) and many countries that are affected by the missing women phenomenon perhaps are not prepared for an ageing population (Chalise and Brightman 2006, Jejeebhoy and Sathar 2001) and least of all envisage the consequences of a female deficit in that population. For example, substantial literature in India discusses the problems that the feminization of ageing in the country would present (Venkatesh and Vanishree 2014).

The geographical analysis of the coverage of missing women literature makes two further things apparent: First, a comparison of patterns in literature by age with patterns in literature for the total population blatantly points to the absence of an in-depth analysis of the missing women phenomenon in the non-Soviet states of Western Asia. In earlier calculations some authors (e.g. Sen 1990, Coale1991) recognized that a female deficit in Western Asia may exist and although Anderson and Ray (2015) include the region in their analysis (to find very few adult missing women therein), there is no detailed reference to or analysis of countries in the region (or the region as a whole) in the remainder of the literature. Second, several countries in Asia (e.g. Thailand, Bhutan, Jordan) have been entirely neglected from an analysis of missing women in the total population and/or at any given life stage.

3.2.3. Demographic change in Asia

A plethora of literature has addressed the challenges brought by the demographic transition in East and Southeast Asia. The majority of this literature addresses the preparedness of different countries in the region in meeting the challenge of a rapidly ageing or a very old population in terms of labor market reforms, pensions, social security and medical care (e.g. Heller 2006, Canning 2007, Lee, Mason and Park 2011). A growing concern is whether countries will be old before they are rich and hence unable to cater to the challenges of ageing (e.g. Heller 2006). Many authors (e.g. Heller 2006, Jones 2013) highlight the exceptional management of ageing in Singapore which appears to be the only country to implement policies to prepare for its rapidly ageing population. Some authors highlight the role of migration in altering the demographic trend in selected countries of the region (e.g. Hugo 2008) and advocate it as a panacea for the challenges brought by population decline (e.g. Huguet 2003). But in this strand of literature, with the exception of China (e.g. Anderson and Ray 2010) no author seems to have addressed the elderly missing women phenomenon for the East/Southeast Asian region. Rather, some reports on the region (e.g. Mujahid 2006) emphasize the feminization of aging in the older and oldest populations of the region.

Literature on demography and ageing in South Asia acknowledges that relatively recent (compared to East and Southeast Asia) decline in fertility and mortality have led to increased longevity within the population of individual countries of the region and marks two outliers in the region: Afghanistan and Sri Lanka (e.g. Veron et al. 2008). The first outlier, Afghanistan, lags behind the South Asian nations in the demographic transition in having a younger population (Veron et al. 2008, Mujahid and Siddhisena 2009). The second outlier, Sri Lanka, supersedes the other South Asian nations with demographic indicators comparable to those of Southeast Asian nations (Veron et al. 2008, Mujahid and Siddhisena 2009). For the remaining countries in the region there is

considerable concern about the divergent size of their youth bulges and the urgent need to productively employ them to generate returns for the future with some countries like India and Bangladesh having had an employable youth bulge for some years (but having failed to utilize it) while other countries like Pakistan and Nepal having reached their demographic window of opportunity fairly recently (Bloom, Canning and Rosenberg 2011, Navaneetham and Dharmalingam 2012). In this regard substantial literature considers the opportunity cost of the failure to use this youth bulge productively not only in terms of lost employment and resource generation (e.g. Dev and Venkatarayana 2007, World Bank 2012) but also the potential for youth radicalization it creates especially in Pakistan and Afghanistan in the wake of U.S. intervention in these countries (e.g. Yusuf 2008, Gaan 2015). When addressing the situation of the elderly population, literature in some countries like Nepal and Pakistan highlights that although the populations in these countries is expected to age rapidly in the coming decades, inadequate academic attention is afforded to the phenomenon of ageing therein (e.g. Chalise and Brightman 2006, Jejeebhoy and Sathar 2001). Nevertheless, a plethora of literature discusses the erosion of traditional family norms and its implications for the elderly population as a result of which an increasing proportion of the elderly will be stuck at the juncture where neither can they rely on the support from their children nor do they have assistance from the state and/or informal organizations (e.g. social security, nursing homes) to cater to their basic needs (e.g. Goldstein, Schuler and Ross 1983, Rajan 2002, De Silva 2005). In this context literature emphasizes the urgency for older countries in South Asia, especially India and Sri Lanka, to adopt a social security system that would cater to the needs of its growing elderly population. It would appear that unlike its exceptional performance on demographic indicators, Sri Lanka fares rather poorly on the provision of social security for its elderly and is at par with India in this regard (Karunarathne and Goswami 2002). On the other hand, literature takes note of India's Civil Pension Reform in 2008 (e.g. Bali 2014) and advocates that the programs initiated by India's government to provide greater income security and health care access be implemented in other countries as well (e.g. Bloom, Mahal, Rosenberg and Sevilla 2010). Literature on ageing in South Asia also touches upon rural-urban differences amongst the elderly especially on health indicators (e.g. Rajkumar and Kumar 1996, Kabir et al. 2003) and some authors associate these findings with socioeconomic conditions and gender (Ahmed et al. 2004). Some authors find that gender becomes an important determinant in health seeking behavior and living arrangement (i.e. increase in the likelihood of women living alone) once socioeconomic conditions are controlled for (e.g. Ahmed et al. 2004, Roy and Chaudhuri 2008) and advocates that policies designed towards the elderly should be aimed at reducing gender and rural-urban differentials amongst the aged (Ali and Kiani 2003). While most of the literature continues to point to the feminization of ageing in South Asia (e.g. Venkatesh and Vanishree 2014), Mujahid and Siddhisena (2009) use UNDESA population projections for 2050 to show that the elderly populations of some countries in the region (i.e. Pakistan and Bhutan) may have masculinized sex ratios in the future.

Although ageing and demographic change in the post-Soviet states of Asia (i.e. all the states of Central Asia and the Caucasian States of Western Asia) is often discussed simultaneously some level of heterogeneity amongst the states is discernible. Armenia, Georgia and Moldova are generally recognized as being the older states and following the pattern of Eastern European countries while majority of the Central Asian countries (except Kyrgyzstan) and Azerbaijan are recognized as being younger and following the

pattern of Southeast Asian countries (Sidorenko 2016, Haub 1994). Although this pertains to all demographic indicators (fertility, mortality, migration), specific emphasis is placed on the diverse fertility patterns amongst countries that is causing populations in some countries (like Georgia and Armenia) to shrink faster than in other countries (i.e. countries of Central Asia, especially Tajikistan) in spite of which all post-Soviet countries are embracing themselves for a rapidly ageing population (Gentile 2007, Lutz 2010, Sidorenko 2010). Literature also compares the extent to which different countries are economically prepared to tackle an ageing population and classifies the post-Soviet Asian countries into two categories: the young late reformers which constitute the four poorer Central Asian countries (Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan) that still have growing populations but have made slow progress towards mature market institutions and need to overcome significant policy challenges to cater to their aged populations; and the ageing late reformers (Armenia, Azerbaijan, Georgia, Kazakhstan and Moldova) that have relatively older populations and face many threats because their reforms are not rapid enough to counterbalance the effects of ageing (Chawla, Betcherman and Banerji 2007). Further, there is an abundance of literature on post-Soviet countries that addresses how pensions and social protection have developed in the post-communist system. The literature highlights that before the fall of the Soviet Union, the state funded a generous pay as you go system so the elderly could live relatively comfortable live. However after the fall of the USSR the decline in public funds made this system untenable as a result of which retirement ages of the population were extended, benefits were cut and the quality of life of the elderly today is poorer. This literature increasingly emphasizes how the majority of post-Soviet countries are in a transition state and have to adopt a system best suited for their needs (e.g. Branco and Ruarte 1998, Becker and Plastev 2004, Falkingham and Vlachantoni 2010). In addition, there is a distinct strand of literature that discusses the causes of decline in male and female life expectancy (especially the former) upon the fall of the Soviet Union (e.g. Brainerd and Cutler 2005, Brainerd 2010). However, as the greatest declines in life expectancy occurred in the Western nations of the former Soviet Union (with relatively smaller declines in Central Asia and Caucasian countries; Brainerd and Cutler 2005) most of this literature discusses the fall in the context of the non-Asian post-Soviet states, especially Russia (e.g. Leon et al. 1997, Bhattacharya, Gathmann and Miller 2013). Nevertheless, there are studies conducted in countries of Central Asia that evaluate the reasons behind differences in male life expectancies in populations of Russian and local descent (e.g. Guillot, Gavrilova, Pudrovska 2011, Guillot et al. 2013). This literature largely concentrates on the excess of females over males in the majority of the countries. Finally, there is some evidence of masculinized sex ratios in the post-Soviet states of Central Asia. Sidorenko (2016) points to more masculinized sex ratios in the populations of Kyrgyzstan, Turkmenistan, Uzbekistan and especially Tajikistan, as compared to other post-Soviet states.

In the Middle Eastern region of Western Asia, several authors discuss stark variations in the pace of aging and the relatively recent improvements in demographic indicators (i.e. fertility and mortality) that led to these variations (e.g. Tabutin 2005, Yount and Sibai 2008, Kronofol, Sibai and Rizk 2013). An immediate concern for many authors is the divergent size of youth bulges (and echo bulges) across different countries and the pressing need to employ them productively (e.g. Saxena 2008, Hayutin 2009). Some authors link the youth bulge with the Arab Spring, delayed marriage and changing household structure (e.g. Puschmann and Matthjis 2015). The integral role of international migration in altering the demographic profile of these countries has also

been discussed (e.g. Hayutin 2009, Kronofol 2013). In a majority of the aforementioned papers, the countries of the Middle East are ranked according to their stage of demographic transition (Tabutin 2005) or pace of ageing and fertility decline (Hayutin 2009). In this framework, the oldest countries in the region are oil rich states of Qatar, UAE, Bahrain and Kuwait while the youngest countries are Yemen, Syria and Palestine. Although, missing women literature has largely ignored this region and some authors like Kronofol (2013) emphasize the feminization of ageing in the region, there is some recognition of the deprivation of women in old age. For example, when addressing the vulnerabilities of the elderly population in the Middle East, Yount and Sibai (2008) recognize that women face greater risks than men due to poor investments in women's schooling and health and customary structures that reinforce women's financial dependence on family life. They emphasize that widowhood and solidarity among older women raise concerns about women's needs being met. However, no author emphasizes the missing women/elderly missing women phenomenon in any country in the Middle East.

It is therefore evident from the literature on demographic transition in Asian countries that there is almost no concern about the emergence of a female deficit in the elderly population with many regions and most countries discussing the feminization of ageing or the consequences of not being able to productively employ current resources to save for an ageing population. This holds true even for countries that are known to exhibit a missing women problem in the younger life stages. There is therefore an urgent need to explore the extent of the elderly missing women phenomenon not only in countries that are known to exhibit a deficit in early life stages but also the majority of Asian countries for which the missing women phenomenon remains unexplored. The discussion that follow is going to describe the extent of the missing women phenomenon across the different regions of Asia with a special focus on age group differences.

3.3. Data

Data from the United Nations Department of Economic and Social Affairs (UNDESA) for the year (2015) is used for three types of analyses: First, to estimate the existence and magnitude of the missing women problem across countries in Asia in the 60+ and 75+ age categories for the year 2015 both including and excluding the immigrant stock. Second, to assess the trend of sex ratios by five-year age groups for countries exhibiting the elderly missing women phenomenon from the first analysis and to compare the results with the inclusion and exclusion of the immigrant stock. Third, to assess future trends in elderly missing women using UN data for the years 2030 and 2050 with the inclusion of the immigrant stock only[21].

The UNDESA follows a four step procedure to construct its yearly population estimates. First, it collects data from census surveys, vital and population registers and other national surveys. Second, it corrects the accuracy of the statistics collected by using post enumeration surveys and demographic adjustment techniques. Areas that require specific attention are under enumeration and age heaping for children under five

[21] Future projections of immigrant population by age group and gender are not available by the United Nations (UNDESA, “custom data” 2015, UNDESA, “Methodology” 2015).

and mortality rate adjustment of older populations (e.g. above age 85). Using these adjusted figures, the UNDESA uses projection equations for its yearly population estimates. Third, it checks whether the estimates are consistent with each other and with the statistics corrected in the second step. This is achieved by using a balancing equation that ensures that fertility, mortality and migration estimates balance each other out and population estimates between population surveys correspond to original estimates from surveys. Finally, since the UNDESA is producing estimates for countries all over the world, it crosschecks the consistency and balances the population estimates at the regional and world levels (UNDESA, "Methodology" 2015).

For projecting future population estimates, the UNDESA applies the cohort component method to individual countries. This is the most common demographic method used for population projections and requires assumptions on fertility, mortality and migration patterns. For fertility and mortality assumptions, the Bayesian Hierarchical Model is used for each country which allows the stepwise incorporation of historical trends within the country and trends from countries that have experienced similar fertility and mortality conditions hence incorporating the fertility and mortality transition in projected estimates. This allows for several fertility and mortality trends for each country to be projected. The estimates used in this paper are based on the median trend of fertility (medium variant fertility assumption) and mortality for any given country. Mortality patterns are adjusted for countries that reflect very high or low life expectancies and for HIV/AIDS. For migration, separate assumptions are made for international migrants and refugees. The pattern of the former is assumed to remain relatively constant till 2045-2050[22] however the latter, in the countries where present, are assumed to return to their home countries within 5-10 years. Migration estimates remain the most unpredictable so that all international patterns of legal and illegal migrants and government policies are taken account of when estimating their numbers. Using these assumptions on fertility, mortality and migration, the cohort component method produces projected population estimates by five-year age groups for individual countries (UNDESA, "Methodology" 2015).

The population estimates and projections of the United Nations are based on the de facto population in a given country (UNDESA, "Methodology" 2015). According to the OECD (2006), the de facto population can be defined as "a concept under which individuals (or vital events) are recorded (or are attributed) to the geographical area where they are present (or occurred) at a specified time." Therefore, estimates of net migration (immigrants – emigrants) need to be subtracted from the population estimates to obtain an accurate demographic profile of the nationals of any given country. Such an exercise would require flow data by gender and age on all countries considered in this paper i.e. Asian countries. Although flow estimates for the population as a whole may be available for most Asian countries,[23] they are estimates for the population as a whole and not disaggregated by gender and age and therefore cannot be used for the

[22] After 2050, the number of international migrants is expected to fall by 50%. This is an unrealistic but necessary assumption by UNDESA as the number of immigrants from 2050 to 2100 would be extremely difficult to predict (UNDESA, "Methodology" 2015).

[23] Abel and Sander (2014) convert migrant stock data provided by the United Nations Population Division into flow data thereby providing flow estimates for 196 countries in the world. The United Nations Population Division provides flow estimates for 43 countries worldwide most of which are in Europe and North America. However, the data provided by Abel and Sander (2014) is not disaggregated by age or gender and therefore cannot be used for the purpose of this chapter.

purposes of this paper (i.e. for the calculation of sex ratios by age). The best alternative, especially for many Asian countries, is the gender and age distribution of the international migrant stock provided by the UNDESA (Fargues 2006, Cainkar 2013). The United Nations defines the international migrant stock as "the number of people born in a country other than that in which they live, including refugees" (UNESC 2010). For countries where information on place of birth is lacking, classification based on country of citizenship is used instead (UNDESA, "Methodology" 2015). Therefore, the UNDESA data on migrant stock is used to analyze sex ratios with the exclusion of immigrants.

3.4. Method

The primary methodological consideration in calculating the number of missing women in any age group is the identification of the hypothetical number of women that should be alive in the given age group in the absence of missing women. This requires the identification of an ideal sex ratio (men/women) that would prevail in the absence of missing women. In this paper the ideal sex ratio is assumed to be the sex ratio prevailing at the world level i.e. the sex ratios in the 60+ and 75+ populations in each country must be less than or equal to the world sex ratios. Any sex ratios higher than the world sex ratios would indicate a female deficit and hence the presence of missing women in the respective populations of the given country.

The analysis within Asia is conducted both at the regional and at the country level. There are two reasons for the former. First, as discussed in the beginning of the chapter, existing discussion of the missing women phenomenon identifies its existence in specific geographic regions – predominantly East/Southeast Asia and South Asia. Therefore, to assess whether there is a regional gap in terms of missing women and elderly missing women literature, such an analysis would be necessary. Second, the introduction of the chapter also discusses the inter regional variations in ageing across Asia. An analysis of these variations in the context of missing women would require a regional grouping of countries. The regional classification of countries used in this chapter are the ones provides by the United Nations and listed in table 3-2. As it can be seen two additional classifications are used for the countries in Western Asia namely dividing them between countries that form part of the Middle East and countries that are members of the Gulf Cooperation Council (GCC). Information for the classification of countries as Middle Eastern and as GCC is obtained via the World Bank ("Middle" 2016, "Gulf" 2016). The GCC consists of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates (World Bank, "Gulf" 2016). These oil rich Arab states are peculiar because as opposed to the majority of countries in the Arab region that are both senders and recipients of labor migrants, they stand out for being recipients of labor migrants only (Fargues 2006, Cainkar 2013, Kronofol 2013). That fact that Saudi Arabia, Qatar, UAE and Kuwait are four countries that form the largest sources of international remittances worldwide (Kronofol 2013) is indicative of the heavy inflow of immigration. Hence, these countries are analyzed separately as it is expected that the immigration patterns therein would have strong implications on the missing women phenomenon (Klasen and Wink 2003).

For the first analysis, the elderly missing women phenomenon is assessed first at the regional level, then at the country level (by region). To this end, sex ratios of each

country are subtracted from world sex ratios for the specific age category and the total population (the latter for comparative purposes, discussed in detail in the results section). A negative number indicates an elderly missing women phenomenon in the given age category and country (as the ratio of men/women of that country is higher than the ratio of men/women for the world) and a zero or positive number indicates no elderly missing women phenomenon in the given age group and country, compared to the world average. This analysis is conducted including and excluding the immigrant stock for each country, as it will become evident in the subsequent discussion, age and gender specific immigration patterns in some countries (for example the United Arab Emirates; Cainkar 2013) may distort the findings.

For the second analysis, the sex ratio trend by age for countries identified as presenting an elderly missing women phenomenon (from the first analysis, including and excluding migrants) is analyzed with respect to the sex ratio trend by age for the world population and the differences with the inclusion and exclusion of migrant stock are evaluated. The purpose of the second analysis is an assessment of the age distribution of missing women to check the age at which the female deficit is concentrated and/or whether the deficit in the elderly population is large enough to create a female deficit in the total population.

For the final analysis, the first analysis is repeated for UNDESA population projections for the years 2030 and 2050. This not only allows future regional and country level patterns in missing women to be determined but also some results from the first analysis to be consolidated (as will be seen later). As a result, the magnitude of the missing women threat can be assessed alongside the ageing of populations since countries with any given level of female deficit in their elderly population would be expected to face a more severe elderly missing women phenomenon the greater the proportion of their population is in the elderly category (i.e. 60+, 75+) as this implies that the female deficit affects larger number of women. Unfortunately, this can only be done with the population including the migrant stock, as projections for migrants by age and gender are not available from any source.

Table 3–2

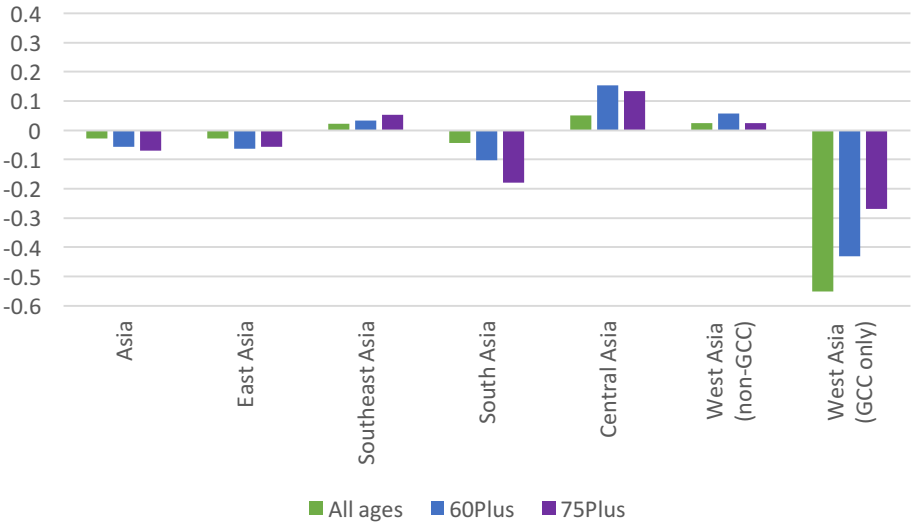
Classification* of countries in Asia	
South Asia	Southeast Asia
Afghanistan	Brunei Darussalam
Bangladesh	Cambodia
Bhutan	Indonesia
India	Laos
Iran (Middle East)	Malaysia
Maldives	Philippines
Nepal	Singapore
Pakistan	Thailand
Sri Lanka	Timor-Leste
	Vietnam
East Asia	Central Asia
China	Kazakhstan (post-Soviet)
Hong Kong	Kyrgyzstan (post-Soviet)
Macao	Tajikistan (post-Soviet)
Japan	Turkmenistan (post-Soviet)
Mongolia	Uzbekistan (post-Soviet)
North Korea	
South Korea	
Western Asia	
Armenia (post-Soviet)	Bahrain (GCC, Middle East)
Azerbaijan (post-Soviet)	Kuwait (GCC, Middle East)
Cyprus	Oman (GCC, Middle East)
Georgia (post-Soviet)	Qatar (GCC, Middle East)
Iraq (Middle East)	Saudi Arabia (GCC, Middle East)
Israel (Middle East)	United Arab Emirates (GCC, Middle East)
Jordan (Middle East)	
Lebanon (Middle East)	
Palestine (Middle East)	
Syria (Middle East)	
Turkey	
Yemen (Middle East)	

* Regional classification of countries according to the United Nations Department of Social and Economic Affairs (2015); Post-Soviet classification of countries according to Chawla, Betcherman and Banerji (2007); Middle- Eastern and GCC classifications according to the World Bank ("Middle" 2016, Gulf "2016").

3.5. Analysis of elderly missing women in 2015

Figures 3.1 to 3.7[24] depict the female deficit in the regions and countries of Asia. Figure 3.1 provides a regional perspective of the female deficit. The figure makes apparent that when compared to the world average, the continent as a whole and three regions therein – East Asia, South Asia and the GCC region of Western Asia – depict a female deficit in the total and elderly populations (both age categories). In the former two regions, the deficit appears to worsen in the elderly categories which may indicate a worsening of female survival chances as the population ages. Of course this cannot be confirmed without examining the situation of individual countries (as the results may be driven by a single country or a set of countries). It is further evident that in all three age categories the deficit is worst for the GCC countries of Western Asia, followed by South Asia and then East Asia

Figure 3.1: Missing Women by region (2015)



Figures 3.2 to 3.7 depict the situation of individual countries within the regions of Asia. It is apparent that amongst the three countries in East Asia that present a female deficit in the elderly population, China and Hong Kong present it for both elderly categories while Macao does so for the 60+ category only. Amongst the seven countries in Southeast Asia that present the same deficit, Malaysia and Timor-Leste appear to exhibit the phenomenon in both elderly categories while Brunei Darussalam, Indonesia, Singapore, Thailand and Laos present it in one elderly category only (60+ for the latter three countries and 75+ for the former countries. Malaysia has the highest female deficit in the region for both elderly categories. In South Asia, all countries except Sri Lanka present the elderly missing women phenomenon and do so in both the 60+ and 75+ age categories. In Central Asia, Tajikistan is the only country that presents an elderly missing women phenomenon and does so for both elderly categories. Amongst the non-GCC countries of Western Asia, Cyprus, Jordan, Lebanon Palestine, Syria and Yemen present an elderly missing women phenomenon in both elderly categories while

[24] The range of values differs for the graph representing the GCC region of Western Asia to allow for better visualization of results.

Iraq presents it in the 75+ category only. Finally, all the GCC countries of Western Asia exhibit high female deficits in both elderly categories with the United Arab Emirates presenting the highest female deficit in Asia in the 60+ category and Qatar doing so in the 75+ category with both countries being outliers in the extent of their respective deficits. At a first glance, some Asian countries like the North Korea (in East Asia), Vietnam (in Southeast Asia) and Kazakhstan (in Central Asia) appear to be outliers in the opposite direction indicating a problem of missing men. However, this is purely a result of using the world as a reference point. If instead, the industrialized countries of Western Europe had been used, perhaps even the countries currently close to and above the origin would present an elderly missing women phenomenon. However, the inadequacy of applying the demographic conditions of the developed nations of the West to evaluate the missing women phenomenon in Asia has already been discussed by several authors (e.g. Coale 1991, Klasen 1994).

Figure 3.2: Missing women in East Asia (2015)

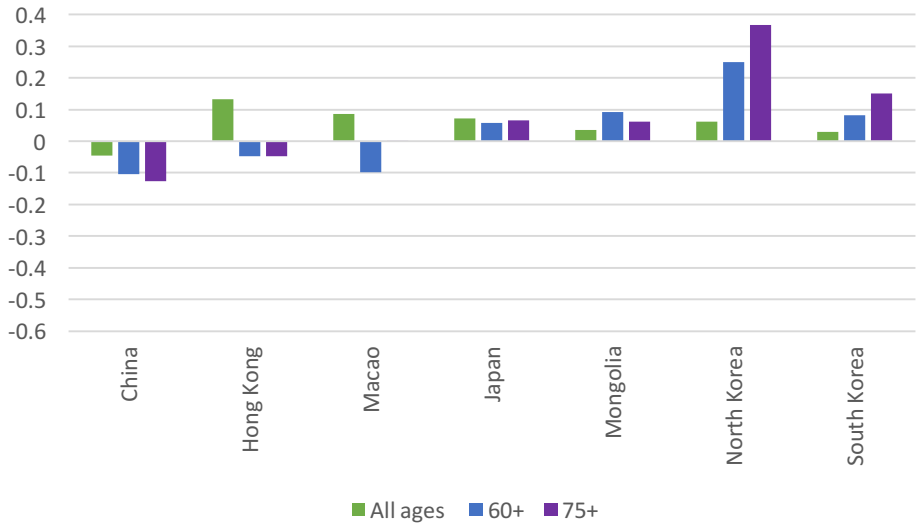


Figure 3.3: Missing women in Southeast Asia (2015)

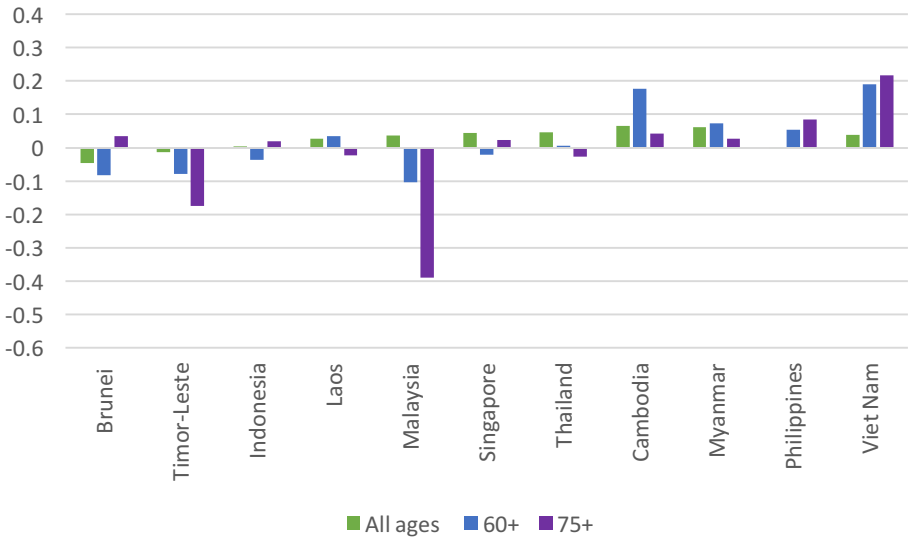


Figure 3.4: Missing Women in South Asia (2015)

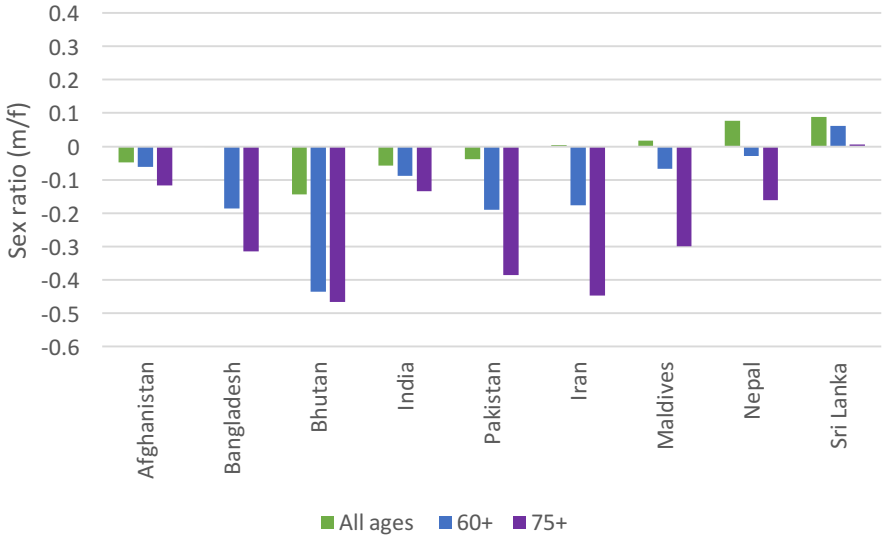


Figure 3.5: Missing women in Central Asia (2015)

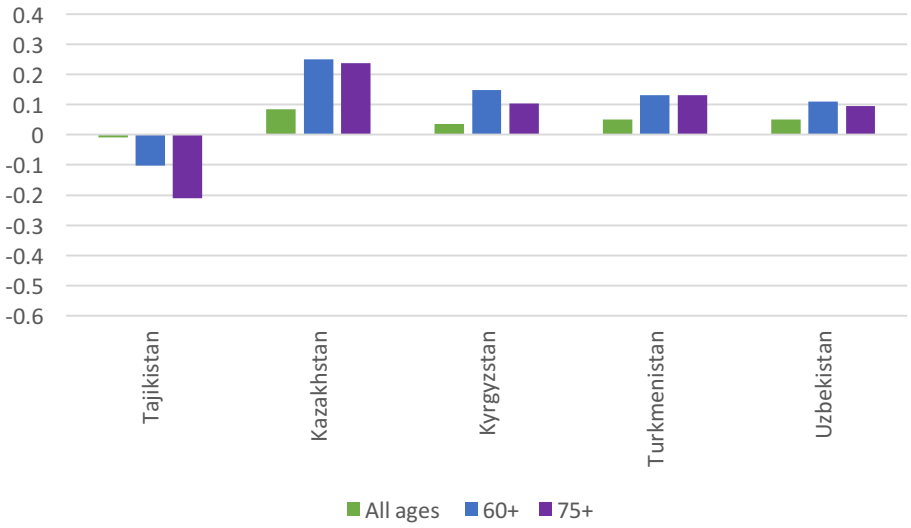
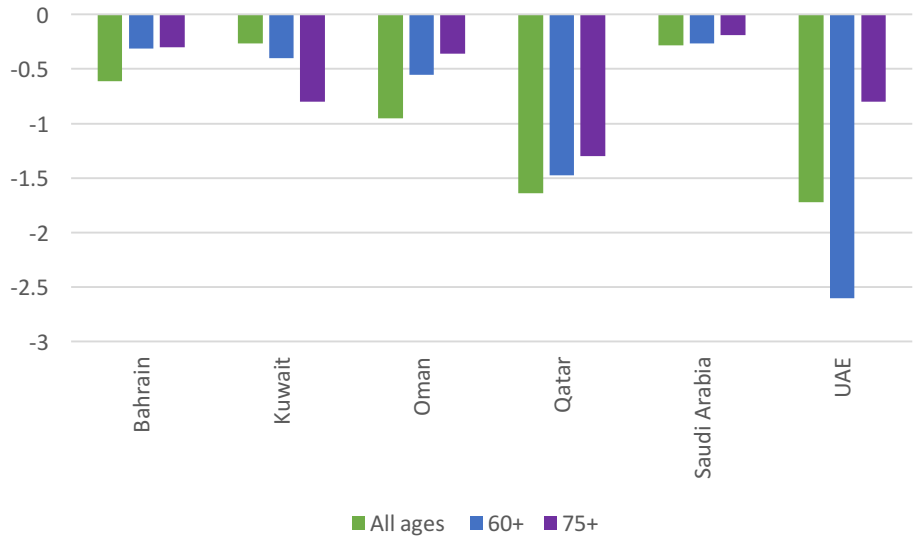


Figure 3.6: Missing Women in non-GCC Western Asia (2015)

Figure 3.7: Missing women in GCC Western Asia (2015)



A comparison of the female deficit in the elderly age categories of given countries with the female deficit or surplus in the total population of these countries may provide hints on whether the elderly missing women phenomenon therein may be the result of a cohort effect, i.e. whether elderly missing women are present in specific birth cohorts due to special demographic circumstances (e.g. war and natural disasters) experienced by these cohorts. Such an interpretation may be plausible if the deficit in the elderly population is not accompanied by a deficit in the total population. Of course without historical, cohort specific data it is impossible to completely rule out the existence of age specific discrimination in these countries (as would be, just for the sake of an example, deaths resulting from accusations of witchcraft as such accusations often specifically target elderly widowed women in some countries like Nepal (Schnoebelen 2009). However, for the moment it is assumed that the discrepancy level between female discrimination in younger ages (below 60) and amongst elderly is not high enough for the female deficit to become suddenly apparent amongst elderly only. Therefore, surpluses in the total population accompanied by deficits in the elderly population may be considered as possible cohort effects of missing women.

In total twelve countries may allow for a cohort effect interpretation: Hong Kong and Macao in East Asia, Indonesia, Malaysia, Thailand, Singapore and Laos in Southeast Asia, Iran, Maldives and Nepal in South Asia, Tajikistan in Central Asia and Lebanon in West Asia. The cohort effect in some of these countries becomes even more apparent when considering two things. First, in Macao, Singapore, Indonesia, Laos and Thailand the elderly missing women phenomenon is apparent in only one of the two elderly age categories (i.e. 60+ in the former three countries and 75+ in the latter two countries). Second, in Hong Kong, Macao, Malaysia, Maldives and Nepal there exists a significant difference between the female deficit in at least one category of the elderly population and the female surplus in the total population. This could suggest that the birth cohort affected by the elderly missing women phenomenon is an outlier in these countries, and on average factors across the life course do not accumulate to create the elderly missing women phenomenon therein.

For the remaining 19 countries the female deficit in the elderly population is accompanied by a female deficit at all ages. In the majority of these remaining countries not only does the female deficit in the elderly population exceed the deficit in the total population but also the deficit in the 75+ population exceeds the deficit in the 60+ population. Both facts hold for China in East Asia, Timor-Lest in Southeast Asia, Afghanistan, Bangladesh, Bhutan and Pakistan in South Asia and Kuwait, Jordan Palestine, Syria and Yemen in West Asia. In these countries this could be indicative of the increased vulnerability of women in old age but may also point to a trend over time. Conversely, in Oman, Qatar and Bahrain the female deficit seems to subside with age which may indicate an improvement in female survival chances, or more likely a change in the demographic makeup of these countries (as may be caused by return migration discussed later).

Figures 3.1 to 3.7 are based on the de facto population in each region and country and therefore estimate the elderly missing women phenomenon with the immigrant stock included. However, gender and age specific immigration may shape the demography of populations (Coale 1991). In fact, one of the reason Klasen and Wink (2003) don't estimate the number of missing women for the GCC countries is that they suspect the results to be heavily distorted by male dominated immigration to these countries. This is justified by Cainkar's (2013) contention that contrary trend in a majority of countries worldwide where women have comprised approximately half of the immigrant population over the past forty years, the GCC countries have a much lower female share of immigrants: 21% in Oman, 26% in Qatar, 27% in the UAE, 30% each in Kuwait and Saudi Arabia and 33% in Bahrain. To correct for the gender specific distortion caused by immigration, the female deficit in the different regions of Asia upon the exclusion of the immigrant stock from each country needs to be re-estimated. However, since the available data on migrants pertains to the number of immigrants only (as explained earlier it is impossible to get an estimate on the number of emigrants by gender and age for all Asian countries) it might be fruitful to get a brief glimpse of the overall migration patterns in the regions and countries of interest to assess the extent to which the absence of emigration data may affect the results.

Although Asia has a long history of migration with South Asian migrants seeking employment opportunities in the Middle East prior to the 1970's, the oil price increase in 1973 ushered in a new era of predominantly male labor emigrants from South Asian and some East/Southeast Asian nations (South Korea, Philippines and Thailand) countries to the GCC countries (Hugo 2005, Asis 2005). Further, in the 1980's, the newly industrialized countries of East and Southeast Asia fell short of labor supply and resorted to import labor in the same vein as the GCC countries – i.e. temporary labor contracts and for jobs deemed undesirable by the local population (Asis 2005). Hence, until 1990 labor migration in Asia was mostly oriented towards the deployment of unskilled workers and only recently has become concentrated on the more skilled work force (Asis 2005). Skill level also has an important bearing on migration outside Asia. Since the 1970's migration from Asia to the West has been increasing and although a proportion of people who make their way to the West are refugee/asylum seekers, European and North American countries mostly attract skilled migrants as a result of which large numbers of emigrants from China, Philippines, India, South Korea, Pakistan and Vietnam are now residing in OECD nations (Hugo 2005). These trends in migration have allowed distinct patterns to emerge among Asian countries. The East

and Southeast Asian regions consists of emigration countries, immigration countries and both emigration-immigration countries: Emigration countries include Philippines, China, Cambodia, Indonesia, Burma, Laos and Vietnam; immigration countries include: Japan, South Korea, Taiwan, Hong Kong, Singapore and Brunei; emigration-immigration countries include: Malaysia and Thailand (Hugo 2005, Asis 2005). All countries of South Asia are emigration countries (Haque 2005). All post-Soviet countries of Central and Western Asia are labor emigration countries (Tishkov, Zayinchkovskaya and Vitkovskaya 2005). Amongst the remaining countries in Western Asia, the GCC countries of the Middle East are labor importing countries only and hence immigration countries while the non-GCC countries of the Middle East are both emigration-immigration countries (Cainkar 2013, Kronofol 2013, Fargues 2013). Cainkar (2013) contends that the following countries rank highest in the world, (as of 2010), for have the largest proportion of immigrants relative to native born in their population: Qatar (86.5% migrants), UAE (70% migrants), Kuwait (69% migrants), Jordan (46% migrants), Palestine (44% migrants), Singapore (41% migrants), Israel (40% migrants), Hong Kong (39% migrants), Oman (28.4% migrants) and Saudi Arabia (27.4% migrants). Kronofol (2013) asserts that Saudi Arabia, UAE, Qatar and Kuwait are noteworthy for being the countries that form the largest source of remittances worldwide which reflects the large number of labor immigrants in their country.

For countries classified as immigrant countries only, the subtraction of immigrants could yield fairly accurate results on the missing women profile of the country however for countries that are emigrant and both immigrant/emigrant, this subtraction would not provide an accurate representation of the female deficit in the elderly population. Therefore, a rudimentary analysis of the gendered nature of migration might aid in understanding the extent to which emigration may affect the elderly missing women phenomenon. It may be assumed at this point that the only type of migration that would distort the results for missing women is individual emigration and not family emigration as, it will be assumed for the moment, that sex ratios of family members in the aggregate, may balance each other out and not create an overall surplus or deficit of women in the total/elderly population. In terms of individual permanent emigration women seem to predominate as a large portion of this emigration is marriage based migration and may involve women from less developed countries migrating to marry men from more developed countries (Hugo 2005, Tseng 2010). With reference to cross continental marriage migration (i.e. from Asian to North America and Europe) women predominantly originate from Philippines or Thailand (Hugo 2005). Marriage migration is also predominant within the East/Southeast Asian region and follows the same pattern of brides emigrating from poorer countries to richer countries (Jones 2012, Tseng 2010). Within this region the immigrant/destination countries for brides are Hong Kong, Taiwan, South Korea and Japan while the emigration/origin countries of brides are China[25], Indonesia, Philippines, South Korea (to Japan), and Vietnam (Tseng 2010). Due to the restrictive nationalization policies of East/Southeast Asian countries,

[25] The inclusion of China as a bride emigration country is somewhat inconsistent with existing evidence from literature (e.g. Hudson and Den Boer 2009) which shows that China is increasingly exhibiting an imbalance in the marriage market in terms of missing brides (described in the young adulthood section of chapter 2). Furthermore, increasing evidence from literature shows that China is compensating for the missing brides phenomenon by "importing" from poorer countries in the region (Ebenstein and Sharygin 2009). This would make China somewhat of an immigration country for brides as well although the trend may be too recent for numbers to be significantly present.

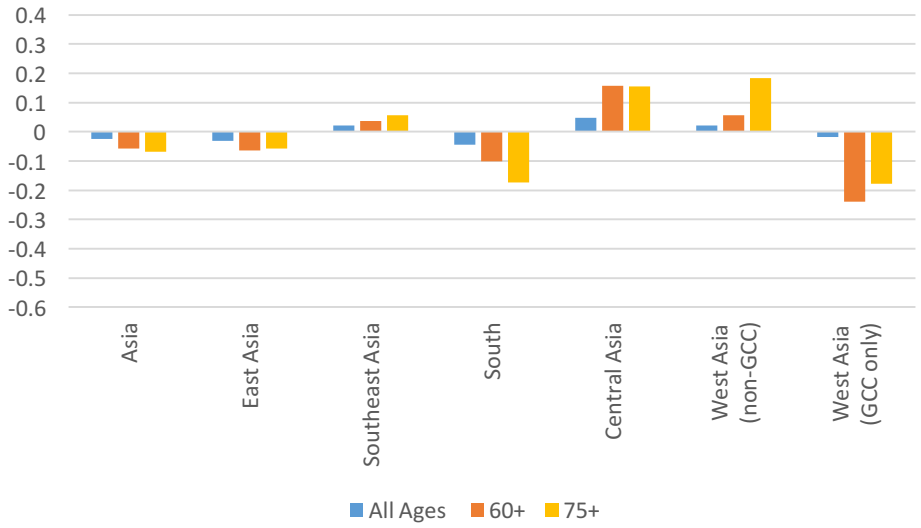
marriage is the only way for immigrants to attain citizenship of these countries (Tseng 2010). Hence, it may be assumed that once these women immigrate and marry, they would attain the nationality of their husband's country and not be counted as immigrants in the listed destination countries. Therefore, although marriage migration may create a female deficit in the countries of bride emigration/origin (Rallu 2008), their effect on sex ratios would not be discernible upon the subtraction of immigrants from the population in the country of destination. A time trend of sex ratios of migration would suggest that the preponderance of women from all major labor exporting countries is increasing in international emigration however cultural factors prevent individual women from some countries like Bangladesh from migrating (Hugo 2005). The feminization of migration is mostly associated with emigration from countries like Indonesia, Sri Lanka and Philippines where women comprise 62% to 75% of annual legal work deployment (Asis 2005). Filipino women are predominant as domestic workers in the Middle East but also as skilled workers (e.g. nurses) in North America (Asis 2005, Hugo 2005). Nevertheless, from the remaining sending countries – e.g. the majority of countries of South Asia – the bulk of individuals who migrate for work related purposes are male and return upon the end of their working years (Haque 2005). Both types of migration however preclude temporary migration for study. Hugo (2005) finds that Asian immigrant students who come to Australia are, on average, equally likely to be male and female, although variations exist at the country level. It will be assumed that students from all Asian countries who emigrate to study are equally likely to be male or female and therefore do not create distortions in sex ratios in their country of origin via this channel alone.

Figures 3.8 to 3.14[26] display the elderly missing women phenomenon for all regions and countries of Asia upon the exclusion of immigrants. A first look at the regional graph (figure 3.8) may give the impression that the results are the same as with the inclusion of immigrants since Asia continues to exhibit a female deficit in all age categories and the same regions display the elderly missing women phenomenon as before (i.e. East Asia, South Asia and GCC region of Western Asia). A closer look at the axes however shows that the female deficit in the GCC region of Western Asia in figure is smaller for all three age categories (especially for the 75+ age category) as compared to with the inclusion of immigrants. It would therefore appear that immigration has a strong impact on the female deficit in this region. While this may not be very surprising for the female deficit in the total population, it is somewhat surprising that the large number of labor immigrants cause a deficit in the elderly population as these immigrants would be expected to return to their home countries upon the end of their working years and therefore allow the sex ratios in the GCC countries to somewhat normalize. The persistence of immigrants beyond the working years may point to illegal migration in the Gulf and the difficulty in attaining exit visas (Shah 2013). On the other hand, the persistence of a large female deficit upon the exclusion of immigration in the elderly population alongside the total population points to the survival disadvantage of women in these countries across the life course into old age. In South Asia, the exclusion of immigrants does not have much effect on the female deficit in either age category. These results are not surprising. Barring inflow of refugees from Afghanistan to Pakistan and Iran (Haque 2005), the countries of the region are classified as net emigration countries so an exclusion of immigrants from the

[26] The range of values differs for the graph representing the GCC region of Western Asia to allow for better visualization of results.

region as a whole would not be expected to have much effect on the female deficit since Afghanistan is also in the South Asian region. Similarly, the exclusion of immigrants has little effect on the female deficit of East Asia.

Figure 3.8: Missing women by region, immigrants excluded (2015)



Figures 3.9 to 3.14 show how the situation of individual countries within each region changes upon the exclusion of immigrants. At the intraregional level, the exclusion of immigrants has eliminated the elderly missing women phenomenon in Kuwait, which now has the largest female surplus in Asia in the total and 60+ populations, and introduced it in Israel in both elderly categories (60+ and 75+). Further, the cohort effect interpretation can now be extended to Bangladesh and Qatar for both elderly age groups and the strength of this interpretation has increased for Maldives which now exhibits a female deficit in one elderly category only (i.e.75+). Bahrain, shows that a cohort effect in the opposite direction may also be possible as female deficits in the 75+ and total population are accompanied by a small female surplus in the 60+ population. Existing literature on missing women may show how this is possible. For example, in the case of China, Das Gupta and Shuzhuo (1999) show that government policy during the Maoist regime in the 1950's led to more equitable treatment of men and women and in the case of Bangladesh Dyson ("Part I", 1991, "Part II" 1991) shows that female adult mortality during the five major famines of the subcontinent (Pakistan, India and Bangladesh) was lower due to lower fertility. Effects of this may be exhibited in specific cohorts of the population in the form of a reduced female deficit or a female surplus contingent upon the cumulative impact of other factors across the life course. However, for Hong Kong and Lebanon the possibility of a cohort effect interpretation needs to be retracted as it now experiences a female deficit in its total populations as well. It is to be noted from the discussion on migration that Hong Kong is a recipient of labor immigration but not bride immigration. Therefore, the appearance of a female deficit in the total population upon the exclusion of immigrants may imply the existence of large number of female labor immigrants in Hong Kong. The UAE still exhibits the largest female deficit in the 60+ and total population, with the deficit in both categories increasing, while Qatar still shows the largest female deficit in the 75+ population.

Figure 3.9: Missing women in East Asia, immigrants excluded (2015)

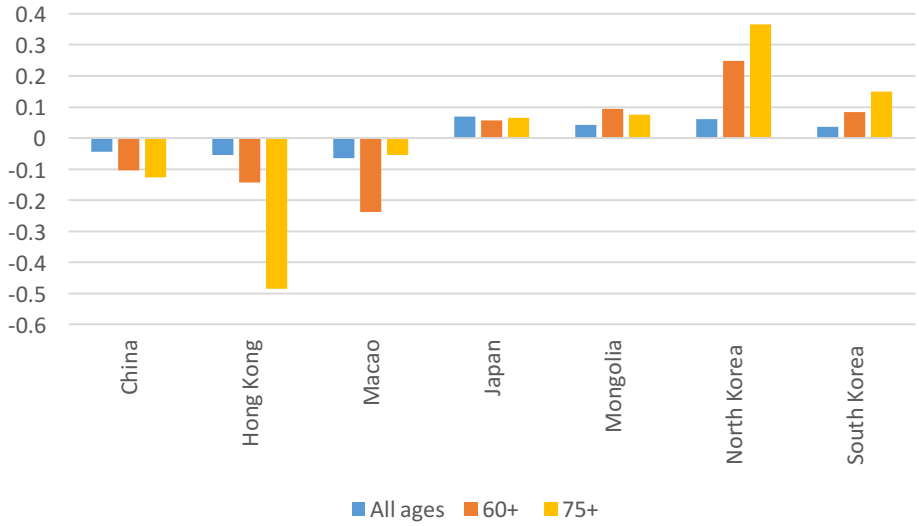


Figure 3.10: Missing women in Southeast Asia, immigrants excluded (2015)

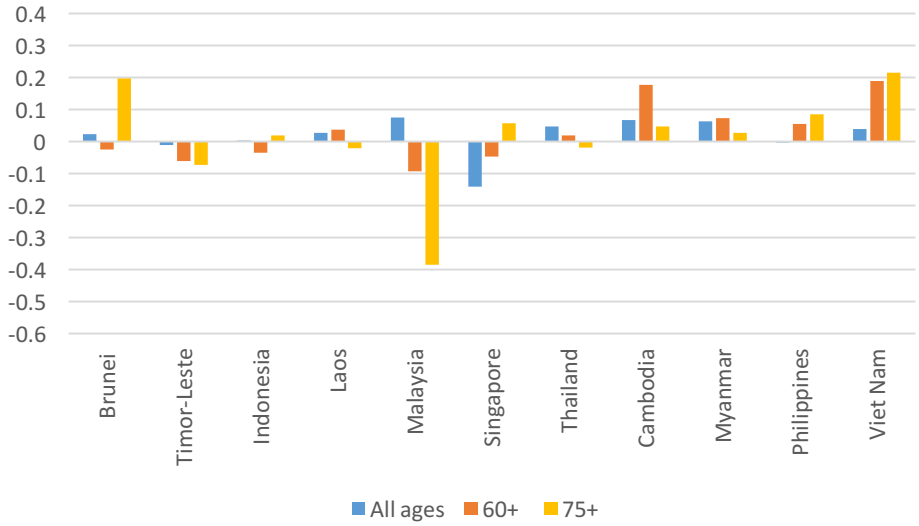


Figure 3.11: Missing women in South Asia, immigrants excluded (2015)

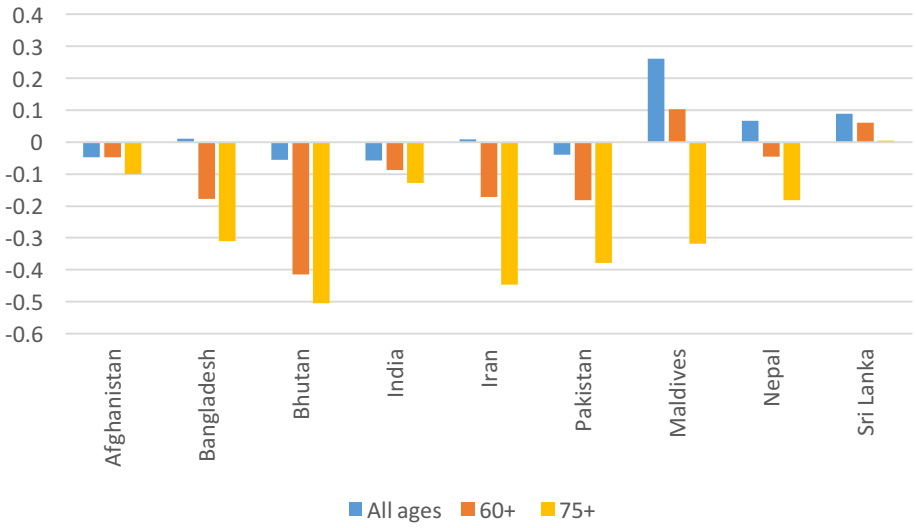


Figure 3.12: Missing Women in Central Asia, immigrants excluded (2015)

Figure 3.13: Missing Women in non-GCC West Asia, immigrants excluded (2015)

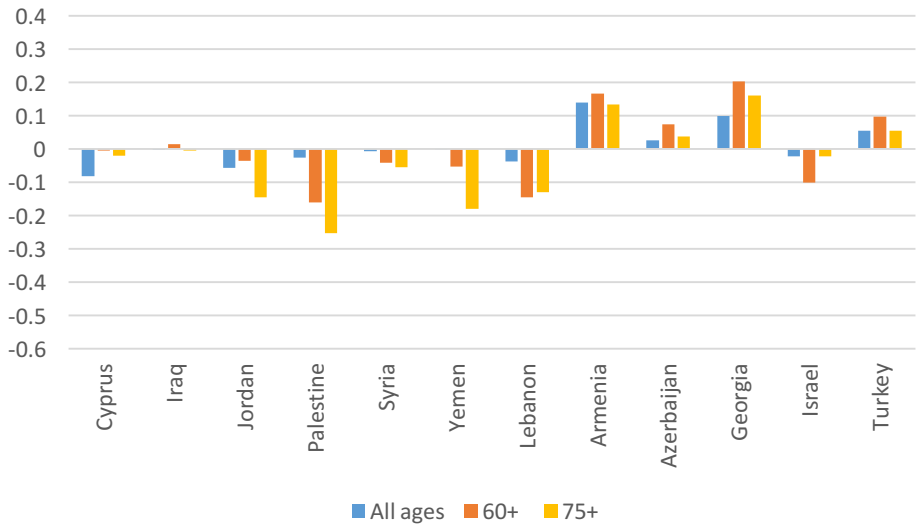
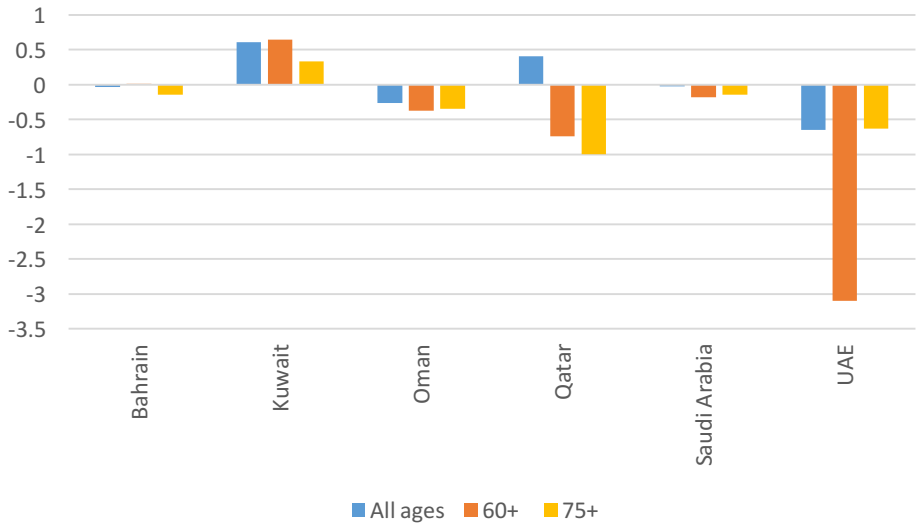


Figure 3.14: Missing women in GCC Western Asia, immigrants excluded (2015)



Overall, the exclusion of immigrants has reduced the number of elderly missing women in China, Malaysia, Thailand, Timor-Leste, Iran, Maldives, Pakistan, Bahrain, Cyprus, Jordan, Qatar, Bangladesh, Iraq, Bhutan, Laos, Saudi Arabia and Afghanistan. On the other hand, there are some countries which have also experienced an increase in the female deficit as result of this exclusion: Yemen, Singapore, Macao, Palestine, Hong Kong, Tajikistan and Nepal. The UAE, Syria and Lebanon witnessed an increase in female deficit in their 60+ but a reduction in their 75+ populations while the converse is true for Oman. Overall, the change in the female deficit in these countries is somewhat surprising as it implies a large number of individual immigrants in the 60+ population. For example, for the first set of countries the results may imply an excessively large male vis-á-vis female immigrant population in the 60+ age categories. Within this first set, the results may not be as surprising for some countries that are immigration

countries or emigration/immigration countries (e.g. Qatar, Saudi Arabia, Malaysia and Thailand) as it may reflect the residual labor immigrants from earlier years of work. However, if migration is becoming increasingly feminized the only region for which this argument would hold is the GCC region of Western Asia especially given that many labor immigrants may enter these countries illegally and may face difficulties obtaining exit visas (Shah 2013). However, this argument may become weaker as even in these countries the number of female immigrants from East/Southeast Asia is increasing. Hence, the presence of individual male immigrants in the 60+ population, the total sum of whom is large enough to distort the sex ratios in the entire 60+ population is an issue that requires further exploration.

3.6. Analysis of sex ratio trends in 2015

Figures[27] 3.15 to 3.26 depict the sex ratios (male/female) by five-year age groups for all ages (i.e. 0-75+) with migrant stock included and migrant stock excluded for countries identified as presenting the elderly missing women problem in section 3.5. The sex ratio trend is dissected by age category to assess the age distribution of the female deficit and evaluate not only the age groups driving the deficit but also specific patterns in this deficit. A comparison of the sex ratio trend with the inclusion and exclusion of immigrants reveals whether a surplus or deficit may be driven by a large concentration of immigrant population in a country at a particular age group.

Figures 3.15 and 3.16 depict the situation in East Asia. For China, the sex ratio trend remains unaffected by the inclusion or exclusion of immigrant stock. The sex ratio trend indicates a female deficit at all ages with the deficit being more pronounced between ages 0 to 24 and after age 54. These findings are somewhat in accordance with the discussion from literature. For the year 2000, Anderson and Ray (2010) find that the bulk of the female deficit in China is either concentrated before/at birth or in the three oldest age groups (Anderson and Ray 2010). Furthermore, since the turn of the century, an increasing amount of literature has addressed the missing brides' phenomenon in the country (i.e. missing women in the young adulthood category so that an increasing number of men of marriageable age are unable to find wives). The existence of the female deficit in 20-29 age category exhibits this missing brides effect. The pattern depicted by the sex ratio trend of China conforms with the results in figure 3.2 and 3.9.

Unlike China, the presence of the migrant stock appears to makes a significant difference in the sex ratio trends of Hong Kong and Macao. With the inclusion of immigrants, both countries have sex ratios roughly equal to world levels till age 24, a large female surplus between ages 20 to 59 (which appears to be larger in Hong Kong) but a female deficit thereafter. Upon the exclusion of immigrants, part of the surplus turns into a deficit (i.e. from ages 15-34 in Hong Kong and 30-49 in Macao) and the female deficit after age 55 increases, more for Macao than Hong Kong. The fact that the sex ratio trend significantly alters after the exclusion of immigrants from Hong Kong is not surprising. As already discussed, it is an immigrant recipient country with 39% of its population constituting immigrants (Cainkar 2013). The fact that the surplus is roughly concentrated in the working age population with the inclusion of immigrants and either reduces or turns into a deficit with the exclusion of immigrants not only

[27] The range of values for each figure varies by region to allow the best visualization of sex ratio trends of countries within the region.

shows that the majority of immigrants may be labor immigrants but also reveals increased feminization of labor immigration in Hong Kong. It is also apparent that the presence of immigrants in Hong Kong and Macao mask a more serious elderly missing women phenomenon as the deficits in old age get higher for both countries upon the exclusion of immigrants and in the case of Hong Kong continue to increase beyond the 75+ population. The sex ratio trends of Hong Kong and Macao (inclusion and exclusion of immigrants) conform with the results of figures 3.2 and 3.9.

Figure 3.15: Sex ratios by age in East Asia, immigrants included (2015)

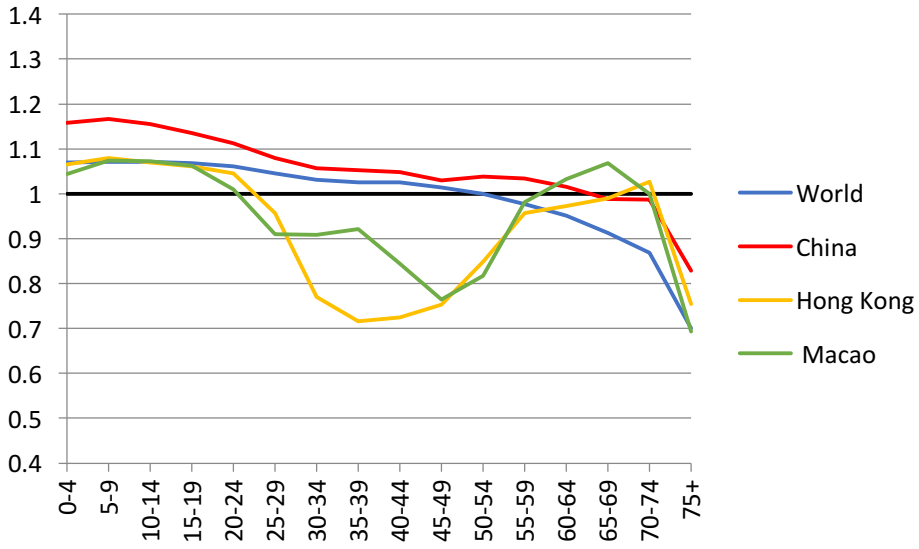
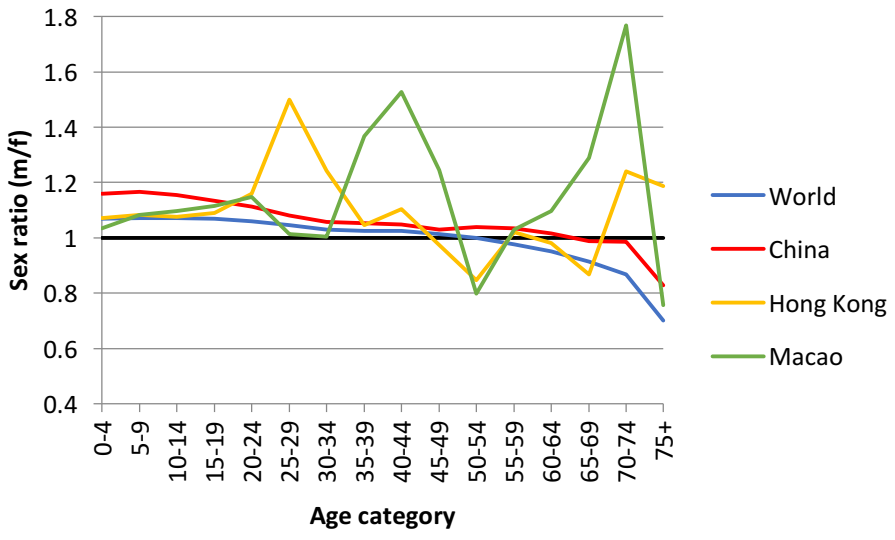


Figure 3.16: Sex ratios by age in East Asia, immigrants excluded (2015)



Figures 3.17 and 3.18 depict the sex ratios by age for selected countries in Southeast Asia. For Indonesia, Malaysia, Thailand, Laos and Timor-Leste the trend is, on average, unaffected by the inclusion or exclusion of immigrants. In Indonesia, sex ratios for almost all ages are approximately equal to the world average. The exception is the 59-

69 age category wherein a slight female deficit is discernible. In Malaysia sex ratios are below world levels till age 29, roughly equal to world levels from ages 25-64 but start to slightly rise above world levels after age 64 and continue to deviate above this level after age 74. In Thailand ratios are approximately equal to world levels till age 74 but rise slightly above the benchmark thereafter. In Laos ratios are again equal to world levels till age 29, exhibit a slight surplus from ages 29-74 but thereafter are slightly above the benchmark. Hence, the sex ratio trends of Indonesia, Malaysia, Thailand and Laos support the cohort effect interpretation as the large female deficit in these countries occurs in old age and it may be expected that future cohorts of the elderly will not suffer from the gross female deficit that current cohorts of the elderly experience. In Timor-Leste, ratios are roughly equal to world levels till age 39 but display a female deficit thereafter till ages 75+ with the deficit being slightly higher for two oldest age intervals. The trend for Timor-Leste is in accordance with its non-cohort effect interpretation but further elaborates that the deficit in the total population is driven by a deficit after the age of 35.

For Brunei Darussalam the inclusion/exclusion of the migrant stock alters the sex ratio trend. With the inclusion of immigrants, sex ratios are roughly equal to world levels till age 29 but display a slight female deficit thereafter which continues till the 75+ age category. Upon the exclusion of immigrants, the trend continues to be roughly similar to that with inclusion till age 34 but shows a small surplus thereafter till age 54 and then again a deficit from ages 50-64. This may indicate the masculinization of labor immigration in Brunei (after age 30) which may be one of the drivers of the female deficit in the total population with the inclusion of immigrants. Sex ratios start to equal world levels from age 65 onward and appear to display a slight surplus only after the 75+ age category. The pattern depicted by the sex ratios in Brunei conforms with the results of figures 3.3 and 3.10. Sex ratios by age have not been evaluated for Singapore upon the exclusion of immigrants because there appears to be an error in the UNDESA estimates of immigrant stock for the country for the ages 15-40.

Figure 3.17: Sex ratios by age in Southeast Asia, immigrants included (2015)

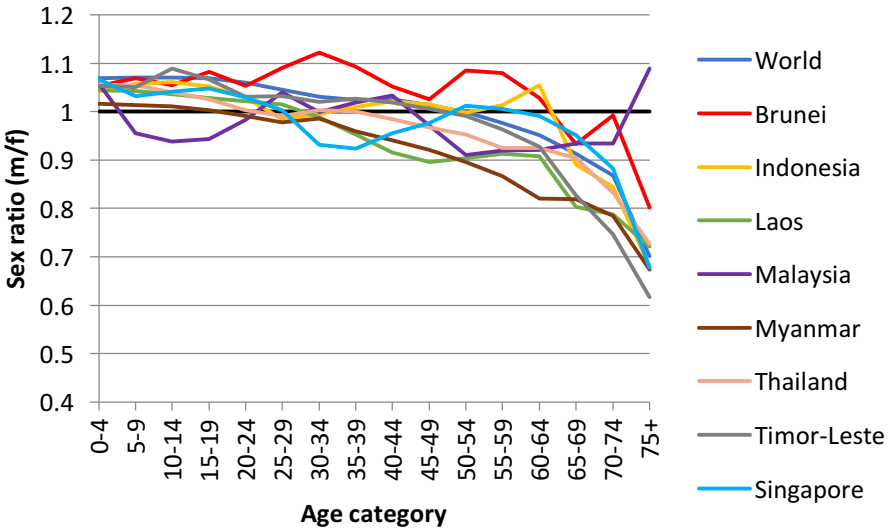
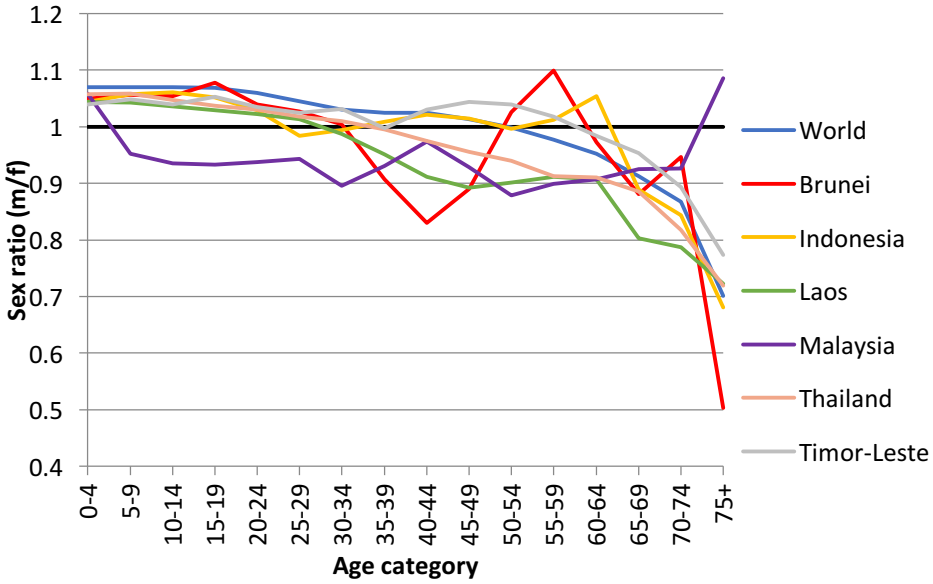


Figure 3.18: Sex ratios by age in Southeast Asia, immigrants excluded



Figures 3.19 and 3.20 display the sex ratios by age of all South Asian countries except Sri Lanka. For Afghanistan, Bangladesh, India, Nepal and Iran the sex ratio trends are roughly similar with the inclusion and exclusion of immigrants. This is not surprising because as mentioned earlier, the countries of South Asia are emigration countries so the exclusion of immigrants would not be expected to have a significant impact on their sex ratio trend. In Afghanistan there is a female surplus at the youngest ages (0 to 4) but ratios equal world levels thereafter till age 24. However, there is a persistent deficit from ages 20-64 and despite a slight female surplus in the 60-69 interval, the female deficit continues throughout the elderly category. In Bangladesh, the sex ratio trend is similar to Afghanistan till age 24, thereafter till age 44 there is a slight female surplus. This is followed by a deficit which starts at age 50 and continues through the 75+ age category. The deficit after age 50 appears slightly larger upon the exclusion of immigrants. The size of this deficit (after age 50) is even large enough to create a deficit in the total population so that the missing women phenomenon after age 50 may be considered a cohort effect to some extent. This is somewhat reflected in figure 3.4 where the size of the deficit in the total population of Bangladesh is very small and in figure 3.11 where, upon the exclusion of immigrants, a cohort effect interpretation for the elderly missing women phenomenon may be possible. In India, the sex ratio trend exceeds world levels at all ages and this deviation increases as the population ages indicating a worsening of the missing women phenomenon with age. These findings are similar to Anderson and Ray's (2010) who show that the missing women problem in India is discernible at all ages of the population. The sex ratio trend of India presents a classic example of the cumulative impact of gender discrimination across the life course with missing women being present at each life stage and increasing as the population ages. In Nepal, sex ratios are roughly equal to world levels till age 19 and then display two intervals of surplus i.e. from ages 15-54 and from ages 50-69, with the latter surplus not only being significantly larger but also standing out as the highest surplus in the region (migrant stock included only, for comparable age groups). Thereafter, there is a female deficit which continues through ages 75+. In Iran, the sex ratio trends follow a very erratic pattern. From ages 0 to 39 there are two intervals of surplus: a smaller surplus from ages 0-19 and a larger surplus from ages 15-39). This is followed by a

short period of deficit from ages 35-54. Despite ratios roughly equaling world levels thereafter till age 64, ratios start to exceed world levels after age 65 and continue to exhibit a female deficit through ages 75+. As Iran, alongside Algeria, presents one of the most rapidly changing age structures in the world (Hayutin 2009) the conclusions for the sex ratio of the total population remain volatile. Coale (1991) explains that the sex ratio of the population depends on the age structure of the population (with younger populations having higher sex ratios than older populations) and if this age structure is in a continuous flux, the total population sex structure would remain indeterminate. Therefore, especially in the case of Iran, the interpretation of the elderly missing women phenomenon would change for each subsequent birth cohort that enters the elderly population. It is evident that the sex ratio trends of Afghanistan, Bangladesh, India and Iran support the results of figures 3.4 and 3.11.

In Pakistan, with the inclusion of immigrants, sex ratios are roughly equal to world levels till age 40 but start to exhibit a female deficit thereafter with the magnitude of this deficit increasing with age. The exclusion of immigrants displays a roughly similar pattern with the exception of a slight female surplus in the 15-29 population and a later starting age for the female deficit i.e. age 45. The trend followed by the deficit after age 40 with the inclusion of immigrants (and age 45 with the exclusion of immigrants) may somewhat point to the cumulative impact of survival disadvantages at later stages of life. Therefore, the case of Pakistan shows that the deficit in the total population is driven by the deficit after the age of 40 or 45 respectively which appears to exhibit the effect of an increasing deficit as the population ages. In Maldives, with the inclusion of immigrants, the sex ratio trend is roughly equal to the world average till age 24 but displays a slight surplus thereafter till age 54. Thereafter, the sex ratios exceeds world levels and significantly deviates above the benchmark after age 70. Upon the exclusion of immigrants, there is a large surplus of women at all ages till age 70. This is the largest surplus in the region with the exclusion of immigrants. Thereafter, sex ratios display a female deficit which continues through ages 75+. It would therefore appear that immigrants are causing excessive masculinization in the population of Maldives till age 70 and this masculinization alone is creating a female deficit between ages 54 and 70 in the country. It is therefore apparent that the results from the sex ratio trend conform with the interpretation of figures 3.4 and 3.11.

Figure 3.19: Sex ratios by age in South Asia, immigrants included (2015)

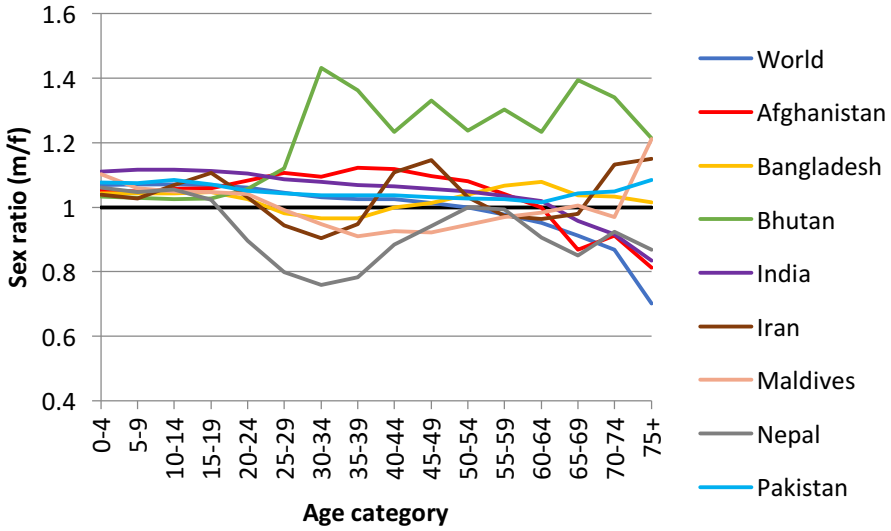


Figure 3.20: Sex ratios by age in South Asia, immigrants excluded (2015)

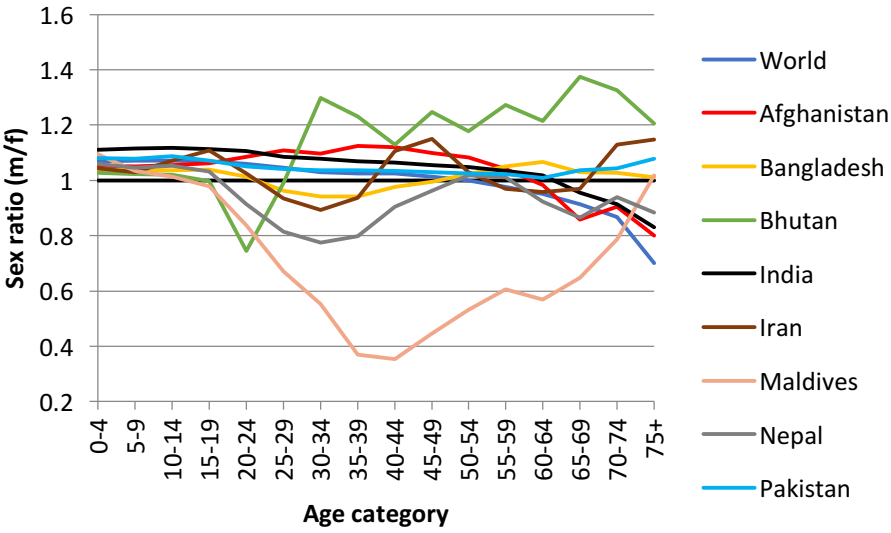


Figure 3.21 and 3.22 display the sex ratio trend of Tajikistan, the only country in Central Asia to exhibit an elderly missing women phenomenon. The trend upon the inclusion and exclusion of the immigrant stock is identical till age 60. Up to age 60 sex ratios are roughly equal to or even below world levels. After this age however ratios rise sharply till age 70 before declining sharply but still remaining above world levels. The exclusion of immigrants makes this peak more pronounced. This result shows that the female deficit in the total population evident in figures 3.5 and 3.12 is driven by a large female deficit in the elderly population. Therefore, the explanation for the elderly missing women phenomenon in Tajikistan as a cohort effect is more likely.

Figure 3.21: Sex ratios by age in Central Asia, immigrants included (2015)

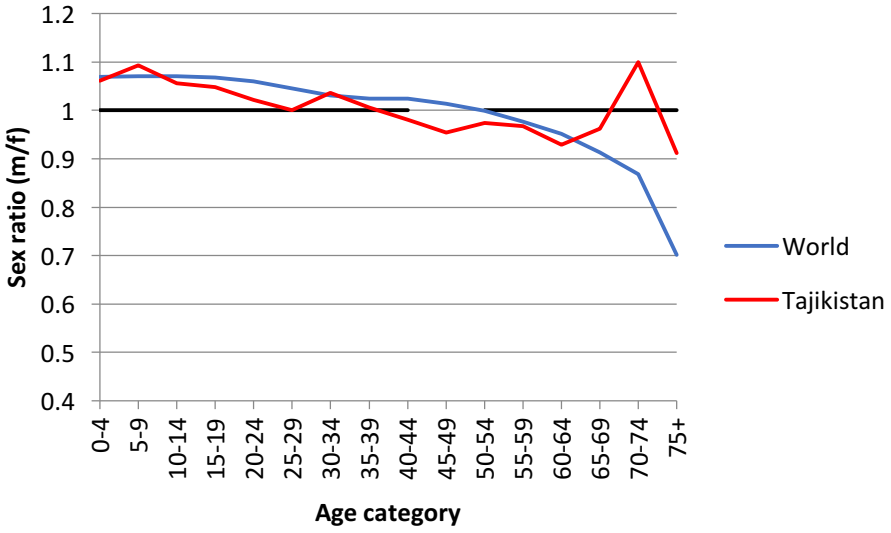
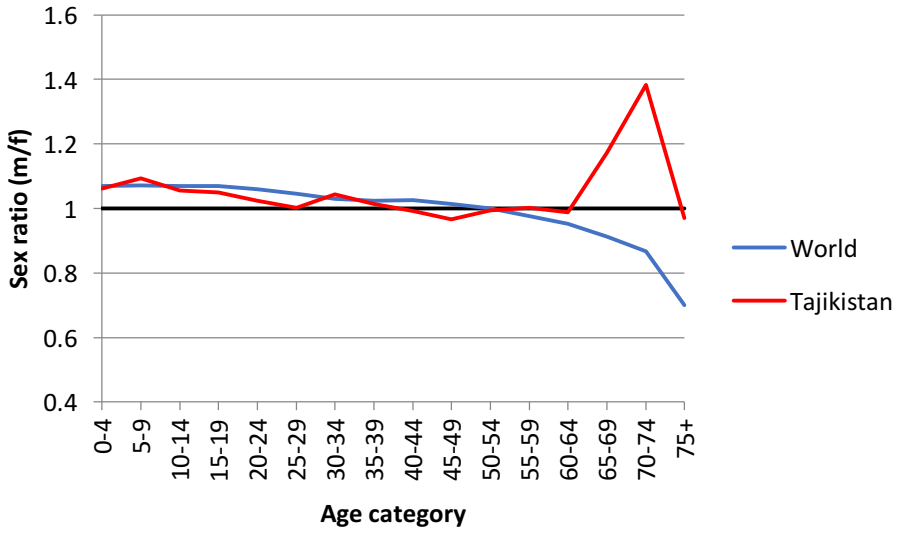


Figure 3.22: Sex ratios by age in Central Asia, immigrants excluded (2015)



Figures 3.23 and 3.24 display the sex ratio trends of the non-GCC countries of Western Asia. For Iraq, Jordan, Syria and Yemen the sex ratio trends with the inclusion and exclusion of immigrants are roughly similar. In Iraq, sex ratios remain below world levels from ages 0 to 19 and then equal world levels between ages 20 to 29. Thereafter, the trend indicates a female surplus from ages 35-64 but, starts to roughly equal world levels from ages 65 onwards. It would therefore appear that the slight female deficits in the total and 75+ categories apparent in figures 3.23 and 3.24 are mostly driven by ratios roughly equaling world levels in the 65+ category. In Jordan, the sex ratio trends indicate a slight surplus in the younger age groups till age 34 after which there is a persistent female deficit till ages 75+. Although the deficit peaks between ages 30 and 59, sex ratios after age 65 remain above the world average pointing to a female deficit

in old age as well. In Syria sex ratios exhibit a slight female surplus at the youngest ages till age 19, this is followed by a female deficit between ages 20 and 29 and a female surplus thereafter till age 59. Between ages 60 and 69 there is a slight female deficit with ratios converging to but remaining slightly above world levels through the 75+ age category. The large female surplus may be the reason why the deficit observed in the total population in figures 3.6 and 3.13 is smaller than the elderly population especially since there is a female deficit in the 20-29 population and is one reason why the deficit in the elderly population may not be considered a possible cohort effect. In Yemen, the sex ratio trend displays a slight female surplus till age 34, exhibits a slight deficit between ages 34-39 but a surplus thereafter till age 64. However, a persistent deficit is present after age 65 which continues through ages 75+. The sex ratio trends of Yemen again show why the deficit in the total population is significantly smaller than both elderly categories (evident in figures 3.6 and 3.13). Nevertheless, due to the female deficit present in the 34-39 category, the relatively large female deficits in both elderly categories cannot be viewed as a possible cohort effect. It is therefore apparent that the sex ratio trend (inclusion and exclusion of immigrants) of Iraq, Jordan, Syria and Yemen support the results from figures 3.6 and 3.13.

For the remaining countries in the region, the sex ratio trends differ upon the inclusion and exclusion of the migrant stock. In Cyprus, with the inclusion of immigrants, the sex ratio trend is roughly equal to world levels from ages 0-19 but displays a female deficit thereafter till ages 75+. Although the extent of this deficit declines with age, the sex ratio trend persists above world levels throughout the oldest age category. The exclusion of immigrants makes no difference to the female deficit in Cyprus till age 19. However, from age 19 onward, although the pattern of the deficit is roughly the same, the size of the deficit is significantly larger till age 59. Therefore, immigrants reduce the extent of the missing women problem in the working age population. This may indicate the feminization of labor immigration. After the age of 60, sex ratios, both with the inclusion and exclusion of immigrants, are only slightly above world levels. In Israel there is no elderly missing women phenomenon with the inclusion of immigrants. However, the exclusion of immigrants raises the sex ratios in all age groups between 25 and 64 to slightly above world levels and creates a large female deficit between ages 64 and 75+ i.e. the elderly population. In Lebanon, despite a slight female deficit in the 0-4 age category, the sex ratio trend with the inclusion of immigrants displays a female surplus in the younger groups till age 39 followed by two subsequent intervals of deficit i.e. between ages 35 and 59 and ages 59 and 75+ with the former interval being larger than the latter. Although ratios start to converge to world levels after ages 70-74, they remain above the world average through the 75+ age category. The exclusion of immigrants in Lebanon creates a large female deficit in the youngest age groups till age 14 but allows for a roughly similar pattern thereafter. These findings are somewhat in accordance with figure 3.13 but contradictory with figure 3.6. Figure 3.6 shows a slight female surplus in the total population of Lebanon accompanied by a deficit in both elderly categories. However, this cohort effect ignores the deficit in the first interval (i.e. the population aged 35 to 59) and is therefore not possible as future cohorts of elderly are expected to create a larger female deficit in the elderly population of the country. In Palestine, with the inclusion of immigrants, the sex ratio trend remains slightly below world levels till age 29 and equals world levels thereafter till age 54 at which point there is a short interval of surplus which ends at age 64. After age 64 there is a short spike in ratios as ratios sharply exceed world levels. Although ratios start to converge to the benchmark thereafter they remain above world levels through ages 75+.

With the exclusion of immigrants, the pattern is roughly the same except that there is a slight deficit between ages 29 and 64 and the spike in older ages is more pronounced and does not converge to world levels at the oldest ages (75+). It would therefore appear that in figure 3.6 the small female deficit in the total population is primarily driven by the female deficit in old age. However, upon the exclusion of immigrants the female deficit (albeit small) becomes visible at other ages as well which may contribute (alongside the larger deficit in the elderly population) to the larger female deficit in the total population. It is therefore evident from this discussion that in the case of Cyprus and Israel the sex ratio trends (with the inclusion and exclusion of immigrants) conform with the results in figures 3.6 and 3.13. However, in the case of Lebanon and Palestine, the results are somewhat contradictory. For Lebanon, the cohort effect interpretation of figure 3.6 needs to be retracted as the sex ratio trend with the inclusion of immigrants would suggest a non-cohort effect interpretation. Conversely, for Palestine, despite the deficit in the total population in figure 3.6, the sex ratio trend with the inclusion of immigrants suggests a possible cohort interpretation.

Figure 3.23: Sex ratios by age in non-GCC Western Asia, immigrants included (2015)

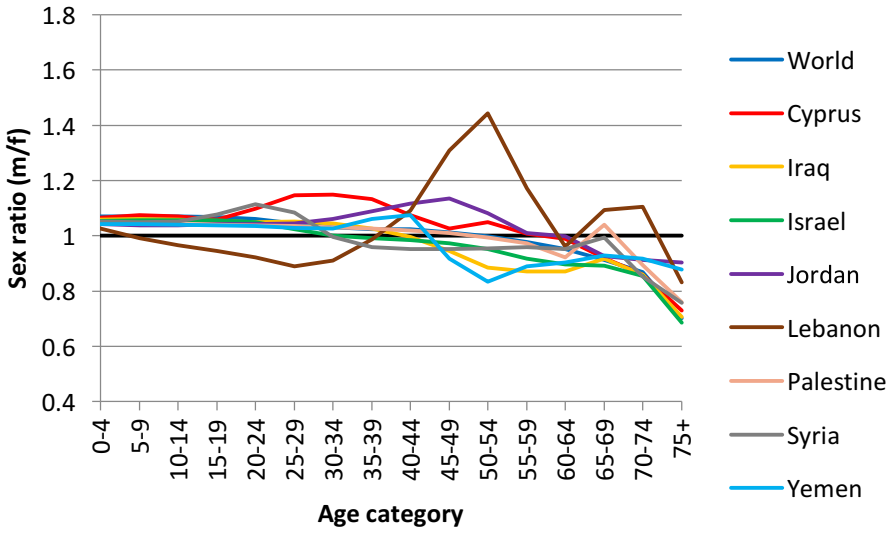
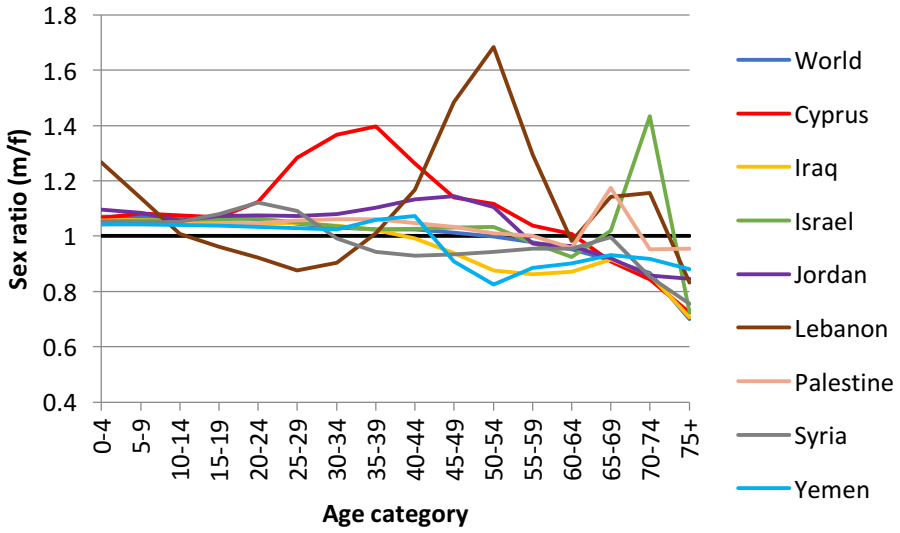


Figure 3.24: Sex ratios by age in non-GCC Western Asia, immigrants excluded (2015)



It is to be noted that alongside Afghanistan in South Asia the sex ratio trends of Iraq, Syria and Yemen need to be interpreted with caution. These countries have been engaged in escalated conflict since 2001, 2003[28], 2011 and 2015 respectively (Murphy 2009, Blanchard, Humud and Nikitin 2015, United Nations High Commission for Refugees 2016, Iraq Body Count 2017). However, official estimates for the de facto population of these countries are based on Population Censuses from 2010 and 2014 in the case of Syria and Yemen respectively, the 2009 food rations system in the case of Iraq[29] and the 1979 Population Census and 2003-2005 Household Listing Survey in the case of Afghanistan[30]. Although the United Nations continuously updates its population estimates based on the most recent demographic trends (e.g. fertility, mortality, migration) emerging from the given countries (United Nations 2014), it would perhaps be impossible to capture the daily variations in population size (e.g. deaths) resulting from these conflicts. For example, in the case of Syria, from March 2011 to April 2014, 191,369 deaths were documented as a result of the conflict, however the gender and age distribution of 83% of these deaths is undocumented (Price, Ghodes and Ball 2014). This would make it difficult to accurately exclude these deaths from the de facto population estimates and hence the calculation of sex ratios.

Figures 3.25 and 3.26 depict the sex ratio trends for the GCC countries of Western Asia. As it has already been discussed, these countries are immigration countries only with relatively large percentage of immigrants in their populations. Therefore, the sex ratio trends with the inclusion and exclusion of immigrants may be expected to

[28] In Iraq, the U.S. invasion of 2003 marks the eruption of a series of conflicts that continue to this day (Terrill 2014, Iraq Body Count 2017).

[29] For Iraq, the data for age and sex is supplemented by the Iraqi Living Conditions Survey, the 2006 and 2011 MICS survey, and the 2006/07 Iraq Family Health Survey (UNDESA 2015).

[30] For Afghanistan, the data for age and sex is supplemented by 2007/08 National Risk and Vulnerability Assessment Survey, the 2011 MICS 4 Survey and the 2014 ALCS estimate (which includes nomadic populations; UNDESA 2015)

substantially differ for all countries in the region. This becomes apparent upon comparing figure 3.25 with 3.26. Not only do the sex ratio trends for each country differ markedly but also some kind of aggregate pattern for all countries is discernible in figure 3.25. Hence the situation of all countries together will first be discussed with the inclusion and then with the exclusion of immigrants. With the inclusion of immigrants, the sex ratios for all countries, in very young age categories (approximately till age14) are roughly equal to world levels but start to soar above world levels thereafter. Kuwait has the lowest female deficit in the region with ratios roughly equaling world levels till age 24 and subsequently persisting above world levels at a roughly constant pace (except at ages 65-69 where they equal world levels) till ages 75+. For Saudi Arabia, the sex ratio trend is similar to that of Kuwait till age 44 after which it rises above Kuwait and after peaking at age 49, continues on a downward trend that approximately steadies at the world level at age 65 and stays at this level till age 75+. For Bahrain, the sex ratio trend is similar to that of Kuwait except the deficit starts at an earlier age (i.e. 19) and exceeds that of Kuwait till age 69 falling below Kuwait thereafter but remaining above the world benchmark till ages 75+. For Oman, the sex ratio trend is the same as Bahrain till age 24 after which it rises and stays above Bahrain till age 64. Thereafter, it declines and roughly equals the level and trend in Bahrain. The UAE follows the same pattern as Oman till age 34 after which it continues on an upward trend and stays above four between ages 40-65 before declining. It is to be noted that between age 34 and 74 the UAE has the highest female deficit in Asia and at ages 75+ its female deficit is only exceeded by Kuwait and Qatar. In Qatar, sex ratios start to rise earlier (i.e. from age 9) and exceed all ratios in Asia between ages 14 and 34. Thereafter, till age 49 ratios are roughly equal to Bahrain and then from 49-75+ start to exceed Bahrain. Hence, ratios in Qatar are the second highest in Asia for the 49-75+ age category. On average, after excluding the youngest age categories (i.e. ages 0 to 9), the countries in this region present the highest female deficit in Asia for all ages with the inclusion of immigrants. Given the previous discussion on the proportion of male immigrants forming the population of these countries, these results are not surprising and conform with the pattern of large female deficits in the total and elderly populations depicted in figure 3.7.

With the exclusion of immigrations, the sex ratio trends of all countries change and on the whole start to present a very erratic pattern as a result of which an aggregate pattern for all countries is no longer discernible. In Kuwait, the female deficit has now turned into a female surplus at all ages with this surplus being most pronounced between ages 15 and 69. Hence, the exclusion of immigrants has eradicated the missing women and elderly missing women problem in the country. In Saudi Arabia, part of the deficit has turned into a surplus i.e. a female surplus between ages 20-44, and the size of the deficit thereafter till age 64 is reduced. Here, the exclusion of immigrants has eradicated the phenomenon in the younger working age categories and reduced it in the older working age categories. After age 64, the trend remains roughly the same as with the inclusion of immigrants. In Bahrain, the deficit between 15 and 29 is smaller and the deficit that follows till age 64 is replaced by a female surplus. Thereafter, through ages 75+ a slight female deficit the pattern similar to the one with the inclusion of immigrants. Again, the exclusion of immigrants has improved the magnitude the missing women phenomenon in Bahrain by reducing the extent of the deficit in the younger working age category, eradicating it in the older working age category and somewhat reducing the deficit in the elderly population by reducing the deficit till age 64. In Oman also the deficit between ages 15-29 has been replaced by a slight female surplus, and with the

exception of the 40-54 age category the size of the deficit between ages 25-64 is smaller. After age 69 the female deficit appears to be roughly equal to that with the inclusion of immigrants, a pattern which persists through the 75+ category. Hence, in the case of Oman it appears that the exclusion of immigrants may have reduced the deficit in the working age and the younger-elderly population (i.e. till age 69). Sex ratios by age have not been evaluated for UAE upon the exclusion of immigrants because there appears to be an error in the UNDESA estimates of immigrant stock for the country for the working age population. It is therefore evident that, the sex ratio trends (with the exclusion of immigrants) of the GCC countries are mimicked by the patterns depicted by figure 3.14. It is to be noted that although the exclusion of immigrants has a different impact on different age categories of the working age populations (i.e. in some countries it affects the younger working age category and in others the older working age category), overall it serves to reduce the female deficit in the working age population and the younger elderly population (aged 60-64) of all countries. This reflects that male immigrants are partly responsible for the large female deficit observed in the total population of the GCC countries (as given the strict nationalization policies of the GCC countries it is very unlikely that immigrants who work in these countries would get citizenship of these countries; Shah 2013). Nevertheless, even with the exclusion of immigrants the GCC countries of the Middle East, with the exception of Kuwait and Bahrain (60+ only), are experiencing a severe missing women problem in their total populations and especially their elderly populations which overshadows that experienced by most of the remaining regions and countries of Asia.

Figure 3.25: Sex ratios by age in GCC Western Asia, immigrants included (2015)

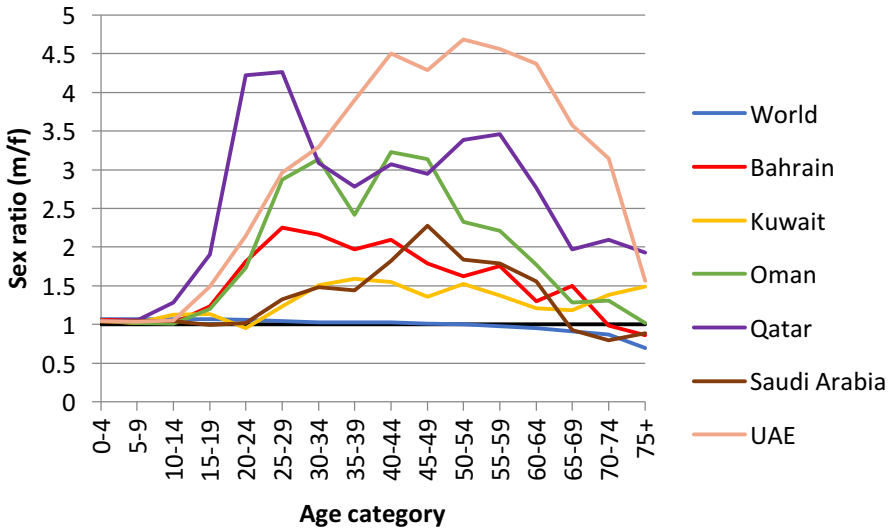
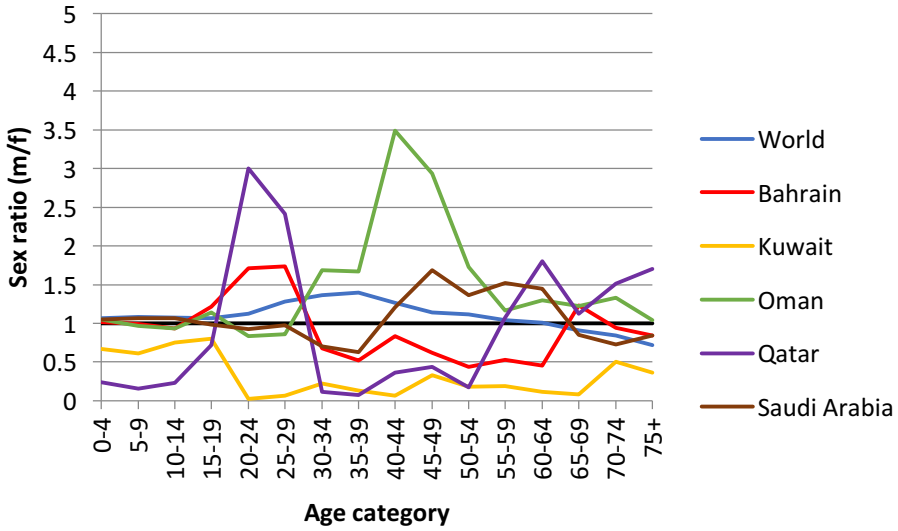


Figure 3.26: Sex ratios by age in GCC Western Asia, immigrants excluded (2015)



The evaluation of sex ratio trends of the countries in Asia with the inclusion and exclusion of immigrants shows that with the exception of China, India and Lebanon, the female deficit is apparent at life stages after birth and for a majority of countries upon reaching the young adulthood stage. This would suggest for that for the year 2015, or perhaps on average a decade before, factors at the time of birth (especially prenatal sex selection technology) are not primarily responsible for driving this female deficit. Rather, factors at different life stages beyond birth, need to be given greater weightage in explaining the elderly missing women phenomenon in these countries. This is somewhat contradictory to the trend in existing literature which places excessive emphasis on the role of prenatal sex selection technology and fertility decline in exacerbating the missing women phenomenon.

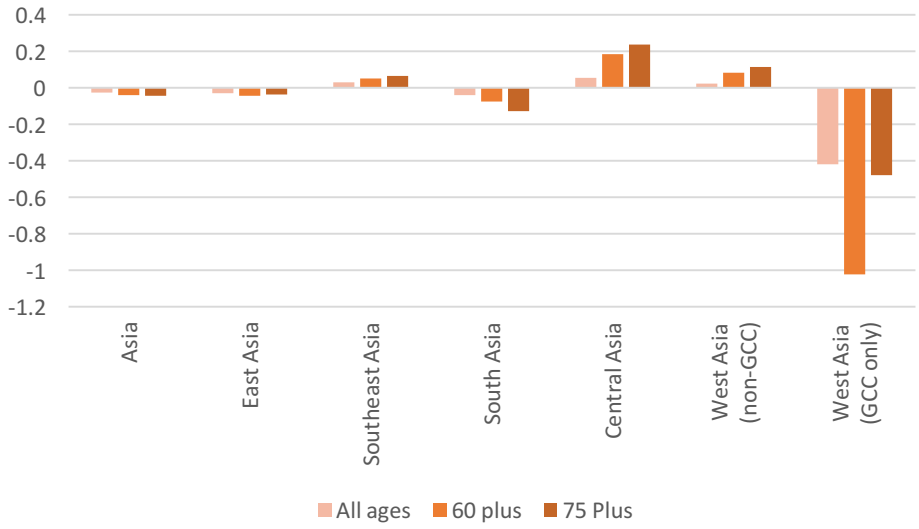
3.7. Analysis of elderly missing women in 2030 and 2050

The analysis to this point shows that the elderly missing women phenomenon exists in many countries of Asia that still have large proportions of their populations that are yet to enter old age (e.g. countries in South and West Asia). The case of the Middle Eastern region of Western Asia is especially striking in this regard as it experienced the most recent decline in fertility and mortality, currently has very large youth concentrations in its population (Hayutin 2009). Despite having youth and echo bugles in the population of some of its countries, the region is expected to age rapidly in the decades to come (Hayutin 2009). For example, although Saudi Arabia is currently classified as a young gradually ageing country, its youth predominance is expected to dissipate by 2030 and the proportion of 60+ in its population to be equivalent to that in Hong Kong by 2050 (Hayutin 2009, UNDESA, "custom data" 2015). Hence, the manner in which the female deficit in these younger age groups evolves will be a crucial determinant of the elderly missing women phenomenon in the future not only in the countries hosting this youth but also in the world due to the demographic bulk they could present in future cohorts of the elderly population. To this end United Nation projections for the years 2030 and 2050 are used to examine the elderly missing women phenomenon in Asia (regional and country level). Unlike the analysis for the year 2015, there is no separate

analysis for these years by excluding the immigrant stock because although the United Nations provides projections of the total number of immigrants by country for these years, it does not provide information on the gender and age distribution of these immigrants.

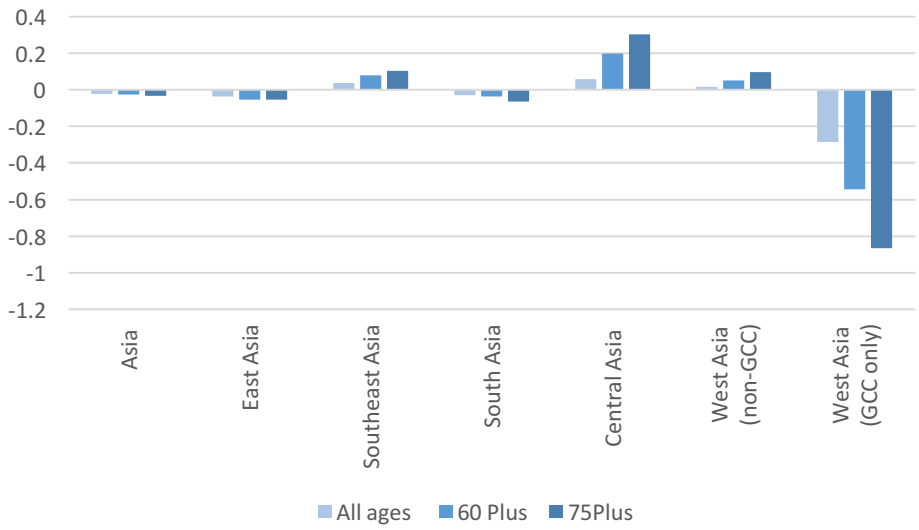
Figures[31] 3.27 and 3.28 show that the regional trends evident in 2015 also persist to 2030 and even further to 2050 i.e. the female deficit is apparent in Asia as a whole and in East Asia, South Asia and the GCC countries of Western Asia. A closer look however reveals that for Asia as a whole the deficit in all three age categories slightly decreases by 2030 only to increase again by 2050. This pattern is followed by both the East Asian and the South Asian regions. For the GCC region of Western Asia however, the female deficit in both elderly categories increases by 2030 but decreases thereafter by 2050. However, the deficit in the total population decreases by 2030 and even further by 2050. Nevertheless, as the figures show, the GCC region of Western Asia has highest female deficit on the continent in 2030 and 2050 for all three age categories.

Figure 3.27: Missing women by region (2030)



[31] The range for the regional graphs and the graphs representing the GCC regions of Western Asia are different to allow for better visualization of the results.

Figure 3.28: Missing Women by region (2050)



Figures A1 to A6 in the appendix indicate an elderly missing women problem in 2030 in the following countries: China and Hong Kong in East Asia; Brunei, Malaysia, Singapore, Thailand and Timor-Leste in Southeast Asia; Afghanistan, Bangladesh, Bhutan, India, Iran, Maldives and Pakistan in South Asia; Cyprus, Israel, Jordan, Yemen and Lebanon in the non-GCC parts of Western Asia; and in all the GCC countries of Western Asia. The majority of these countries have a deficit in both elderly categories. Exceptions to this are: Hong Kong (60+ only), Malaysia (75+only), Thailand (75+only), Israel (75+ only), Jordan (60+ only) and Yemen (75+ only). Amongst the countries that present the deficit in both elderly age categories, some exhibit a worsening of the deficit as the population gets older (from 60+ to 75+). These include: China, Brunei Darussalam, Bangladesh, Bhutan, India, Iran and Pakistan. The converse is true only for Bahrain. A possible cohort effect interpretation is applicable to Hong Kong, Maldives, Malaysia, Singapore, Thailand, Timor-Leste, Bangladesh, Iran, Israel and Yemen. For the remaining countries, the life course interpretation of missing women is assumed such that factors accumulate across all ages to deplete female survival chances at each age and accumulate into an elderly missing women phenomenon. For a majority of countries (except India, Bahrain, Cyprus and Oman), the female deficit in the elderly population is worse than the deficit in the total population pointing to the worsening of sex ratios with age. The UAE exhibits the worst female deficit in both the 60+ and 75+ age categories. Iraq is the only country which exhibits a phenomenon in the total population but not in the elderly population.

Figures A.7 to A.12 in the appendix point to an elderly missing women phenomenon in 2050 in the following countries: China in East Asia; Brunei and Malaysia in Southeast Asia; Afghanistan, Bangladesh, Bhutan, India, Iran, Maldives and Pakistan in South Asia; Cyprus, Israel, Jordan and Lebanon in the non-GCC region of Western Asia; all the GCC countries of Western Asia. Malaysia is the only country which exhibits the phenomenon in the 75+ category only with all the remaining countries depicting the phenomenon in both the 60+ and the 75+ categories. Further, a cohort effect interpretation is now applicable to four countries only: Bangladesh, Iran, Malaysia and

Lebanon. In a majority of the countries the missing women phenomenon is worse in the 75+ category as compared to the 60+ category. Exceptions to this are China, Jordan, Afghanistan and Cyprus. In the former two countries the size of deficit in both elderly categories is roughly equal while in the latter two countries the size of the deficit in the 60+ category is higher than the 75+ category. Further, except Bahrain, the size of the deficit in the total population exceeds that of the elderly population in all countries not displaying a possible cohort effect. Iraq and Timor-Leste are two countries that have a deficit in the total population but not in their elderly population which may indicate a possible cohort effect. The UAE still presents the highest female deficit in the 60+ and 75+ populations.

Projections into the future show three things: First, the composition of countries presenting the elderly missing women phenomenon has changed. By the year 2050, the following countries no longer depict a female deficit: Hong Kong, Macao, Thailand, Singapore, Indonesia, Laos, Timor-Leste, Nepal, Syria and Yemen. However, Israel now presents a female deficit as a possible cohort effect in its elderly population. This implies that overall the number of countries presenting the elderly missing women phenomenon has fallen. Second, although the total number of countries presenting the elderly missing women phenomenon has fallen, elderly missing women as a percentage of women missing from the world's total elderly population has increased. In 2015 the countries that included Asia's elderly missing women population formed 28% of the world's 60+ population and 23% of the world's 75+ population. However, in 2050, the smaller number of countries presenting the elderly missing women phenomenon will form 29% of world's 60+ population and 28+ of world's 75+ population. Hence, while the number of countries presenting the elderly missing women phenomenon may decline in the future, the number of elderly missing women may be increasing in the future. Again this becomes clear when considering that many of the younger countries of Asia (with large youthful populations) are presenting the phenomenon in both their elderly populations and total populations so as the total population ages and enters the elderly category the problem will probably get magnified (both because disadvantage continue to accumulate and because the size of the elderly population gets larger). Third, the projections show that some of the countries that depict the elderly missing women phenomenon as a cohort effect in 2015 continue to do so in 2030 and 2050. This holds true for Malaysia and Iran. For these countries, the cohort effect interpretation now appears to be highly implausible as subsequent cohorts would have entered the elderly category by 2050 and it is unlikely that each subsequent cohort would have undergone some historical event that would create a female deficit in its population. It is more likely that women in these cohorts suffer from some disadvantage that becomes more pronounced with old age. Further exploration would require access to cohort specific data from these countries, if available, to identify the reason behind a pronounced deficit that appears in old age. In other countries like Singapore, Thailand and Maldives the cohort effect persists till 2030 but disappears thereafter. This may be plausible if there is a strong cohort effect in the young-elderly population because it would take some time for it to disappear however as in the case of Thailand where it occurs in the 75+ population repeatedly till 2030, a deeper analysis of its causes may be required. Further, the cohort effect interpretation appears for Bangladesh and Israel in 2030 and continues till 2050. For Bangladesh this is an evolution from the life course interpretation and supports the findings from section 3.6 for the country (immigrants excluded). The sex ratio trends by age depicted that the female deficit in the total population in Bangladesh may be driven by a female deficit after the age of 50. This

may indicate that as the birth cohort aged 50+ in 2015 ages and starts to die, a female deficit perhaps does not emerge in younger birth cohorts. Of course, a deeper analysis of sex ratios by age (in 2030 and 2050) is necessary for a definitive conclusion.

In general, the absence of Vietnam in missing women projections for 2030 and 2050 is surprising. Using data from population censuses in Vietnam, Guilmoto, Hoáng and Van (2009) find that sex ratios at birth in Vietnam started to rise in 2001 from the biologically normal level of 1.05, reach 1.08 and continued to rise to 1.12 in 2006. According to Guilmoto (2012), these ratios were approximately 110.6 in 2009 and 111.2 in 2010. Guilmoto (2012) emphasizes that, although sex ratios at birth started to rise later in Vietnam, the pattern depicted by the rise in sex ratios at birth in the country is similar to the pattern depicted by other countries in East and South Asia (e.g. China, India) suffering from the missing women phenomenon. Therefore, the channels through which fertility decline, the spread of ultrasound technology (to enable sex selection) and prevalence of son preference operate in Vietnam to increase sex ratios at birth is similar to that of its Asian counterparts.[32] This is supported by evidence from Bélanger and Oanh (2009) who not only find that women in Hanoi were more likely to undergo a sex selective abortion[33] if they had too many daughter or no sons but also that 2% of all abortions to women with at least one living child were performed with the intention to avoid the birth of a girl. However, perhaps sex ratio distortions are too recent to significantly alter the sex ratios of the total and elderly populations by 2030 or 2050.

The absence of three post-Soviet countries - Georgia, Azerbaijan and Armenia - from the list of countries presenting the missing women phenomenon is also surprising. As already mentioned, Guilmoto (2009) points to the rising sex ratios at birth in these countries upon the fall of the Soviet Union. Duthé et al (2012) confirm this by showing that in Armenia and Azerbaijan sex ratios at birth started to rise from biologically normal levels in the 1990s to 1.2 in Armenia in 2000 and 1.17 in Azerbaijan in 2003 and remained high at 1.14 in Armenia and 1.16 in Azerbaijan in 2010. In Georgia the sex ratio at birth remained at 1.08 in 2010. The authors further contend that there is a strong son preference in these countries which is practiced by the use of sex selective abortion. Michael et al. (2013) compare sex ratios at birth across 12 post-Soviet states and find that Armenia, Azerbaijan and Georgia are the only countries to present skewed sex ratio at birth which account for approximately 10% fewer than expected (biologically normal) girls born in 2010. They argue that the collapse of the Soviet Union, facilitated the import of ultrasonography (the technology that allows the gender of the fetus to be identified in utero) so that although abortions were common in the Soviet era, abortions based on gender became common only after the collapse of the Soviet Union. Guilmoto (2013) estimates that if current practices of sex selection at birth continue, skewed sex ratios at birth will result in approximately 93,000 missing women in Armenia by 2060. It is therefore surprising that these numbers are not apparent in the graphs. However, one reason for this contradiction may be the unnaturally high rate of male mortality in post-Soviet countries especially in old age (Dyson 2012). Such high male mortality rates may counterbalance the excess female mortality rates and cause sex ratios in the population to appear relatively normal.

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[32] Guilmoto (2009) outlines the three preconditions that are necessary for couples to resort to sex selection. Guilmoto (2012) extends these preconditions to Vietnam.

[33] The authors contend that sex selective abortions usually take place during the second rather than the first term so they use the timing of abortions (i.e. second term abortions) to signal a sex selective abortion (Bélanger and Oanh 2009).

3.8. Conclusion

In East/Southeast Asia China, Brunei Darussalam and Timor-Leste are the only countries that present an elderly missing women phenomenon alongside a missing women phenomenon in the total population. The presence and persistence of a female deficit in China in 2015 (migrant stock included), 2030 and 2050 in both the elderly and total populations is not surprising. As already mentioned China is the most frequently discussed country in missing women literature and the most recent estimates suggest that in 2010 there were about 62.3 million missing women in the total population of China i.e. about the half of the world's missing women are concentrated in the country (Bongaarts and Guilmoto 2015). However, as Klasen (2008) argues, China presents a special case. The imposition of the One Child Policy in the Country served as an exogenous shock that amplified the factors behind masculinized sex ratios at birth and delayed the normalization of these ratios (as for example in South Korea[34]). Hence, the elderly missing women phenomenon may in part be a reflection of decades of government policy. Nevertheless, the presence of China on the list is a cause for alarm as it constitutes 18.7% of the world's population and is one of the fastest ageing countries in the world (Bloom Canning and Sevilla 2003), UNDESA, "custom data" 2015). Aside from China, Brunei Darussalam and Timor-Leste (migrants included) are the only countries in East/Southeast Asia that present an elderly missing women phenomenon alongside a missing women phenomenon in the total population. Although this may be a significant problem for these countries, this is a relatively small problem for the region as a whole today: According to Jones (2013), these countries present only 0.3% of the population of Southeast Asia, though they are growing very rapidly. This growth however is somewhat disconcerting for the future as the elderly missing women phenomenon persists (alongside a missing women phenomenon in the total population) for both countries in 2030 and for Brunei-Darussalam in 2050.

The remaining countries in East/Southeast Asia that present an elderly missing women problem in 2015 (migrant stock included) appear to do so as a cohort effect. These include Hong Kong (60+, 75+), Malaysia (60+, 75+), Singapore (60+ only), Macao (60+ only), Thailand (75+ only). The general persistence of elderly missing women in these countries is surprising. Not only is there scant literature on the missing women phenomenon in these countries but also they are pioneers in terms of economic development in Asia (after Japan; Sarel 1996). Malaysia, Thailand, Hong Kong and Singapore are part of the eight East Asian Miracle countries with the latter two being part of the four Asian Tigers (Sarel 1996). The exclusion of immigrants in 2015 changes the main results for Singapore, Hong Kong and Macao where the elderly missing women phenomenon can no longer be seen as a cohort effect bur persists across the life course. Compared to 2015 (migrant stock included), in 2030 the pattern of elderly missing women changed for all countries in the region. In Hong Kong and Malaysia, it is evident in one elderly age category only (60+ for the latter and 75+ for the former). However, in Singapore it is now evident in the 75+ category as well and in both Singapore and Thailand it is accompanied by a slight female deficit in the total population. In 2050, Malaysia is the only country in the selected group that depicts an elderly missing women phenomenon and presents it as a cohort effect only. The elimination of the phenomenon in the remaining countries is of some consolation as the

[34] Of course in South Korea the role of the government in promoting gender equity has been integral in the normalization of sex ratios at birth (Chung and Das Gupta 2007)

pace of ageing amongst countries projected till 2050 is fastest in Hong Kong, followed by Thailand, China and finally Malaysia (Lee, Mason and Park 2011). However, the persistence of the phenomenon in the elderly category of Malaysia throughout the three phases is problematic and may no longer allow for a cohort effect interpretation.

In South Asia, all countries except Sri Lanka present an elderly missing women phenomenon in the elderly population with the inclusion of immigrants in 2015 and within this set of countries only Iran, Nepal and Maldives allow for a possible cohort effect interpretation. Compared to the results for 2015 (migrant stock included), the findings for 2030 have changed for Nepal and Bangladesh. The former no longer presents an elderly missing women phenomenon whereas for the latter a possible cohort effect interpretation is possible. Further extending the projections to 2050 changes the results for Maldives only where the female deficit in the elderly population is now accompanied by a female deficit in the total population. The fact that Iran continues to present a female deficit in the elderly population accompanied by a female surplus in the total population implies the cohort effect interpretation for the country needs to be revised. The results for some of the South Asian countries are not very surprising in terms of the presence of missing women in their total population: the three countries of the sub-continent – Pakistan, India and Bangladesh – have already been discussed in literature as having missing women in their total population and Anderson and Ray (2010) have discussed the existence of missing women in the elderly population of India. However, the presence of a female deficit, especially in the older age groups, in the remaining countries of South Asia is mostly undocumented. This is especially true in the case of Bhutan as the magnitude (immigrants included) of the deficit therein is equivalent to that of the GCC countries and remains high till 2050 thereby making it the country with the highest female deficit in the elderly and total populations of South Asia.

In central Asia, the only country which exhibits an elderly missing women phenomenon, including and excluding the migrant stock is Tajikistan. The relatively higher sex ratios in the elderly populations of Kyrgyzstan, Turkmenistan, Uzbekistan and Tajikistan - with the sex ratios in Tajikistan being highest of all - have been noted by Sidorenko (2016). It would therefore appear that it is only in Tajikistan where these higher sex ratios translate into an elderly missing women phenomenon. The sex ratio trend upon the exclusion of immigrants indicates that the elderly missing women phenomenon in the country may be interpreted as a possible cohort effect. This is bolstered by fact that the elderly missing women phenomenon in the country disappear in 2030 and 2050 placing Tajikistan alongside the other post-Soviet countries that do no display an elderly missing women phenomenon.

Amongst the remaining countries in Western Asia, all the Middle Eastern countries of the region except Israel display a female deficit in both elderly categories (except Iraq which does so for the 75+ category only) and for all these countries (except Palestine) the deficit is accompanied by a deficit in the total population. Although the exclusion of immigrants changes the main results for some countries (Kuwait has a female surplus at all ages, Qatar has a surplus in the total population and Bahrain has a surplus in the 60+ population) and adds Israel to the list of countries with a female deficit in the elderly category, the general finding that alongside Bhutan the countries in this region display the worst female deficit in the elderly and total population on the continent holds. The general trends of 2015 (migrant stock included) for the Middle Eastern region hold for

2030 and 2050 as well.

This comparison of elderly missing women across Asia indicates that although missing women literature has disproportionately concentrated on missing women in East/Southeast Asia and to some extent South Asia, the phenomenon is more pervasive in South Asia and the Middle Eastern region of Asia. The few countries in East/Southeast Asia that exhibit the elderly missing women phenomenon – except for China – seem to fit a cohort interpretation, so that the phenomenon disappears by 2050 for all these countries except Malaysia. China, where the phenomenon persists at all ages, will not get rid of then phenomenon for many decades. Hence, the pattern of China and Malaysia fits in with the South Asian and Middle Eastern countries of Asia: The majority these countries display this phenomenon not only in old ages but across all ages of the population and continue do so till 2050 so that the missing women phenomenon in these countries is the norm rather than an exception.

Results from a comparison of sex ratios trends by age further show that in 2015 for all countries except China, India and Lebanon, the female deficit is not apparent at the time of birth and for a majority countries not existent at the childhood level either. This may lead to the conclusion that sex selection technology at the time of birth is not primarily responsible for the observed deficit in the total population these countries. Therefore, factors across the life stage versus factors at birth (as a bulk of the literature has done by limiting a detailed analysis of the phenomenon to China, India and South Korea) need to be given greater weightage in evaluating the missing women phenomenon in the total and elderly populations.

This chapter therefore depicts the necessity of redirecting the focus of missing women literature from East/Southeast Asia to South Asia and especially the Middle Eastern countries of Asia, and from younger ages to older age groups in both regions. Similarly, an evaluation of the causes behind these missing women necessitates a focus on later life stages rather than the stage before/at birth.

Chapter 4 - Elderly missing women and demographic shocks: The special case of Pakistan

4.1. Introduction

It is evident from table 1-1 in the introduction that an elderly missing women phenomenon exists in the population of Pakistan in 2015 such that not only does the number of men exceed the number of women in the 60+ age category but also this preponderance of men over women increases as the population ages, i.e. in the 80+ age category. Chapter 2 examines the first group of effects that could create this female deficit in old age: how disadvantages exist at each stage of the female life course (before/at birth, childhood, young adulthood, adulthood and old age) that either elevate mortality at that life stage or erode survival chances in subsequent stages. The evaluation of the sex ratio trends of Pakistan by age in 2015 in Chapter 3 reveals that the missing women phenomenon in the country is primarily driven by a female deficit after the age of 40. The concentration of this deficit after the age of 40 necessitates the exploration of whether the elderly missing women phenomenon in Pakistan today may be the consequence of a second group of potential effects i.e. demographic shocks. Demographic shocks such as conflicts and natural disasters in the history of Pakistan may have affected a particular gender (women in this case) or age group more adversely thereby creating a shortage of woman in that age group. The adversely affected age group may form the 40+ age category and consequently also the elderly population of Pakistan today (i.e. 2015). Therefore, the elderly missing women phenomenon in Pakistan today may partly or entirely be a result of these demographic shocks. This chapter uses Pakistan as a case study to examine whether this second group of effects creates an extraordinary situation in the country in terms of the elderly missing women phenomenon, or whether simply an increased intensity of the first group of factors at later life stages must be assumed.

To examine the potential and factual impact, I will first provide an overview of literature that quantitatively assesses the gendered impact of conflict and natural disasters. I will then discuss the design and methods adopted in the chapter. In the third step I will provide an overview of key demographic events in Pakistan and evaluate their respective impact on sex ratios of the population. I will then examine the sex ratio trends by age of missing women in Pakistan from 1950 to 2015 by age group and correlate these to demographic events. Finally, I will draw conclusions regarding the relevance of demographic events to explain the missing women phenomenon in Pakistan and implications for other countries as well as for the theory of the missing women phenomenon and its further development.

4.2. Literature review

Conflicts and natural disasters have different impacts on boys, girls, men, women and the elderly. However relatively few resources have been invested in collecting sex and age disaggregated data for these events (Mazurana et al. 2011). Therefore, there is a dearth of quantitative analysis on the gendered impact of conflicts and natural disasters (Plümper and Neumayer 2006, Neumayer and Plümper 2007). Nevertheless, there are at

least some studies that have quantitatively assessed the differential impact of conflict on men and women.

Ghobarah, Huth and Russett (2003) conduct a cross-national analysis of the long term effects of civil wars between 1991 and 1997 by gender, age and disease[35] and disability affliction. They theorize that civil wars deteriorate the public health of the civilian population not only by increasing the exposure to disease and disability but also by limiting the allocation of human and financial resources to the health needs of the population. Using the WHO measure of Disability Adjusted Life Years (DALYs) to represent the public health effects of civil wars from 1991-1997 on the civilian population in 1999 (i.e. the long term effects) they develop two hypotheses: First, more DALYs are lost with the occurrence and increasing severity of civil war. Second, DALYs are lost if a geographically contiguous state (sharing a border or separated by less than 12 miles of water) has had a civil war. To test these hypotheses they use datasets from several different academic sources[36] for conflicts whose total deaths have exceeded 1000 people. They also used several control variables: investment in public health, education level of population, democracy level of country, pace of urbanization, inequity in distribution of income, cultural and linguistic diversity and tropical climate in country. The authors conclude that civil wars in own state have increased the risk of death and disability in 1999 from malaria, tuberculosis and other respiratory infectious disease and may have increased this risk from break down of social order and transport accidents. However, when civil wars had taken place in a contiguous state, the greatest threat was that of HIV/AIDS. In both instances women and children were the most common long term victims with this long term impact being strongest for children under five but almost non-existent for the elderly. Quantitatively, they calculated the indirect impact of all civil wars from 1991-1997 to result in a total of 8.01 million lost DALYs in 1999, a figure roughly equal to the direct deaths from civil wars in the period of conflict. However, they argue that the indirect estimate does not include the effect of disability from long term diseases that develop slowly over time.

Another study has been undertaken by Li and Wen (2005). Their analysis assesses the impact of armed conflict on the mortality of working age population (15-64 years) across 160 countries over time, using data from 1961-1998 to conduct separate empirical analysis for males and females. They use various sources to construct their variables: WHO world mortality database for the dependent variable (age standardized sex specific death rate), the conflict related data from Gleditsch et al. (2002) for key independent variables (in the form of dummy variables: conflict, interstate/intrastate conflict, minor/severe conflict, conflict history and interstate/intrastate conflict history) and various other sources for country specific control variables (e.g. income inequality, GDP per capita). They have four main results. First, they find that armed conflict has both immediate and lingering effects on adult mortality with the latter being more robust[37] than the former. Second, interstate conflicts have a large immediate effect on

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[35] Diseases include infectious diseases, sexually transmitted diseases, maternally linked illnesses and certain types of cancers (i.e.cervical and lung).

[36] Doyle and Sambanis 2000, Regan 2000, Wallensteen and Sollenberg 2000, Licklider 1995, Singer and Small 1994.

[37] To check for robustness the authors re-estimate their regression equation under 6 different models. Model 1 examines the immediate effect of any type of conflict, model 2 examines the lingering and immediate effect of any type of conflict, model 3 examines the immediate effect of interstate and intrastate conflict, model 4 examines the immediate and lingering effects of both types of conflicts,

mortality of both genders but no strong or robust lingering effect. On the other hand, intrastate conflicts have a robust lingering effect on mortality of both genders. Third, minor conflicts have no statistically significant immediate or lingering effect whereas severe conflicts affect mortality both immediately and in the long run whilst raising female mortality mainly in the long run. Finally, when armed conflict affects men it almost always affects women because men usually suffer higher immediate mortality (at least in intrastate and severe conflicts) but in the long run the mortality of women is at least as high as that of men. This may be because women are more susceptible to the risks presented by the long term lingering effects of conflict highlighted by the authors: homelessness, forced migration, deterioration in public health infrastructure, lack of social cohesion, violence, exposure to diseases and scarcity of resources.

Plümper and Neumayer (2006) examine the impact of militarized conflict on the gender gap in life expectancy (ratio of female to male life expectancy at birth). They contend that the spillover effects of conflict are more adverse for women than men and deteriorates the female vis-á-vis male life expectancy via three channels: the economic damage effect, the displacement effect and the sexual violence effect. The economic damage effect implies that women are more adversely affected than men when resources are diverted from the normal functions of the economy (e.g. health and infrastructure) to war related activities. The displacement effect implies that women are more adversely affected than men by the disadvantages of being unsettled by war (e.g. hygiene conditions in refugee camps are worse for women). The sexual violence effect implies that the incidence and intensity of such violence against women increases in periods of conflict. To conduct their analysis, the authors use data from various sources: Life expectancy panel data from US Census International database to estimate the ratio of life expectancies (dependent variable), Gleditsch et al. (2002) for conflict related variables (independent variables) and various sources for other independent variables (e.g. The Emergency Disasters Database for the impact of natural disasters). These authors are the first to quantitatively assess the impact of armed conflict on the gender gap in life expectancy by accounting for not only interstate and civil wars but also ethnic civil wars and civil wars in failed states. They have three main results: First, both interstate and civil wars decrease the gender gap in life expectancy i.e. women suffer more than men from these wars. Second, the decrease in gender gap in life expectancy in civil wars is stronger than interstate wars only for ethnic civil wars in failed states. Finally, since most civil wars are ethnic and take place in failed states, low variation in data and inefficient estimation may be the reason why significant results for other civil wars were not found.

With reference to the differential impact of natural disasters on mortality of men and women, two studies by Dyson ("Part I" 1991 and "Part II" 1991) stand out. Both studies examine the fertility and mortality implications of the five worst famines on the subcontinent (i.e. Pakistan, India and Bangladesh) in the 19th and 20th centuries. Dyson ("Part I" 1991) uses data from the Indian Vital Registration System to examine the three worst famines of the 19th Century which occurred in the geographical region that forms India today. For all three famines the author finds that seasonal droughts (i.e. absence of seasonal Monsoon rains) served as a precursor to the famines and the seasonal drought was inevitably followed by a rise in food prices. This rise in food

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model 5 provides the immediate effects of minor and sever conflicts. Finally, model 6 provides the immediate and lingering effects of minor and severe conflicts (Li and Wen 2005).

prices was a crucial predictor of fertility: in all three famines: the author finds that the rise in food prices was accompanied by a fall in conceptions which became evident by a subsequent fall in fertility rates. This fall in fertility rates started before the famine but continued throughout the famine. With regards to mortality, the results indicate that the largest absolute increases in mortality occurred in age groups where mortality had already been high i.e. infancy, childhood and old age. However, the largest proportional increases in mortality occurred in the age groups where morality had initially been low i.e. in the adult category. With regards to the gender distribution of mortality, from the teen years to age 50, the author finds that male mortality was higher than female mortality. At all other ages, the gender distribution of mortality rates was relatively equal except at the infant level where female infant mortality rates were slightly higher than male infant mortality rates.

Dyson ("Part II", 1991) also uses data from the Indian Vital Registration System to examine the fertility and mortality implications of the Great Bengal Famine in the 1940's which affected the geographical regions which forms India today. There have been several reasons behind this drought: Japanese invasion of Myanmar which led to a shortage of food supply, inadequate management of food resources by British colonial government and crop failure (brought upon by torrential rains and floods; Dyson, "Part II" 1991). The crop failure and resulting gathering crises was followed by a rise in prices, decline in conceptions and resultant fall in fertility - a pattern similar to the 19th century famines (Dyson, "Part II" 1991). The author finds the mortality patterns generated by this famine have also been very similar to the ones described in the previous paragraph for the 19th century famines in India in terms of the absolute and proportional number of deaths and the gender distribution of deaths with women faring better in late childhood and reproductive years and worse as infants. For the second great famine in the 20th century, i.e. the Bangladesh Famine of 1974 to 1975, Dyson ("Part II", 1991) uses data from the International Center for Diarrheal Disease Research. He contends that monsoon floods of summer 1974 set the backstage for this famine (although the repercussions of the war in 1971 exacerbated the situation) by creating a shortage of food supplies, causing prices to rise as a result of which there was a decline in conceptions and thereafter fertility. Dyson ("Part II" 1991) concludes that, although the data for this famine is limited to a specific geographical region within Bangladesh, the findings are consistent with those of earlier famines in the similarity of mortality patterns (except for children who may have had higher absolute and proportional death rates due to the outbreak of measles) and in the higher preponderance of male deaths.

Another study of relevance is Ikeda's (1995) analysis of gender and age distribution of mortality from the 1991 Bangladesh cyclone. From the period 1991 and 1992, the author first uses several existing surveys (conducted between 1991 and 1992) to calculate the distribution of immediate mortality from the cyclone and then conducts interviews to assess the reason behind this distribution. She finds that mortality rates had been highest for children aged 0 to 4 followed by the 50 plus age group. Conversely, they had been lowest for the 15 to 19 age group followed by the 20 to 49 age group. Disaggregation by gender revealed that female mortality rates had been higher than male mortality rates in most age groups with the most significant gender differential being in the 20 to 49 age group where female mortality rates had been 4 to 5 times higher than male mortality rates. Based on interviews, the author suggests that the main reason behind the high female mortality rate is the lack of information women had

about the imminent risk of the cyclone and their inability to make the decision to evacuate (as this decision usually rested on male family members). Women's weaker physical strength, inability to swim and traditional dress code further hampered their survival capability. Although the author contends that at later stages of the cyclone, restrictions on women's social movements did not hinder them from seeking shelter in public strongholds, she states that at earlier (warning) stages of the cyclone women preferred to seek shelter in households of relatives where they perceived themselves to be safer from the general public.

Neumayer and Plümper (2007) conduct a cross-national quantitative analysis on the effect of natural disasters on the gender gap in life expectancy (ratio of female to male life expectancy) from 1981 to 2002. They contend that three features increase the vulnerability of women to disasters vis-a-vis men: First, the biological makeup of women makes them more vulnerable to natural disasters (e.g. men may be physiologically better equipped to survive the impact of a disaster (i.e. they may be able to run or swim faster or women at late stages of pregnancy may be less mobile). Second, women's immediate response to disaster is disadvantaged by social norms and role behavior (e.g. dress codes may hinder women from moving rapidly, behavioral restrictions may prevent women from escaping without a male companion or social prejudice that for e.g. prevents women from learning to swim may reduce their survival probability in floods). Third, disasters may lead to shortages of resources and breakdown of social order which worsen existing forms of discrimination (e.g. parents may allocate scarce resources to sons instead of daughters, domestic and sexual violence against women may increase due to temporary breakdown of law and order and women who are forced to relocate to refugee camps may face increased health hazards due to poor health and hygiene conditions). For their empirical investigation, the authors use the same data sources as described for their 2006 study with the exception of not using conflict related variables. The Emergency Disasters Database (Em-DAT) is especially important to their work as they use this source to find information on the number of people killed from 4065 disasters across 141 countries in the given period. They have two main results. First, disaster strength has a statistically significant negative effect on the gender gap in life expectancy, i.e. the stronger the disaster, the greater the reduction in the gender gap. Second, women's socioeconomic status has a statistically significant positive interaction effect with disaster strength i.e. the first relationship gets weaker with an improvement in women's socioeconomic status.

Three papers directly address the impact of conflict and natural disasters on the missing women phenomenon. Coale and Bannister (1991) use the Population Censuses (1953 to 1990) and Fertility Surveys (1982 to 1988) of China to trace the trend of missing women from birth cohorts of late 1930s to late 1980s. They attribute the large numbers of missing women in birth cohorts of 1930's and 1940's to the traditional practice of female infanticide. Although they find this practice to have somewhat declined by 1950's, they note that the famine in this era caused higher female than male child mortality (beyond the neonatal period). Thereafter, in 1960 and early 1970's the number of missing girls in each birth cohort reached a minimum. However, they conclude, in the late 1970's and 1980's the introduction of ultrasound machines (to determine the gender of the fetus) led to a sudden increase in the number of missing women especially in the late 1980's.

Similarly, Jiang, Feldman and Jin (2005) analyze the trend of sex ratios in China from 1900-2000 and consider the impact of wars, famine, political events and fertility changes on this trend. To do so they divide the given period into five phases and assess the sex ratios of birth cohorts in those phases by comparing data from the Population census of China with different Model Life Tables. Their end result, from all phases, is that there were 31.78 million missing women in China in the given era. They conclude that the number of missing women increased drastically after 1980 with the figure between 1980 and 2000 alone being 9.2 million.

Das Gupta and Shuzhuo (1999) assess the impact of war, famine and fertility decline on missing women in China, South Korea and India between 1920 and 1990. For all three countries the authors use population censuses[38] conducted during the period to approximate the effect of these events on sex ratios by age group and the resulting consequences for the marriage market. The authors find that different events in China may have had a diverse impact on missing women and these impact may differ by age or life stage. While the majority of events (e.g. wars and uncertainty associated with conflicts) led to an increase in missing women at birth and childhood some events like the political dominion of the Maoist regime in 1950's led to an improvement in the situation of women due to a more equitable treatment of women in society (e.g. through increased employment opportunities for women) which may have led to a reduction in missing girls at birth and childhood stages. The authors find that the events in China and South Korea led to a shortage of brides with the problem being worse in former. India on the other has had a surplus of brides since the 1920's[39]. The authors conclude that this resulted in the retention of bride price in China and South Korea and the inflation of dowry and hypergamy (i.e. the competition to marry daughters into a caste higher than one's own; Das Gupta and Shuzhuo 1999) in India. Nevertheless, all three countries are experiencing a shortage of women since the 1980's due to the introduction of sex selection technology[40].

Four conclusions can be drawn from the discussion so far. First, the immediate effect of conflict may be equal for men and women but the long term effect (on health and mortality) appears to be worse for women especially in intrastate conflicts. Second, the average impact of most natural disasters (except famines in adulthood) is to increase the immediate and long term mortality of women. Third, demographic events may affect missing women in different life stages differently (as is evident from the famines in India and Bangladesh) so that at one life stage they may lead to the worsening of a female deficit (e.g. as famines on the subcontinent led to an increase in female infant mortality; Dyson "Part I" 1991, "Part II"1991) whereas at the other a reduction in the deficit (e.g. as famines on the subcontinent led to a reduction in female mortality in the reproductive ages; Dyson "Part I" 1991, Dyson "Part II" 1991). Finally, given the first three conclusions and the experiences of China, South Korea and India, it appears that conflicts and natural disasters not only affect the number of missing women at the time

[38] For China and South Korea, they augment their results by using additional population surveys from the era. The authors note that the results for these countries are highly accurate (as people accurately recall the animal year of their birth) in comparison to India where census data is likely to be affected by misreporting and age heaping (Das Gupta and Shuzhuo 1999).

[39] However, the shortage of brides is evident in some regions of Northern India today although to a lesser intensity than China (Hudson and den Boer 2002).

[40] For South Korea the outcome on the marriage market is uncertain due to government policies to reverse the problem (Das Gupta and Shuzhuo 1999).

of the event but also have a trickle-down effect on the missing women phenomenon (as cohorts enter older age categories) and on other non-demographic factors in society (e.g. bride price in South Korea and China and dowry in India). However, it is clear that despite the potential significant impact of disasters and conflicts on the demographic balance of a country, a country-wise analysis on the effect of these events on missing women is limited to three countries only. The extreme sex ratios in the elderly population of Pakistan provide one example of a country where such an analysis is needed. As no study has analyzed the distortions in sex ratios in the elderly population of Pakistan, subsequent discussion of this paper will analyze the specific case of Pakistan, as an example, to assess whether factors across the life course or historical events are responsible for the elderly missing women phenomenon today.

The case of Pakistan may be especially interesting because in other countries, i.e. China, South Korea and India, whereupon the impact of exogenous shocks on the missing women phenomenon has been evaluated, the impact of fertility decline and sex selection technology has been strong enough to overshadow any demographic shock. As fertility decline is influenced by the social context, it does not allow a true evaluation of exogenous events attacking the endogenous foundation. In Pakistan, despite active government programs since the 1960s to curb rapid population growth, fertility decline has been slow and the presence of prenatal sex selection technology is relatively non-existent (Sathar and Karim 1996). Furthermore, in the case of both India and South Korea, the effect of demographic shocks was considered only in terms of its impact on the marriage market (i.e. whether demographic shocks led to a shortage or surplus of brides in the affected countries). The exception of China in this instance is masked by the imposition of the One Child Policy, which may be regarded as an extreme form of fertility decline. Therefore, an evaluation of the impact of demographic shocks on the elderly missing women phenomenon in Pakistan is the first to trace the trend of purely exogenous demographic shocks on sex ratios in the population.

4.3. Design and methods

To examine the impact of historical events on the elderly missing women phenomenon in Pakistan two main types of analysis have been conducted. First, mortality statistics for main disasters and conflicts in the history of Pakistan since independence (in 1947) have been compiled from various sources and compared with population estimates from the United Nations Department of Social and Economic Affairs (UNDESA) for the respective year to assess whether mortality rates were high enough to affect the sex ratios (male/female) in the given year. Second, data from the UNDESA (2015) has been used to asses two types of sex ratio trends: The sex ratio trend by ten year age groups for the years 1950 to 2015 to correlate the timing of historical events with aberrations from the trend and the sex ratio trend for the years 1990 to 2015 by five year age groups to identify prevailing patterns of missing women and elderly missing women in Pakistan by age group.

A detailed explanation of the method adopted by UNDESA is provided in Chapter 3. A summary of the method is provided here. UNDESA follows a four step procedure to collect, calculate and perfect the accuracy of its yearly population estimates from 1950-2015. First, it collects data from census surveys, vital registers, population registers and other sources. Sources of data used for Pakistan are provided in table 4-1 below.

Second, it corrects the accuracy of the statistics collected by using post enumeration surveys and demographic adjustment techniques. Areas that require specific attention are under enumeration and age heaping for children under five and mortality rate adjustment of older populations (e.g. above age 85). Using these adjusted figures, the UNDESA uses projection equations for calculate its yearly population estimates. Therefore, in the third step it checks whether the estimates are consistent with each other and with the statistics corrected in the second step. This is achieved by using a balancing equation that ensures that fertility, mortality and migration estimates balance each other out and population estimates between survey years correspond to original estimates from surveys. Finally, since the UNDESA is producing estimates for countries all over the world, it cross checks the consistency and balances the population estimates at the regional and world levels (UNDESA, “methodology” 2015).

Table 4–1

United Nations sources of data for Pakistan	
Year	Source
1951, 1961, 1972, 1981, 1998	Population Census of Pakistan
1962 – 1965	Population Growth Estimation Experiment
1968 – 1969	National Impact Survey
1968 – 1971	Population Growth Survey I
1974 – 1975	Pakistan Fertility Survey
1976 – 1979	Population Growth Survey II
1980	Labour Force and Migration Survey
1984 – 2007	Pakistan Demographic Survey
1984/85, 1992, 1993, 1994/95	Contraception Prevalence Survey
1990/91, 2006/07, 2012, 2013	Pakistan Demographic and Health Survey
2006/07, 2012/13	Demographic and Health Survey
1991, 1995/96, 1996/97, 1998, 2001/02	Pakistan Integrated Household Survey
1991, 2005/06	Living Standards Measurement Survey
1996/1997	Pakistan Fertility and Family Planning Survey
2000/01	Reproductive Health and Family Planning Survey
2003	Status of women, Reproductive Health and Family Planning Survey
Up to 2010/11	Labour Force Survey
	South Asian Model of UN Model Life Tables
	UNHCR data on immigrants, emigrants, refugees

4.4. Analysis of historical events

4.4.1. Partition

The first demographic event in the history of Pakistan accompanied its creation. The partition of British India into two countries in 1947, which led to the independence of Pakistan, was the largest international human flow in world history involving the movement of 14.5 million people in 4 years (Weiner 1993, Bharadwaj, Khwaja and Mian 2008). The time period immediately before, during and immediately after partition was riddled by violence (riots, looting, abductions, torture and killings) and accompanied by a breakdown in political authority. Violence was concentrated along the lines of partition, specifically along the Punjab[41] border and was often aimed at victimizing women (Weiner 1993, Brass 2003). Women were victimized through murder, rape and kidnapping (and subsequent forced marriage with their kidnappers and conversion to kidnapper's religion) not only because they were more vulnerable but

[41] One of the four province of Pakistan, one of the two provinces bordering India and the main province in which migration between the two countries had been concentrated (Hill et al. 2008).

also because they preserved the honor of the society that was being victimized. The logic behind their victimization was therefore to defile the honor of society and humiliate the men who failed to protect them. The worst form of humiliation was to return to one's own society years later with the kidnapper's child which led to both the mother and child being ostracized and belonging neither to the kidnapper's society nor to the mother's natal society (Brass 2003).

Hill et al. (2008) analyze how partition has affected population growth and migration in the entire province of Punjab (India and Pakistan combined). They use data from the 1931 and 1941 census of British India and 1951 and 1961 censuses of India and Pakistan to differentiate demographic changes (births and deaths) that could have taken place in Punjab in the presence and absence of partition. Their work is amongst the first to incorporate demographic information from these censuses into one study and to apply this information to the geography of undivided Punjab in the pre and post partition period. They have two main results about missing people (i.e. people who are accounted for in the 1941 census of British India (for Punjab) but unaccounted for in 1951 census figures of India and Pakistan (for Punjab) after factoring in estimates for net migration) that are relevant for this chapter. First, they estimate that the number of missing people in Punjab due to partition ranges from 2.3 to 3.2 million (as of 1951). They assume that these numbers are a result of the violence that has accompanied Partition because these people cannot be accounted for by migration or the occurrence of a natural disaster (e.g. famine) and the areas from where these people were missing had been riddled by violence. Second, they assert that men and women are about equally likely to be missing. It is to be noted that the results of Hill et al. (2008) hold only for populations aged 20 and above due to inaccurate population data for younger age groups.

Bharadwaj, Khwaja and Mian (2008, 2009) assess how migratory flows between India and Pakistan during partition (1947) and four years after have altered the sex ratios of the regions affected by population movements. To do so they compared population data from the 1931 Census of British India with the 1951 Censuses of India and Pakistan at the district level (the smallest level for which such data is available). However, they faced two challenges: First, since boundary lines underwent change during partition, they had to geographically equate pre and post partition districts. Second, they had to disentangle the effects of partition from demographic changes that would occur in these districts anyway. They were able to overcome the latter challenge because in each case there were neighboring districts with zero migratory flows that could thereby serve as control districts for demographic change. The authors find three results relevant to this chapter: First, partition related migration to Pakistan has led to a decrease in sex ratios (male/female). Specifically, a one standard deviation increase in inflows has caused an approximately 0.25% decrease in percentage male in Pakistan (conversely, outflows from Pakistan increased the sex ratio however the coefficient of increase is minute and statistically insignificant and thereby has no visible impact on sex ratios). The authors highlight that in 1931 Muslims in India had a lower sex ratio than Muslims in Pakistan but a higher sex ratio than Hindus in India. Hence, when Muslims from India had come to Pakistan, the sex ratio in both countries had decreased. Second, they find that not only had men been more likely to migrate, but also to migrate to more distant districts and larger cities. Nevertheless, they contend that in Pakistan migration had been concentrated in the province of Punjab. Third, they approximate 2.2 million missing people along the Punjab border due to partition related mortality.

Two other papers provide useful quantitative information on the demographic impact of partition on Pakistan. Visaria (1969), using data from Indian population censuses and government reports, finds information on migratory patterns between India and Pakistan between 1951 and 1961. He contends that while there had been substantial out migration of Pakistani born persons into India during this period, there had been negligible in migration of Indian born persons to Pakistan. He estimates that net emigration from Pakistan has resulted in approximately 1.16 to 1.32 million people moving to India during this period. Using estimates from two competing sources, the author contends that this emigration may have either been slightly feminized or slightly masculinized). In order to affect the sex ratio of a specific population, the excess females or males have to formulate at least 1% of that population. As 1.32 million form less than 1% of the entire ten-year population (from 1951 – 1961) of Pakistan of all ages (as emigrants are assumed to comprise the entire spectrum of the population), the slight feminization or masculinization of these 1.32 million emigrants could not have affected the sex ratios of the population of the Pakistan.

Khan (1974) uses data from the 1901, 1911, 1921, 1931 and 1941 censuses of British India and 1951 and 1961 censuses of Pakistan and India to estimate the extent of emigration from Bangladesh (former East Pakistan)[42] between 1901 to 1961. With reference to this chapter only migration from Bangladesh to Pakistan after partition is relevant. The author finds that although between the years 1951 to 1961 there is some migration between Bangladesh and Pakistan, the figures are too small to have affected the sex ratios of the population (UNDESA, "custom data" 2015). Nevertheless, he notes that family migrations aside, individual migrants were more likely to be male.

The analysis of Partition reveals two things: First, the effects of migratory flows from this event on Pakistan were concentrated in the first four years after independence (from 1947 to 1951). Second, these migratory flows reduced the sex ratios of the total population of Pakistan so sex ratios before partition may have been even higher before 1947 and have become less masculinized by the effects of population flows caused by partition.

4.4.2. Conflict

Since partition there have been several conflicts between Pakistan and India over the control of Kashmir. Gleditsch et al. (2002) estimate that Pakistani battle related deaths[43] in three Indo-Pak wars (i.e. Indo-Pak wars of 1948, 1965 and 1975) have exceeded 1,000[44]. According to Sarkees and Wayman (2010) the same minimum casualty estimate holds for the civil war in East Pakistan (1971).

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[42] From Independence (1947) till 1971 Pakistan constituted of two parts: East and West. In 1971, East Pakistan separated to form Bangladesh and West Pakistan continued to be known as Pakistan (Paulsen 2006).

[43] Civilian or military deaths in one year and the entire duration of the conflict (if the conflict has lasted for more than one year) and not as a long term consequence of the conflict (Melander, Pettersson and Themmér 2016).

[44] For the UCDP/PRIO conflict dataset, that records conflicts between 1946 and 2015, exact mortality estimates are not provided. Rather, a benchmark of 1000 battle related deaths is given and mortality estimates are recorded as being above or below this estimate (Gleditsch et al. 2002).

Although exact fatality statistics for these wars are difficult to obtain some authors have made approximations. Sarkees and Wayman (2010) estimate that Pakistan suffered from 1,000 battle deaths during the first Indo-Pak War (1948). However, Krishna estimates 6,000 fatalities and suggests that this constitutes Pakistani army officers and men. A description of the conflict by Lamb (1991) suggests that the bulk of the fighting took place in the Jammu and Kashmir area. It would therefore follow that the deaths did not include Pakistani civilians but military soldiers who had been assigned combat duty. It can be assumed that in all three Indo-Pak wars, only men suffered from military fatalities. This is because although women have been a part of the Pakistan Army[45] for decades, they are mostly employed for medical or engineering services (Express Tribune, "Army" 2013, "Fighter" 2013). It is only in recent years (well after the 1971 war) that the army started to train women for active combat duty (Express Tribune, "Army" 2013, "Fighter" 2013). As already mentioned, in order to affect the sex ratio of a specific age group or population, the number of men killed has to formulate at least 1% of that age group or population. A comparison of 6,000 casualties with the total male population of Pakistan and the male population of Pakistan in the 20-45[46] age groups for 1948 shows that the fatalities could not have severely impacted the sex ratios (UNDESA, "custom data" 2015). This argument can be exemplified in more detail for specific events.

For the Second Indo-Pak War (1965), Sarkees and Wayman (2010) estimate 3,800 battle deaths. Newspaper reports[47] take this number to 4,000 and contend that these were soldier deaths (Dawn, "Golden" 2015, Express Tribune 2015). An analysis of newspapers during the period of conflict[48] does not reveal any civilian deaths among Pakistani citizens (Pakistan Times, August - September 1965). Hence, it can safely be assumed that all 4,000 casualties were military deaths. These deaths constitute less than 1% of the male population of the 20-45 age group in 1965 in Pakistan (UNDESA, "custom data" 2015). Therefore, the Second Indo-Pak War has had no impact on the sex ratios of Pakistan.

In 1971, Pakistan engaged in two conflicts: Third Indo-Pak War (1971) over Kashmir and Civil war in East Pakistan. Sarkees and Wayman (2010) estimate that the Third Indo-Pak War resulted in 7,982 Pakistani battle related deaths and the civil war resulted in 2,500 Pakistani battled related deaths. The civil war took place in the geographical territory of Bangladesh (Bose 2005) and although there is evidence to suggest that it grossly affected both men and women in Bangladesh (Bose 2005), it may not have affected the citizens of the geographical territory that is Pakistan today. It can therefore be assumed that the 2,500 Pakistani battle deaths were military deaths of the soldiers sent from West Pakistan to East Pakistan to fight during the civil war. A newspaper

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45 Pakistan Army refers to the Pakistan Army, the Pakistan Navy and the Pakistan Air Force.

46 This interval includes the ages of the ten soldiers received the highest military award in Pakistan posthumously for their services in the Indo-Pak wars (Shaheed Foundation 2015, Pakistan Army 2016). It is assumed that this interval provides a good proxy for the ages of the soldiers who fought during the first, second and third Indo-Pakistan conflicts.

47 Analysis of Newspapers "Dawn" and the "Pakistan times" for dates: 6th September 1965, 1966, 1970, 1975, 1980, 1985, 1990, 1995, 2000, 2005, 2010 and 2015. Exceptions: years 1990 and 1995 for Dawn.

48 Period during which the Indian army attacked the territory of West Pakistan. Newspaper articles indicate that cities were bombed but there is no mention of Pakistani civilian casualties.

analysis of the Third Indo-Pak War[49] shows that it resulted in approximately 250[50] civilian deaths. Although no specific gender or age group is given for these civilian deaths it is clear that even if they had been concentrated to a specific gender and age group their fatalities too small to have affected the sex ratio (UNDESA, "custom data" 2015). This implies that the remaining 7,732 deaths are of a military nature leading to a total of approximately 10,232 male deaths in the 20-45 age group for the year 1971. This is still too small a number to have had any impact on the 20-45 age interval leading to the conclusion that the events of 1971 had no effect on sex ratios or missing women in Pakistan (UNDESA, custom data" 2015). It may add to other phenomena, but the impact of these incidences alone is absent with regard to the missing women phenomenon.

Since 1947 there have been five phases of conflict in Baluchistan (one of the four provinces of Pakistan) between the government (involving the military) and the Baluch rebels: 1948, 1958, 1961-1963, 1973-1977 and 2005-2014 (Grare 2013). Mullenbach (2016) suggests that the first three interventions resulted in a total (civilian and military) of 1,000 deaths. This figure is not large enough to affect the sex ratios of the population of any gender in any age interval aggregated over the given time period (UNDESA, "custom data" 2015). Gleditsch et al. (2002) estimate that the death toll of the fourth military intervention (1973-1977) have exceeded 1,000 battle deaths with the majority of deaths concentrated in 1974. Sarkees and Wayman (2010) record 3,300 battle related military deaths and 5,300 battle related rebel deaths for this intervention. Leitenberg (2006) provides figures of 6,000 civilian and 3,000 military deaths. Mullenbach (2016) estimates a total of 12,000 deaths which includes 3,300 government soldiers, 5,300 rebels and 3,400 civilians. The effect of Mullenbach's (2016) high estimate of 12,000 deaths will be considered on sex ratios because if this high figure has had no impact on the population then the lower estimates will not have an impact either. Taking account of the culture of Baluchistan[51] and the previous discussion on soldiers during Indo-Pak wars, it may be assumed that the rebel and government soldier casualties have been male. Whilst the age distribution of rebel deaths is unknown, it would be safe to include them in the same age category as the soldiers (i.e. 20-44) when assessing the impact on sex ratios because it will not affect the accuracy of the results. An exact knowledge of their ages may increase the numbers in the baseline population (for example to the 15-44 age interval). However, if military and rebel deaths don't affect the 20-44 interval they are unlikely to affect a larger interval. Calculations reveal that 8,600 male deaths represent less than 1% of the 20-44 age group of the 1974 population of Pakistan and therefore have again no impact on sex ratios of the country (UNDESA, "custom data" 2015).

With reference to civilian deaths, given that these are the immediate rather than the long term consequences of the conflict, it can be assumed that male and female deaths have been roughly equal. These would then cancel each other out and have no impact on sex ratios. Even if the 3,400 civilians are assumed to be males and added to the 8,600 male

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[49] Analysis of newspaper "Dawn" for dates: 3rd – 20th December, 1971 i.e. the period during which India had been attacking West Pakistan.

[50] Analysis of newspaper "Dawn" for dates: 7th December 1971, 10th December 1971, 11th December 1971, 14th December 1971, 15th December 1971.

[51] Hakim and Aziz (1998) use indicators from the Pakistan Fertility and Family Planning Survey to show that women from Balochistan (and in some cases from the North West Frontier Province and Balochistan) have the lowest social, cultural and religious status of all four provinces of Pakistan.

rebel and soldier deaths (giving a total of 12,000) they still represent less than 1% of the 20-44 age interval of the 1974 population of Pakistan (UNDESA, "custom data" 2015).

The UCDP Battle Related Deaths Dataset (2015) provides an estimate for the number of deaths from the fifth conflict (2005-2014). It provides a best estimate of 576 deaths for all years combined, with 2006 being the year with the highest number of deaths i.e. 200 deaths. Calculations reveal that 576 deaths over the entire period or 200 deaths in 2006 is too small to affect the sex ratios of the population of Pakistan (UNDESA, "custom data" 2015).

It is to be noted that Gledistch et al. (2015) and the UCDP Battle Related Deaths Dataset (2015) classify the last two conflicts in Baluchistan as internal. As per the literature review on the gendered impact of conflict, it is likely that there are spillover effects on the population of Baluchistan which are large enough to affect the sex ratios of the country. For example, it is reported that after the 2006 military operations in two districts of Baluchistan, not only did 250,000 people migrate but also 10,000 of those migrating died of food shortages (Dawn 2010). However, these indirect impacts of conflict are not considered in this analysis as statistics, especially by gender and age group, are very difficult to obtain (Mazurana et al. 2011).

A discussion of historical conflicts in Pakistan would be incomplete without assessing the ramifications of political turmoil in the province of Sindh. Urban Sindh emerged as the most serious threat to Pakistan's political order since the loss of East Pakistan in December 1971 (Kennedy 1991). Ethnic riots in Sindh[52] first took place in 1964-1965 and then 1972, but it was after the 1985 riots that the situation in the province began to intensify (Ahmar 1996).

Initially, the violence in Sindh took place between civilians and did not involve any state or military intervention (Kennedy 1991, Ahmar 1996). The total death toll of victims affected by the riots between 1985 and 1988 has not exceeded an average of 1,500 deaths (both genders included; Kennedy 1991, Ahmar 1996). For the violence and ethnic riots occurring in 1989 and 1990, Gleditsch et al. (2002) provide a best estimate of 114 and 252 deaths for the years 1989 and 1990 respectively. These estimates are too small to affect the sex ratios of the population in either year of the five years (UNDESA, "custom data" 2015).

State involvement in the conflict began in the 1990's (Ahmar 1996). Gledistch et al. (2002) record four encounters of the state with a political party engaged in the conflict: 1990, 1994, 1995 and 1996. Their best estimate for fatalities in each encounter is 70, 38, 52 and 42 respectively (Gledistch et al 2002). This is clearly too small to affect the sex ratios of the population of the respective year in any age interval for any gender (UNDESA 2015). However, the long term implications may be much more severe. For example, Operation Cleanup launched by the Pakistan Army in May 1992 to rally the dacoits and guerrillas in rural Sindh cost thousands of lives and led to the army being accused of genocide (Ahmar 1996). Another example are civil strifes' in Karachi which have claimed 1,113 civilian lives in 1994 and 2,095 civilian lives in 1995 (Ahmar 1996). However, even if these estimates are attributed to a particular gender, the effects are too small to impact the sex ratios of the population (UNDESA 2015).

The most recent conflict in Pakistan is the War on Terror. Although incidents of terrorist activity have been recorded in Pakistan since 1969, they have become more frequent and intense in the 21st century (RAND Corporation, n.d.). Pakistan joined the War on Terror in October 2001 by giving the United States access to four of its air bases to attack the Afghan Taliban (Murphy and Malik 2009). However, the repercussions of this war intensified after 2004 (Crawford 2015). Fatalities from the War on Terror can be classified under three categories: terrorist deaths, military (i.e. Pakistani soldier) deaths and civilian deaths (Gunaratna and Iqbal 2011). Pakistani civilian deaths are a result of three factors: victims of terrorist attacks[53], unintended victims of US drone strikes and unintended victims of Pakistani military operations against terrorists (Crawford 2015).

Using data from the Pakistan Institute of Peace Studies and South Asian Terrorism Portal, Crawford (2015) estimates that from 2001 to March 2015, the War on Terror has killed 28,954 Pakistani terrorists, 6,216 soldiers and 21,547 civilians. It is impossible to ascertain the exact gender and age distribution of these deaths however some assumptions can be made. Using data on terrorists arrested by Police Agencies in Pakistan between 1990 and 2009, Hussain (2010) finds that 99.8% of the arrested terrorists have been male and constitute the 16-60[54] age interval. This information can be used as a proxy for the age and gender of the Pakistani terrorists killed during the war on terror. With reference to soldiers, the same gender and age assumptions will be maintained as for the earlier conflicts i.e. male and 20-44 age interval. For the civilian victims it is impossible to disaggregated the gender and age groups of all fatalities. A description of terrorist attacks from 2001-2009 (RAND, n.d.) and targets of US drone strokes from 2005 to February 2010 (Gunaratna and Iqbal 2011) gives no indication that on average[55] a specific gender or age group has been affected by these events. Hence, it can be assumed that the civilian casualties affect all age groups of both genders in the entire population of Pakistan.

When assessing the impact on sex ratios two assumption needs to be made. First, as mentioned above, the repercussions of the War on Terror in Pakistan have increased after 2004. Hence, it would be realistic to assume that the majority of the fatalities occurred after 2004. This is in line with the fact that Pakistan military operations (e.g. Waziristan operation) and US drone strikes in Pakistan started after 2004 (Gunaratna and Iqbal 2011). Therefore, the impact of the fatalities will be considered on sex ratios from 2004-2015. Second, it may initially be useful to reduce the age interval of the terrorists from 16-60 to 20-44 so that the soldiers and terrorists fall in the same age interval. Since, the age data of arrested terrorists (used as a proxy for killed terrorists) presents a standard normal distribution with a mean age of 30.7 year, median of 30 years and modes of 26 years and 30 years (Hussain 2010), using a smaller interval would not lead to a loss of accuracy. Further, as the logic is explained above, if sex

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[53] Terrorist attacks include suicide attacks, ambushes and assassinations by Taliban, Al-Qaeda and other militant organizations (Crawford 2015).

[54] The minimum and maximum ages respectively with the average age being 30.7 (Hussain 2010). The author notes a standard normal age distribution for the arrestees (Hussain 2010).

[55] Some attacks have specific targets which lead to victims in a specific age category however when viewed in the aggregate with other attacks and victims no specific gender or age category seems to be targeted (Gunaratna and Iqbal 2011, RAND, n.d.)

ratios of a smaller age interval are not affected by mortality statistics, it is impossible for sex ratios of a larger age interval to be affected.

Calculations reveal that the number of military and terrorist fatalities combined in the 2004-2015 period form less than 1% of the male population of the 20-44 age interval (UNDESA 2015). With reference to the civilian fatalities, calculations reveal that they form less than 1% of the total population of Pakistan from 2004-2015 and hence cannot affect the sex ratios. It must be noted however that even if the fatalities had been higher than 1% of the population, the effect would probably not have shown in sex ratios because the male and female effects would have cancelled out hence the missing women effect, if present, would not have revealed itself.

The repercussions of terrorism and the war on terror extend beyond fatalities and affect people living in terrorist controlled areas and internally displaced people camps. Bari (2010) evaluates the vulnerability of women in both situations. Women who live in terrorist controlled areas are vulnerable along various dimensions. The primary area of concern is the health of women: not only is there a shortage of medical supplies but also the availability and access to these medical supplies is limited for women due to their inability to visit health facilities on their own and restrictions on consultations with male doctors. Given the absence of female doctors, it becomes virtually impossible to address female health concerns, and especially female reproductive health concerns, placing women's health at great risk (Bari 2010). This is exacerbated by higher rates of violence in these areas and frequent incidents of forced early marriages of girls to terrorists thereby increasing the need for women to access health care (Bari 2010). The author also finds that women, and especially female headed households (in households where no other adult males are present), are severely affected along economic dimensions as they have limited opportunities for labor force participation and hence cannot provide income for household survival.

Bari (2010) estimates that terrorism and the war on terror has led 3 million people in Pakistan to flee their homes with 80% of these living in IDP camps. When discussing the difficulties encountered by women in these camps she emphasizes the lack of health facilities that do not address the needs of women particularly in their reproductive role. She notes the high incidence of malnutrition amongst pregnant and lactating women and finds that the high rate of pregnancy itself is due to the unavailability of contraceptives. Health concerns aside, she highlights that purdah restrictions (as woman usually do not come in proximity with unrelated males and hence cannot stand in line to receive relief packages) and absence of male family members put women at a serious disadvantage when collecting relief packages (as women often do not stand in long lines with other males to receive food packages and hence families with no male heads are often disadvantaged) which are designed with little regard to the needs of women. Finally, the author argues that the low proportion of female relief workers is an indicator of the neglect of women's needs as there is no open channel of communication for the affected women.

Relating the evidence provided by Bari (2010) for the situation of women in IDP camps with the arguments of Ghobarah, Huth and Russett (2003) above about the long term indirect health effects of civil war being more deleterious for women may lead to the conclusion that in the long run, there may be an increased number of missing women in the population due to women's quality of life in terrorist controlled areas and IDP

camps. Further, comparing the evidence of Bari (2010) with the arguments of Plümper and Neumayer (2006) on the channels through which the long term effect of conflict could lead to a reduction in the gender gap in life expectancy, shows there could be an elderly missing women problem within the IDP population of Pakistan in the long run. However, the War on Terror is too recent for the long run effects on the population of Pakistan to be evident yet.

The analysis of conflict mortality shows that the immediate impact of no conflict in the history of Pakistan has been strong enough to affect the sex ratios of the population at the time of the conflict.

4.4.3. Natural disasters

The International Disasters Database (EM-DAT 2016) compiles statistics on the number of people killed and affected by natural[56] disasters in countries around the world. The database has a record of 175 natural disasters for Pakistan from 1950-2015. The ten worst natural disasters in the history of Pakistan, in terms of the highest number of deaths, are considered first. If these disasters do not affect the sex ratios of the country then the remaining less severe disasters are not expected to affect the sex ratios of the country's population either.

Table 4-2 shows a list of these ten worst natural disasters alongside the total number of deaths, the percentage these deaths constitute of the total Pakistani population and the percentage these deaths constitute of the female Pakistani population.[57] The calculation of the percentage these deaths constitute of the total Pakistani population is based on the assumption that these disasters affect men and women equally and as shown in table 4-2, the deaths from each disasters constitute less than 1% of the population of each year.

As the literature review in this chapter would suggest, apart from famines (and none of the natural disasters in Pakistan can be classified as famines), women suffer higher mortality from natural disasters than men. The latter calculation therefore (i.e. percentage the of disaster deaths that constitute the female Pakistani population) is primarily based on the extreme assumption that all deaths from these disasters are females. For some of the disasters, additional assumptions are also made. For all disasters except the 2005 earthquake, the findings of Ikeda (1995) for mortality from the Bangladesh cyclone are used as a proxy for age disaggregated mortality patterns from these disasters. Therefore, the extreme assumption can be made that all victims of these events are women within the 20-49 age group. For the 2005 earthquake, Sullivan and Hussain (2010) use cross sectional data from the day before the earthquake, the day of the earthquake and the day after the earthquake to find that children under 5 years of

[56] A natural disaster pertains to any geophysical (e.g. earthquake, mass movement, volcanic activity), meteorological (extreme temperature, fog, smoke), hydrological (flood, landslide, wave action), climatological (e.g. drought, glacial lake outburst, wildfire), biological (epidemic, insect infestation, animal accident) or extraterrestrial (impact, space weather) hazard (Guha-Sapir, Below, Hoyois 2009). For an incident to be recorded as a natural disaster in the database at least one of four criterions must be fulfilled: ten or more people are reported killed, hundred or more people are reported affected, a state of emergence is declared, international assistance is called for (Guha-Sapir, Below, Hoyois 2009).

[57] Gender and age disaggregated data for these natural disasters is not available and not found (despite extensive research into newspaper records of these events) so assumptions are made about the manner in which they may affect the sex ratios of the population.

age and adults aged 50 years and above have suffered from a higher mortality risk on the day of the earthquake. A newspaper analysis[58] suggests that school children have been a major tragedy of the earthquake with nearly half (about 35000) of the victims being children (Koster 2005, Asghar 2006, Dawn 2015). Given this information the extreme assumption can be made that all school aged victims are girls under 5 years of age and the remaining victims are women above 50 years of age. The last column of table 4-2 shows whether these extreme assumptions of natural disasters would alter the sex ratios of the population. It is be noted that if these extreme assumptions have no impact then a more accurate distribution (which would provide a more relaxed interval and a more even distribution of mortality between men and women) would have no impact on sex ratios either.

Table 4–2

Worst natural disasters in the history of Pakistan

Year	Type	Deaths	Deaths (%total)	Deaths (%female)
2015	Extreme heat	1229	<0.01%	<0.01%
2010	Flood	1985	<0.01%	<0.01%
2005	Earthquake	73338	0.05%	0.10%
1998	Flood	1000	<0.01%	<0.01%
1993	Storm	609	<0.01%	<0.01%
1992	Flood	1334	<0.01%	<0.01%
1977	Flood	848	<0.01%	<0.01%
1974	Earthquake	4700	<0.01%	0.02%
1965	Storm	10000	0.02%	0.04%
1950	Flood	2900	<0.01%	0.02%

It is evident from table 4-2 that even under extreme conditions, each disaster has affected less than 1% of the respective female population and hence has had no impact on the sex ratios of the population for the respective year and age group. Hence, no natural disaster can explain the elderly missing women phenomenon in the population of Pakistan today.

4.4.4. Aggregated numbers

Up to this point it is clear that no single event (conflict or natural disaster) in the history of Pakistan has had a measurable impact on the sex ratios of the population. However, this does not rule out the possibility that taken together, across time, the events may have trickled down to influence sex ratios of the elderly population today, i.e. in 2015. Table 4-3 attempts this exercise by listing the cumulative impact of the events which have had a clear impact on a specific age interval.

[58] Analysis of the newspaper "Dawn". Dates: 9th - 31st October 2005, 8th November 2005, 8th December 2005, 8th October 2006, 8th October 2010, 8th October 2015. The earthquake struck on 8th October 2005 so these dates correspond to newspapers from the month of the earthquake, one and two months after the earthquake and one, five and ten years after the earthquake respectively.

Table 4–3

Trickle down effects of conflicts and natural disasters		
Event	**Impact at time of event**	**Impact in 2015**
First Indo-Pak War (1948)	3,500 men aged 20 to 44	3,500 men aged 85 to 100
Second Indo-Pak War (1965)	3,900 men aged 20 to 44	3,500 men aged 70 to 84
Storm (1965) Extreme*	10,000 women aged 20 to 49	10,000 women aged 70 to 89
Third Indo-Pak War (1971)	7,700 men aged 20 to 44	7,700 men aged 64 to 88
Baluchistan conflict (1974)	8,600 men aged 20 to 40 Civilian effect indeterminate	8600 men aged 58 to 92
Baluchistan conflict (2004-2015)	Imperceptible	-
Political turmoil in Sindh	Imperceptible	-
Earthquake (2005) Average**	17,500 boys aged 0-5 years 17,500 girls aged 0-5 years 19,169 women aged 50+ years 19,169 men aged 50+ years	17,500 girls aged 10-15 years 17,500 boys aged 10-15 years 19,169 women aged 60+ years 19,169 men aged 60+ years
Earthquake (2005) Extreme***	35,000 girls aged 0-5 years 38,338 women aged 50+ years	35,000 girls aged 10-15 years 38,338 women aged 60+ years
War in Terror (2004 – 2015)	35,170 men aged 20-44 years Civilian effects: unknown and imperceptible by age group	35,170 men aged 20-54 years
Trickle down effects in 2015: Average Scenario		
Reduction by age group: 17,500 girls aged 10-15 years = 0.19% of female population aged 10-15 years 17,500 boys aged 10-15 years = 0.17% of male population aged 10-15 years 35,170 men aged 20-54 years = 0.10% of male population aged 20-54 years 20,169 women aged 60+ years = 0.30% of female population aged 60+ years 42,569 men aged 60+ years = 0.61% of male population aged 60+ years Reduction total population: 37,669 females = 0.04% of total female population 95239 males = 0.10% of total male population		
Trickle down effects in 2015: Extreme Scenario		
Reduction by age group: 35,000 girls aged 10-15 years = 0.37% of female population aged 10-15 years 35,170 men aged 20-54 years = 0.10% of male population aged 10-15 years 45000 women aged 60+ years = 0.67% of female population aged 60+ years 42,569 men aged 60+ years = 0.61% of male population aged 60+ years Reduction total population: 80,000 females = 0.09% of total female population 77,739 males = 0.08% of total male population		

* Only the extreme effect of the 1965 storm is considered as the average effect has affected all ages of both genders and is therefore is expected to have an imperceptible impact on sex ratios of the population even as a trickle-down effect.

**Considers the impact of the 2005 earthquake affecting men and women equally
***Considers the impact of the 2005 earthquake affecting women only

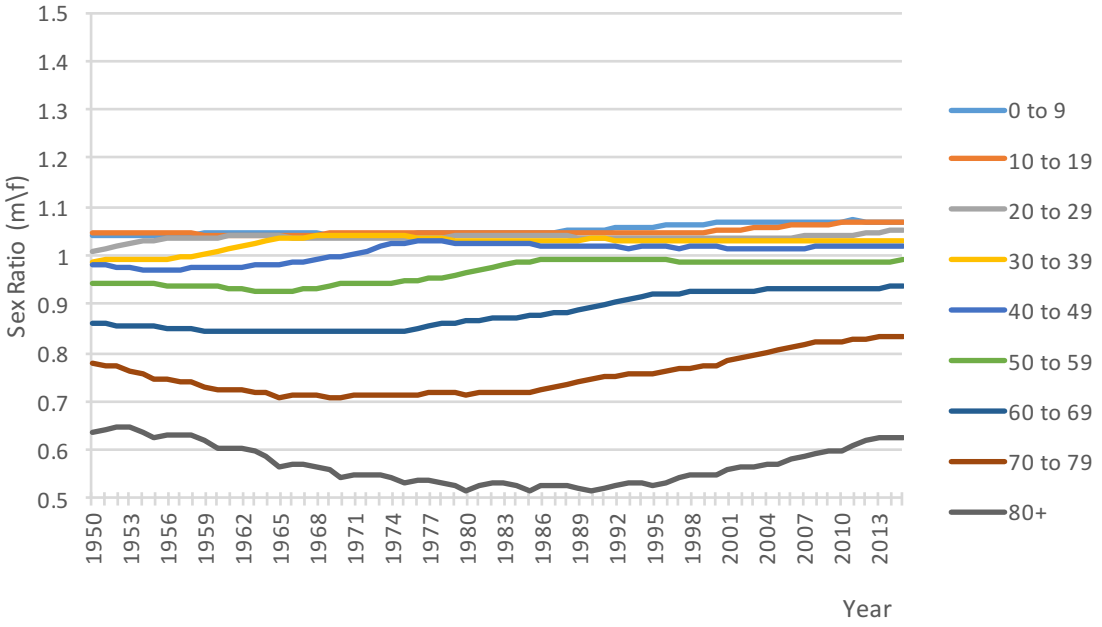
The trickle-down effect of conflicts and disasters is apparent in the last two rows of table 4-3 (like some of the conflicts, the remaining eights disasters have had too small an effect to be included in the table). It is evident that taken in aggregate and even under extreme assumptions, the conflict and natural disasters described above are too small to affect the sex ratios of the elderly population in 2015 and hence cannot be used to explain the elderly missing women phenomenon in Pakistan today.

However, it is to be noted that the fatality figures presented here include only the immediate effect of conflict and disasters. Although some of the conflicts may not have a lingering effect on the population (e.g. Indo-Pak wars) other conflicts have a clear long lasting effect (e.g. Baluchistan conflict and War on Terror). These long lasting effects may not manifest themselves directly as effects of exogenous shocks but perhaps indirectly by worsening the factors across the life course (as described by Bari (2010) about the effect of the War on Terror).

4.5. Analysis of sex ratio trends

Before analyzing the sex ratio trends of Pakistan, a brief analysis of trends in world sex ratio (used as the standard of comparison) for the period of interest (1950 to 2015) is necessary. Using data from UNDESA (2015), Figure 4.1 provides an overview of world sex ratios by five-year age groups for the given period. It is evident that for each ten-year age category from ages 0-9 till 30-39, sex ratios hover between 1 and 1.1 with each older age category having slightly lower ratios than the preceding younger age category. This is to be expected as men outnumber women maximum at birth and the number of women at each age is expected to increase as the population ages (Coale 1991). The majority of these age categories follow a roughly linear trend with an extremely shallow slope so that although sex ratios in each ten-year age category slightly increase from their 1950 level, they do not depart significantly from their initial levels. Sex ratios for the 40-49 age category remain at a level of approximately 0.98 between 1950 and 1970 but rise to 1 thereafter. Similarly, sex ratios in the 50-59 age category remain at a level of approximately 0.95 till 1986 but then rises to a level of 1. The same trend is observed from the 60-69 age category whereupon sex ratios remains at a level of 0.85 till 1995 but rise to 0.92 thereafter. In the 70-79 and 80+ age categories, sex ratios follow a U-shaped trend, for the entire period that lies between 0.7 and 0.8 in the case of the former and 0.5 and 0.62 in the case of the latter with the shallowest points between 1965 to 1986 and 1980 to 1995 respectively.

Figure 4.1: World sex ratios by age (1950 – 2015)



Two kinds of analyses are conducted with the world as a benchmark. First, sex ratios by ten-year age groups for Pakistan (figures 4.1, 4.2 and 4.3) are calculated from 1950 to 2015. The sex ratio trend in Pakistan reveals marked discrepancies with respect to the world trend. The sex ratios of Pakistan remain above the world benchmark for almost all ages and years. The exception is the 0-29 age category from 1978-2015. This indicates the presence of large numbers of missing women in the population of Pakistan (in all but the exception years). It is further evident that world sex ratios present a relatively stable time trend that yields a preponderance of women as the population ages while Pakistani sex ratios exhibit very volatile trends that, for a majority of years, depict an increase in the preponderance of men especially in old age. This shows that the magnitude of the missing women phenomenon in Pakistan, throughout history, has been (for most years) greater in older age categories. The exception appears to be the 80+ category in the initial decades after Partition where sex ratios are above the world benchmark. Perhaps the magnitude of the female deficit herein is lower than that in other age categories for comparable years. A further exploration of the figures presenting the sex ratio trends by age will make this evident.

The volatile sex ratios of Pakistani form three distinct patterns as observable in figures 4.2, 4.3 and 4.4. The timing of historical events is inserted into the sex ratio trend to assess whether these events cause marked deviations from the trend or lead to the emergence of distinct patterns in the trend in the aftermath of the event. It is clear from all three figures (4.2,4.3 and 4.4) that no conflict or disaster appears to alter the trend of sex ratios at the time of or after the event. However, in 1950 sex ratios for the 0 -9 age interval category at start at 1.09 and, for each subsequent age category, start at a higher value (e.g. 1.15 and 1.25 for age categories 10-19 and 20-29 respectively). This continues till the 50-59 age category when they reach a maximum of 1.41 and then take on a lower value of 1.35 in the 60-69 age category and even lower values in subsequent older age categories. Such high ratios in 1950 may be attributed to events before partition. This is in congruence with the analysis of Bharadwaj, Khwaja and Mian (2008, 2009) discussed earlier. The authors contend that sex ratios in Pakistan were

highly masculinized before partition and although partition may have reduced this masculinization it may not have been enough to compensate for pre-partition events. This shows that the missing women and elderly missing women phenomenon that has existed in Pakistan since before Partition continues to affect the population of Pakistan after Partition and perhaps to this day as the some of the youngest 10-year birth cohorts (e.g. 0-9, 10-19) of 1950 may form the elderly population of the country in 2015.

Figure 4.2: Sex ratios by age for three youngest age groups in Pakistan (1950-2015)

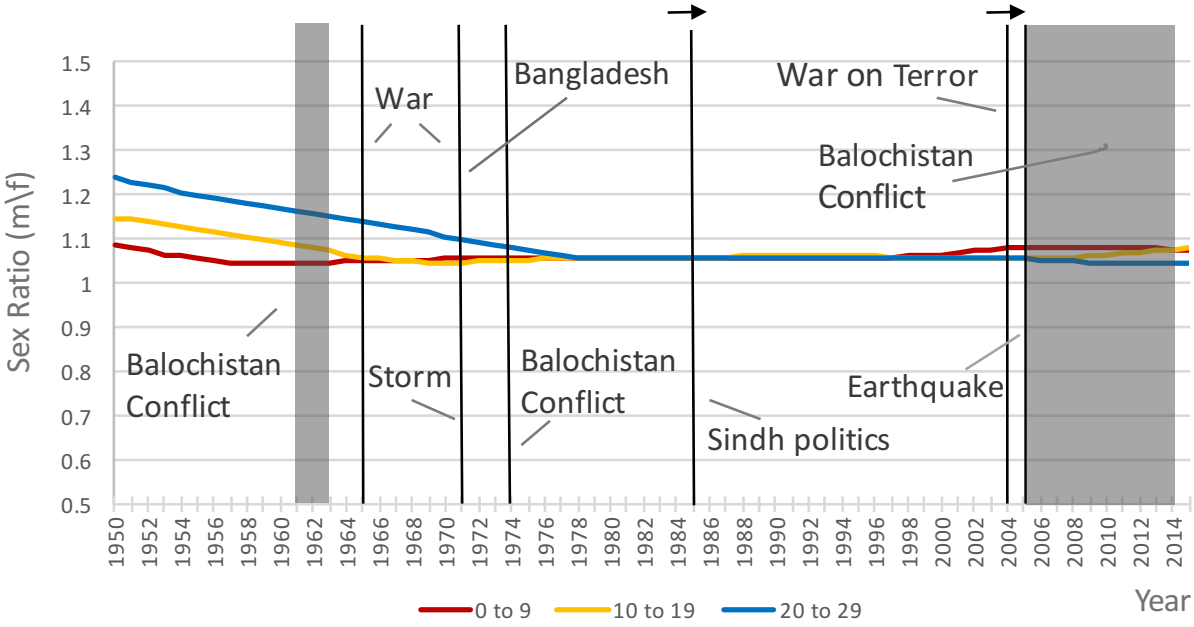


Figure 4.3: Sex ratios by age for three middle age groups in Pakistan (1950-2015)

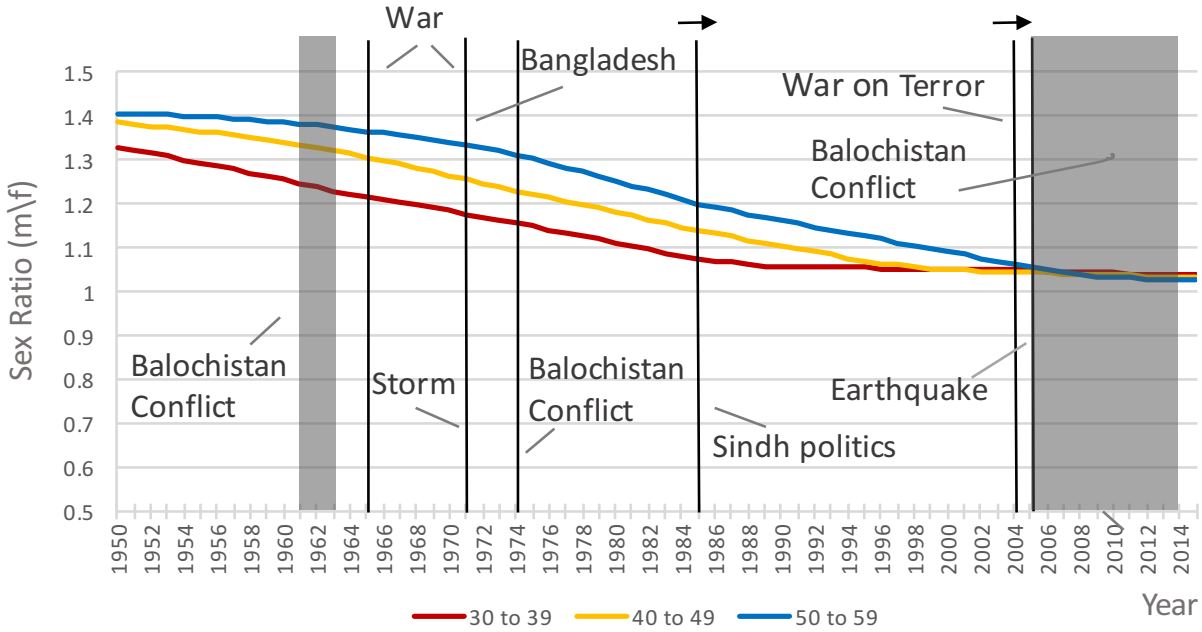
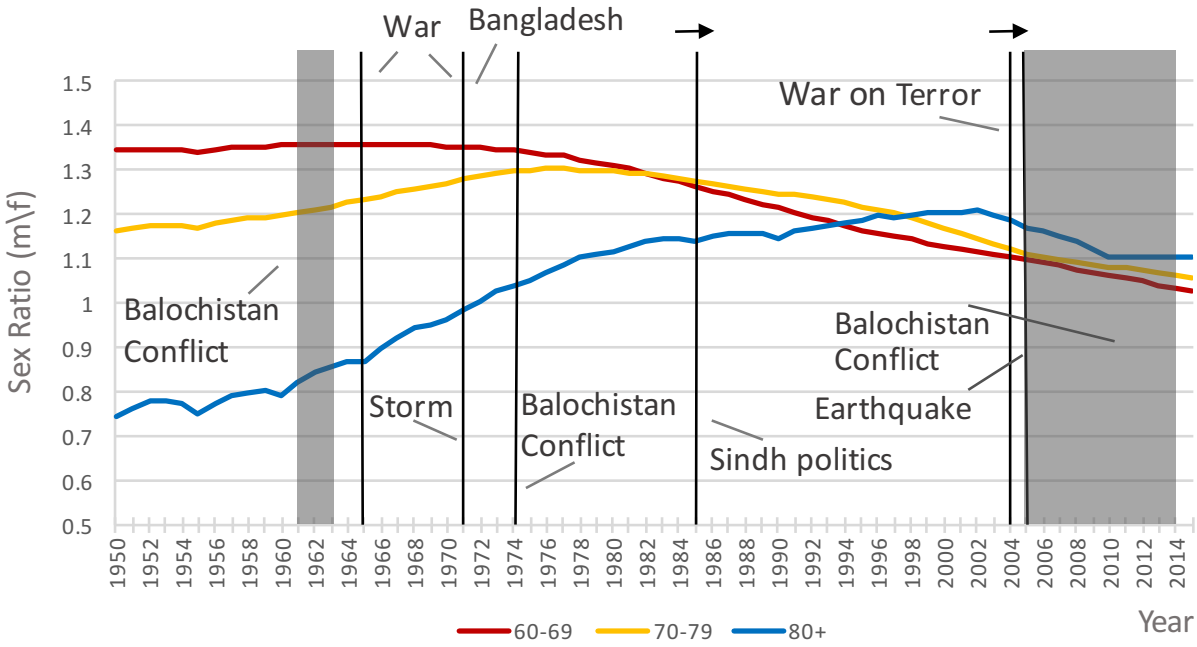


Figure 4.4: Sex ratios by age for three oldest age groups in Pakistan (1950-2015)

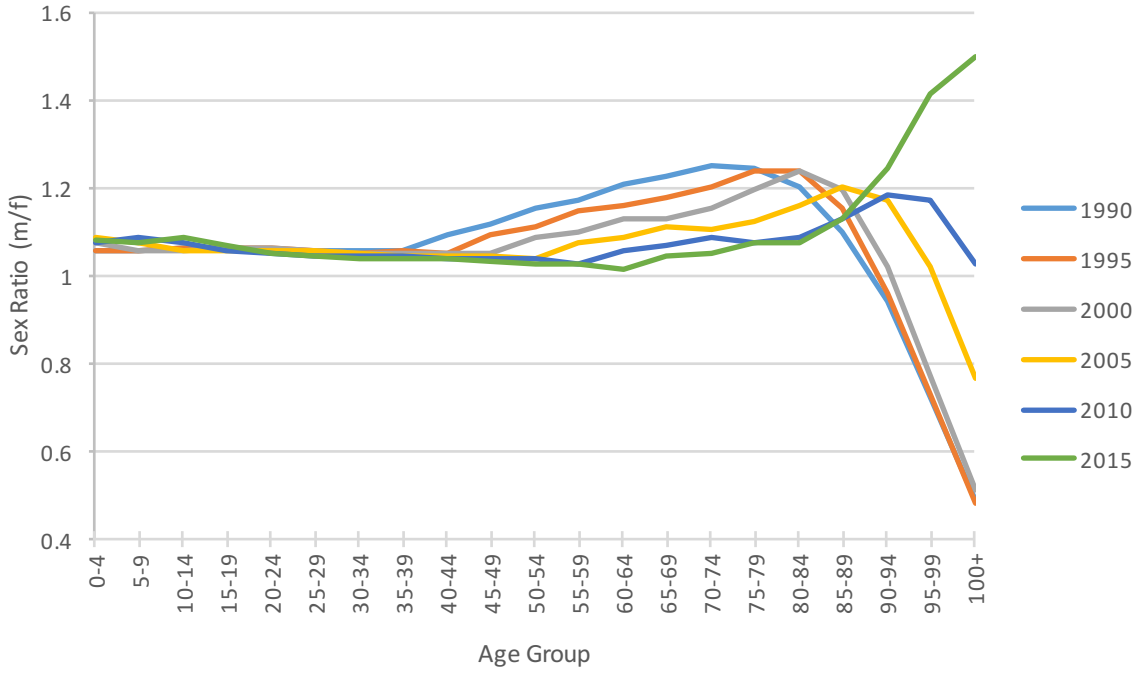


After 1950 all age groups from 0-59 (figures 4.2 and 4.3) experience a decline in sex ratios to a level of approximately 1.05/1.06. This 1.05/1.06 is then roughly maintained till 2015. The decline has two features: the rate and time period of decline. For the first three age intervals (figure 4.2) the decline is roughly linear with a very shallow slope indicating a small constant rate of decline. In the following three age intervals (figure 4.3) the linear decline becomes slightly concave indicating a decreasing rate of decline. An assessment of the time period of decline shows that each subsequent age interval takes approximately three to five additional years in steadying at the 1.05/1.06 level. This can be explained by the fact that the sex ratios in 1950 of almost every subsequent age group are higher than the preceding age group and although there have been changes in the rate of decline of sex ratios, the acceleration or deceleration has not been rapid enough to alter the prevailing pattern in ratios. These trends depict that although the number of missing women has fallen from the initial high levels in 1950, there still exist very large numbers of missing women in the population till age 59 that cannot be accounted for by any historical event (apart from Partition). This is especially true when considering that the sex ratios of all age groups converge to roughly 1.05/1.06 implying there are more missing women amongst the relatively older than the relatively younger in 0-59 population (because world sex ratios for older ages are lower than world sex ratios for younger ages).

The three age intervals from 60 to 80+ (figure 4.4) portray a somewhat different trend. In 1950 the youngest of these intervals (i.e. 60-69) has a ratio of 1.35 with the two subsequent intervals having lower ratios (i.e. 1.18 and 0.73 for 70-79 and 80+ respectively). The trend of sex ratios in the 60-69 age group differs from earlier age categories in that sex ratios stay constant at the 1950 level for a few years before decreasing concavely at first and then linearly. This linear pattern continues through 2015 when ratios reach approximately 1.02. For the 70-79 age category, ratios rise concavely till the 1980's where they peak at roughly 1.30 and subsequently decline

concavely to approximately 1.05 in 2015. A best fit line through the 80+ category would indicate a slow continuous rise till 2003 where ratios peak at 1.30 followed by a decline till 2008 where ratios stabilize at 1.10 till 2015. These trends imply large absolute numbers of missing women in the 60-79 age group throughout the history of Pakistan with a particular elevation between 1960-2000. The convergence in sex ratios of all age groups to a level of 1.05/1.07 in 2015 indicates a much higher number of missing women for older age intervals than the younger age intervals as world sex ratios for the elderly population fall below 1. Figure 4.4 shows that the situation is worst for the 80+ population (oldest old) which has the highest sex ratios in 2015 amongst all age intervals. when it should have the lowest sex ratios of all age intervals. This is somewhat unnerving because not only is this age category supposed to have the greatest excess of women in its population (being the oldest age category) but also, historically (1950 to 1992) it has had the lowest sex ratios in the elderly category (which does not necessarily mean the lowest number of elderly missing women). This means that the relatively lower sex ratios in 80+ population observed in the beginning of figure 4.4 may have been due to a pre-partition cohort effect that led to an initial relative reduction in the number of missing women in the 80+ age category but a subsequent high number of missing women upon recovery from this cohort effect.

Figure 4.5: Sex ratios by year (1990 – 2015) for all ages, Pakistan



For the second analysis (figure 4.4), the sex ratio trend for selected recent years (1990, 1995, 2000, 2010 and 2015) by five-year age groups is evaluated to obtain a comprehensive picture of the development of the missing women and elderly missing women phenomenon in the population of Pakistan. Three anomalies are apparent in these sex ratio trends. First, despite sex ratios for the three youngest age groups being roughly at par with world sex ratios till the year 2000, an increase in sex ratios in the youngest age groups (0 to 4) is discernible in 2005 which shifts to subsequently older age groups with the passage of time (i.e. 5 to 9 and 10 to14 in 2005 and 2010 respectively). Not only does this indicate an increase in the number of missing women in the younger age groups but also may imply that missing women in the future may

increase as the initial increase persists and the affected age groups get older. Second, the number of missing women in 1990 is particularly elevated for the age groups 35-94 (i.e. women born between 1896 and 1955). However, since this anomaly is concentrated in a particular age group, as the population ages the anomaly shifts to correspondingly older age groups indicating the presence of a cohort effect that leads to an increase and then decrease in missing women in the affected age groups. Consequently, as the birth cohorts born between 1896 and 1955 die, it can be expected that the missing women and elderly missing women phenomenon concentrated within these birth cohorts will disappear. Finally, the trends depicted by the years 2005 and 2010 indicate that sex ratios in the oldest population are becoming more masculinized. The sex ratio trend depicted by the year 2015 crystallizes this trend with a reversal of sex ratios from roughly below one and one to above one indicating a sudden increase in the number of missing women in the oldest old population. This reversal is particularly alarming because it is concentrated in the age group where sex ratios should be descending rapidly as evident from figure 4.1.

Three things are evident from the analysis of sex ratio trends: First, for the majority of ages and years (exception 0-29 for years 1978-2015) sex ratios in Pakistan have remained above world sex ratios indicating the presence of missing women at all almost all ages. Second, this missing women phenomenon persists and for a majority of year worsens as the population ages, pointing to a clear elderly missing women phenomenon in the population of Pakistan to the extent that sex ratios in the 80+ population in 2015 are more masculinized than any other 10-year age interval in the given year. Third, whilst the sex ratio trends in Pakistan show visible fluctuations across age groups and years, demographic events in the history of the country cannot be blamed for the elderly missing women phenomenon today and the first group of effects (i.e. factors across the life course discussed in chapter 2) need to be given greater weight.

4.6. Conclusion

This chapter assesses whether the existence of elderly missing women in the population of Pakistan today may be a result of one of two possible group effects: historical events in the history of Pakistan (conflicts or natural disasters) that may have created a deficit in the number of women that trickled down to the elderly population today. An analysis of available statistics and reports on conflicts and disasters suggests that direct deaths from conflicts and natural disasters did not affect the sex ratios of the population at the time of the event or trickle down to the population of Pakistan today (i.e. 2015).

These results are corroborated by the graphical representations of sex ratio trends which do not indicate any year when a historical event coincided with a disproportionate reduction of women in the population. The graphical analysis leads to three further conclusions: First, sex ratios are elevated at almost all age intervals indicating the presence of missing women and elderly missing women problem at almost all ages in Pakistan from 1950 to 2015 (possible exception being the 0-29 age groups from 1978 onwards where sex ratios are closer to world levels). Second, the elderly missing women problem appears to be particularly severe between 1960 and 2008. Finally, there is some indication that the elderly missing women problem may continue in the future as younger cohorts (those exhibiting a cohort effect and the youngest age groups with slightly elevated ratios) enter old age.

It follows from this discussion that demographic events have not altered the sex ratios in Pakistan and the first group effects (factors across the life course) are crucial determinants of the elderly missing women phenomenon in the country. A detailed discussion of these factors is available in chapter 2. It suffices to say that tackling the effect of these factors on missing women is a much more difficult task than overcoming the effect of specific demographic events. Whilst the effect of demographic events on missing women automatically fades (as older cohorts who have suffered the impact of an event are replaced by newer cohorts who haven't), an eradication of factors responsible for missing women is an overwhelmingly challenging task for society. Sen (1992) emphasizes that changing the behavior and norms of society first requires a recognition that there is a need for change at least by the women themselves. Even with this recognition the repercussions of the missing women phenomenon may not be rectifiable for generations.

Chapter 5 - Describing and explaining country differences in sex ratios

5.1. Introduction

The discussion in chapters 2, 3 and 4 display a hierarchical level of development: It starts from the contention that the individual life courses of men and women are differentiated by the disadvantages women may face at each stage of their life alongside intermediary forces that may lead to a missing women phenomenon in the total and elderly populations (Chapter 2). Furthermore, these disadvantages and forces display some level of historical variability i.e. they may differ by birth cohort (Chapter 3). It is further evident from Chapter 3 that for each level of historical development the extent of the female deficit in the total and elderly populations (as measured by sex ratios in old age) varies across different countries in Asia. Chapter 3 also shows that the sex ratios in old age differ across countries that do not display an elderly missing women phenomenon. For example, neither Japan nor North Korea exhibit a missing women or elderly missing women problem but the sex ratio in the total and elderly population of Japan is 0.95 and 0.80 respectively and in North Korea 0.96 and 0.61 respectively. This shows that there are some underlying generative mechanisms behind the factors, forces and exogenous shocks that may cause systematic variations in the sex ratios of the total and elderly population across all countries of the world (Mayer, "Life" 2004).

The purpose of this chapter is to unearth the genesis of global volatility in sex ratios through a two-pronged approach: First, identify variables to represent the factors, forces and exogenous shocks discussed in the preceding chapters. Second, examine these variations from a cross-national perspective. A cross-national evaluation is the most effective technique to unveil variations in generative mechanism that forge marked changes in life course outcomes (Mayer, "Life" 2004). It allows the timing, turning point and direction of change to be tested as it partly avoids the pitfalls of both intra-cohort comparisons (as a result of which the reason behind cohort differences cannot be assessed) and longitudinal studies (as a result of which the life stages of individuals beyond the stage of examination cannot be evaluated; Mayer, "Life" 2004). Hence, this chapter evaluates relevant variables from a cross-national perspective to test the empirical validity of the discussion so far i.e. whether the factors, forces and exogenous shocks affect sex ratios of the total and elderly population in the expected manner, to confirm the mechanism whereby they lead to the elderly missing women phenomenon in countries presenting a female deficit in old age.

The chapter begins by providing an overview of the data used to collect the variables followed by a description of the methods used to assess the impact of the variables. Thereafter, section 5.4 provides a detailed discussion of the relevance of the different variables to the sex ratios of the population (total/elderly). Sections 5.5 tests the correlations of these variables with respect to the sex ratios of the population (total/elderly). Section 5.6 evaluates the simultaneous impact of these variables on the sex ratios of the population through a linear regression model. Finally, Section 5.7 concludes.

5.2. Data

Data from several different international sources is collected: The World Bank Databank (i.e. the Gender Statistics database, World Development Indicators database, Health, Nutrition and Population database, Education Statistics database, Millennium Development Goals database), United Nations Organizations (i.e. the United Nations Department of Economic and Social Affairs and United Nations Development Program), OECD (i.e. the Social Institutions and Gender Index database), the World Health Organization (i.e. the Global Health Observatory database), the Institute for Health Metrics and Evaluation (i.e. the Global Burden of Disease Study) the International Labor Organization, PEW Research Center (Global Religious Futures Project), the EM-DAT International Disasters database and the Uppsala Conflict Data Program/International Peace Research Institute database (i.e. UCDP/PRIO Armed Conflict dataset, UCDP Battle Related Deaths dataset, UCDP Non-state conflict dataset).

These databases offer several variables of relevance. However, the primary consideration is whether the chosen variable is available for the majority (if not all) of the countries worldwide and especially if it is available for the countries presenting the missing women phenomenon in their total and elderly populations (as identified in chapter 3). Within this set of countries, a special consideration is made for those countries that appear to be outliers in exhibiting the phenomenon (i.e. exhibiting largest number of missing women) in old age. These conditions lead to the exclusion of several interesting variables that could have been relevant for the analysis. For example, the World Development Indicators database of the World Bank provides a measure of the proportion of women subjected to physical and/or sexual violence in the last 12 months (World Bank, "World" 2016). However, the values of this variable are missing for many countries (e.g. Afghanistan; World Bank, "World" 2016) where an analysis of the elderly missing women phenomenon is crucial would due to the magnitude of the female deficit therein Therefore, this variable is not included in the multivariate analysis.

Although the analysis is conducted for the year 2015, the reference period for which the variables are selected ranges from 2000 to 2015. The logic behind this is simple: choosing a single year, especially a year close to 2015 produces many missing values for most of the variables of interest. However, going further back in time reduces the number of missing values for a majority of the variables. For example, the contraceptive prevalence (any method, women aged 15-49) variable is not available for many countries in 2015, the number of countries for which it is available increases between 2010 to 2015 and this number of countries increases even further between 2005 to 2010 (World Bank, "World" 2016). Furthermore, in the 2000 to 2015 period, some of the countries for which the data for this variable is available in a given year do not have it for another year. For example, in the entire period from 2000 to 2015 the only year for which Malaysia has the data is 2004 (World Bank, "World" 2016). Hence, for each country values as close to the year 2015 are chosen and if the value is not available for the year 2015 earlier years are looked at i.e. 2014, 2013, 2012 and so on till the year 2000. The year 2000 is used as the lower benchmark because the Millennium Development Goals (MDGs) were adopted in this year (UN 2008). The MDG's are eight goals that all 191 UN member states agreed to try achieving by 2015 when they signed the United Nations Millennium Declaration in September 2000

(WHO 2016). These eight goals include: the eradication of extreme poverty and hunger, the achievement of universal primary education, the promotion of gender equality and empowerment of women, a reduction in child mortality, an improvement in maternal health, the fight against HIV/AIDS, malaria and other diseases, the assurance of environmental sustainability and the creation of a global partnership for development (UN 2008). It is evident that many of these goals include elements that are directly or indirectly relevant to the elderly missing women phenomenon. For example, efforts to combat HIV/AIDS, if successful, may directly reduce the number of adult missing women (aged 15-44) in Sub-Saharan Africa (Anderson and Ray 2010).

The special relevance of MDG implementation in the context of this chapter arises from the necessity to collect adequate data to monitor the timely progression towards the achievement of MDG targets (UNDESA 2015). To this end the implementation of the MDGs set in motion an unprecedented attempt to collect, compile and utilize development related data effectively (Manning 2009). For example, the Partnership for Information and Statistics for the Twenty First Century (PARIS21) was adopted in response to the United Nations Economic and Social Council's resolution about the need to help developing countries attain monitoring statistics for MDG's (Manning 2009). It is aimed at helping developing countries build policy relevant statistics to measure the various dimensions of MDGs (Manning 2009). The success of such initiatives becomes evident upon comparing data availability in the pre and post MDG phases. A comparison of data availability in the National Statistical Offices in India, Ethiopia and Ghana before and after 2000 shows that the number of censuses in all three countries increased after the year 2000. This increase is especially pronounced in the latter two countries which experienced a doubling in the number of surveys in the post MDG implementation phase (Chen et al. 2013). This reflects not only an increase in the number of surveys/censuses but also an improvement in the compilation and documentation of these surveys (Chen et al. 2013). An important factor contributing to this increase was the rise in donor funding for these censuses/survey in Ghana and Ethiopia. Although, surveys in Ghana had been donor funded in the pre-MDG era, in the post-MDG era research funding for these surveys increased substantially. Surveys in Ethiopia had been mostly reliant on domestic resources in the pre-MDG era but, in the post-MDG era, benefitted from complete reliability on donor funding for all education, health and social surveys (Chen et al. 2013). The ongoing improvement in data availability spurred by MDG implementation is also evident within the first decade and a half of the 21st century. For example, between 2000 and 2015 there was a six-fold increase in the number of surveys and censuses in the WHO/UNICEF joint program on Water and Sanitation. Further, country coverage for a subset of twenty-two official MDG indicators improved significantly from 2003 to 2014 (UNDESA 2015). As a result, while only 2% of developing countries had at least two data points for sixteen or more of the twenty-two MDG indicators in 2003, 79% of developing countries had the corresponding two data points by 2014 (UNDESA 2015). This discussion therefore shows that MDG implementation has played an instrumental role in creating a viable database even in countries where adequate data was not formerly available. Therefore, the year 2000 serves as an adequate lower benchmark as looking at years prior to 2000 will do little to improve data quality in terms of reducing the number of missing values.

5.3. Method

The variables collected from the datasets are considered with respect to two variables of interest: sex ratio of the total population and sex ratio of the elderly population. The literature review in chapters 2 and 3 shows that while substantial literature calculates the number of missing women in the total population, missing women therein are mostly attributed to being missing at the time of birth or childhood. Nevertheless, the discussion in chapter 2 elucidates that missing women exist at all life stages and old age presents the culmination of the female deficit thereby depicting the accumulation of factors that cause a female survival advantage from all life stages. Furthermore, the results from chapter 3 show that all countries of Asia that display an elderly missing women phenomenon either do so as a female deficit in old age only (with a possible cohort effect explanation for some countries only) or display a worse female deficit in old age than in the total population. Therefore, the discussion for far presents a dichotomy between sex ratios of the total population and sex ratios of the elderly population and the manner in which the variables interact with each sex ratio in each population category may be expected to differ. Sex ratios of the total population aggregate the sex ratios of all life stages of the population and therefore take account of the impact of selected variables on sex ratios of all life stages simultaneously. Sex ratios of the elderly (60+) population extract the impact of the variables on the oldest life stage – after the population has experienced the impact of the variable in all preceding life stages – and therefore allows the effects on the sex ratios to be identified when the population is most vulnerable. Therefore, a comparison of the impact of selected variables on these two sex ratios not only reveals the immediate association of factors and forces on the masculinization of the population but also allows an identification of the lagged association of the variables that continue to exacerbate sex ratios through the culmination of experiences from all previous life stages.

The chapter starts by discussing the relevance of each variable with respect to the sex ratios of the population (total/elderly) and organizing these variables into eleven broad categories based on what the variables represent. This categorization facilitates an understanding of the relevance of the variable to the sex ratios of the population (total/elderly) in terms of its role as a factor across the life course, intermediary force or exogenous shock. This is followed by calculating the correlations (Pearson, Spearman and Kendall) of each variable with respect to the sex ratios of the population (total/elderly). The main purpose of this is to assess the independent association of each individual variable with the variables of interest to test whether the theoretical underpinnings about the behavior of each factor, force or exogenous shock (discussed in earlier chapters, primarily chapter 2) represented by the variable is correct. As the factors and forces that these variables represent may reinforce or contradict each other the final part assesses the simultaneous impact of all variables on the sex ratio of the population (total/elderly). In order to do so the problem of multicollinearity is first addressed by grouping together the mostly highly correlated variables using exploratory factor analysis. Then the ordinary least squares (OLS) regression model is used to assess the simultaneous impact of these variables on sex ratios of the population (total/elderly).

5.4. Variable description

The variables are classified according to eleven broad categories: economic development indicators, population composition indicators, legislation indicators, early childhood indicators, non-reproductive indicators, reproductive indicators, disease environment, survival expectations, education indicators, labor force participation indicators and demographic shock indicators. The discussion that follows provides a description of the variable (source, definition) and how it is relevant to the respective category and consequently the sex ratios of the population (total/elderly).

5.4.1. Economic development indicators

Several variables are used to assess the impact of economic development on sex ratios of the population (total/elderly). These include: Goss National Income (GNI), GNI per captia (GNI/capita), the Gini index, public health expenditure, sanitation, ratio of urban to rural population (urban/rural) and the Gender Development Index (GDI). The first six variables were obtained from the World Bank databases. The GNI variable is defined by the World Bank ("World" 2016) as the "gross national income, measured in international dollars converted to purchasing power parity rate." The gross national income is defined by the World Bank ("World" 2016) as the "sum of value added by all resident producers plus any product tax (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income from abroad)." The GNI/capita is the GNI of a given country divided by the midyear population of the respective country (World Bank, "World" 2016). The Gini index is defined by the World Bank ("World" 2016) as a "measure of the extent to which the distribution of income (or in some cases consumption expenditure) amongst individuals or household within an economy deviates from a perfectly equal distribution." It captures the degree of income inequality in a country with a value of 0 indicating perfect equality and a value of 100 indicating extreme inequality (World Bank, "World" 2016). The variable public health expenditure represents the spending from government, external borrowing, grants and social health insurance funds on the provision of curative and preventive health services, family planning and nutrition activities and emergency aid (except water and sanitation; World Bank, "World" 2016). The variable sanitation refers to the percentage of population in a given country with access to improved sanitation facilities (these facilities include flush/pour flush, ventilated and improved pit latrines, pit latrines with slab and composting toilet; World Bank, "World" 2016). This variable is a measure of hygiene to gauge the extent to which sanitation facilities ensure the separation of human excreta from human contact (World Bank, "World" 2016). The urban/rural variable has two components: The urban variable is defined by the World Bank ("World" 2016) as "the proportion of population living in urban areas as defined by national statistical offices[59] in the given country. The rural variable is obtained from the urban population statistic by calculating the proportion of population in a country that does not dwell in urban areas (World Bank, "World" 2016). The Gender Development Index (GDI) was obtained from the United Nations Development Program (UNDP) database. This index is the ratio of the female human development index to male human development index and therefore is a

[59] The definition of urban and rural varies across countries. On average, a community with a population greater than 1000 individuals is considered urban but the size of the locality and the presence of certain types of infrastructures may also matter (World Bank, "World" 2016).

composite measure of the gender gap along the three dimensions of the human development indices: life expectancy, years of schooling (mean and expected) and GNI per capita (UNDP 2015).

There are three general theories that explain the relationship between economic development and gender inequality (i.e. the general well-being of women and the position of women relative to that of men; Forsythe, Korzeniewicz and Durrant 2000). Forsythe, Korzeniewicz and Durrant (2000) provide a brief summary of these theories. The first approach, called the modernization neoclassical approach, argues that differences between men and women are primarily a result of differences in human capital investment (e.g. education, occupation, skills) and the extent to which one gender (i.e. male) exploits this advantage versus the other (i.e. female). Economic growth therefore undermines this unequal exploitation of human capital investment by allowing modernization to erode traditional structures that block women's participation in skill acquisition and elevating them to the same position as men. The second approach, called Boserup's thesis and Women in Development, suggests a curvilinear relationship between economic development and gender inequality (Forsythe, Korzeniewicz and Durrant 2000). This approach argues that at initial stages of economic growth, inequality between men and women increases because growth leads to a polarization and the hierarchizing of male and female roles (which is assumed to not exist in pre-industrial societies) which increase the gender gap (especially in the labor market) between the two sexes. However, after the initial stage, the process characterized by the modernization and neoclassical approach comes to the fore and gender inequalities between men and women are swept away by modernization. This approach underscores that the inequalities reinforced at the initial stages of economic growth create a scarcity of women in the process of economic development which perpetuates the demand for women thereby elevating their position and eradicating gender inequality. However, Boserup thesis emphasizes that economic development is not the only factor that promotes the equality of women with cultural and traditional factors (e.g. patriarchy and power relations within the family) having very influential roles to play. The final approach summarized by Forsythe, Korzeniewicz and Durrant (2000), also known as the critical feminist and gender and development approach, is in opposition to the previous two approaches and emphasizes that economic development increases the vulnerability of women for two reasons. First, institutional arrangements (e.g. patriarchy, family structure, labor force participation, gender discrimination and property laws) are immune to the forces of economic growth. Second, economic development exacerbates existing inequalities by widening the gender gap in education and wages, abandoning the household model of production and excluding women from various spheres of activities (e.g. the scarcity of women in positions of leadership and authority).

In the context of the missing women phenomenon, Duflo (2012) provides five reasons why economic development may enhance the position of women in society and consequently lead to a reduction in sex ratios. First, economic development, on average, relaxes the monetary constraints on households who survive at the subsistence level of income and are therefore forced to make daily decision about allocating scarce resources between sons and daughters and men and women. This is pertinent with the discussion in earlier chapters: chapter 2 shows that one of the prime causes behind missing girls is neglect in food and healthcare; the study by Das Gupta and Shuzhuo (1999) described in chapter 4 shows that during times of famine in China the number of

missing girls increased due to increased scarcity of resources and allocation of these limited resources in favor of sons. Second, economic development may reduce the number of missing women at the young adulthood stage by dampening the effect of maternal mortality. As countries develop, the level of fertility falls (thereby reducing women's exposure to maternal risks) and access to technology and healthcare (that reduces the risk of maternal mortality) increases. This is directly related to the findings of Nadarajah (1983) discussed in Chapter 2, where reductions in fertility and improvement in maternal care significantly reduced the number of missing women from maternal causes in Sri Lanka. It further points to the disadvantages associated with inability of women to access healthcare in a timely manner (discussed in the young adulthood section in chapter 2). Third, increasing the valuation of women as daughters provides incentives for parents to invest in their future. Using the example of female labor force participation, the author contends that when parents see greater opportunities for their daughters to participate in the labor market and expect higher earnings for them in the future, they are more likely to invest in their education. She contends that the availability of factory work for women in both China and Mexico and the outsourcing of jobs in India led to the advancement of women in these countries (Duflo 2012). Education may also create greater opportunities for women to participate in formal jobs in the economy rather than being secluded to the informal sector that has lower pay but perhaps more flexible working hours (Duflo 2012). Some of the disadvantages of being confined to the informal sector of the economy, such as poor working conditions and low pay, are explained in the adulthood section of chapter 2. Fourth, economic development may free up women's time not only due to a reduction in the number of children to care for but also (and especially) because of the greater amenities provided by development (e.g. electricity, availability of appliances). This may directly improve the well-being of women by reducing their burden of household responsibility and/or indirectly by reducing the opportunity cost of their time (for e.g. chapter 2 discusses that women may not spend hours traveling to and waiting at medical facilities for health related concerns because this entails neglecting their domestic chores). Finally, Duflo (2012) argues that economic development enhances the rights of women at the household level from two perspectives. First, economic development increases technological progress which prioritizes human capital investment as a result of which men are willing to surrender some of their rights to women to ensure a better education for women (Duflo 2012). Second, with fertility decline, the father's role as a husband (in which he wants to retain all the power) competes with his role as a father (where he wants to protect his daughter from his future son in law). With continued economic development and fertility decline the latter proclivity dominates and families invest increasing resources in their daughters' education and well-being (Duflo 2012).

The Gross Domestic Product (GDP) and/or Gross National Income (GNI) have been used in several academic studies as a measure of economic growth or development in a given country. For example, when cross-nationally assessing the effect of gender inequality in the labor market (reflected in women's lower wages) on economic growth from 1975-1995 in semi-industrialized middle income countries, Seguino (2000) uses GDP growth as an indicator of economic growth over the prescribed period. Another example is provided by Klasen (2000) who uses the average annual compounded growth rate in GDP per capita from 1960-1992 as a proxy for economic development to assess how gender inequalities in education and employment reduce the level of economic development through several channels (e.g. fertility, child mortality). A third

example is provided by Knowles, Lorgelly and Owen (2002) who use the long run steady state level of GDP (i.e. the average GDP per capita for each year) to assess the long run impact of gender gap in education on output per worker and the subsequent consequences for economic development for a cross section of countries from 1960-1990. Ghaida and Klasen (2004) give examples of several other studies that adopt GDP or GDP/capita as a measure of economic growth on development when assessing the impact of gender inequalities stemming from various factors but especially education. These studies would justify the use of GDP or GNI per capita as an indicator of economic development in the analysis of missing women. However, in this analysis the GNI/capita rather than the GDP/capita is used. The use of the per capita alternative may be obvious. Many of the countries presenting the missing women phenomenon (e.g. China, countries in South Asia) have very large populations so ignoring the size of the population would give an unrealistic presentation of the effect of GNI at the population level. Moreover, it is important to use GNI rather than GDP because GNI incorporates the receipt of remittances which may have an impact on the missing women phenomenon. For example, Mansuri (2006), using data from Pakistan Rural Household Survey (2000-2001), finds that families in rural Pakistan receiving remittances from domestic and international male emigrants (and therefore having a more relaxed household budget) are less likely to discriminate against daughters in the allocation of basic food resources as female children from these families' fare better on malnutrition indicators compared to female children from non-emigrant families.

Duflo's (2012) arguments appear to hinge on the fact that all members in a society are benefitting equally from the effects of economic development – for example all members of a country are lifted from subsistence levels of poverty. This may not necessarily be true and while the GNI/capita may capture growth/development as a function of the population, it doesn't capture whether the entire population equally benefits from this growth so that countries may have high GNI's per capita but the benefit of this may be limited to a segment of the population (as may be the case, for example, at early levels of economic development; Barro 2000). If a high level of GNI/capita are accompanied by a highly unequal distribution of income, they would not be successful in benefitting the majority of the population which would for example continue to face constraints in resource allocation. The Gini Index is therefore included in the analysis to complement the GNI and GNI/capita variables as it provides a measure of inequality in any given country. The Kuznet's curve, which describes the U-shaped relationship between income inequality and economic growth within a country succinctly captures the importance of including the Gini Index: economic development first leads to an increase in income inequality followed by a period of stabilization and eventual decrease, as countries continue to achieve higher levels of development (Barro 2000)[60]. Therefore, including the Gini index measures whether the benefits of economic development are distributed equally across different segments of the population.

The public health expenditure variable captures whether the health effects of economic development have a beneficial impact on women. Given that neglected health of female children is a prime cause of missing girls and financial constraint may be one reason

[60] Of course inequality may persist despite rapid levels of industrialization and development (Aghion and Williamson 1998) but the Kuznets curve is only used as an example to show that high levels of development may be accompanied by income inequality.

behind female neglect in access to medical treatment at all ages, the public health expenditure variable may directly ameliorate the survival prospects of women. There is some evidence from literature to suggest that increase in public health expenditure could reduce the mortality rates of women. For example, Farhani, Subramanian and Canning (2010), using data from the Indian National Family and Health Survey (1998-199), find that for India, an increase in public health expenditure by 10% at the state level reduces the average probability of death in the given state by 2% with the mortality reduction being most prominent for the young (under 18 years of age), the elderly (40+ years of age) and for women, amongst poorer households and amongst households that lack adequate sanitation facilities. Furthermore, Kumar, Ram and Singh (2013), using the Indian National Family and Health Survey (1992-1993, 1998-1999 and 2005-2006), find that contingent upon mother's education and age at the time of birth of the child, yearly state health expenditure in India has a marginal effect on reducing mortality in children under five years of age. The authors contend that this result holds despite not only the majority (70%) of the health expenditures being borne privately by the patient's families but also the large variations in public health expenditure across the different states of India. Therefore, they conclude that public health expenditure could have a stronger impact on infant and child (under 5) mortality rates in India if states with low investments on this domain increased their levels of public health expenditure.

The variable sanitation is included in the analysis to assess the extent to which the infrastructural development that accompanies economic development meets the basic needs of society and in particular women. Several authors discuss the effects of sanitation in terms of both its health and non-health effects. In the health sphere Brewster et al. (2006) argue that lack of sanitation coupled with poverty increases the incidence of diarrhea, cholera, typhoid, parasitic infections, worm infestations and schistosomiasis among school aged children. Cairncross (2003) lists studies from India, Brazil and Gambia that directly link the incidence of some of these diseases (worm infestation, diarrhea and trachoma respectively) to the absence of a toilet facility and hence the exposure to germs from open defecation. The discussion in chapter 2 in the childhood section highlights that the primary reason for missing girls is unequal distribution of health and nutrition resources between boys and girls. By increasing the burden of infectious diseases among children, the absence of sanitation facilities indirectly increases the number of missing girls in society. However, the health effects may affect women directly as well. Women's need for privacy may mean that they do not want to relieve themselves openly during daylight hours and therefore control themselves till after dark (Brewster et al. 2006). For example, Bapat and Agarwal (2003) find that in slums of large Indian cities where no proper toilet facilities are available, women due to their reluctance towards defecation in the open during daylight hours, control themselves till after dark to protect their privacy and often eat little during the day as a result (Bapat and Agarwal 2003). Such practices may cause women to suffer from health problems, for example in the form of gastric disorders (Brewster et al. 2006). Furthermore, as women often go alone in the dark to relieve themselves, the lack of appropriate sanitation facilities within the household may often be linked with sexual violence (Brewster et al. 2006, Pearson and Mcpherdan 2008). In the non-health sphere, Pearson and Mcpherdan (2008), argue that the most frequently discussed benefits of sanitation pertain to female education. They contend that the installation of adequate sanitation facilities that provide girls privacy significantly reduces

absenteeism and dropout rates from school especially after puberty (Pearson and Mcpherdan 2008).

The urban/rural variable may affect sex ratios in three ways: via its impact on economic development via the gendered patterns of migration and urban/rural settlement and via the effect on missing women outlined in chapter 2. The inextricable link between urbanization and economic development can be summarized in two points: First, as economies develop, there is a change in the demand structure of the population which leads to a decline in the relative and absolute importance of the agricultural structure and an increase in the relative and absolute importance of the manufacturing and services sector, so people move away from agricultural areas to urban centers (Moomaw and Shatter 1996). Second[61], the increased division of labor associated with economic development leads to the development of a core (i.e. urban) and a periphery (i.e. rural). The concentration of economic and commercial services in the core and the openness of the economy makes relocation to the core more profitable (e.g. in terms of transportation costs) and results in the concentration of skill therein (Moomaw and Shatter 1996, Henderson 2003). Therefore, the sex ratios of highly urban populations may be affected in the same manner as economic development (i.e. through the arguments outlined by Forsythe, Korzeniewicz and Durrant 2000 and Duflo 2012). The sex ratios in urban areas may differ from rural areas due to the gender selectivity inherent in the domestic migration patterns within a given country. Tacoli (2012) argues that domestic (i.e. internal) migration is itself determine by the level of urbanization in a country: in highly urbanized countries (e.g. those in Latin America) population movement is predominantly between urban areas whereas in less urbanized countries (e.g. those in Sub-Saharan Africa) population movements occur between predominantly rural areas. Using data disaggregated by sex from 46 countries worldwide, Tacoli (2012) finds that women predominate rural-rural population movements in 26 of the countries with all 26 of these countries concentrated in Africa and South Asia and women's migration resulting from marrying outside their natal village. In the case of urban-urban and rural-urban population movements, Tacoli (2012) finds that although there has been a recent increase in the feminization of these movements (especially with more women coming to urban centers as a result of conflict), there are wide discrepancies around the world in the sex ratios of urban areas: In many Sub-Saharan African countries (for which data is available) men outnumber women in urban centers; In South Asian countries the masculinized sex ratios of the population at the national level are also reflected at the urban level (especially in India where many cities that have a population of more than a million have sex ratios of 1.16); In South America women outnumber men in urban centers (with the reverse in rural areas); In Southeast Asia there is an increasing trend for women to migrate to urban centers in search of employment which has now started to reflect in the urban sex ratios. This shows that urbanization may be a crucial determinant of sex ratios but with varying impacts in different regions of the world. The effect of urbanization on missing women can further be understood via its categorization as an intermediary force in chapter 2. The discussion elucidates various mechanisms through which urbanization may affect sex ratio at birth (via accessibility to sex selection technology), in young adulthood and adulthood and old age (e.g. via access to health care services).

[61] The second argument is a brief outline of the Core-Periphery model first developed by Krugman in 1991 in his New Economic Geography Model (Henderson 2003).

The GDI is incorporated in the analysis to measure the effects of economic development alongside a human dimension. This index incorporates the same variables as the human development index (HDI) but emphasizes the inequality between men and women on HDI parameters (Kumar 1996). The HDI was constructed by the United Nations in 1990 to enunciate that income alone cannot serve as an adequate measure of a country's level of development and people's capabilities should be accounted for when gauging a society's level of success (Neumayer 2001, UNDP 2015). One of the most significant contributions of HDI is its success in proving that income levels and trends in GDP growth may deviate substantially from levels and trends in human development (Dervis and Klugman 2011). However, since the HDI does not incorporate gender differentials on the indices it measures (i.e. life expectancy, education and GNI – the same as those for GDI, but without a gender element; UNDP 2015), it does not incorporate how capability differences between men and women may be accounted for by different levels of development across nations. Hence, to account for gender disparities in human capabilities, in 1995 the United Nations introduced the GDI by measuring the gender gap along the three dimensions of HDI (Jäger and Rohwer 2009). Therefore, the larger the gender gap between men and women in the achievement of any three dimension, the greater the difference between HDI and GDI (Jäger and Rohwer 2009). A study from India may be used to demonstrate the utility of including this variable in the analysis. The discussion in Chapters 2 and 3 has already established that not only does the missing women phenomenon exist in the country but also there are wide discrepancies between the Northern and Southern States with Northern States (especially Punjab and Haryana) exhibiting the phenomenon to a much greater extent than the Southern States. Kumar (1996) calculates GDI across different states of India and assesses the extent to which it differs from the HDI for each state. She finds that the states with the highest gaps between GDI and HDI are Punjab, Haryana, Uttar Pradesh and Bihar. She contends that these are the five states in India which have the highest sex ratios in the population therefore the gap between GDI and HDI (due to the significantly lower value of GDI) may be accounted for by the gap in the capabilities at least in the first four states (especially Punjab and Haryana where income levels are high overall and systematic bias against women on all fronts has been documented) whereas in Bihar the high gender gap in income may be simulating the results (Kumar 1996). Therefore, the GDI not only allows for the impact of human capabilities on economic development but also takes measure of gender inequality on these capabilities.

5.4.2. Population composition indicators

Ten variables are used to measure the impact of population composition on the sex ratios of a given country: the migrant sex ratio, the ratio of dependency ratio and eight variables on the religious composition of the population. Data for migrant sex ratio (female/male) was obtained from the United Nations Department of Economic and Social Affairs (UNDESA)[62]. This variable is calculated by dividing the number of female immigrants by the number of male immigrants. Data for the ratio of dependency ratio was obtained via the World Bank database. It is calculated by dividing the old age dependency ratio with the youth dependency ratio. The old age dependency ratio is the ratio of older dependents (i.e. ages 64+) to the working age population (i.e. ages 15-64) and the youth dependency ratio is the ratio of younger dependents (under 15 years of

[62] The data section in Chapter 3 provides a detailed explanation of migration data.

age) to the working age population (World Bank, "World" 2016). The ratio of dependency ratios therefore represents the ratios of older dependents to younger dependents. The remaining eight variables were obtained from the Pew Research Center database. The Pew Research Center provides a profile of each country according to the percentage of its population following a particular religious' belief. It divides followers into eight categories: Christians, Muslims, Jews, Hindus, Buddhist, Folk religion adherents, Unaffiliated religion adherents and Other religion adherent. The first five categories are self-explanatory. The Pew Research Center ("Folk" 2012) describes Folk religion as a traditional religion which is closely tied to a particular people, ethnicity or tribe and includes (but is not limited to) African traditional religions, Chinese traditional religions, Native American religions and Australian aboriginal religions. The Pew Research Center ("Religiously" 2012) uses the Unaffiliated category to include atheists, agnostics and other people who do not identify with any particular religion (but may believe in God). The Pew Research Center ("Other" 2012) describes the Other Religions group as residual category that includes all religions not included in the other seven categories and often not measured in census and surveys separately. Examples of such religions include Bahaism, Jainism, Shintoism, Taoism, Zoroastrianism and several other religions (Pew Research Center "Other" 2012).

The importance of including the migrant sex ratio may be evident from chapter 3. The variables of interest here i.e. sex ratios of the population (total/elderly) are calculated with the inclusion of the migrant stock. Coale (1991) argues that the migration is one of three factors that affects the sex ratio of populations in a given country and cites the example of male biased immigration in the United States between 1900 and 1910 as being responsible for raising the ratio of males to female by 0.043 (from 1.017 to 1.060) in 1910. The starkest contemporary example of this, as discussed in Chapter 3, is provided by the GCC countries of Western Asia where immigrants comprise 47% of the total population of these countries and women comprise only 28.4% of the total immigrant population in these countries (Shah 2013). The 71.6% of immigrant men clearly played some role in distorting the sex ratios in the GCC countries, as evident from the results in Chapter 3.

The ratio of dependency ratio variable attempts to capture the age structure of the population. According to Coale (1991), the sex structure of the population is contingent on its age distribution. Countries that have a younger age population age distribution have lower population sex ratios than countries that have an older population age distribution. This is because in each birth cohort, males outnumber females the maximum at birth after which the biological female advantage (in societies without the missing women phenomenon) ensures a gradual female preponderance which increases as the cohort ages (Coale 1991). As evident from the trends in world sex ratio trends (1950 – 2015) discussed in chapter 4, the argument continues to work within the elderly category as well so that, in the absence of an elderly missing women phenomenon, the younger elderly population (i.e. in 60+ age category) should be less feminized than older elderly population (i.e. 80+ age category).

The inclusion of religion as a variable of analysis is important for two reasons. First, existing literature that describes trends in missing women across countries shows that the countries where this phenomenon is predominant (i.e. specific countries in Asia and Sub-Saharan Africa) fall under five religious categories: Muslims, Hindus, Buddhists Folk religions and Other religions (Bongaarts and Guilmoto 2015, Klasen and Wink

2003, Pew Research Center 2016). The findings from chapter 3 also support this view. Second, there is a distinction between religions that cause elevate sex ratios at birth and sex ratios at older ages. The discussion in chapter 2 includes religion as an intermediary force to elucidate that it can be a predictor of not only fertility levels but also sex selection decisions. It is evident from this discussion that Muslims and Christians from Asian countries (exhibiting the missing women phenomenon) exhibit lower/biologically normal sex ratios at birth compared to adherents of other religious faiths from Asian countries (also exhibiting the missing women phenomenon). The results of chapter 3 further show that the female deficit in the total population and especially the elderly population is relatively high amongst predominantly Muslim Asian countries (Pew Research Center, "Muslims" 2012). This suggests that almost all Asian religions cause elevated sex ratios in the total and/or elderly population but the impact of a given religion may differ by life stage.

5.4.3. Legislation indicators

Seven variables are used to assess the impact of legislation on the sex ratios of the population (total/elderly) of a given country: laws on domestic violence, laws on rape, laws on sexual harassment, laws on widow inheritance, laws on divorce, female seats in national assembly and female legislators/senior officials/managers. Data for the first five variables is obtained from the OECD SIGI database. The first three variables are ordinal in measure and take on five distinct value from 0 to 1 – i.e. 0, 0.25, 0.5, 0.75 and 1 – where 0 indicates the presence and perfect implementation of laws to address domestic violence, rape and sexual harassment, 1 indicates the complete absence of legislation and laws to deal with these issues, and values in between (0.25, 0.5 and 0.75) indicate graded measures of imperfect implementation of these laws (OECD 2014). The widow inheritance and divorce variables measure whether widows/widowers and men/women have the same rights in terms of widow inheritance and divorce respectively (OECD 2014). Both variables are also ordinal and assume three values: 0 (perfect equality in inheritance/divorce), 0.5 (perfect equality by law in inheritance/divorce but some inequality rooted in custom/religion) and 1 (legal inequality in inheritance/divorce or widows/women have no inheritance/divorce rights at all; OECD 2014). Data for the latter two variables is obtained via the World Bank databases (2016). Female seats in national assembly refers to the percentage of parliament seats in a single or lower chamber held by women (World Bank, "World" 2016). Female legislators/senior officers/managers refers to the percentage of legislators, senior officials and managers who are women (World Bank, "World" 2016).

The first five variables measure the extent to which the legal institutions in a given country promote and protect the interests of women. The prevalence of laws on the five fronts indicated here directly shape the well-being of women. The role of violence in elevating female mortality has already been explained in the young adulthood section of chapter 2. The OECD SIGI scale of measurement is the best way to capture the imperfect way in which these laws are implemented. In many developing countries, authorities often aid the perpetrator in controlling and demeaning the victim especially in intimate partner relationships, where even when preventive laws exist, domestic violence against women is often considered the norm and not prosecuted under the law (UNICEF 2000). In some cases, as in that of South Asia (e.g. India, Pakistan Bangladesh), the law either directly discriminates against women or creates a contradiction that renders the authorities useless in disputes especially at the household

level (Niaz 2003). For example, the law in Pakistan inadequately protects women against domestic violence by not explicitly prohibiting domestic violence: while serious acts of domestic violence may be prosecuted as crimes against the individual (e.g. as aggravated assault or murder) the absence of a legal clause for domestic violence implies that charges levied against the husband in civil or criminal court are often dismissed as private or family matters rendering no justice to the victims (Niaz 2003). Hajjar (2004) argues that in Muslim countries across Asia and Africa the incorporation of religious tenets into state laws often guarantees men impunity in domestically abusing their wives. She gives three ways in which the Sharia law is embedded into State laws: first, the Shariah and State laws may co-exist independently, second, the State may include the principles of Sharia in its laws; third, the State laws may be entirely based on Shariah laws. Although the laws are implemented differently across countries, in all cases the interpretation (or misinterpretation – a result of culture rather than religion; Doucki et al. 2003) of these laws leads to the subservience of women and acceptance of domestic violence against women while subverting the efforts of those acting to protect the position of women (Hajjar 2004). Hence, the graded scale through which the OECD measures laws against domestic violence, rape and sexual harassment attempts to capture the variability across nations not only in the legal aspects of drafting and implementation but also the traditional and social variability in the acceptance of these laws. A similar argument may hold for laws on widow inheritance and laws on divorce. Chapter 2 provides a detailed discussion of the financial vulnerability that widows are exposed to (partly as a consequence of not being able to inherit their husband's assets) and how this exacerbates a life time of existing disadvantages. It further elucidates how a change in inheritance legislation, that provides women with a monetary bedrock, may improve the position of women in the marital household. Legislation that guarantees widows their husbands inheritance may work in a similar manner by providing women with a strong asset base to overcome the survival disadvantages associated with financial vulnerability. Laws on divorce are included in the analysis to complement the laws on widow inheritance variable by serving as an indicator of the strength pf patriarchal institutions. Countries that guarantee men and women the same divorce rights may be expected to exhibit lower levels of son preference, daughter devaluation and female subordination.

The importance of including the female seats in national assembly variable is embedded in the fact that the United Nations has prioritized increasing the percentage of female shares held in parliament as one of its millennium development goals (Kabeer 2005). Women's parliamentary representation symbolizes the decision making power and role of women in the political arena and their participation in legislative affairs (Kabeer 2005). Women are underrepresented in politics in almost all areas of the world (Kabeer 2005). The highest female participation in national assembly is in the Nordic countries where women hold 40% of the seats in national parliament and the least representation is in in the Arab and Pacific Island States (excluding Australia and New Zealand) where the comparative estimates are 6.7% and 3.2% respectively (Karam 2005). Norrison and Ingelhart (2001) provide three explanations for the low representation of women in politics: structural factors, nature of political institutions and cultural factors. Structural factors refer to the level of female socioeconomic development (i.e. the occupational, educational and socioeconomic status of women) and the proportion of women in professional and managerial positions in a given country. The nature of political institutions refers the features of the political system (e.g. proportional representation in elections and gender quotas) and whether they allow for the equal representation of

women in politics. It is based on the premise that the type of political system is the primary deterrent in women's access to political career and changing the rules of the system is the most effective way to enhance the participation of women in politics. One example of political institutions provided by the authors is the level of democratization so that higher levels of democracy promote greater participation of women in politics. Cultural factors include inegalitarian gender norms that prevent women from participating not only in political life but also in the public sphere. Some of these factors have been discussed in chapter 2: For example, if women face difficulty in access to basic services such as health care, the barriers to accessing public office may seem insurmountable. It is therefore evident that women's representation in national parliament also captures many of the latent variables that may be relevant for the sex ratios of the population (total/elderly). However, some contradictions are apparent with this measure. Jalalzai and Krook (2010) note that while in the early 1980's countries where women constituted the highest representation in national parliament were also those where women enjoyed a relatively high socioeconomic status, today the two may not necessarily be linked. The highest representations of women come from a wide range of countries in Africa, Latin America, Oceania and Europe (where the socioeconomic status of women may or may not be very high) with many countries like France and United States, that have long standing democracies and score well on women's indicators, having very low comparative estimates of female participation in national assembly (Jalazai and Krook 2010). Furthermore, from 1960 to 2009, women in many countries have become heads of states where the status of women lags far behind those of men. Examples include Benazir Bhutto in Pakistan, Indira Gandhi in India and Sheikh Hasina Wajed in Bangladesh (Jalazai and Krook 2010). Therefore, while the representation of females in national assembly may indicate the favorability of structural, political and cultural factors for women, it may need to be interpreted with caution.

The final variable, female legislative officers/senior officials/managers is therefore included in the analysis to complement and enhance the female seats in national assembly variable. The three constraints (structural factors, natural of political institutions and cultural factors) described by Norrison and Ingelhart (2001) would continue to operate with regards to this variable as well except that this variable also allows inequalities faced by women in education and labor force participation to be correlated with the political domain (World Bank, "World" 2016). Jalazai (2004) argues that since in countries like Pakistan, India and Bangladesh women who became heads of states not only had education levels far superior to women in the general population but also had family connections that allowed them to attain positions of power, the female head of states in these countries may be viewed as the exceptions rather than the norm in their respective countries. Including the female legislators/senior officials'/managers variable in the analysis therefore may allow for a wider representation of women's success in the general population and not just a measure of the outlier women who have exceptional opportunities to make it to the top. This is because it doesn't only include women who reach the top office in the political sphere but also includes women who acquire the best jobs in the labor market (i.e. senior officers and managers) and therefore measures women's participation in law making activities through a broader lens.

5.4.4. Childhood indicators

Five variables are used to measure the impact of childhood indicators on the sex ratios of the population (total/elderly): stunting, wasting, underweight, infant mortality rate and under five mortality rate. The first three indicators are obtained via the WHO database and measure the incidence of malnutrition in children under the age of five (WHO 2017). Stunting is defined by the WHO (2017) as "a state of having failed to reach linear growth potential as a result of suboptimal health and/or nutritional conditions." Wasting, which may also be referred to as thinness, is defined by the WHO (2017) as either (most cases) a "recent and severe process of weight loss which is often associated with acute starvation and/or sever disease" or "a recent and severe process of weight loss as a result of chronic unfavorable conditions." Underweight is described by the WHO (2017) as low body mass index relative to chronological age and constructed in a way to be influenced by age height and weight of the child. The latter two variables are obtained via the World Bank databases. The Infant Mortality Rate as defined by the World Bank ("World" 2016) is "the number of infants (male or female) dying before reaching one year of age per 1000 live births in a given year." Similarly, the under-five mortality rate is defined by the World Bank ("World" 2016) as "the probability per 1000 that a newborn baby (male or female) will die before reaching age five if subject to the age specific mortality rates of the specified year." All five variables are taken as the ratio of female to male of the given variable to determine whether (and the extent to which) each malnutrition and mortality indicator is stronger amongst girls as compared to boys and thereby assess its contribution to the sex ratios of the population (total/elderly).

Chapter 2 emphasizes that the majority of missing women literature at the childhood level points to gender discrimination in health and nutrition as the prime reason for missing girls. Therefore, substantial research assesses whether these variables serve as good measures of child survival. De Onis et al. (1993), based on evidence from 79 developing countries worldwide between 1980 and 1992, contend that growth assessment is the best measure of a child's health and nutritional status because it captures minute variations in the provision of these services, indicates the standard of living of children (e.g. quality of food, exposure to infections) and is linked to the standard of living of the population (e.g. housing quality, access to health care). They find that the best child growth assessors are height for age (where stunting indicates low height for age), weight for height (where wastage indicates low weight for height) and weight for age (where underweight indicates low weight for age). The first assessor measures long term growth faltering, the second assessor measures the harmony of growth and is therefore sensitive to acute growth disturbances and the third assessor is a combination of the two representing linear growth and body proportion (De Onis et al. 1993). Victora (1992) stresses the importance of using wastage and stunting variables simultaneously when comparing incidence of malnutrition across regions. Using evidence from 175 studies on malnutrition indices compiled by the WHO, she contends that in both Africa and Latin America, the correlation between wasting and stunting is low but the prevalence of wasting is three time higher in Africa (for any given level of stunting) than Latin America. Further, in Asia and Eastern Mediterranean, the correlation between the two indicators is high but wasting is twice as common in the former as compared to the latter (Victora 1992). This may suggest that these indicators cannot be used as substitutes for one another. Further, Frongillo et al. (1997) using data from 70 developing countries, find that the reasons for stunting and wasting may be

different at the national, provincial and individual level. For example, at the national level, they find that female literacy, health expenditure and gross national product were associated with stunting whereas immunization was associated with wasting. Their results allow them to conclude that 76% of stunting and 66% of wastage amongst children under the age of 5 can be explained by national and geographic factors as these factors are strongly linked to child malnutrition at the household level and may therefore capture the gender differential in malnutrition amongst children aged under five years.

Several studies also provide examples of instances where malnutrition indictors display gender discrimination in health and nutrition. For example, Khuwaja, Selwyn and Shah (2005) conduct a survey amongst 1,915 school children (aged 6 to 12 years) in rural Pakistan and find that the most important predictors of stunting were the gender of the child, the age of the child, and the occupation of the father with the incidence of stunting being higher amongst females who were older than 7 years of age and whose fathers were not landlords. In another study, Pillai and Rodriguez (2015), using data from the Indian National Family Health Survey (2005-2006), find a significant difference in mean levels of stunting between boys and girls, with the incidence being higher amongst the latter but the overall difference reducing as the education level of the mother and wealth level of the household increase. The authors interpret this to mean that an increase in mother's education and household wealth reduces son preference as a result of which the gender differential on these two malnutrition indices decreases. Similarly, upon analyzing stunting, underweight and wastage among children in a sample of 485 households in India (West Bengal), Sarkar (2016) finds that gender disparity in malnutrition amongst children increases with age with older girls (after 24 months) being more deprived than boys compared to younger girls. Alongside age, he finds religion, caste and birth order of the child to be significant predictors of malnutrition. He further finds that stunting is the most common form of malnutrition which is indicative of past or chronic inadequacy of nutrition or long term growth faltering. He contends this may be because once the child is no longer breastfed he has to compete for resources. Religion and caste are a means of social stratification in India and castes more vulnerable to discrimination in access to public health services, hygiene and sanitation fared poorer on these indices. This indicates that females may be losing their survival advantage as they are getting older. Hence, these indicators adequately capture the gender differential in malnutrition amongst children.

5.4.5. Non-reproductive indicators

Five variables are used to gauge the impact of female non-reproductive variables on the sex ratio of the population (total/elderly): female marriage age, contraceptive prevalence (any method), prevalence of anemia among non-pregnant women, female genital mutilation (FGM) and access to public space. The first three variables were obtained via the World Bank databases and the latter two variables were obtained via the OECD database. Female marriage age refers to the mean age at first marriage of all females who were married before the age of 50 (World Bank, "World" 2016). The anemia (non-pregnant) refers to the percentage of women aged 15-49 who are not pregnant and present symptoms of anemia (World Bank, "World" 2016). Female contraceptive prevalence refers to the number of women aged 15-49 currently married or in a union who are either themselves or their partners using any traditional or modern form of contraception (World Bank, "World" 2016). The access to public space

variable assesses whether women face legal and/or social[63] restrictions on their freedom of movement and access to public space (e.g. restrictions on choosing their place of residence, restrictions on visiting their friends or barriers in applying for a passport; OECD 2014). It is an ordinal variable measured according to three levels of intensity (0, 0.5 and 1; with 0 indicating legal and social equity in access to public space, 0.5 indicating legal equity only in access to public space and 1 indicating legal and social inequity in access to public space). The FGM variable is obtained via the OECD SIGI database and refers to the percentage of women in a given country who have undergone any type of female genital mutilation (OECD 2014).

The channels through which female marriage age, anemia (non-pregnant) and FGM contribute to a female survival disadvantage have been explained in detail in chapter 2 so their relevance to sex ratios of the population (total/elderly) is clear. The remaining two variables, i.e. contraceptive prevalence and access to public space, represent female autonomy within the household and society respectively. Contraceptives may not only be a means to control fertility but also a way for women to protect themselves from sexually transmitted diseases (Clark et al 2013). The use of contraception may not only imply that women have access to information and resources (Sedgh et al. 2007) that allows them to behave in their self-interest but also that they are empowered to actively participate in important household decisions (e.g. number of children to have; c.f. Saleem and Bobak 2005, Schuler and Hashemi 1994). Several academic studies further prove these linkages: Mahmood and Ringheim (1996), using the Pakistan Demographic and Health Survey (1990-1991), find that three factors lead to higher contraceptive use amongst Pakistani women: knowledge of a source for family planning, effective communication between husbands and wives and religious attitudes[64]. Also, Stephenson, Koenig and Ahmed (2006), using data from Uttar Pradesh India (1995-1996), find a negative association between contraceptive adoption and domestic violence suffered by women. They contend that since sterilization is the most common form of contraceptive method adopted in India (accounting for approximately 85% of contraceptive methods adopted) for which the explicit permission of the husband is required for its adoption, violence as a response to this request is perceived by wives as punishment for misconduct and as a mechanism to hold wives to preconceived gender roles. Access to public space may be directly linked to women's well-being: Chapter 2 emphasizes that social restrictions on women's movements may restrict appropriate access to healthcare and expose them to chronic diseases. Chapter 4 highlights that women's seclusion to the household (i.e. their lack of access to public space) may place them at a higher degree of risk when faced with emergency evacuation in case of a disasters (e.g. in the case of floods in Bangladesh; Ikeda 1995). Further, as also discussed in chapter 4, purdah restrictions (which limit women's access to public space) increase women's vulnerability in refugee camps as they avoid standing in public lines to receive aid packages.

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[63] Social restrictions refer to customary, traditional or religious practices that restrict the movement of women (e.g. although the law guarantees equity in access to public space in Pakistan, in the Taliban controlled areas of the country women's movements are often limited to the household; OECD 2014).

[64] Communication between husband and wives is measured by assessing whether husbands and wives know if the other wants another child or prefers not to have any more children. Knowledge implies whether the wife knows where to get the contraceptive i.e. it ranges from being easily accessible to being something heard of from the media. Religious belief is whether the wife believes the number of children to be a be determined by fate (decided by God) or expresses a desire to act upon her fertility (Mahmood and Ringheim 1996).

5.4.6. Reproductive indicators

Eight variables are used to measure the impact of female reproductive indicators on the sex ratio of the population (total/elderly): births attended by skilled health staff, pregnant women receiving prenatal care, abortion, neonatal mortality rate, prevalence of anemia among pregnant women, total fertility rate, adolescent fertility rate and maternal mortality rate All reproductive variables, except abortion (obtained via the OECD database), were obtained via the World Bank databases. Births attended by a skilled health staff represents the percentage of women attended by personnel trained to provide the necessary supervision to women during pregnancy labor and postpartum period, to conduct deliveries and care for newborns (World Bank, "World" 2016). Percentage of women receiving prenatal care pertains to the percentage of women attended to by a skilled health professional at least once during pregnancy for pregnancy related reasons (World Bank, "World" 2016). The abortion variable is an ordinal measure of the legality of abortion in a given country and assumes values – 0, 0.5 and 1 – with a value of 0 indicating that abortion is legal, a value of 1 indicating abortion is illegal and value of 0.5 indicating abortion is legal only under certain circumstances (e.g. to save the life of the mother; OECD 2014). The neonatal mortality rate refers to the number of infants dying before reaching 28 days of age per 1000 live births in a given year (World Bank, "World" 2016). The anemia (pregnant) variable refers to the percentage of women aged 15-49 who are pregnant and present symptoms of anemia (World Bank, "World" 2016). The total fertility rate is the number of children a woman would have if she lived to the end of her reproductive years and had children according to the age specific fertility rate (i.e. annual number of births to woman of a specified age group per 1000 women in that age group) in the given year (World Bank, "World" 2016). The adolescent fertility rate is the age specific fertility rate for women in the 15-19 age category (World Bank, "World" 2016). The maternal mortality ratio is defined by the World Bank ("World" 2016) as "the number of women who die from pregnancy related causes while pregnant or within 42 days of pregnancy termination per 100,000 live births." Therefore, it includes maternal deaths due to complications of abortions.

The skilled health staff and prenatal care variables are used to indicate health care utilization during pregnancy. Chapter 2 highlights how the failure to regard pregnancy and related complications as serious health concerns may elevate the number of missing women during the young adulthood stage. Some academic studies may be used to shed further light on this. Navaneetham and Dharmalingam (2000), using the 1992-1993 Indian National Family Health Survey, find that health care utilization during pregnancy in Southern Indian States is much higher than Northern Indian states with utilization in Kerala being the highest of all. Existing literature (e.g. Das Gupta and Mari Bhat 1997) has already shown the wide discrepancy in missing women between Northern and Southern states of India (with the missing women toll being much higher for Northern States). Further, Mistry, Galal and Lu (2009), using data from the Indian National Family and Health Survey (1998-1999), find that healthcare utilization in India during pregnancy may also be an indicator of female autonomy. Their results show that women's use of prenatal and post-natal care is associated with a greater

degree of female autonomy[65] as health care utilization is most pronounced in the South which also has the highest levels of female autonomy.

The abortion variable is included in the analysis to measure the discrimination women may encounter with respect to their reproductive rights in case of an undesired pregnancy, which may for example be a result of rape (OECD 2014). It may therefore serve as a stronger measure of female and reproductive autonomy compared to contraceptive prevalence as women may need to overcome greater opposition (at the household and societal level) to assert their desire for an abortion. Therefore, countries that legalize abortion (even if only under special circumstances) may also protect the interests of women in other reproductive domains. For example, women may find it easier to get treatment for sexually transmitted diseases (STDS) in societies were abortion is acceptable as opposed to societies where abortion is illegal under all circumstances. As chapter 2 indicates, STDs may elevate the risk of missing women in young adulthood as the biological and social consequences of not seeking timely treatment may place women's lives at risk.

The variable neonatal mortality rate is included in the analysis to provide some indication of post-natal care. Several studies have shown that even when pregnancy and childbirth are treated as health concerns, there may be large differences between pre and post-natal health care utilization by the mother especially when financial resources are constrained. For example, Bhatia and Cleland (1995) use the results of a cross-sectional survey conducted in rural and urban areas of a city (1993) in Southern India to show that while 90% of women surveyed had had at least one pre-natal checkup, only 20% of them had had a postnatal checkup. Furthermore, Anwar et al. (2008) use the results of a community survey conducted in a rural area near Dhaka to find that while 93% of pregnant women in the sample had at least one prenatal visit only 23% had a post-natal visit with Caesarean section (which may indicate a complication of delivery) not being an indicator of post-natal care. The same study shows that skilled birth attendants and prenatal care is correlated with postnatal care. Higher rates of neonatal mortality would therefore indicate that fewer trained personnel are available to provide attention to seriously ill infants. Sines et al. (2007) argue in favor of the inextricable link between postnatal care and neonatal mortality. They contend that the highest mortality rates for both mothers and infants are approximately at the same time after the time of birth and the availability of postnatal care in this period significantly reduces neonatal mortality. Furthermore, postnatal care helps promote practices (trains the mother in raising the infant in certain ways e.g. breastfeeding, passing on warmth) that allows the infant to develop in a healthier manner (Sines et al. 2007).

The variables total fertility rate and adolescent fertility rate represent the periodicity of women's exposure to the perils of reproduction and therefore the frequency with which reproductive factors contribute to the missing women phenomenon in young adulthood and adulthood. Chapter 2 describes some of the dangers of reproduction for women (and in the context of child marriage, the dangers of adolescent reproduction). However, Chapter 2 also includes fertility as an intermediary force that may affect sex ratios via two mechanisms: First, it may increase sex ratios at birth due to a rise in marginal cost of having daughters. Second, it may reduce missing women in young

[65] Female autonomy is measured as decision making autonomy in different spheres, independence in leaving the house alone and financial autonomy (Mistry, Galal and Lu 2009).

adulthood as discussed in the beginning of this paragraph. The role of fertility is further evident through the discussion of demographic shocks in chapter 4 where the case of the subcontinent shows that during periods of famine there has been a reduction in fertility (Dyson, "Part I" 1991, Dyson "Part II" 1991). This may have had an impact in reducing maternal mortality as adult mortality rates during the five great famines of the subcontinent discussed in chapter 4 were higher for men than for women (Dyson, "Part I" 1991, Dyson "Part II" 1991).

The maternal mortality ratio is included in the analysis to capture the most extreme negative outcome of female reproductive behavior. The example of Sri Lanka (by Nadarajah 1983) in Chapter 2 shows that reductions in maternal mortality have led to vast improvements in female survival at the population level. Ronsmans and Graham (2006), using data for 189 countries worldwide for the year 2000, find that Sub-Saharan Africa and South Asia have the highest maternal mortality rates in the world and highlight the exceptionally high mortality rates in India, Bangladesh, Pakistan, Nigeria and Ethiopia. Bongaarts and Guilmoto (2015) identify the latter four countries as having large numbers of missing women with India being the country with the second largest number of missing women today. This points to a link between maternal mortality and sex ratios in the population (total/elderly) that necessitates an exploration.

5.4.7. Disease environment

Five variables are used to estimate the impact of the disease environment on the sex ratios of the population (total/elderly): total number of communicable disease deaths, total number of non-communicable disease deaths, injury deaths, ratio of non-communicable disease deaths to communicable disease deaths (COMM) and ratio of female to male HIV deaths. Data for the first four variables was obtained by the World Bank databases. Communicable diseases include deaths by infectious and parasitic diseases, respiratory infections and nutritional deficiencies and maternal and prenatal conditions (World Bank, "World" 2016). Non-communicable diseases include deaths by cancer, diabetes mellitus, cardiovascular diseases, digestive diseases, skin diseases, musko-skeletal diseases and congenital diseases (World Bank, "World" 2016). Injuries include deaths by unintentional or intentional injuries (World Bank, "World" 2016). Deaths by these three causes pertain to 100% of deaths of all ages in a population (Ghaffar, Reddy and Singhi 2004). The COMM variable measures the ratio of non-communicable to communicable diseases and hence represents the burden of death by each type of disease in a country. Data for the female to male ratio of HIV is obtained via the Global Burden of Disease (GBD) Study and pertains to the number of women and girls divided by the number of men and boys who died as a result of HIV in the given year (GBD 2015).

Evidence from literature suggests that the pattern of communicable and non-communicable diseases not only differs between developed and developing countries but also amongst different age categories in developing countries. After WWII, quality of life improvements and medical progress (e.g. advent of vaccinations) had virtually eradicated communicable diseases as the main causes of death in developed countries paving the way for non-communicable diseases to take over (Boutayeb 2006). Further, by the 21st century non-communicable diseases had spread to developing countries as well where fatality from communicable diseases continues to be high (Boutayeb 2006). As a result, developing countries across Asia and Africa today have to combat with this

dual burden of communicable and non-communicable diseases as causes of mortality (Boutayeb 2006). For example, approximately half of the adult disease burden in South Asia is attributable to non-communicable diseases with the remaining half accounted for mostly by communicable diseases and a smaller percentage by injuries (Ghaffar, Reddy and Singhi 2004). Furthermore, across many developing countries non-communicable diseases are considered disease of affluence, i.e. only the population that survives to a certain age will be able to experience these diseases (Sen and Bonita 2000). The distribution of deaths by type of disease is therefore extremely relevant. The discussion of disease composition as an intermediary force in chapter 2 elucidates that, in countries unaffected by the missing women phenomenon, men and women are expected to be equally affected by communicable diseases whereas women are expected to have a survival advantage in non-communicable diseases. Therefore, the first two disease environment variables (i.e. total number of communicable disease deaths and total number of non-communicable deaths) measure whether the relationship described for these diseases in chapter 2 holds for the total and elderly population. The third disease environment variables, i.e. COMM, attempts to test and compare how the sex ratios of the population (total/elderly) are affected by the preponderance of either type of disease (communicable or non-communicable).

The injury deaths variable is included in the analysis to assess the extent to which the gendered pattern of deaths from injuries in a given country may be expected to affect the sex ratios in the total and elderly population of the country. Evidence from literature suggests a sex specific pattern in injury deaths: Using data on mortality, incidence and disability adjusted life years from injuries from 187 countries worldwide for the period 1993 to 2006, Haagsma et al. (2016) find that the burden of injuries (in terms of suffering and fatality) from most causes in the 0-80 age category is higher for men compared to women for almost all countries. In the 80+ category, the burden of injury is equally shared between both genders (Haagsma et al. 2016). The authors find South Asia to be an exception to the general pattern where the burden of fire related injuries and deaths is higher amongst women in the 0-80 category. These findings somewhat corroborate the results of Anderson and Ray (2010), discussed in chapter 2, that injuries are the second largest cause of missing women in India.

The inclusion of the female to male ratio of HIV is essential for two reasons, as already discussed in chapter 2. First, Anderson and Ray (2010) find large numbers of missing women in Sub-Saharan Africa due to excessively high female mortality rates caused by HIV. Second, the gendered impact of HIV varies by country (e.g. men are more severely affected in Scandinavian countries whereas women are more severely affected in Sub-Saharan Africa; Quinn 1996). The ratios of HIV mortality rates, therefore, capture these gendered variations across countries to test whether an average association with respect to the sex ratios of the population (total/elderly) at the cross-national level is discernible.

5.4.8. Survival expectations

The female to male ratio of five variables is used to estimate the impact of survival expectations on the sex ratios of the population (total/elderly): life expectancy and healthy life expectancy (HALE) at birth, life expectancy and healthy life expectancy at 60 and adult mortality between ages 15 and 60. The life expectancy at birth and life expectancy at 60 variables were obtained from the World Bank databases. The HALE

at birth variable was obtained from the WHO database, the HALE at 60 variable was obtained from the GBD study and the adult mortality (15 to 60) variable was obtained from the United Nations databases. Life expectancy at birth is defined by the World Bank ("World" 2016) as "the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the stay the same throughout its life." HALE at birth as the average number of years a person (at the time of birth) can be expected to live in full health by taking into account years lived in less than full health due to the impact, duration and severity of major diseases and/or injuries that cause morbidity but not mortality (WHO 2016). Life expectancy at 60 is defined by the World Bank ("World", 2016) as "the average number of years that a person of 60 years old could expect to live if he or she were to pass through life exposed to the sex and age specific deaths rates prevailing at the time of his or her 60 years for a specific year, in a given country, territory or geographic region." HALE at 60 may be described as life expectancy at 60 after taking into account years lived in less than full health due to the impact, duration and severity of major diseases and/or injuries that cause morbidity but not mortality (WHO 2016). Adult mortality between ages 15 to 60 is defined by the UNDESA (2015) as "the number of deaths under age 60 per 1000 alive at age 15." The female to male ratio of all these variables is used to measure how the gender differential with reference to each variable affects the sex ratio of the population (total/elderly).

The life expectancy variable is included in the analysis to measure how the differing expectations about female and male survival (which somewhat reflect the mortality conditions in a given country) may affect the sex ratios of the population (total/elderly). The life expectancy and HALE variables serve as complements to one another. Chapter 2 elucidates that despite the universal female survival advantage in life expectancy at birth, the elderly missing women phenomenon persists in many countries. However, measuring female advantage in terms of life expectancy alone doesn't account for the burden of ill health brought about by these additional years of longevity (Luy and Minagawa 2014). As evident in the definition of HALE, this variable provides a measure of the burden of ill health that accompanies women as a result of their increased life span. By weighting years lived with a measure of functional health loss before death, the HALE measure supersedes any competitive measure that may have been proposed by being the only one to fully capture a range of functional health losses. (GBD 2015 DALYs and HALE collaborators 2016). As a result, the gender gap in HALE at the global level is lower than that of life expectancy thereby capturing the burden of disability experienced by women during their additional years (Mathers et al. 2002). Therefore, while high income countries exhibit a gender gap in both life expectancy and HALE in favor of females, low income countries may only exhibit the former with the gender gap in HALE being almost non-existent for them (Bennett and Zaidi 2016). Hence, including the HALE variable adds explanatory power to the life expectancy variable as it shows how the impact of life expectancy on sex ratios is affected by the disability burden that accompanies increased female longevity.

It is crucial to include the life expectancy and HALE at birth and at 60 in the analysis to allow the difference in survival created by loss in healthy years at these two points in time to be observed. Using data from 192 countries for the year 2002, Mathers et al. (2004) find that while the number of lost healthy years (i.e. life expectancy at age 'x'-HALE at age 'x') continues to increase for both genders with age, in developed countries the pattern somewhat changes after the age of 70: the loss in healthy years of life remains relatively constant for males and reverses for females (i.e. the number of

lost healthy years' declines for females). This may be a result of the relatively higher prevalence of conditions such as dementia and musko-skeletal disorders in these countries which cause lower morbidity than, the relatively less common, cardiovascular and respiratory diseases (Mathers et al. 2004). Within developing countries also, life expectancies at birth and at 60 may vary greatly. Life expectancy at birth in poorer countries is very different from life expectancy in middle ages in these countries because the percentage of the birth cohort therein that survives to middle ages starts to exhibit a life expectancy pattern similar to that of developed countries (Sen and Bonita 2000). This may be because all the gains in life expectancy in developing countries have benefitted the upper social classes, irrespective of the wealth of the country (Sen and Bonita 2000).

The adult mortality rate (ages 15 to 60) variable is included in the analysis to measure cross country variation in the extent to which the factors in the young adulthood and adulthood stage identified in chapter 2 lead to excess female mortality. The sex ratio trends depicted in Chapter 3 show that many of the countries in South Asia and West Asia depict large female deficits in the 15 to 60 age category. This may be responsible for propelling an elderly missing women phenomenon in the future as depicted by projections for the majority of these countries for the years 2030 and 2050.

5.4.9. Education indicators

Nine variables are used to measure the effect of education on the sex ratios of the population (total/elderly): percentage of literate females above the age of 15 (female literacy), percentage of females above the age of 15 with no education, with primary education, with secondary education and with tertiary education (female no education 15, female primary 15, female secondary 15, female tertiary 15) and percentage of females above the age of 60 with no education, with primary education, with secondary education and with tertiary education (female no education 60, female primary 60, female secondary 60, female tertiary 60). All variables were obtained via the World Bank databases. Female literacy is defined by the World Bank ("World" 2016) as "the percentage of females' people above age 15 who can both read or write, with understanding, a short simple statement about their everyday life." The latter eight variables are described by Barro-Lee (2016) as referring to the percentage of female population in a given country above the age of 15 or 60 that has no education or has completed a primary or secondary or tertiary level of education respectively.

The role of education as an intermediary force affecting the number of missing women has been discussed in Chapter 2. It is therefore evident that education variables provide a measure of the extent to which education is a priority for girls and women in different countries and the barriers they may face in acquiring any given level of education. Hill and King (1995) outline the barriers faced by girls in accessing education in three categories: opportunity cost of education, sociocultural factors and returns to education. The opportunity cost of education pertains to the time daughters spend aiding their mothers with domestic chores (the authors note that in rural areas daughters are engaged in domestic and marketplace chores which take up a significant amount of time – for example, consuming up to one third of the day in Nepal and Java), the alternative traditional training forgone (i.e. transferable skills by mothers to daughters as in for example the case of crafts) due to time spent acquiring an education and the depreciation/delay in bride price (or inflation in dowry) if daughters aren't married at a

young enough age (Hill and King 1995). The sociocultural factors pertain to the social and institutional norms that pressurize daughters to conform to predetermined behavior according to which education (or higher levels thereof) tarnish the reputation of girls (Hill and King 1995). The authors note that in such instances opportunities may not exist for girls to attend schools or schools may present perils in the form of coeducation, male teachers, poor facilities for girls (e.g. toilets) and distance from home. In many instances the presence of these perils increases the cost of education. Hence, even in countries where education may be free, parents would need to invest resources in sending girls to school (e.g. purdah), the equivalent of which would not be needed for boys. These norms are also reflected in textbooks and the attitude of the instructors both of which perpetuate the stereotypical notion of girls not being as capable as boys. The prevalence of such norms may be the reasons why girls frequently drop out of school upon reaching puberty (Hill and King 1995). Finally, the authors describe the returns to education logic as being based on the premise that in many societies education is not regarded as useful for girls as it is for boys since women have to take frequent breaks from the labor market (for maternal reasons) and therefore have lower earning capacity than men.

Chanana (2000) builds upon the same arguments as Hill and King (1995) when emphasizing the barriers faced by women in accessing higher education in India. He cites male dominance in the control of institutions (e.g. male administrators create unfavorable dormitory rules for female students) as one of the reasons why female dropout rates may be high. He further notes that females are usually encouraged to assume the profession of teaching a given set of subjects and the "unfeminine" style of other subjects such as engineering precludes them from many fields of study. In addition, he emphasizes that the pursuit of higher education comes at a transitional stage in a woman's life where a choice must be made between spending money on a daughter's education or saving for a daughter's dowry. As having an educated daughter may make it difficult to find a suitable match (as husbands must be at least equally, if not more educated than the bride), higher education for women is viewed as consumption rather than an investment especially in comparison with the higher education of sons (Chanana 2000). Higher education of daughters may therefore be perceived as a waste of resources[66] especially since, even when daughters are successfully employed, money received from daughters is considered shameful (Chanana 2000). The role of patriarchy in education is also discussed by Malik and Courtney (2005) when assessing female participation in higher education in Pakistan. They note that when resources are constrained sons are usually given preference in education and when daughters do have the opportunity to attain higher education decisions regarding the university to attend, the subject of study and the place of residence are often determined by different family members (Malik and Courtney 2005).

The purpose of outlining these barriers is twofold: First, they show that any level of education beyond literacy is highly correlated with other factors that may affect the missing women phenomenon (e.g. sociocultural norms on the position of women in society) and that this correlation may increase with higher levels of education. Second,

[66] Nevertheless, the author states that these views may be linked to socioeconomic class so that resource constraint as a deterrent to education is a less prominent feature in the upper and middle income groups than lower income groups. Sociocultural barriers however may remain regardless of socioeconomic class (Chanana 2000).

the barriers point to the importance of using completed education levels (as used here). The discussion makes it visible that the possibility of girls being enrolled at a certain level of education (e.g. secondary education) but not reaching its completion is relatively high overall. In such cases using some of the competing measure available by the World Bank like gross enrolment ratio at each level of education would be inaccurate as they would overestimate the effect of any given level of education and thereby underestimate the impact of these barriers on the sex ratios of the population (total/elderly).

Furthermore, the attainment of different levels of education may have different impacts on the factors that affect the missing women phenomenon. For example, data from 72 developing countries from 1970 to 1985, shows that female secondary education (as measured by gross enrollment rates at the secondary level) plays an especially strong role (vis-á-vis female primary and tertiary level education) in reducing fertility and infant mortality due to gains in maternal education (Subbarao and Raney 1993). The inclusion of graded education levels therefore allows an assessment of not only the extent to which education affects sex ratios (total/elderly) but also which level of education that has the strongest impact on sex ratios (total/elderly).

Two separate age categories of education are included because the sex ratio of the total population and the elderly population are being assessed and it may be expected that the educational opportunities afforded to the 60+ population differ grossly from the education opportunities available for the 15+ population.[67] For example, in the case of India at the tertiary education level, Chanana (2000), using data from various national sources, argues that over time the enrolment of women at this education level has increased: from 1950 to the mid-1980s there has been a dramatic increase in female enrolment at the tertiary education level followed by a stagnation in the 1990s. Stark differentials between the education levels of the 15+ and the 60+ populations therefore also captures the development of latent variables, associated with education variables, over time and how this may in turn interact with sex ratio of the population (total/elderly).

5.4.10. Labor Force Participation Indicators

Four labor force ratios (female/male) are used to measure the effect of labor force participation on sex ratios of the population (total/elderly): the employment ratio, employment ratio with primary level of education, employment ratio with secondary level of education and employment ratio with tertiary level of education. These variables are obtained via the International Labor Organization database. The employment ratio can be described as the proportion of a country's working age (aged15 to 64 years) female population to the country's working age male population that is employed (ILO 2016). The latter three variables measure the difference in labor force participation rates by gender contingent on the level of education (primary, secondary or tertiary). Hence the employment ratio with primary/secondary/tertiary education is the ratio of the country's female population with primary/secondary/tertiary education respectively actively engaged in the labor market (i.e. working or looking for work) to the country's male population with

[67] Amongst all the variables included in the analysis, the education and life expectancy variables are the only variables that had data disaggregated by two separate age categories.

primary/secondary/tertiary education respectively actively engaged in the labor market (ILO 2016). Therefore, these three variables provide a measure of female supply of labor by education level to the male supply of labor by education level (ILO 2016).

The inclusion of the employment ratio is crucial in the analysis as when Sen (1990) introduces the idea of missing women he strongly advocates female labor participation as the mechanism whereby the position of women in household and society may by improved. He describes four pathways to this improvement: First, employment gives women access to a regular and reliable source of income. Second, the social perception of women as a breadwinner may increase the share women receive in the division of resources in the household (and/or society). Third, outside employment may provide security and/or legal protection that makes the economic position of women less risky (thereby strengthening their well-being). Fourth, exposure to the labor market may prove to be educational and again improve women's standing in the household. Further, similar to the role of education, several authors from chapter 2 (e.g. Qian 2008) show that female labor force participation may improve the survival of women and girls (e.g. as mothers may value daughters and sons more equally or as they become more valuable to the household due to their future earning potential). The employment ratio, therefore, is included in the analysis to represents the equity/inequity of female and male representation in the labor market and the extent to which this equity/inequity may have spillover effects on the sex ratios of the population (total/elderly).

However, the employment ratio alone does not capture the entire effect of female labor force participation on the missing women phenomenon. Chapter 2 elucidates that women may suffer from distinct disadvantages when participating in the labor force because of three reasons: the dual burden of care (household and labor force participation) argument, poorer working conditions for women vis a vis men and lower earnings (or lack of control over earnings) for women. There is no perfect way to capture these disadvantages faced by women but ILO data affords two opportunities. First, gender differentials in labor force participation by type of occupation may be considered (i.e. agriculture, manufacturing and services). This information may provide an idea of the sector in which the employed females are concentrated and whether this employment is very different from the proportions of male employment in that sector. For example, a high female employment ratio accompanied by a high female to male labor force participation rate in the agriculture sector and a low female to male participation rate in the services sector may indicate a gender gap in the skilled employment opportunities available to men and women. This type of information would be important because chapter 2, for example explains some of the hazards faced by women in the agricultural sector. However, the data for occupation by employment level is infiltrated by missing values for many countries (especially those depicting distorted sex ratios in Chapter 3). Therefore, the second option may be considered: labor force participation ratio of female to male by education level. This is a more complete dataset. The ILO uses educational attainment as a measure of the skill level of the labor force (ILO 2016). Therefore, educational attainment may be correlated not only with the type of jobs a person may have access to but also (if an economic argument is used) the amount of time a person is willing to invest in the labor market (Psacharopoulos 1994). The use of this measure could serve as a proxy for the first argument under the assumption that higher levels of education are associated with higher quality jobs and hence allow for a similar interpretation. Therefore, a high employment ratio and a high employment with primary education ratio accompanied by

a low employment ratio with tertiary education may imply that although women are participating in the labor force, they are concentrated in lower skilled jobs than men (due to the lower educational requirements of the jobs in which women are concentrated in) and hence may be burdened by several disadvantages (longer workings hours, low pay, exposure to dangers etc.). Again, this is not a perfect measure as it doesn't capture discrimination within jobs but it does somewhat assess the differential working conditions of men and women at the national level and shows that it is not enough for women to be employed but also necessary for them to be employed at an advantageous position.

5.4.11. Demographic shocks

Seven variables are used to assess the effects of demographic shocks on sex ratios of the population (total/elderly): disaster deaths, disaster affected, conflicts with cumulative intensity greater than one, battle related deaths state, battle related deaths non-state, battle related deaths total and refugee by country of origin. Both disaster variables were obtained from the International Disaster Database. Total disaster deaths represents the total number of people documented dead or missing by all recorded natural disasters in a given country from 1950 to 2015 (Guha-Sapir, Below and Hoyois 2009). Total disaster affected represents the total number of people reported as having required assistance (e.g. basic survival needs, medical attention) in the immediate aftermath of all natural disasters recorded for the specified country from 1950-2015 (Guha-Sapri, Below and Hoyois 2009). The first four conflict variables, incidents with cumulative intensity greater than one (incidents > 1), battle related deaths state, battle related deaths non-state (BRD non-state) and battle related deaths total (BRD total), were obtained from the conflict datasets compiled by the collaborative efforts of the Uppsala Conflict Data Program (UCDP) and the International Peace Research Institute (PRIO). Incident > 1 measures the number of armed conflicts[68] between state and an opposition party in a specified country from 1946 to 2015 in which the battle related death[69] toll exceeded 1000 deaths (Melander, Pettersson and Themnér 2016). Only conflicts resulting in greater than 1000 battle related deaths are included because as chapter 4 discuses, for the sex ratios of the population to be affected, at least 1% of a given gender (male or female) needs to be affected. The 1000 battle related deaths toll benchmark may be too low but it is the only cut off point available in this dataset and this dataset is the only dataset available that provides information on all conflicts between state and non-state actors from 1946 to 2015. BRD state variable provides the number of battle related deaths from all conflicts recorded in the incidents > 1 variable but for the years 1989 to 2015 only. The BRD non-state provides the number of battle related deaths due to non-state conflicts[70] for the years 1989 to 2015. The refugee variable is obtained from the World Bank database and refers to the refugee population in a given country by country of origin (World Bank, "World" 2016).

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[68] The UCDP/PRIO defines an event as a conflict if there exists "a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle related deaths in a calendar year." (Melander, Pettersson and Themnér 2016).

[69] A battle related death is a death directly attributed to the use of armed force between the two warring groups (Melander, Petterssen and Themner 2016).

[70] A non-state conflict is the use of armed force between two organized armed groups neither of which is the government of a state which results in at least 25 battle related deaths in a year (Melander, Petterson and Themnér 2016).

The demographic shock variables are included in the analysis for the same reason as chapter 4 i.e. to measure the impact of exogenous forces on the sex ratios of the population (total/elderly). The literature review in chapter 4 suggests that all natural disasters, except famine, may have a more deleterious impact on female versus male mortality. Therefore, the total number of disaster deaths and disaster affected are included to measure whether the strength of a disaster (as captured by death or affected statistics) has an impact on the sex ratios of the population (total/elderly). It is further evident from the literature review in chapter 4 that in the long run, conflicts may have a more deleterious impact on the life expectancy and mortality of women and the effect may vary by type of conflict so that ethnic conflicts that take place in failed states (and are characterized by a complete breakdown of state machinery) have the most severe negative impact on female life expectancy. The incidents>1 and BRD total variables attempt to measure the effect of conflict intensity on sex ratios of the population (total/elderly). As the latter variable includes battle deaths from non-state conflicts as well, it may provide a stronger measure of the negative externalities of conflict on the civilian population. BRD state and BRD non-state are both included in the analysis to allow some measure of heterogeneity from the effects of conflict to be evaluated i.e. although being classified as a non-state conflict does not imply that a conflict is ethnic in nature (or occurs in a failed state), it may imply that the effects on the population (apart from the battle related deaths) are different from that of state conflicts. To complement the effect of conflicts and disasters (but especially conflicts) on the civilian population, the refugee origin variable is included in the analysis. It would be expected that the greater the intensity of the conflict, the greater the effect would be on the civilian population as a result of which a larger number of refugees would flee the country.

5.5. Correlation analysis

Three types of correlations are calculated for each variable with respect to the sex ratio of the total population and sex ratio of the elderly population: Pearson's product moment correlation coefficient, Spearman's rho correlation coefficient and Kendall's tau-b[71] correlation coefficient. Pearson's correlation measures the strength of the linear relationship between two variables that are quantitatively measured (Hauke and Kossowoski 2011). Spearman's rho and Kendall's tau-b measure the strength of the monotonic relationship between two variables that can be ranked at the ordinal level (Hauke and Kossowoski 2011). The rho and tau-b coefficients are therefore a special case of Pearson's coefficient in which data are converted to ranks before calculating the coefficients (Hauke and Kossowoski 2011). While all three coefficients require the variable to be normally distributed, certain distributional properties in the data may render the rho and tau coefficients more desirable (Hauke and Kossowoski 2011). The most relevant problem with respect to the current variables is the existence of outliers which are present in a majority[72] of the selected variables. While Pearson's correlation coefficients are very sensitive to the presence of outliers, Spearman's rho and Kendall's

[71] As Kendall's tau-a does not adjust for ties and the data is expected to yield a large number of ties, only the tau-b coefficient is reported

[72] There are of course some variables that do not present outliers (e.g. the GINI coefficient and the prenatal care) however since the two variables of interest contain outliers, the final correlation coefficient may be affected by the presence of these outliers.

tau-b are more robust[73] to the presence of outliers (Abdullah 1990). Therefore, only the correlations estimated by the latter two variables are provided in the table and interpreted while the results for Pearson's correlation coefficient are provided in the appendix.

Kendall's tau-b is more robust (with respect to outliers) and slightly more efficient measure of correlation than spearman's rho (Croux and Dehon 2010). The main advantage of Kendall's tau-b is that its distribution has better statistical properties and there is a direct interpretation of its statistic in terms of the observation of concordant and discordant pairs (Hauke and Kossowoski 2011). Hence, while spearman's rho is interpreted as the regular Pearson's coefficient i.e. measuring the degree of variability in the data, Kendall's tau-b represents the probability that the observed data are in the same order versus the probability that they are not in the same order (Hauke and Kossowoski 2011). In the case of sex ratios, a low tau-b coefficient with respect to for example maternal mortality would indicate that when ranked with respect to the sex ratios of the population, the number of discordant rankings is higher than the number of concordant rankings so the probability of an association is low. There is some evidence to suggest that in many cases[74] Spearman's rho is larger than Kendall's tau (Capéraá and Genest 2007) it would therefore be normal to expect the absolute value on the tau coefficient to be lower than the absolute value of the rho coefficient.

Tables 5-1 to 5-11 provides the rho and tau coefficients with respect to the sex ratio of the total population and sex ratio of the elderly population for all variables discussed in section 4. When interpreting the correlations three things have to be borne in mind: the statistical significance, the substantive significance and the direction of the correlation. Statistical significance assesses the probability that the correlation observed in the sample may have occurred by chance if there were no actual correlation in the population (Acock 2008). In the table below, the correlation coefficients that are accompanied by an asterisk are statistically significant at the 5% level. The substantive significance is based on the size of the correlation (Acock 2008). Generally, (in the social sciences), a correlation coefficient with an absolute value of 0.1 indicates a weak relationship, 0.3 indicates a moderate relationship and 0.5 indicates a strong relationship (Acock 2008). The substantive significance allows the calculation of the coefficient of determination. The coefficient of determination is the square of the correlation coefficient and may be interpreted as the percentage of variation in one variable that is explainable by the other (Ozer 1985). Both the statistical and substantive significance are affected by the sample size (Altman and Krzywinski 2015). An increase in sample size generally brings the sample correlation coefficient closer to the population coefficient thereby improving its substantive significance (Altman and Krzywinski 2015). However, very large sample sizes can lead to very small p-values and hence an over exaggeration of the statistical significance of correlation coefficients that may have a very small substantive significance (Altman and Krzywinski 2015). Given that the sample size for all variables is well above a 100 observations, the asterisk accompanying some very small substantive correlation coefficients in table 5-1

[73] Unless the presence of outliers in the data is very large which does not appear to be the case for any of the variables except FGM.

[74] The authors find that when one variable simultaneously left-tail decreases in one and right tail increases in the other variable, the absolute value of rho is greater than tau in 500 simulations (Capéraá and Genest 2007).

may not indicate their statistical significance but rather may be driven by the sample size. Finally, the direction of correlation may be indicated by a positive or negative sign. A positive number indicates that the two variables are directly correlated with one another i.e. an increase (or decrease) of one variable is associated with an increase (or decrease) in the other variable and a negative correlation indicates the two variables are inversely correlated i.e. an increase (or decrease) in one variable is associated with a decrease (or increase) in the other variable.

When interpreting the correlation coefficients, the statistical and substantive significance and the direction of correlation will be borne in mind. However, given that the sample size of all variables is fairly large, the statistical significance will be considered alongside the substantive significance (so that if coefficients have a low magnitude but are statistically significant, they will be considered as having no monotonic relationship with respect to the variable(s) of interest). Given that Kendall's tau is usually smaller and presents a more robust correlation than Spearman's rho, a coefficient will be assumed to display at least some (though weak) monotonic relationship if the absolute value of the tau-b coefficient is at least 0.15 and the rho coefficient is at least 0.2. It is to be noted that these benchmarks are already quite low as an absolute value of 0.15 means that 97.75% of the variation in the sex ratios (total/elderly) is accounted for by variables other than that being measured. Nevertheless, it is above the minimum requirement of a weak monotonic relationship thereby suggesting some minimum level of association (Acock 2008) and will therefore be considered. If the rho and the tau-b coefficients contradict each other, primacy will be given to the tau-b coefficient as it is a more robust estimator.

5.5.1. Correlations: Economic development indicators

When correlated with the sex ratios of the total population two of the seven variables – GDI and public health expenditure – present a statistically and substantively significant monotonic relationship. The Gender Development Index displays the expected negative correlation implying that a higher value of this index is associated with a preponderance of women in the population. The relatively higher values taken by this index lend credence to Duflo's (2012) arguments about the essential role of female education and female labor force participation in promoting economic development. More importantly it points to the association between reducing the gender gap in female and male capabilities (and thereby elevating female capabilities) and the returns to economic development for women. This is especially notable as the majority of remaining indices that ignore gender inequality fail to be highly substantively significant. The second variable that is substantively significant (although weakly) is public health expenditure. Again, the inverse relationship is in accordance with the theoretical evidence and discussion earlier in the chapter (and chapter 2) that an increase in public health expenditure is associated with an increase in the proportion of women in the population.

Table 5–1

Correlation coefficients economic development indicators				
	S. R. Total Pop.		***S. R. Elderly Pop.***	
	Rho	**Tau**	**Rho**	**Tau**
GNI	-0.15*	-0.10	-0.01	-0.01
GNI/capita	-0.17*	-0.11*	-0.02	-0.01
GINI Index	0.20*	0.12*	0.13	0.09
Urban/rural population	-0.11	-0.08	0.07	0.04
Public Health Expenditure	-0.27*	-0.17*	-0.09	-0.06
Sanitation Access	-0.18*	-0.11*	-0.06	-0.04
Gender Development Index	-0.50*	-0.35*	-0.40*	-0.28*

When correlated with the sex ratio of the elderly population the substantive significance of all variables falls and the only variable that remains both statistically and substantially significant is the GDI. The fall in GDI may be attributed to the fact that many of the recipients of the joint benefits of economic development, education and labor force participation are no longer in the analysis (i.e. the population aged 0-59). Nevertheless, the magnitude of the correlation suggests that there is a strong effect of GDI on the elderly population. This may be the direct result of elderly women benefiting from lower gender gap in capabilities (perhaps, but not necessarily, due to higher female capabilities) or the indirect cumulative result of lower gender gap in capabilities through earlier stages in the life course. What is more astonishing is the disappearance of the statistical and substantive significance of public health expenditure. This may imply either that public health expenditure (or its associated latent variables) does not adequately cater to the health needs of the elderly population (and in particular elderly women) or the elderly women who do survive till old age are not in need of the health services and subsidies provided by the government (thereby a selection effect evident across many developing countries: the majority of women who survive till old age are not the most vulnerable in society and may be able to some extent provide for their own health needs).

The most surprising results is perhaps for the urban/rural variable that appears to depict no monotonic relationship. This may be because, as discussed earlier, the urban sex ratios vary across different regions with sex ratios being more feminized in some urban regions of the world (e.g. South America) compared to others (e.g. South Asia and Africa). As a result, the correlation coefficients on this variable may not be displaying any clear pattern with respect to the sex ratio of the population (total/elderly).

5.5.2. Correlation: Population composition indicators

When correlated with the sex ratio of the total population, six of the ten variables – migrant sex ratio (female/male), ratio of dependency ratio, Muslims, Christian, Hindus

and Unaffiliated religion adherents – have coefficients that are both statistically and substantively monotonically significant. The expected negative correlation on migrant sex ratios (male/females) suggests that as the migrant population gets more masculinized, the sex ratio of the total population also gets more masculinized. This explains why the sex ratios in chapter 3 for some of the GCC countries (e.g. Kuwait) fall upon the exclusion of immigrants, as these countries are importers of predominantly male immigrants. Similarly, the expected negative correlation with respect to the ratio of dependency ratios suggests that as the population gets older, sex ratios become more feminized. The positive correlation with Muslims and Hindus and the negative correlation with Christians is again as expected. Results from Chapter 3 show that many countries that have predominantly Muslim populations (e.g. GCC countries, Pakistan, Bangladesh, Malaysia, Lebanon Iran; Pew Research Center, "Muslims" 2012) exhibit female deficits in their total and/or elderly populations. Nevertheless, the fact that the coefficient on Muslims is higher than that for Hindus requires some explanation. The discussion earlier in this chapter and in chapter 2 highlights that Muslims are likely to have lower sex ratios at birth than Hindus. Nevertheless, the correlation results may be explainable by the fact that the calculations are based on ordinal measures and the ordinal rankings are based on the percentage of population within each country that compose a particular religion. Not only is the geographical spread of Islam wider than that of Hinduism but also this geographical spread, when considered in light of the findings from Chapter 3, pertains to many of the countries (e.g. predominantly Muslim countries in Western and South Asia) that have strong female deficits in their total populations (Pew Research Center, "Hindus" 2012, Pew Research Center, "Muslims" 2012). The magnitude of correlation of religiously unaffiliated category also requires some explanation. Although 62.2% of the world's unaffiliated population resides in China (Pew Research Center, "Other" 2012) which, as suggested by literature and chapter 3, presents a substantial female deficit in its population, amongst the remaining countries that sustain 37.8% of the religiously unaffiliated, there is no evidence of a missing women phenomenon.[75] Given that the ordinal correlation measures do not account for the bulk of the concentration of the population but rather the ranking according to the percentage religiously unaffiliated in a given country (in which case China ranks three preceded by North Kore and Japan; Pew Research Center, "Other" 2012), the direction and even the magnitude of the calculated correlation is to be expected. The results for Christians are as expected indicating that countries with a higher proportion of Christians have a greater proportion of women in their population.

When correlated with the sex ratio of the elderly population, the results remain the same as in the previous paragraph however the substantive significance changes. For migrant sex ratios, ratio of dependency ratios, Muslims and unaffiliated religions, the substantive significance falls while for Hindus and Christians it rises. A brief reference back to chapter 3 may elucidate why the fall in migrant sex ratio is to be expected. In chapter 3, migration that altered sex ratios is expected to take place at the individual level i.e. either for work or for marriage. However, by the time the population reaches the elderly category, labor immigration (which is a significant source of distorted sex ratios) may be expected to recede so the impact of immigration on sex ratios of elderly population may be lower than total population. The fall in correlation on ratio of dependency ratios is to be expected as this variable measures the effect of age structure with respect to the total population. The sex ratio of the 60+ population may thereby be

[75] Exception may be Vietnam based on Guilmoto (2013) but not on Chapter 3.

affected to a significantly lower degree by the presence of people under the age of 60. A better way to measure the effect of age structure on the elderly population would perhaps be to calculate the ratio of younger elderly to older elderly - for example 80+ population/60-79 population – as the 80+ population is expected to be more feminized than the 60-79 population (in countries not exhibiting the elderly missing women phenomenon). The fall in sex ratios for Muslims is a little surprising as it indicates that the correlation for 60+ population is lower than that with respect to the younger population. As indicated in the previous paragraphs there is little evidence of sex selection at birth in Muslim communities so the missing women phenomenon therein would result from the accumulation of factors in subsequent life stages. As chapter 3 shows many Muslim countries exhibit worse female deficits in the older age categories as compared to the total population. However, chapter 3 considers the case for Asian countries only and at the world level the preponderance of women in the elderly population in Muslim countries where there are no elderly missing women (and hence lower population sex ratios) may be driving these results. For Hindus, the higher correlation in the elderly population may be indicative of a selection effect (in terms of the women who went missing at birth and didn't survive till old age) and/or the burden of cumulative disadvantage that women in old age face from previous life stages.[76] Similarly, for Christians, the higher negative correlation may be interpreted in light of the fact that neither the literature to date nor the results from chapter 3 have provided any evidence of elderly missing women, so in countries where this religion predominates the normal age-sex structure relationship may be expected to prevail such that as the population gets older, the preponderance of women in the population increases.

[76] When considering the countries across which the Hindu population is distributed (and hence how these countries will be ranked according to sex ratios), the majority of countries (6 out of 10) have a female deficit in their total and elderly population (Pew Research Center, "Hindus" 2012).

Table 5–2

Correlation coefficients population composition indicators				
	S. R. Total Pop.		***S. R. Elderly Pop.***	
	Rho	**Tau**	**Rho**	**Tau**
Migrants (female/male)	-0.55*	-0.40*	-0.35*	-0.25*
Ratio of dependency ratios	-0.48*	-0.32*	-0.29*	-0.19*
Buddhists	0.01	0.01	0.13	0.11
Christians	-0.23*	-0.15*	-0.28*	-0.20*
Folk religious adherents	0.11	0.08	0.12	0.09
Hindus	0.24*	0.19*	0.27*	0.21*
Jews	-0.01	-0.01	0.06	0.05
Muslims	0.38*	0.27*	0.33*	0.23*
Other religious adherents	0.04	0.03	0.05	0.04
Unaffiliated religious adherents	-0.41*	-0.29*	-0.27*	-0.19*

Overall, the low statistical and substantive significance of Buddhism, Folk religions (e.g. Confucianism) and Other religions with sex ratios of the population (total/elderly) is surprising. In the case of the former two religions, literature emphasizes strong patriarchal norms that elevate the position of men and may lead to skewed sex ratios in the total population (e.g. Chung and Das Gupta 2007). Given that 72.7%, 63% and 52.9% of Folk religion practitioners, Other religion practitioners and Buddhists respectively reside in China and India (Pew Research Center, "Folk" 2012, Pew Research Center, "Other" 2012), some level of statistical and/or substantive significance would be expected. However, this again may be related to the ordinal nature of the correlation coefficients. For example, in the case of Buddhism, for the ten countries where 94.5% of the world's Buddhist population resides, two present a missing women phenomenon in both their total and elderly populations (i.e. China and India; Chapter 3, Pew Research Center, "Buddhists" 2012) and two present a female deficit in their elderly population only (i.e. Thailand and Malaysia; Chapter 3, "Buddhists" 2012). In this case the almost non-existent correlation in the total population may be explainable by the low ranks for India and China (10^{th} for India and 8^{th} for China).

5.5.3. Correlation: Legislative environment

When correlated with the sex ratio of the total population, six of the seven variables - laws on rape, laws on domestic violence, laws on widow inheritance, laws on divorce, female seats in national assembly and female legislators/senior officials/managers - appear to present a statistically and substantively significant monotonic relationship. The direction of correlation is as expected indicating that the stronger the legislative

capacity to protect women against domestic violence, sexual harassment and rape, the more equitable the laws on widow inheritance and divorce and the greater the female participation in national assembly and senior positions, the greater the preponderance of women in the population. The highest substantive significance is that on laws of widow inheritance and laws on divorce. This may be a reflection of the latent variables these laws represent. Ezer (2006) uses the example of Tanzania to show that the social mechanism whereby inequitable inheritance laws are implemented often expose women to a variety of disadvantages that elevate their vulnerability to poverty. Perhaps the most extreme example of this, also relevant to the elderly missing women phenomenon, is accusing the widow of witchcraft which may not only prevent her from inheriting her share of her deceased husband's assets but as explained in chapter 2, may also elevate her mortality risk (Ezer 2006). Further, the existence of strong laws to protect women against rape, domestic violence and provide equitable widow inheritance and divorce rights may show that the general living conditions in a country are favorable for women as legislation places a high value on protecting women and this may be a reflection of people's perception about the positive value of women to society. As discussed earlier in the chapter, female seats in national assembly and female legislators/senior officials/managers may represent the variables associated with structural, political and cultural factors of a society. Hence, the higher correlation on the female legislators/senior officials/managers variable, as also explained earlier, may indicate that it is a better predictor than the former variable of the structural, political and cultural forces in society and thereby a better indicator of opportunities available to women to reach high positions not only in the political domain but also in the labor market.

Table 5–3

Correlation coefficients legislative environment

	S. R. Total Pop.		***S. R. Elderly Pop.***	
	Rho	**Tau**	**Rho**	**Tau**
Laws on rape	0.33*	0.25*	0.13	0.10
Laws on domestic violence	0.30*	0.20*	0.22*	0.16*
Laws on sexual assault	0.14	0.10	0.05	0.03
Laws on widow inheritance	0.50*	0.40*	0.43*	0.34*
Laws on divorce	0.50*	0.40*	0.41*	0.32*
Female legislators/managers/senior officials	0.50*	0.34*	0.45*	0.31*
Female National Assembly Seats	0.23*	0.15*	-0.14	-0.10*

When correlated with the sex ratio of the elderly population the values on all variables fall as a result of which the female seats in national assembly variable is no longer substantively significant. Further, the laws on rape variable loses both its statistical and substantive significance. The effect on the latter variable may be explained by the relatively lower reported incidence of non-fatal crimes in old age in some countries, as

discussed earlier, as a result of which laws to combat rape would have a lower impact on sex ratios in old age versus the total population. The continued (but lower) significance of laws on domestic violence in old age (relative to laws on rape) represents the high degree to which abuse/violence against the elderly and especially elderly women may still be an issue that needs to be addressed (as is also evident from the discussion in the old age section in chapter 2). At the same time the relatively lower value on this variable (compared to the total population) shows that domestic violence laws have a lower impact on the sex ratio in old age than at younger ages which may indicate a selection effect in the sense that women who bear the worst brunt of domestic violence may die before reaching old age and therefore may not benefit as much from laws against domestic violence as younger age categories. In the case of divorce, the results are again not surprising based on the assumption that divorce rates within the elderly population alone may be lower than in the total population (as divorce rates among the younger population may be higher than amongst the elderly) therefore divorce rights may be expected to have a weaker association with women in the elderly versus the total population. Similarly, in the case of widow inheritance the number of widowed women in the total population is likely to be higher than in the elderly population alone. The study by Anderson and Ray (2015) shows that in many regions across Asia and Africa where elderly missing women do exist, there is a very large gender gap in marriage and many women may be exposed to widowhood before reaching the age of 60. Therefore, widow inheritance rights can be expected to have a stronger association when younger women are also included in the analysis. This is especially true because women who become widowed at a younger age may face longer periods of widowhood and thereby be more strongly affected by laws on widow inheritance. The continued statistical and substantive significance of these laws may also be a result of the cumulative effects of these laws (and the associated latent variables) on the elderly population (particularly women) of a lifetime of living in a country under a particular form of legislation. Similarly, the continued correlation of female legislators/senior officials/managers may be the effect of positive externalities that accrue to women and society from this variable and the cumulative advantages to elderly women from having maintained such positions in earlier years of their life.

5.5.4. Correlation: Childhood variables

When correlated with the sex ratio of the total population only two in five variables, i.e. ratio of infant and under five mortality rates (female/male), display a statistically and substantively significant monotonic relationship. The coefficient on these variables suggest a negative correlation with the variable of interest so that countries with higher ratios (female/male) of infant and under-five mortality rates have higher female deficits in the total population. This results supports the discussion earlier in this chapter and in the childhood section in chapter 2.

Table 5–4

Correlation coefficients childhood variables				
	S. R. Total Pop.		***S. R. Elderly Pop.***	
	Rho	**Tau**	**Rho**	**Tau**
Stunting (female/male)	-0.03	-0.02	0.04	0.03
Wastage (female/male)	0.16	0.11	0.02	0.01
Underweight (female/male)	-0.10	-0.06	0.03	0.03
Infant mortality (female/male)	0.22*	0.15*	0.16*	0.10*
Under five mortality (female/male)	0.29*	0.27*	0.30*	0.21*

When correlated with the sex ratios of the elderly population the statistical significance and direction of correlation remains the same but the substantive significance falls with only the female to male ratio of under-five mortality rate being high enough to present some monotonic relationship. This may be interpreted as the lagged effect of female deficit that was created when the 60+ population was aged under 5 years and/or the cumulative effect of a lifetime of exposure to factors correlated with the under-five mortality rates that continue to affect the mortality of the 60+ population even in old age.

Overall, it is astonishing that all three malnutrition variables remain statistically and substantively insignificant. As discussed earlier in the chapter, the three malnutrition variables collectively capture the extent of neglect in nutrition and health among children under 5 and as emphasized in chapter 2, these two factors are underscored by many authors as being crucial in increasing the number of missing girls. Furthermore, as shown by the example of anemia in chapter 2, nutrition and health in early life affects many aspects of health at later stages of life, beyond childhood. Therefore, countries in which these malnutrition ratios are higher would be expected to have higher sex ratios and therefore provide stronger correlation coefficients. Nevertheless, the insignificance of these variables may be partly explainable by the discussion on the interaction between child malnutrition and education and income levels of the family described in intermediary forces section of chapter 2. This discussion shows that, in some cases, the effect of education (mother's/father's) or family income may be a stronger determinant of child malnutrition than gender. However, given the findings of missing women literature, the explanation offered by Mishra, Roy and Retherford (2004) on why literature sometimes fails to find evidence of gender differential in malnutrition appears more relevant. Using data from the Indian National Family Health Survey (1992-1993, 1998-1999), the author lists two reasons that may be relevant here: First, gender discrimination in food allocation is often restricted to girls of higher parity (i.e. a birth parity effect at the childhood level) and as these girls form a relatively small portion of all female children the effects may not be visible at the national level. Second, gender discrimination in favor of boys may sometimes be detrimental for boys: for example, when boys are breastfed for excessively long periods of time or fed too much meat (versus vegetables that are deemed inferior foods), they are denied some

essential nutrients that may lead to the detriment of their health and lead to poorer malnutrition indices among male children.

5.5.5. Correlation: Female non-reproductive indicators

When correlated with the sex ratio of the total population, all variables appear to be statistically and substantively significant. The negative correlation for age at first marriage and contraceptive prevalence suggest that countries with higher ages and contraceptive prevalence rates have a greater proportion of females in their population. Conversely, the positive correlations for anemia prevalence (non-pregnant), FGM and access to public space indicate that a higher incidence of these variables lead to a greater proportion of men in the population. The directions of all correlations are as expected and in accordance with the discussion in chapter 2. The relatively stronger correlations of contraceptive prevalence and access to public space may be indicative of the latent variables they represent. For example, as discussed earlier, contraceptive prevalence is tied to the autonomy of women (e.g. in terms of their bargaining position alongside their husband; Schuler and Hashemi 1994), knowledge about available methods of contraception, ability to obtain (in terms of access to finance and shops) the method of contraception and may even be associated with reduced risk of HIV infections especially in polygamous marriage arrangements (Clark, Bruce and Dude 2013).

Table 5–5

Correlation coefficients non-reproductive indicators				
	S. R. Total Pop.		***S. R. Elderly Pop.***	
	Rho	**Tau**	**Rho**	**Tau**
Female age at first marriage	-0.26*	-0.17*	-0.12	-0.08
Contraceptive prevalence (ages 15-49)	-0.37*	-0.24*	-0.19*	-0.13*
Anaemia (non-pregnant women)	0.25*	0.16*	0.13	0.08
FGM	0.21*	0.17*	0.11	0.09
Access to public space	0.44*	0.36*	0.31*	0.25*

When female non-reproductive indicators are correlated with the sex ratio of the elderly population, the only variable that remains both statistically and substantively significant is access to public space, although with a lower magnitude. The continued significance of this variable of course stems from the advantages and cumulative advantages that arise from having greater access to public space (for example, women living in societies with greater access to public space may visit health facilities with greater ease due to fewer taboos on leaving the house without a male companion and therefore are less likely to accumulate ill-health morbidity). However, the lower magnitude may be due to the fact that women in old age face fewer social restrictions than their younger counterparts so barriers in accessing public space may affect elderly women to a lesser degree than younger women. Hence, in old age this variable may be a lower deterrent in preventing women from, for example, health seeking behavior (even in societies where women's movements are heavily restricted) and may therefore have a lower impact on

sex ratios of elderly vis a vis total populations. The lack of statistical and/or substantive significance for the remaining non-reproductive variables in old age is somewhat unexpected. While the insignificance of FGM may be explained on the grounds of its non-prevalence in a majority of the countries examined (OECD 2014), the remaining variables would be expected to have some cumulative impact on women in old age especially since literature is rife with the multifaceted pathways through which they can affect the missing women phenomenon and the well-being of women in general (as discussed earlier in this chapter and in chapter 2). Therefore, these variables would be expected to present some cumulative association (even if via a latent variable) in old age. One explanation for this lack of association may be an extreme selection effect: women in developing countries who survive to old age may marry late and are not affected by anemia. Therefore, the cumulative disadvantage of these factors may not present themselves in old age. Hence, the results may represent the situation of women in developed countries and the extreme selection effect of women in developing countries.

5.5.6. Correlation: Female reproductive indicators

When correlated with the sex ratio of the total population, all variables except adolescent fertility rate are statistically and substantively significant with the direction of all correlations as expected. The negative correlation on skilled health staff and prenatal care indicate that countries where women have higher access to these facilities have a greater proportion of women in their population. This may be a result of women's direct access to these services or their access to latent variables associated with the provision of these services (e.g. countries with better prenatal care services may also have more physicians per 1000 patients). The positive correlation with total fertility rate, anemia (pregnant), abortion, neonatal mortality rate and maternal mortality rates shows that countries with a higher incidence of these features have a greater proportion of women in their population. The relatively high substantive significance of total fertility is to be expected as it represents the frequency with which women are exposed to the dangers of reproduction. It may therefore be seen as a composite of the other variables. On the other hand, the high substantive significance on abortion shows that countries where abortion is legal have a lower preponderance of men in their total and elderly populations. As discussed earlier in the chapter and similar to the access to public space variable, the abortion variable may serve as a proxy for the reproductive autonomy of women and may therefore point to the particular health concerns of women that may be considered socially taboo in societies (e.g. chapter 2 discusses that young women may find it shameful to get treatment for sexually transmitted diseases). The relatively high correlation coefficient on the abortion variable may therefore indicate that in countries where women don't have access to legal abortion, women may also face greater social constraints in accessing reproductive health services.

Table 5–6

Correlation coefficients reproductive indicators				
	S. R. Total Pop.		***S. R. Elderly Pop.***	
	Rho	**Tau**	**Rho**	**Tau**
Abortion	0.44*	0.36*	0.37*	0.29*
Skilled health staff (at time of birth)	-0.28*	-0.19*	-0.17*	-0.12*
Availability of prenatal care	-0.30*	-0.22*	-0.23*	-0.16*
Anaemia (pregnant women)	0.29*	0.19*	0.17*	0.12*
Total fertility rate	0.45*	0.29*	0.23*	0.15*
Adolescent fertility rate	0.19*	0.11*	0.04	0.03
Neonatal mortality rate	0.28*	0.18*	0.14	0.10
Maternal mortality rate	0.27*	0.17*	0.14*	0.09

When correlated with the sex ratio of the elderly population, only three variables, i.e. prenatal care, total fertility rate and abortion are both statistically and substantively significant although the magnitude of correlation is lower than when correlated with the sex ratio of the total population. The results are again not surprising for total fertility rate as women in their reproductive years are no longer included in the analysis. The correlation on this variable may now represent the cumulative association of past fertility on the sex ratio of the elderly population (especially as in the past, when the elderly women of today were in their child bearing years, the fertility rates would have been even higher so the effects of this variable on women would be expected to be relatively stronger and prevail for long). The continued statistical and substantive significance of abortion and prenatal care strengthens their proxy variable interpretation and may indicate that related latent variables directly or indirectly (through their cumulative effect from earlier years) affect the health of women in old age. The absent substantive significance of the remaining variables is notable as it would be expected that their cumulative and latent effects on elderly women would lead to a higher association in old age.

Overall, the lack of statistical and/or substantive significance of adolescent fertility rate appears surprising. While total fertility rate indicates the frequency with which women are exposed to the dangers of reproduction, adolescent fertility rate provides a measure of the intensity of these dangers in the sense that being exposed to reproductive dangers at earlier versus later ages increases the intensity of exposure. Therefore, adolescent fertility rate would not only be expected to raise the sex ratio of the total population but through a cumulative lagged effect, raise the sex ratio of the elderly population as well.

5.5.7. Correlation: Disease environment

When correlated with the sex ratio of the total population, four of the five disease environment variables - Communicable Disease Deaths, Non Communicable Disease

Deaths, COMM and Injury Deaths – present a statistically and substantively significant relationship. Communicable Disease Deaths and Injury Deaths present a positive monotonic correlation indicating that countries with increasing incidents of these deaths by these causes have high female deficits in their populations. Non-communicable disease deaths present a negative monotonic relationship indicating the reverse. The results for communicable disease and non-communicable disease deaths are as expected. The majority of missing women literature (as described in chapter 2) lists communicable diseases deaths as the prime cause of excess female mortality at the childhood and young adulthood stages. The coefficient for non-communicable deaths may depict the female survival advantage in terms of non-communicable disease described earlier in the chapter and in chapter 2. The COMM variable therefore summarizes the relationship between non-communicable and communicable diseases by showing that as the proportion of deaths from non-communicable versus communicable diseases in a country increases, the preponderance of women in the population increases. This may indicate one of two things: either the gender disproportionately exposed to communicable diseases is female (as is the case in countries affected by the missing women phenomenon) or women have a survival advantage in terms of non-communicable diseases. This result matches disease environment arguments in chapter 2. The results for injury deaths are a little puzzling. It has already been discussed earlier in the chapter that with the exception of South Asia, the burden of injury deaths falls on men. Hence, the correlation should work in the opposite direction, with injury deaths reducing the female deficit. Even if injuries are one of the main causes of missing women in India (Anderson and Ray 2010), the results are contradictory with the study of Haagsma et al. (2016) on worldwide patterns in injury. This result requires further exploration.

Table 5–7

Correlation coefficients disease environment

	S. R. Total Pop.		***S. R. Elderly Pop.***	
	Rho	**Tau**	**Rho**	**Tau**
COMM	-0.36*	-0.24*	-0.24*	-0.15*
Communicable disease deaths	0.36*	0.23*	0.23*	0.15*
Non-communicable diseases deaths	-0.38*	-0.25*	-0.25*	-0.17*
Injury deaths	0.39*	0.27*	0.30*	0.21*
HIV deaths (female/male)	0.10	0.07	0.06	0.04

When the disease environment variables are correlated with the sex ratio of the elderly population the results remain the same but the substantive significance of all variables falls. The decline in the substantive significance of communicable diseases is to be expected as, the discussion in chapter 2 shows, younger populations (in countries where these diseases are still prevalent) are more likely to be exposed to communicable diseases. However, for the same reason the fall in the substantive significance of the non-communicable disease variable and COMM variable is unexpected. It has already

been discussed that non-communicable disease deaths are more prevalent in developed countries and in the elderly populations of developing countries (as diseases of affluence; Sen and Bonita 2000). Therefore, if only the elderly population is considered in all countries of the world, the correlation of non-communicable diseases with respect to the elderly population may be expected to be higher than with respect to the total population. By the same logic, the COMM variable (which is the ratio of non-communicable to communicable diseases) would be expected to have a higher substantive significance with the sex ratio of the elderly population. The decline in magnitude in injury deaths is to be expected as part of the population that is affected by these deaths has been excised so only effects on a fraction of the population and the cumulative effects on survivors from previous stages are being captured. However, as the direction of correlation on injury deaths is contradictory, no definitive conclusion can be drawn.

Overall, the lack of significance and low correlation of the HIV fatality ratio (female/male) is not very surprising. Although Anderson and Ray (2010) do find HIV to be one of the prime causes of the female deficit among women aged 15-44 in Sub-Saharan Africa, as mentioned earlier in the chapter, variations in the incidence of HIV (by gender) exist across countries and continents (with the disease being more prevalent among men in some countries and among women in other countries). Therefore, at the global level there may exist no correlation between gender ratio of HIV deaths and sex ratio of the population (total/elderly).

5.5.8. Correlation: Survival expectations

When correlated with the sex ratio of the total population, all variables in this category display a statistically and substantively significant monotonic relationship. In fact, the substantive significance of the variables herein exceeds that of most other variables. The direction of correlation for all variables is as expected suggesting that as the female to male ratio of life expectancy and healthy life expectancy (at birth and at 60) increases and female to male ratio of mortality between ages 15 and 60 decreases, the proportion of women in the population increases. Two things are to be noted about the correlations: First, the substantive significance for both the life expectancy and healthy life expectancy is higher at birth than at 60. Second, the substantive significance of healthy life expectancy is higher than that of life expectancy. (both at birth and at 60). The first point is not surprising given that life expectancy at birth is a summary measure of mortality across all age groups (children, adolescents, adults and elderly; WHO 2006) and is calculated before the population experiences the adverse mortality conditions of subsequent years. Similarly, the slightly higher substantive significance of healthy life expectancy is to be expected: Using data from 191 countries worldwide for the year 2000, Mathers et al. (2002) find that, at the cross-national level, the gender gap in healthy life expectancy is lower than the gender gap in life expectancy because the former accounts for higher burden of injury and disease borne by women. The second chapter describes how the missing women phenomenon may be a result of women's greater propensity to suffer from disease and disability at several stages of life Therefore, in especially accounting for the impact of morbidity on the population the substantive significance of healthy life expectancy becomes higher than that of life expectancy. The monotonic relationship indicated by mortality between 15 and 60 may imply that factors identified in the young adulthood and adulthood stages in chapter 2 (some of which are represented here as female reproductive and non-reproductive

indicators and present correlations in the expected direction) may serve to elevate the premature mortality of women at least in countries exhibiting the elderly missing women phenomenon.

Table 5–8

Correlation coefficients survival expectations				
	S. R. Total Pop.		***S. R. Elderly Pop.***	
	Rho	**Tau**	**Rho**	**Tau**
Life expectancy at birth (female/male)	-0.52*	-0.37*	-0.59*	-0.44*
Life expectancy at 60 (female/male)	-0.44*	0.32*	-0.52*	-0.38*
HALE at birth (female/male)	-0.54*	-0.39*	-0.66*	-0.50*
HALE at 60 (female/male)	-0.47	-0.34	-0.54	-0.38
Mortality ages 15 to 60 (female/male)	0.46*	0.32*	0.42*	0.30*

When correlated with the sex ratios of the elderly population the results remain the same as before except the substantive significance on the variables changes. For the life expectancy variables, the substantive significance is higher than when correlated with the sex ratio of the total population whereas for the mortality variable it is lower. The higher correlation of life expectancies with sex ratio of the elderly vis a vis sex ratio of the total population may be explained through an example: Vaupel (1986) uses data from Swedish life tables to show that if deaths could be reduced by 1% in any decade of life to increase life expectancy at birth, the greatest increase would come from reducing deaths from a specific decade in later life (after 60+, varies for men and women) versus a specific decade from earlier in life. Therefore, the higher correlation with the 60+ population may be a reflection of this result as it shows the extent to which female gains in lower deaths rate in later life are reflected in actual female preponderance in later life. The lower correlation of adult mortality (15 to 60) may be due to the fact that the variables that affect adult mortality (15 to 60) are less strongly associated with the 60+ population than the total population because the population directly affected by these variables has been excised. Therefore, the association in the 60+ population may be a reflection of the lagged effect of female deficit from earlier stages (i.e. excess female mortality in adulthood being presented as the absence of females in old age) or the effect of variables correlated with adult mortality that either display a cumulative effect on the population that survives to old age or continue to cause excess female mortality in old age, although to a lesser degree than younger life stages.

5.5.9. Correlation: Education indicators

When correlated with the sex ratio of the total population, all variables except primary education (15+ and 60+) and tertiary education (15+) display a statistically and substantively significant monotonic relationship. The results would therefore suggest that as the proportion of literate women (15+), proportion of women with secondary education in the population, and proportion of elderly women only with tertiary education in the total population increase and the proportion of uneducated women in

the population falls, the sex ratios of a population decrease. The high substantive significance for no education is not surprising because it captures the aggregate impact of having zero levels of primary, secondary or tertiary education and therefore represents the most educationally disadvantaged female population. Thereafter, the relatively higher correlation for literacy alone vis-á-vis education seems a little surprising because it would be expected that education would have a stronger association than literacy with regards to the sex ratios of the population. However, this result may be driven by the fact that the set of women who are literate includes the set of women with primary, secondary and tertiary education so in addition to reflecting the association of literacy only (and not education), the literacy variable may also capture the aggregated association of each education level with respect to the sex ratios of the total population. It is to be noted that amongst all three education levels (15+ and 60+) the substantive significance of secondary education is the highest. This may be a reflection of the findings of Subarao and Raney (1993) discussed earlier in the chapter which show that although all levels of education are beneficial for women, secondary education has an especially favorable impact in reducing fertility and maternal mortality. Therefore, the substantive significance of secondary education may partly be driven by the interaction of these variables on the sex ratio of the total population. It is also to be noted that for the secondary and tertiary education levels, the magnitude of correlation for female education in the 60+ population is higher than in the 15+ population. Female education in the 60+ population reflects the attainment of the given levels of education decades earlier. For example, women aged 70 or 80 today probably attained their secondary education between 1945 and 1965. In any given society, the attainment of female education (especially higher levels thereof), may have been a much more challenging task decades earlier than today. Therefore, elderly educated women today (especially those with tertiary education) may have been exposed to favorable early life conditions (through several latent variables) that may have positively affected them at each subsequent life stages. For example, many of the studies in the economic development indicators section link education to GNI. Hence, the higher correlation on the variables associated with a 60+ level of education may somewhat indicate the lagged association of economic development which as Duflo (2012) explains improves the position of women in society.

Table 5–9

Correlation coefficients education indicators				
	S. R. Total Pop.		***S. R. Elderly Pop.***	
	Rho	**Tau**	**Rho**	**Tau**
Female literacy rates (ages 15+)	-0.32*	-0.22*	-0.35*	-0.34*
Female 15+: no education	0.39*	0.27*	0.32*	0.22*
Female 15+: primary education	0.06	0.04	0.06	0.03
Female 15+: secondary education	-0.22*	-0.14*	-0.19*	-0.12*
Female 15+ tertiary education	-0.19*	-0.12*	-0.06	-0.03
Female 60+: no education	0.41*	0.28*	0.35*	0.24*
Female 60+: primary education	-0.16	-0.10	-0.10	-0.06
Female 60+: secondary education	-0.35*	-0.24*	-0.29*	-0.19*
Female 60+: tertiary education	-0.24*	-0.16*	-0.16	-0.11

When correlated with the sex ratio of the elderly population all the variables discussed in the previous paragraph, except tertiary education (60+), remain statistically and substantially monotonically significant. Nevertheless, the substantive significance on all these variables, except female literacy, falls. In light of the positive externality effect of female education (60+, discussed in the previous paragraph – as a result of which younger populations in countries that have a more educated elderly female population may be exposed to better living conditions, especially for women) and given that the direct beneficiaries from the gains in secondary education are no longer in the analysis these results seem plausible. This is because the direct and indirect effects of women both not having an education (15+, 60+) and having a secondary education (15+, 60+) would be expected to be stronger for all women in the population rather than women in the elderly population alone. The rise in magnitude for adult literacy rate however does not fall in line with these arguments.

Overall, the low substantive significance of primary education (15+ and 60+) is somewhat surprising especially because the factors that would serve as barriers to the completion of primary education would perhaps be even stronger for subsequent levels of education and given that the no education variable has the largest substantive significance in the group, primary education would be expected to be statistically and substantively significant.

5.5.10. Correlation: Labor force indicators

When correlated with the sex ratio of the total population only the female to male employment ratio and the female to male employment with primary education ratio are statistically and substantively significant. The direction of correlation for these variables is as expected suggesting that an increase in the female (vis a vis male)

proportion of labor force participation would increase the proportion of women in the population. These results are similar to the findings of Sen's (1990) seminal paper discussed earlier in the chapter. The fact that the substantive significance of the female to male employment ratio is higher than the other variables in the group and higher than that for the percentage of females with primary, secondary and tertiary education (15+) may show that the variables associated with women's earning capacity are more important than education in enhancing women's position in society.[77] However, the statistical and substantive significance of female to male ratios with primary education is somewhat surprising given that the percentage of females with primary education is statistically and substantively insignificant. This would suggest that the associative benefits of primary education for women come via the associative benefit it creates in terms of employment opportunities. However, this contradicts the insignificant results for female to male ratios of labor force participation with secondary and tertiary education. This is especially surprising because it may be expected that the participation of women with higher levels of education would have an important bearing on excess female mortality due to the negative consequences that arise from women working in the informal and agriculture sector (some of which are discussed in chapter 2) and may partly be a result of women not having the necessary education to reach the formal level of employment.

Table 5–10

Correlation coefficients labour force indicators

	S. R. Total Pop.		***S. R. Elderly Pop.***	
	Rho	**Tau**	**Rho**	**Tau**
Employment ratio (female/male)	-0.35*	-0.23*	-0.30	-0.20
Female employment-population ratio	-0.17*	-0.11*	-0.12	-0.07
Labour force primary education (f/m)	-0.21*	-0.14*	-0.25*	-0.15*
Labour force secondary education (f/m)	-0.05	-0.04	0.04	0.02
Labour Force tertiary education (f/m)	0.13	0.08	0.11	0.07

When correlated with the sex ratio of the elderly population, the results remain the same but the substantive significance changes: falling for the female to male employment ratio but rising for employment with primary education ratio. As labor force participation rates of the elderly population are expected to be lower than that of the total population (at least in the case of the OECD countries; OECD 2016), all labor force participation variables would be expected to have a lower impact (direct/or cumulatively) on the 60+ population than the younger population. Therefore, the rise in substantive significance of employment with primary education ratio is somewhat inexplicable.

[77] However, this may be partly driven by the higher sample size of female/male employment ratio vis-a-vis the other six variables (i.e. 179 observations of employment ratio only, 149 observations for education variables and 118 observations for ratios of education-labor force ratio variables).

5.5.11. Correlation: Demographic shocks

When correlated with the sex ratio of the total population, the only variable that is both statistically and substantively significant is battle related deaths (non-state conflicts). However, the direction of correlation suggests that an increase in battle related deaths leads to an increase in the preponderance of men in the population. Using the example of Pakistan, Chapter 4 shows that battle related deaths intuitively pertain to male deaths. If this is extended to other countries, the direct effect of battle related deaths (non-state conflicts) should be to reduce the number of men in the population. However, if battle related deaths is used as a proxy for severity of battle and the implications of the short term and long term consequences of conflict are considered from literature review in chapter 4 (i.e. in the short term men and women suffer equally from conflict but in the long run women may suffer more in terms of mortality and gender gap in life expectancy (Plümper and Neumayer 2006) then the positive sign on battle related deaths (non-state) is explainable especially given the fact that this variable considers battle related mortality from all conflicts from 1989 to 2015 so the long term effect of earlier conflicts would also become somewhat evident on the population. Furthermore, Chapter 4 discusses that ethnic conflicts, especially ethnic conflicts in failed state (where there is a complete breakdown of state machinery) have more deleterious long term implications for women (in terms of reducing the gender gap in life expectancy).[78] This may also explain why conflicts may not have a lingering impact on the sex ratio trend of Pakistan (Chapter 4) as no conflict (ethnic or otherwise, that engulfs the entire country) has taken place on the geographic region that encompasses Pakistan today. Under these considerations, the negative sign of battle related deaths (non-state) variable becomes plausible.

Table 5–11

Correlation coefficients demographic shocks				
	S. R. Total Pop.		***S. R. Elderly Pop.***	
	Rho	**Tau**	**Rho**	**Tau**
Incidents >1000 deaths	0.09	0.07	0.08	0.06
Battle related deaths (non-state)	0.28*	0.19*	0.14	0.08
Battle related deaths (state)	0.01	0.00	-0.04	-0.02
Battle related deaths (total)	0.11	0.12	0.12	0.09
Refugee origin	0.03	0.02	-0.01	-0.01
Total disaster deaths	-0.04	-0.03	0.03	0.02
Total disaster affected	-0.04	-0.02	-0.09	-0.06

[78] It is to be noted that non-state conflicts are not necessarily limited to ethnic conflicts or conflicts in failed states. They merely include those in which the state does not directly participate (Melander, Pettersson and Themnér (2016) so the effect of this significance may only partly be driven by ethnic conflict and conflict in failed states.

When correlated with the sex ratios of the elderly population none of the conflict and disaster variables are significant. These results are exactly similar to the findings from chapter 4 regarding demographic events in the history of Pakistan and their impact on elderly missing women in Pakistan today. Further, since the starting year for the variables is 1989, and based on the assumptions from chapter 4 about the age of men fighting in battles (approximately 20-44 years) it may be assumed that the deficit created by men directly affected by the conflict has yet to impact the elderly population. However, it remains unclear why the effect on women in the elderly population is not more adverse than women in the elderly population.

5.5.12. Correlation: Summary

A comparison of all statistically and substantively significant variables in the different categories discussed so far reveals that the variables with the highest substantive significance, except the majority of the economic development indicators, are the ones that represent the intermediary forces in chapter 2. Amongst these variables representing intermediary forces, the highest correlations, with respect to both the total and elderly populations, are for the female to male ratios of life expectancy and healthy life expectancy at birth. Both of these represent a strong monotonic relationship with respect to the sex ratios of the total and elderly populations. These are also amongst the few variables whose substantive significance is higher with respect to the elderly population compared to the total population. One reasons for their general high substantive significance may be that the social/lifestyle explanation that partly drives the gender gap in life expectancy (e.g. men engage in more damaging ways to health than women; Wingard 1984) is similar to the various gender related arguments used to explain sex differentials in mortality rates (Nathanson 1983). In other words, almost all the factors presented in chapter 2 that explain the existence of the elderly missing women phenomenon by life stage are gender related and thereby the result of the various behavioral and social pathways through which the health and well-being of women is undermined. Therefore, some of the reasons driving sex ratios in life expectancy (which are driven by the gender gap in life expectancy) and sex ratios of the population (total/elderly) may be similar. For the majority of the remaining variables (representing both the factors across the life course and the intermediary forces) the correlation with respect to the total population is higher than the elderly population.

5.6. Regression analysis

The correlation analysis considers the association of each variable with the sex ratios of the population (total/elderly) independently of how they may be affected by all the other variables. Given that the variables can be intuitively grouped together to form the above 11 categories; these variables may be expected to affect each other. Therefore, in the next step the simultaneous impact of the variables is evaluated via on ordinary least squares (OLS) model to test for their impact on the sex ratios of the population (total/elderly). The OLS method is one of the major data analytical techniques, the most frequently used method for the linear regression model and forms the foundation of many other useful technique (e.g. ANOVA and Generalized Linear Model; Long 1997, Hutcheson 2011). It would therefore be the most obvious first step in exploring the simultaneous interaction of these variables on sex ratios of the population (total/elderly).

There are many pathways through which these variables are interlinked. The correlation amongst some of these variables can be explained by Sen's (1998) explanation of associative relevance of human mortality with a variety of variables. Sen (1998) postulates that income is only one variable that determines the quality of life (or mortality rate) of a population. Other deterministic variables include: the distribution of national income, the epidemiological environment in which a person lives, the availability of healthcare services, nature of medical insurance, education, organization of urban living and access to modern medical knowledge (Sen 1998). To prove his point, he provides four examples where the interplay of these different variables has affected mortality patterns in different environments. First, he argues that while the trends of GDP growth rate and life expectancy in 20th century England and Wales followed opposite trends, the end of the war decades (i.e. 1911 to 1921 and 1941 to 1951) coincided with substantial increases in life expectancy. He attributes the latter phenomenon to be a result of improved delivery of food and health care services during the war decades in the UK so that while total supply of food during the war years went down, the incidence of undernutrition, due to the improvement in services and the establishment of a rationing system also went down (Sen 1998). Second, he provides two contrasting examples to show that increase in GNP may lead to an increase in life expectancy if the increase in GNP is accompanied by poverty removal and increased expenditure on public health. For the first example, i.e. where growth in GNP per capita leads to an increase in life expectancy, he cites countries like South Korea and Hong Kong where rapid and equitable economic growth diverted resources to the expansion of health care services and allowed life expectancy to increase very rapidly in a short span of time. He also cites the example of Costa Rica that, in spite of its low levels of real per capita GDP, was able to reduce mortality by expanding basic social services like education and health. For the second example, i.e. where growth in GNP per capita was not accompanied by an increase in life expectancy, he cites the example of Brazil to show that, despite high rates of economic growth the country has not experienced an equally rapid rises in life expectancy due to its inability to divert resources to health care and poverty reduction. Third, Sen (1998) quotes the exceptionally low sex ratios in the Indian State of Kerala (i.e. sex ratios in the total population of Sen 96.15, below the Indian average; Sen 1990) and argues that these low ratios persist despite GDP levels in the state being lower than the Indian average. He contends that the reasons for this may be the matrilineal inheritance patterns and higher literacy and labor force participation rates for women compared to the rest of the country (Sen 1998). Finally, he argues that even countries with similar levels of GDP display different mortality patterns in their sub-populations. For example, he shows that although the United States as a whole has the same GDP per capita, African American populations within the United States have a higher mortality rate than American white populations and African American's from Harlem have an even higher mortality rate than African American's in the United States as a whole. In fact, African American men from Harlem in their late thirties have a higher mortality rate than men from Bangladesh in their late thirties despite the former having higher income levels than the latter. Reasons for this include violence, social deprivation and hazards of urban life that are not faced by Bangladeshi males once they pass the childhood phase. The discussion shows that one variable alone (GDP/GNP in this case) cannot independently explain the various channels that affect the mortality of men and women in a society. Therefore, the diverse channels and interlinkages through which various variables interact with mortality need to be explored.

The interconnectivity of different types of variables comes as no surprise when considered in the context of Sen's treatise on Development as Freedom (Sen 1999). Sen (1999) contends that the aim of Development is the expansion of different types of human freedoms (i.e. political freedoms, economic facilities, social opportunities, transparency guarantees and protective security) and this aim is achieved not just through higher levels of GDP and income per capita but also improvement in education and health facilities, expansion in civil liberties, technological progress and social modernization (Sen 1999). Complementary to the development process is the removal of various forms of un-freedoms like poverty, tyranny, poor economic opportunity, social deprivation, neglect of public facilities, intolerance and state repression (Sen 1999). The process of development is therefore contingent on the attainment of the interlinked human freedoms for two reasons: the evaluative reason (i.e. ability to assess progress in terms of whether the freedoms people have are enhanced) and the effectiveness reason (i.e. the achievement of development is entirely dependent on the free agency of people; Sen 1999). The latter implies that people's positive achievements are influenced by economic opportunities, political liberties, social powers and the enabling conditions of good health, basic education and the encouragement and cultivation of initiatives (Sen 1999). Hence, the attainment of each type of freedom encourages the general capability of a person (Sen 1999). The idea of capability captures a person's opportunity to achieve valuable combinations of human functioning (i.e. what a person is able to do or be) and focuses on whether a person is able to do the things he values doing (Sen 2005).

It is therefore evident that an exploration of the association of one variable with the sex ratios of the population (total/elderly) in isolation of the myriad of interlinkages with other variables cannot satisfactorily explain its impact on the sex ratios of the population (total/elderly). It is for this reason that the OLS model is used. However, before proceeding with the OLS regression two caveats must be borne in mind: First, although the variables were initially chosen to have a minimum number of missing values, the presence of missing values for a distinct set of countries within each variable implies that when all variables are included in the model together, the set of countries absent from the analysis increases. Second, as mentioned in the preceding two paragraphs (and evident from section 4 of this chapter), the majority of variables may be highly correlated. This holds not only for variables that fall within the same category (e.g. different levels of educational attainment are correlated with each other) but also variables across categories (deaths by communicable disease and total fertility rate have a correlation of 0.88) Their inclusion in an OLS model would likely cause it to collapse due to the problem of multicollinearity. Multicollinearity is a result of two or more independent variables being highly correlated, making it difficult to know the importance of each as a predictor as a result of which the explanatory power of one or more of the variables becomes partly or completely redundant (Acock 2008).

The first caveat can be addressed by excluding some of the variables from the OLS regression. The objective would be to include the maximum number of variables while ensuring the maximum number of observations (countries in this case). However, of equal if not greater importance is ensuring that countries presenting the missing women problem (as evident from chapter 3), and especially those presenting the problem as an outlier (e.g. the GCC countries of the Middle East) are represented in the model. Table 5-12 below shows the final list of countries and variables that ensure the least number of missing values and the maximum number of observations and variables.

Table 5–12

List of countries included in regression analysis			
Afghanistan	Cuba	Lithuania	Rwanda
Albania	Dominican Republic	Macedonia	Saudi Arabia
Algeria	Ecuador	Madagascar	Senegal
Angola	Egypt	Malawi	Serbia
Armenia	El Salvador	Malaysia	Sierra Leone
Azerbaijan	Equatorial Guinea	Maldives	South Africa
Bangladesh	Gabon	Mali	Sri Lanka
Belarus	Gambia	Mauritania	Sudan
Belize	Georgia	Mexico	Suriname
Benin	Ghana	Moldova	Swaziland
Bhutan	Guatemala	Mongolia	Tajikistan
Bolivia	Guinea	Montenegro	Tanzania
Bosnia & Herzegovina	Guinea-Bissau	Morocco	Thailand
Botswana	Guyana	Mozambique	Timor-Leste
Brazil	Haiti	Namibia	Togo
Burkina Faso	Honduras	Nepal	Trinidad Tobago
Burundi	Indonesia	Nicaragua	Tunisia
Cabo Verde	Iran	Niger	Turkey
Cambodia	Iraq	Nigeria	Turkmenistan
Cameroon	Jamaica	Oman	Uganda
Central African Republic	Jordan	Pakistan	Ukraine
Chad	Kazakhstan	Panama	Uruguay
China	Kenya	Papua New Guinea	Uzbekistan
Colombia	Kyrgyz Republic	Paraguay	Vietnam
Comoros	Laos	Peru	Yemen
Congo*	Lebanon	Philippines	Zambia
Costa Rica	Lesotho	Portugal	Zimbabwe
Cote d'Ivoire	Liberia	Qatar	
Croatia	Libya	Romania	

It can be seen from the table that some important countries are excluded from the analysis. Foremost amongst these are United Arab Emirates, Kuwait and Bahrain followed by Brunei, Hong Kong, Macao, Palestine and Syria and finally South Korea. As shown in Chapter 4, the first set of 3 countries are outliers in terms of the missing

women phenomenon (i.e. they are amongst the countries presenting the largest female deficit in Asia). Nevertheless, as there are three other countries (i.e. Qatar, Oman and Saudi Arabia) that form the same group of the GCC countries that are also outliers in the extent of their deficit, the exclusion of the former three countries may be somewhat compensated by the inclusion of the latter three countries. The exclusion of the second set of six countries is distressing because, with the exception of South Korea, they represent countries that present the missing women phenomenon in the total/elderly population so their inclusion versus exclusion in the analysis would have been more desirable. The inclusion of South Korea would have been desirable because although it does not present a missing women phenomenon in its population today, it did so in the past and until the 1990's followed a trend similar to that of China (Das Gupta and Shuzhuo 1999). However, given that not all countries that do not present a female deficit in the population are included in the analysis (e.g. some Western European countries are excluded from the analysis), that many more countries that present the elderly missing women phenomenon are included versus not included in the analysis and that at the world level, it can be expected that the number of countries that present the elderly missing women phenomenon does not exceed the countries that do not present it, the data may be considered adequately representative of the countries of the world.

The second caveat (i.e. multicollinearity) can be addressed by using exploratory factor analysis. Cudeck (2000) describes exploratory factor analysis as a technique in which "relations among variables are explored by testing a series of factors that account for the shared variance among the variables." It hinges on the idea that the intense correlation amongst variables is a result of some common but unobserved forces (Cudeck 2000). The goal of exploratory factor analysis is therefore to identify these latent forces behind a set of variables and obtain the smallest number of factors that would account for the correlation created by these latent forces (Cudeck 2000, Yong and Pearce 2013). For factor analysis to be used successfully the correlation amongst the variables needs to be at least 0.3 (Yong and Pearce 2013). As evident from the correlation matrices in the appendix (tables I-2, I-3, I-4), the correlation amongst majority of the variables included in the factor analysis is above 0.3. In many cases it exceeds 0.4 and 0.5 which are the benchmark values to be considered important and practically significant respectively (Williams, Onsman and Brown 2010). There is some debate about the minimum number of observations required for factor analysis with values ranging between 50 and 300 (Williams, Onsman and Brown 2010). However, this minimum number is contingent upon the strength of the correlations, i.e. the stronger the correlations the smaller the number of values required to make the technique work successfully (Williams, Onsman and Brown 2010). Given that the correlation amongst the majority of variables exceeds 0.3 at least, in many cases goes up to 0.5 or 0.6 and at times even beyond that, the sample size of 117 observations with the selected variables seems appropriate.

The exploratory factor analysis conducted here is performed on continuous data as the theory and methods for this are already well developed (Jöreskog and Moustaki 2001) and the assumption of a continuous and normal distribution for these variables holds. For this reason, the following variables are excluded from the analysis: GDI, GINI, abortion, FGM, laws (domestic violence, rape, sexual harassment, divorce and widow inheritance) and incidents with cumulative intensity higher than 1000 deaths. This is lamentable as some of these variables (e.g. GDI, laws on widow inheritance) present

relatively high correlations with respect to the sex ratio of the population (total/elderly). The fact that most of these variables are highly correlated with some or all variables in the factor analysis means that they cannot be included in the regression independently. Additional variables excluded from the factor analysis and regression are: stunting, wastage, underweight, all education variables except literacy and all employment variables except the employment ratio. These variables are excluded from the analysis because when taken together they not only substantially reduce the number of observations (to approximately 62) but also exclude additional important countries from the analysis that present the (elderly) missing women phenomenon in their populations (e.g. Afghanistan, Yemen). Apart from these variables, public health expenditure and injury deaths are also excluded from the analysis. Public health expenditure, although correlated with a majority of the variables, has a very high level of uniqueness and does not adequately load onto any of the factor variables. In addition, some of the variables are modified before inclusion in the factor analysis: First, anemia (pregnant) and anemia (non-pregnant) is replaced by a single variable anemia (reproductive age group) that represents the burden of anemia amongst all pregnant and non-pregnant women in the reproductive age group. Second, the female to male employment ratio is now represented by the female employment to population ratio. This is because the correlation of female employment ratio with the majority of the variables in the factor analysis is higher than the employment ratio so it would be expected to provide better results when the factors are grouped together.

Two population composition variables (migration and religion) and all demographic shock variables are excluded from the factor analysis but included in the regression equation. In the case of migration some measure needs to be taken of the percentage of the population that migrants form to see whether their numbers are high enough to affect the total population. Chapter 4 explains that the sex ratio of a given population will only be affected if 1% of either gender is affected. Therefore, the migrant sex ratio is multiplied by a dummy variable that measures the proportion of population constituting immigrants. If immigrants account for more than 1% of the total population then this dummy variable is equal to 1, otherwise 0. Therefore, the migrant sex ratio is replaced by a new variable "migration" which is a dummy interaction term representing the sex ratio (female/male) of the migrant population if migrants form greater than 1% of the population of a given country. In the case of religion, the situation is a little more complicated because the data provides the percentage of people in a given country who adhere to a particular religion. As a result, the inclusion of all religious categories simultaneously would create the problem of perfect multicollinearity as all religious categories are perfectly dependent upon one another. Therefore, existing literature on missing women and the findings from chapter 3 are used to formulate a representative religion variable. In doing so a distinction is first made between Asian and non-Asian religions. Asian religions include all religions except Christianity and Judaism. The discussion on religion to this point shows that there is clear evidence from missing women literature that Christians and Muslims do not practice sex selection at birth. Further, the correlation results provide a statistically and substantively significant inverse relationship between Christianity and sex ratios of the population (total/elderly). Literature provides no evidence of the impact of Judaism on missing women. or sex ratios of the population, Chapter 3 only shows an elderly missing women phenomenon in Israel (the predominantly Jewish Asian country; Pew Research Center, "Jews" 2012) upon the exclusion of immigrants and the correlations above don't show any relationship between sex ratios of the population (total/elderly) and Judaism. For the

Asian variables a distinction is made between Muslims and other Asian religions. This is because in addition to the literature already mentioned Chapter 3 clearly shows that many of the countries that experience a missing women phenomenon in their population (total/elderly) do so at later stages of their life. Hence, to see how religion might have a different effect on sex ratios in total versus elderly populations in countries that are predominantly Muslim versus countries that are not, the Asian religion variable is converted to the ratio of Muslims in a given country to the ratio of the remaining Asian religious adherents in that country. This ratio is then multiplied by a dummy variable that captures the percentage of Asian religious adherents (including Muslims) in a given country and equals 1 only if this population is greater than 50% of the country's population and 0 otherwise. This dummy interaction term is then included in the analysis as the variable "religion."

The demographic shock variables are included as independent variables because they are expected to behave as an exogenous force on the sex ratio of the population (total/elderly). Therefore, they are not grouped together with the other variables that are representative of the endogenous factors and forces across the life course as this would muddle the interpretation of the factor variables that contain both endogenous variables and exogenous shocks. Furthermore, not only is the correlation amongst the demographic shock variables lower (on average) than that amongst the endogenous factors/forces but also the correlation of the demographic shock variables with respect to the endogenous factors/forces variables is lower than amongst the endogenous factors/forces alone. To avoid multicollinearity amongst the highly correlated demographic shock variables, the total disaster deaths and total disaster affected variables are replaced by a single variable: disaster total. This variable represents the sum of the former two variables. For the same reason, only the battle related deaths (total) variable is included in the analysis.

The Kaiser-Meyer-Olkin (KMO) test is conducted before running the factor analysis to ensure that the variables used in the factor analysis are adequately suited for this technique. The KMO test takes account of sample size, number of variables, magnitude of correlation amongst the variables and effective number of factors to test for sampling adequacy (Ferguson and Cox 1993). Therefore, it evaluates whether the variables used in the factor analysis can be adequately grouped together to form a smaller set of factors (Ferguson and Cox 1993). The results of this test range from 0 to 1and a minimum value of 0.5 is required to justify the use of exploratory factor analysis (Ferguson and Cox 1993). The results of the KMO test for variables included in the factor analysis provide a value of 0.89 indicating that the variables are well-suited for the use of this technique.[79]

The result of the factor analysis is shown in table I-5 of the appendix. The next step would therefore be to select the number of factors to retain. Kaiser's rule of thumb suggests retaining all factors with eigenvalues greater than 1(Yong and Pearce 2013). In this case there are four variables that have eigenvalues higher than 1. However, before deciding whether to retain these four factors the scree test and percentage of explained variance will also need to be examined. The scree test requires an examination of the

[79] The results for the KMO test for the demographic shocks (including the variables total disaster deaths, total disaster affected, battled related deaths (total) and refugee origin) provide a KMO statistic of 0.45 showing that the data is inadequately suited for factor analysis with these variables.

plot of eigenvalues for point(s) of inflection to decide upon the number of factors to retain (Hayton, Allen and Scarpello 2004). It is based on the logic that the first few factors are the main factors that explain the majority of variance observed in the data (Hayton, Allen and Scarpello 2004). Therefore, the scree-plot is expected to be very steep at first, where the factors with most of the variance are concentrated, followed by a shallow scree where the small and relatively consistent variance of the minor factors is concentrated (Hayton, Allen and Scarpello 2004). Figure 5.1 depicts the scree-plot of the factor analysis. The horizontal red line indicates the point above which factors have eigenvalues higher than 1. It can be seen that the distance between the first and second point is relatively large showing that the proportion of variance added by the second factor to the cumulative variance is quite high. The second factor presents one point of inflection. A second point of inflection is presented by the third factor. Here the proportion of explained variance added is lower but still higher than the subsequent factors. At the fourth factor another point of inflection is evident. However, by the fourth factor the graph is relatively smooth and the additional variance explained by this and subsequent factors is approximately equal. This proportion of explained variance and cumulative variance is also evident from the results table I-5 in the appendix: the first factor explains 60.7% of the variance, the second factor 13.2% of the variance, the third factor 7.8% of the variance and the fourth factor 5.3% of the variance. Since the fourth factor comes after the second point of inflection and its addition does not lead to a substantial increase in the proportion of explained variance in the model, only three of the factors are retained.

Figure 5.1: Scree plot

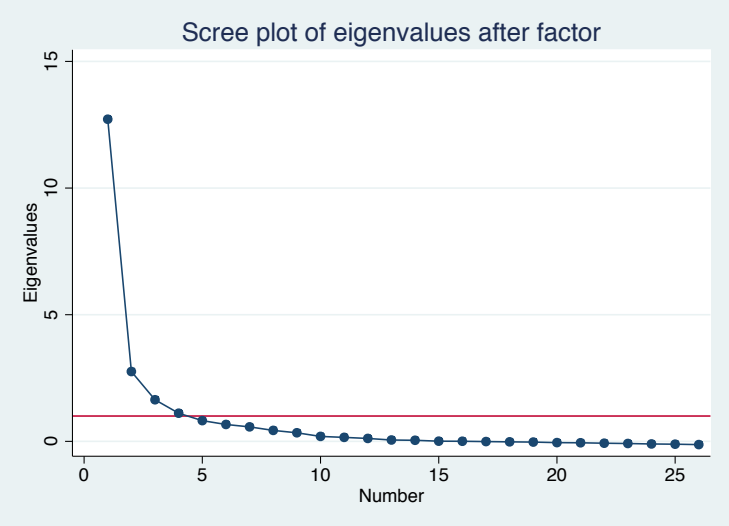


Table I-6 in the appendix shows the uniqueness and factor loadings for each variable when three factors are retained in the analysis. The retained factors are rotated orthogonally to see if they provide a more interpretable grouping of variables within each factor. Rotation techniques allow a redefinition of factors so a clearer demarcation can be made between the meaning of factors (Small 2007). The factor loadings of the rotated factors alongside their uniqueness are provided in table 5-13 below.

Table 5–13

Rotated factor loadings and uniqueness

Variable	FEMCAP	EARLY SURV	ECON DEV	Uniqueness
Female marriage age	0.63			0.57
Contraceptive prevalence	0.66			0.47
Total fertility rate	-0.88			0.17
Adolescent fertility rate	-0.79			0.35
Births skilled health staff	0.77			0.27
Prenatal care	0.46			0.65
Neonatal mortality rate	-0.84			0.20
Maternal mortality rate	-0.82			0.26
Anaemia reproductive age	-0.60			0.49
COMM	0.71			0.47
Communicable disease deaths	-0.94			0.08
Non-communicable disease deaths	-0.95			0.07
HIV (female/male)	-0.67			0.48
Life expectancy at 60 (f/m)	0.56			0.46
HALE at 60	0.47			0.56
Adult mortality ages 15 to 60 (f/m)	-0.79			0.21
Literacy ratio (f/m)	0.62			0.20
Female employment ratio	-0.46			0.67
Ratio of dependency ratios	0.75			0.40
Sanitation	0.86			0.20
Life expectancy at birth (f/m)		0.66		0.27
HALE at birth (f/m)		0.71		0.31
Infant mortality rate (f/m)		-0.87		0.23
Child mortality rate (f/m)		-0.87		0.16
GNI/capita			0.80	0.20
Urban/rural			0.82	0.32

Since the aim of factor analysis is to explain the variance amongst the variables through common factors, variables that have low communalities are often excluded from the

analysis (Yong and Pearce 2013). Since uniqueness (i.e. the unique variance of each variable) is equal to 1 minus communality (Yong and Pearce 2013), variables with high uniqueness need to be excluded from the analysis. A uniqueness of above 0.8 may be considered too high to be included in the analysis and a uniqueness below 0.4 may be considered good enough to compensate for relatively smaller sample sizes (Yong and Pearce 2013, Williams, Onsman and Brown 2010). In table 5-13, the uniqueness of the majority of the variables is quite low with 17 of the 26 variables presenting a uniqueness below 0.4 and only 2 of the 26 variables having a uniqueness between 0.6 and 0.7. Uniqueness should be interpreted alongside the factor loading of each item – i.e. the higher the factor loadings the better the analysis (Cudeck 2000). Here, a cut-off pint of 0.4 for factor loadings is assumed (Yong and Pierce 2013). It can be seen in table 5-13 that the loadings of most of the variables on the factors are substantially higher (i.e. around 0.7, 0.8) and may compensate for the inclusion of the few variables that have loadings closer to the cutoff point.

Three distinct factors are identifiable from table 5-13. The first factor includes the female reproductive variables (total fertility rate, adolescent fertility rate, births attended by skilled health staff, prenatal care, neonatal mortality rate, maternal mortality rate and anemia reproductive ages), female non-reproductive variables (female marriage age, contraceptive prevalence), disease variables (COMM variable, deaths by communicable diseases, deaths by non-communicable diseases and mortality ratio of HIV), female survival variables for older ages (ratios of life expectancy and healthy life expectancy at 60, ratio of adult mortality between ages 15-45), ratio of dependency ratios, sanitation, literacy ratio and percentage of female population employed. Based on the capabilities approach developed by Sen, this factor can be labelled female capabilities (FEMCAP) because the variables included in this factor not only measure the survival chances of women but also to some extent the quality of life during survival. For example, as already described the contraceptive prevalence variable may be linked to the autonomy of women and the literacy ratio and employment variable capture whether society offers women the opportunities to develop their intellectual skills.

The second factor includes four variables: life expectancy and healthy life expectancy at birth, infant mortality rate and under five mortality rate. These variables measure the survival chances at the time of birth and during childhood therefore this factor can be labelled early survival (EARLYSURV).

The third factor includes only two variables: GNI per capita and urban to rural ratio. Both variables are included in the economic development indicators section which explains in detail how these variables are linked to economic development. Therefore, this factor is labelled economic development (ECONDEV).

The three factor variables obtained from the factor analysis and the four independent variables (religion, migration, battle related deaths(total) and disaster total) are used in two ordinary least squares regression models with the sex ratio of the total population and the elderly population as dependent variables. However, before doing so the dependent variables are logarithmically transformed because, as evident from figures 5.2 and 5.4, both the sex ratio of the total population and the elderly population are slightly skewed when considering only the observations that are to be included in the OLS models (i.e. countries in table 5-12). After the logarithmic transformation is

applied, as depicted by figures 5.3 and 5.5, the data for both the sex ratio of the total population and the elderly population respectively, approximates a more normal distribution.

Figure 5.2: Sex ratio of total population, before logarithmic transformation

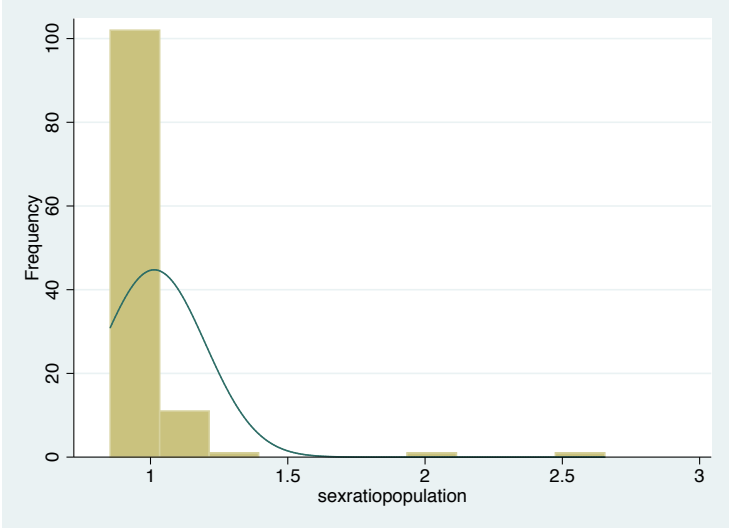


Figure 5.3: Sex ratio of total population, after logarithmic transformation

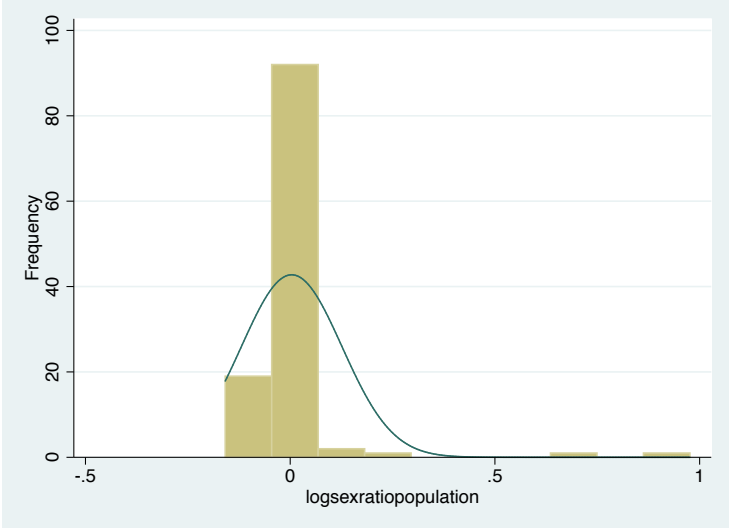


Figure 5.4: Sex ratio of elderly population, before logarithmic transformation

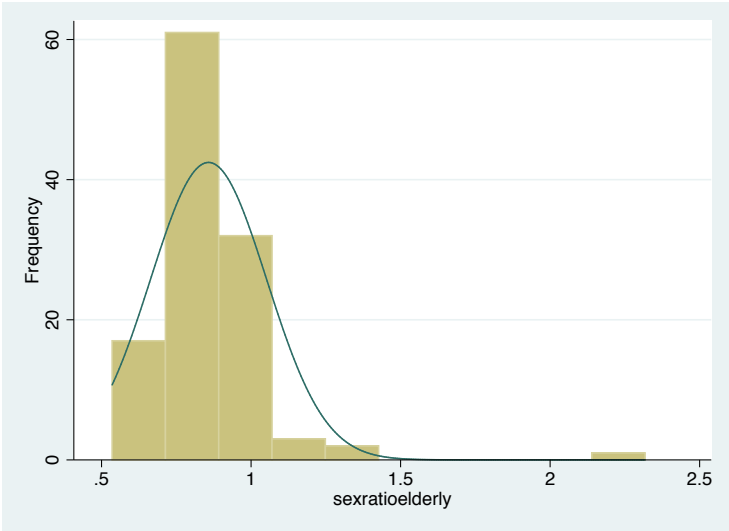
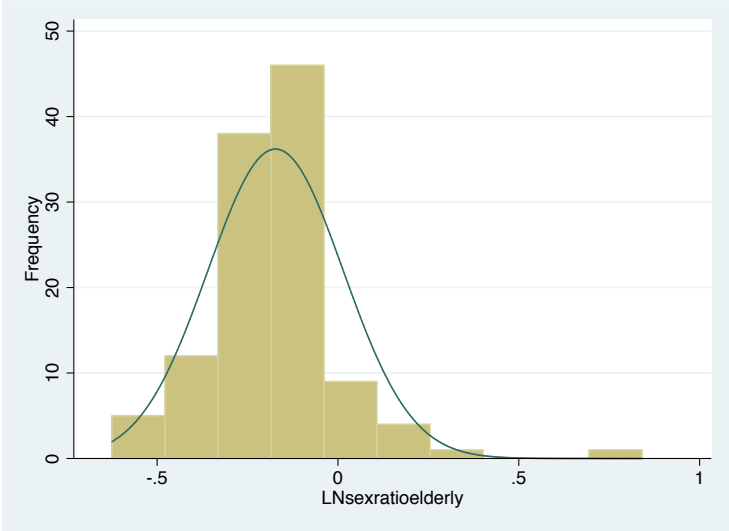


Figure 5.5: Sex ratio of elderly population after logarithmic transformation



Before proceeding with the OLS regression it is pertinent to note that the independent variables are expected to depict a linear relationship with the dependent variables. However, the theories of economic development discussed under economic development indicators suggest that the ECONDEV factor may exhibit a quadratic relationship with the sex ratio of the population (total/elderly). The modernization neoclassical approach argues that economic development erodes the traditional barriers that create differences between men and women in human capital investment and allows women's skills to be elevated to the same level as men (Forsythe, Korzeniewicz and Durrant 2000). It may therefore be assumed that the effects of ECONDEV on women at higher levels of development would be different from lower levels of

development as in the case of the latter perhaps higher traditional barriers would have to be overcome and a larger gender gap filled for equitable investment in male and female skill formation. The women in development approach directly states that a curvilinear relationship between economic development and gender inequality exists, as discussed earlier in the chapter (Forsythe, Korzeniewicz, Durrant 2000). Therefore, it would be more accurate to include the ECONDEV variable as a quadratic term by using the square of ECONDEV (i.e. ECONDEVsq) to show that the impact of development on income inequality differs for different levels of development. In case of the first theory this shows that at initial levels of development the rate of decrease in gender inequality is lower than at later stages of development. In the case of the second theory, this captures the latter part of the curvilinear relationship again depicting that once women start to benefit from the gains of development, the rate of decrease in gender inequality at initial stages is lower than at later stages of development.

The results of an OLS regression with first the total population and then the elderly population as the dependent variable are displayed in table 5-14. Both the unstandardized and standardized beta coefficients are displayed in the table. The unstandardized coefficients allow the interpretation of the beta coefficients in terms of the original metric of representation (Long 1997). Hence, they allow the battle related deaths (total) coefficient, for example, to be interpreted in terms of the percentage of people affected by the conflict. This interpretation however does not allow a comparison of the relative strength of the different variables i.e. since all variables are represented in different metrics of measurement, it is difficult to assess which variable has the strongest impact on the sex ratios of the population (total/elderly). Standardized coefficients convert the metrics of all variables into standard deviations and allow all variables to be interpreted in terms of standard deviations (Long 1997). Since all variables have the same metric of measurement, the relative strength of each variable on sex ratios of the population (total/elderly) can be compared (Long 1997).

The results show that the model with the total population is overall significant at the 1% level and has an adjusted R-squared of 62.6%. Three of the seven predictors are significant at 5% with two of these being significant at 1% as well i.e. both the Early Survival and Economic Development Square factor variables are significant at 5% and 1% while the Migrant variable is significant at 5%. The results show that a one unit increase in the EARLYSURV factor variable leads to a 2.18% reduction in the sex ratios of the total population, a one unit increase in the ECONDEVsq variable leads to a 1.33% increase in sex ratios of the total population and a one unit increase in Migrant sex ratios (female/male) leads to a 3.65% decrease in population sex ratios. The standardized beta coefficients show that ECONDEVsq is the strongest predictor of sex ratios in the total population, being more than four times stronger than the two other significant predictor variables. However, since both the EARLYSURV and ECONDEVsq are factor variables, their results need to be interpreted in terms of the variables that make up these factors. The results on the early survival factor suggest that sex ratios of the total population increase as the ratio of female to male infant and under five mortality rate increase and the ratio of female to male life expectancy and healthy life expectancy at birth decrease. The results on the ECONDEVsq factor suggest that sex ratios of the total population increase as the GNI/capita and the urban/rural variables increase.

The model with the elderly population as the independent variable is also significant overall at 1% and has an adjusted R-square of 45.4%. Four of the predictor variables are significant at least at the 5% level. The FEMCAP factor variable is significant at 5% only. The EARLYSURV, ECONDEVsq and the Migrant (factor) variables are significant at both 5% and 1%. The regression coefficients suggest that a one-unit increase in FEMCAP decreases the sex ratios of the elderly population by 2.89%, a one increase in EARLYSURV leads to a 7.14% decrease in sex ratios of the elderly population, a one unit increase in ECONDEVsq leads to a 1.32% increase in ratios of the elderly population and a 1 unit increase in Migrant sex ratios (female/male) leads to a 7.17% decrease in sex ratios of the elderly population. The standardized beta coefficients again suggest that the ECONDEVsq variable has the strongest impact on sex ratios of the elderly population however the magnitude of this impact has substantially declined vis-a-vis its impact on sex ratio of the total population. Further, the impact of the remaining significant predictors has increased compared to the previous model. The increase is most dramatic for the Early Survival variable but also holds true for the more modest increases in Migrant and FEMCAP (factor) variables. Consequently, after ECONDEV square EARLYSURV has the strongest impact on sex ratios of the elderly population followed by Migrant population and FEMCAP. Again, the impact on the factors will need to be interpreted in terms of the variables they are composed of. The interpretation for EARLYSURV and ECONDEVsq is the same as that described in the previous paragraph. The negative sign on the Female Capabilities factor implies that the sex ratio of the elderly population increases with an increase in fertility rates (total and adolescent), ratio (female/male) in adult mortality (ages 15-60), ratio (female/male) of HIV deaths, communicable disease deaths, anemia (reproductive age groups), neonatal mortality,

Table 5–14

OLS regression results				
	Sex ratio population (log)		Sex ratio elderly (log)	
	Unstandardized Coefficients	Standardized Coefficients	Unstandardized Coefficients	Standardized Coefficients
Female Capabilities	-0.98%	-0.08	-2.89%*	-0.15*
Early Survival	-2.18%**	-0.17**	-7.14**	-0.38**
Economic Development Square	1.33%**	0.75**	1.32%**	0.49**
Battle Related Deaths (total)	0.00%	-0.02	-0.00%	-0.01
Disaster (total)	0.00%	0.01	0.00%	-0.06
Religion	0.05%	0.07	0.00%	0.11
Migration	-3.65%*	-0.15*	-7.17%**	-0.20**

- Single asterisk (*) indicates significance at 5%
- Double asterisk (**) indicates significance at 1%

maternal mortality and percentage of females employed. Further, the sex ratio of the elderly population decreases with an increase in female marriage age, contraceptive prevalence (ages 15-49), births attended by skilled health staff, prenatal care, ratio (female/male) of life expectancy and healthy life expectancy, deaths by non-communicable disease, COMM, sanitation, literacy ratio (female/male) and the ratio of dependency ratios.

The beta coefficients of the ECONDEVsq (factor) variable suggest that a unit increase in the level of economic development, holding all other variables constant, leads to an increase in the masculinization of sex ratios. This may seem contradictory to the theory of economic development at first. However, the direction of the relationship may be explicable by the variables used to construct the economic development factor i.e. urban/rural and GNI/capita. For the former variable this may be because the data considers the urban/rural ratio at a given point in time and as discussed earlier in the chapter, many cities around the world have more men in their population than women. If instead the change in sex ratio in urban regions over time were captured, the results might be different (not only due to the discussion in chapter 2 but also because of the feminization of migration; Tacoli 2012). For the latter variable the unexpected direction may not be very alarming because chapter 2 highlights that despite rapid economic development in South Korea from 1960's onwards, the de-masculinized the sex ratios at birth necessitated active government intervention to alter social norms of son preference and daughter devaluation in the country. The discussion in this chapter further emphasizes that GNI/capita alone cannot be considered an adequate measure of economic development or of mortality (Sen 1998) therefore perhaps if other variables like the GDI could also be included in the analysis, the overall interpretation of ECONDEVsq may have been different.

Although the religion variable is insignificant the unstandardized coefficients on the variable suggest that an increase in the percentage of Muslims in the population versus other Asian religions, increases the sex ratio of the total population by 0.05% but almost imperceptibly for the elderly population. Nevertheless, the standardized coefficient suggests that the effect on the latter is stronger than the former. This may be driven by the large female deficits observed in the total and elderly populations of the countries of Asia in chapter 3 many of which are predominantly Muslims and all of which have a higher deficit in their elderly population compared to their total population.

The results on battle related deaths (total) and disaster (total) confirms the discussion for the special case of Pakistan in chapter 4. Both The battle related deaths (total) and disaster (total) variable have an imperceptible effect not only in terms of the significance of the variable but also in the magnitude of the standardized and unstandardized coefficients.

The results from the model suggest that factors that represent the accumulation of female disadvantage over the life course and intermediary forces (with the exception of those related to economic development) have a more significant bearing on the elderly population than on the total population. Both early survival and female capabilities contain variables that represent not only factors discussed in chapter 2 that could lead to a female disadvantage in old age (e.g. child marriage and contraceptive prevalence) but also factors that directly elevate mortality at each life stage (e.g. under five mortality

and adult mortality between ages 15 and 60). This supports the idea that the elderly population is the culmination of female deficit from all previous life stages as the effect of factors on previous life stages and intermediary forces snowball into a stronger impact when the elderly population is segregated from the total population. The fact that this doesn't necessarily hold true when individual variables are correlated with sex ratios of the population (for example the correlations of the reproductive variables show that each variable has a stronger impact on the total population than the elderly population) may imply that the true effect of each variable on the sex ratio of the population (total/elderly) is revealed via the way it interacts with the other highly correlated variables in the model which is exactly what Sen (1998) tries to show with the GDP example and the various channels through which it may impact mortality.

5.7. Conclusion

The aim of this chapter is to assign variables to the causal factors, forces and exogenous shocks behind the elderly missing women phenomenon (discussed in the preceding chapters) in order to evaluate their empirical validity with regards to sex ratios of the population (total/elderly) from a cross-national perspective and thereby not only uncover their generative mechanism but also ascertain whether they operate in the expected theoretical direction.

An evaluation of the correlation of each individual variable with the sex ratios of the population (total/elderly) shows that on average, apart from most economic development indicators, the intermediary force variables are the ones that are most statistically and substantively significant in affecting the sex ratios of the population (total/elderly). The most significant of these include the survival expectation variables, specific education variables, the population age structure, the Gender Development Index and some legislation variables (especially laws on inheritance and divorce). Furthermore, migrant sex ratio appears to have an important bearing on population sex ratio. For a majority of these variables, with the notable exception of those associated with the survival expectations, the correlation with respect to the total population is higher than with the elderly population.

The results change when these variables are evaluated via an OLS regression model. When the sex ratio of the total population is taken to be the dependent variable the life stage factors included for the childhood stage (female to male ratio of infant and child mortality rates) are relevant and operate in the expected direction. Some of the intermediary forces are also relevant to the sex ratios of the total population: the female to male ratio of life expectancy and healthy life expectancy at birth, the urban/rural variable and the GNI/capita. While the life expectancy variables operate in the expected direction, the latter two variables follow a somewhat unexpected trend (i.e. an increase in both urban/rural ratio and GNI/capita increases the masculinization of the population). The reason for this may be the nature of variables that consist the economic development indicator so that if other variables that provide a more adequate measure of human capabilities could be included (e.g. GDI) perhaps the results would be different. The exogenous shock variables have no significant impact on the sex ratio of the total population which is similar to the findings in Chapter 4 (which evaluate the special case of Pakistan only).

With the sex ratio of the elderly population as the dependent variable three things are evident. First, all the life stage variables included in the model are significant and interact with the sex ratios of the elderly population in the expected direction: in the childhood stage the variables are the same as for the total population in the preceding paragraph. At the young adulthood and adulthood stages an increase in fertility rates, HIV deaths (females/males), anemia incidence (reproductive ages), maternal mortality rate, neonatal mortality rate, and female employment ratio leads to an increase in sex ratios. Conversely, an increase in female marriage age, contraceptive prevalence, availability of prenatal care and skilled birth health staff leads to a decrease in sex ratios. Second, all the intermediary forces included in the model except religion are now significant. Therefore, an increase in fertility rates (total and adolescent), communicable disease deaths, female employment ratio and adult mortality (female/male), GNI/capita and urban/rural leads to an increase in sex ratios. Whereas an increase in communicable disease deaths, the ratio of non-communicable disease deaths to communicable disease deaths, literacy ratio (female/male), life expectancy and healthy life expectancy (female/male), sanitation and immigrants (male/female) leads to a decrease in sex ratios. All variables except GNI/capita and urban/rural operate in the expected direction but the reason for this has already been elaborate. Finally, the exogenous shock variables (conflict and disasters) do no significantly affect the sex ratios of the elderly population which again supports the findings of chapter 4.

In general, the results not only suggest that the role of factors, forces and exogenous shocks is correctly identified in the preceding chapters but also that their true impact becomes evident only upon evaluating the sex ratios in the elderly population. An assessment of sex ratios in the total population disregards many of the life stage factors and forces that could not only be associated with the missing women phenomenon in old age but also is relevant for missing women in preceding life stages.

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Chapter 6 - Conclusion

The female versus male advantage in life expectancy in all countries of the world has been well established since 2006 (Barford et al. 2006). Many researchers have taken this to translate into female preponderance over males in old age (e.g. Davidson, DiGiacomo and McGrath 2011). Indeed, an appraisal of global statistics reveals that in all regions of the world, regardless of the level of development, the number of women exceeds the number men in the 60+ population and this preponderance of women increases in the 80+ population (United Nations Population Division 2015). Nevertheless, there are some countries in the world that are an exception to this certitude: not only does the number of men in the 60+ population exceed the number of women but also this preponderance of men increases as the population ages – a trend opposite to that observed in the rest of the world. Examples of such countries include Iran, Pakistan and Bhutan amongst others. The purpose of this research is to provide an explanation for this male preponderance.

In 1990 Amartya Sen introduced the term missing women to refer to the number of women who should to be alive at a given point of observation but are not (Sen 1990). Taking from the writings of Sen (1990), this research uses the term elderly missing women to refer to missing women in the 60+ population. While substantial academic attention has addressed the missing women phenomenon at younger ages, older ages and especially the elderly age category has been largely neglected.

This work began by exploring this age specificity in literature. It is indeed evident that the primary focus of missing women literature is on exploring the factors that cause excessively masculinized sex ratios at the time of birth (e.g. Guilmoto 2009), how this masculinization at birth is affected by the number and gender of existing children in the family (e.g. Park and Cho 1995) and how forces such as fertility decline and sex selection technology serve as an impetus to this masculinization (e.g. Klasen 2008). The second frequently discussed category is childhood where the neglected health and nutrition of girls is often emphasized (e.g. Das Gupta 1987) but even here some of the same factors such as those at the time of birth are re-emphasized so that girls belonging to larger families and with older sisters have a greater likelihood of being missing (e.g. Das Gupta and Mari Bhat 1997). Missing women literature beyond childhood is severely limited. Although some literature discusses the role of HIV and widowhood in creating a missing women phenomenon in adulthood (e.g. Anderson and Ray 2010, 2015), this literature is barely sufficient to explain the full extent of the phenomenon. Other factors such as honor killings, child marriage, female genital mutilation (FGM), accusations of witchcraft, burden of care, changing household structure etc. may also be causes for excess female mortality and therefore need to be attributed to the missing women phenomenon. Chapter 2 is a first attempt at considering factors that may be causing the missing women phenomenon at all ages and systematizing them across different stages (before/at birth, childhood, young adulthood, adulthood and old age) of the life course. In doing so it not only distinguishes between individual level factors and societal level forces that may be propelling the phenomenon at each life stage (or all life stage simultaneously in the case of the latter) but also takes account of social change by applying the cohort perspective to explanations.

The crux of this systematization is that factors may exist at each life stage that either lead to the premature mortality of women and prevent women from proceeding to the

next life stage, or, if women make it to the next life stage, they may be burdened by a survival disadvantage from previous life stages that may be exacerbated by disadvantages in the current life stage. These disadvantages accumulate across the life course to create an elderly missing women phenomenon. The almost exclusive focus of the majority of existing literature on not only younger age categories but also on particular factors within these age categories has precluded an evaluation of the manner in which the survivability of women across different life stages is interlinked. By linking the elderly missing women phenomenon to female disadvantages at different ages, the chapter blazes a trail for the evaluation of missing women at all life stages and shows that the existence of missing women at any one life stage necessarily leads to the existence of missing women in old age but the converse may not necessarily be true because the female deficit may originate in old age. Therefore, the chapter shows that the elderly population presents the worst manifestation of the female deficit as it is the culmination of female disadvantages and premature mortality from all previous life stages.

The next chapter in this research explores whether there is also an inaccurate geographical specificity to the literature. Existing literature on missing women has mostly focused on younger age groups in specific countries (e.g. China and India) of East, Southeast and South Asia. The remaining countries in these regions and regions of Asia are mostly neglected. This is especially true of the Middle Eastern region of Asia. Using data from UNDESA and the world as a reference standard, this chapter is a first attempt to evaluate the elderly missing women phenomenon (60+ and 75+ age categories) for all countries of Asia and compare it with respect to the missing women phenomenon in the total population of these countries. The chapter finds that even in East/Southeast Asia there are countries that display an elderly missing women phenomenon that the literature has not concentrated on (e.g. Thailand, Laos). However, for a majority of the countries herein the phenomenon is apparent as a cohort effect that may be expected to disappear in future decades. What is more striking is the result for South Asia and especially the Middle Eastern region of Western Asia. In South Asia all countries except Sri Lanka display a fairly large female deficit in their elderly populations with the deficit for many of these countries (e.g. Bhutan and Afghanistan) not only being accompanied by a deficit in the total population but also being mostly ignored by literature. Furthermore, all the Middle Eastern countries of Asia, except Israel, depict an elderly missing women phenomenon in their populations. The female deficit in the elderly population for a majority of the countries cannot be interpreted as a possible cohort effect and exceeds the female deficit in the total population of the respective country. Further, the female deficit for some of the countries in the Middle Eastern region of Asia, exceeds that of any other country on the continent not only in the total population but also in the elderly population. This is the most unexpected result because the Middle Eastern countries of Asia have barely been evaluated by missing women literature. Chapter 3 therefore reveals that missing women literature is inaccurately concentrated on specific countries and needs to reorient itself towards concentrating on a broader set of countries and at later life stages in South Asia and especially on assessing the missing women and elderly missing women phenomenon in all the Middle Eastern countries of Asia.

Chapter 3 identifies Pakistan as one of the countries presenting the elderly missing women phenomenon in both the total and elderly populations. Chapter 4 uses Pakistan as a case study to assess whether, apart from the factors and forces identified in chapter

2, a second group of effects, namely exogenous demographic shocks, may be responsible for the elderly missing women phenomenon therein. Exogenous demographic shocks, in the form of conflicts and natural disasters may have more adverse consequences for women than men in particular life stages. Therefore, the chapter evaluates the impact of historical events in Pakistan on the sex ratios of the elderly population in the country in. 2015. The use of Pakistan as a country of analysis is novel for two reasons: First, given the difficulty in obtaining age and gender disaggregated mortality statistics for conflicts and disasters in general (Mazurana et al. 2011) and especially for conflicts and disasters in Pakistan, such a comprehensive analysis on the special impact of these events on women and on sex ratios in Pakistan has not been conducted before. Second, in the case of countries upon which such an analysis has been conducted before (i.e. China, South Korea and India), the effect of fertility decline on sex ratios has been found to be stronger than any single disaster or conflict (Das Gupta and Shuzhuo 1999). In the case of Pakistan, fertility decline has been very slow and has had no accompanying effect from sex selection technology (Sathar and Karim 1996). As a result, the case of Pakistan allows the pure effects of exogenous demographic shocks on sex ratios to be evaluated with no confounding interaction with the endogenous force of fertility decline. The effect of demographic events on sex ratios in Pakistan are analyzed from two angles. First, mortality statistics for each event by gender (and age, when possible) from various sources (e.g. newspapers, journals, books etc.) are collected and compared with respect to the male and female population of Pakistan for the given year to see if the mortality toll had been large enough to affect the sex ratio of the population. Second, the sex ratio trend by 10-year age groups is traced for all ages from 1950 to 2015 and the timing of events infused in these trends to assess whether the timing of the event is associated with a deviation from the trend. The results from both analyses reveal that with the exception of Partition no conflict or natural disaster in the history of Pakistan has had a significant enough impact either individually or in the aggregate to affect the sex ratios in the elderly population of Pakistan today. The analysis of Partition shows that it led to a decrease rather than an increase in the sex ratios of the population so this event cannot be used to explain the highly masculinized sex ratios evident in the country today. An examination of the sex ratio trends of Pakistan further reveals that, when the world is used as a reference standard, an elderly missing women phenomenon is evident throughout the history of Pakistan and this phenomenon seems to be particularly elevated between 1956 and 2007. As historical events cannot explain the existence of these elderly missing women in Pakistan, factors across the life course as described in Chapter 2 need to be given greater weightage.

The discussion in Chapter 3 shows that not only does the size of the female deficit in old age vary across countries but also differences in sex ratios of the elderly population may exists amongst countries that do not display an elderly missing women phenomenon. Chapter 5 assigns variables to the factors, forces and exogenous shocks discussed in the preceding chapters to test their empirical validity at cross-national level. These variables, collected from diverse international databases, are allocated into 11 categories based on what they represent and on their relevance to sex ratios of the total and elderly population. These categories include: economic development indicators, population composition, legislative environment, child malnutrition indicators, female reproductive indicators, female non-reproductive indicators, diseases environment, survival expectations, education indicators, labor force participation indicators and demographic shocks. First, the individual correlation (Spearman and

Kendall) of each variable with respect to the sex ratios of the total population and elderly populations is evaluated. This evaluation shows that on average, except the majority of economic development indicators, the variables that represent intermediary forces present higher correlations with respect to the variables of interest than the variables that represent the factors across the life stage. For both types of variables, the correlation is higher with respect to the total population compared with the elderly population. In a second step the simultaneous impact of these variables on each other and on the sex ratios of the population (total/elderly) is examined via an ordinary least squares regression model. To avoid the problem of multicollinearity, exploratory factor analysis is used to group together the highly correlated variables into factors. These factors are used as variables in the regression model. The factor analysis yields three factor variables (economic development, female capabilities and early survival) which alongside four variables (for disaster, conflict, religion and migration) are incorporated as independent variables into two regression models (with total population and elderly population respectively as dependent variables). This analysis reveals distinct results for the sex ratios of the total population and elderly population with more intermediary forces and factors being significant for the former than the latter. With regards to sex ratios of the total population results show that some of the variables relevant to the early childhood stage and some intermediary forces associated with survival expectations and economic development are significant. While the variables consisting the former two operate in the expected direction the economic development variables indicate that an increase their intensity would lead to a masculinization of sex ratios. However, this interpretation might be justifiable in light of the variables that constitute economic development factor in the regression model only (i.e. urban to rural ratio and GNI/capita). If perhaps some of the other variables included in the correlation analysis (e.g. Gender Development Index) were also included in this factor, the results may be different. When regressed against the sex ratios of the elderly population all the life stage factors and the intermediary forces, except religion, included in the model are significant. Hence, the life stage factors associated with childhood, young adulthood and adulthood and the intermediary forces of survival expectations, disease environment and economic development are significant. Although economic development continues to operate in the same manner as with sex ratios of the total population, the strength of the impact is lower with respect to sex ratio of the elderly population and the impact of the remaining factors and forces is higher. Furthermore, the conflict and disaster variables remain insignificant thereby corroborating the results of chapter 4. The migrant interaction dummy term remains significant with respect to both models pointing to the importance of incorporating immigrants in missing women calculation. In general, the results for chapter 5 would not only suggest that the role of factors, forces and exogenous shocks has been correctly identified in the preceding chapters but also that their true impact becomes evident only upon evaluating the sex ratios in the elderly population. An assessment of sex ratios in the total population alone disregards many of the life stage factors and forces that could be associated with the missing women phenomenon in old age and therefore be relevant for preceding life stages as well.

When the discussion in chapters 2, 3, 4 and 5 is merged together the emergence of the life course perspective as an explanatory framework for the elderly missing women phenomenon is evident. Chapter 2 sets the foundation for this framework by first dividing the individual life course into distinct life stages (before/at birth, childhood, young adulthood, adulthood and old age) and linking these stages by the principle of

life course effects, so that what happens at an earlier stage in life (e.g. childhood) will have repercussion for later stages in life (e.g. adulthood; Komp and Johansson 2016). It is hinged on the assumption that individual life courses do not develop in a vacuum but are influenced by the social context (e.g. norms of son preference and daughter devaluation, institution of dowry) that generate inequalities within the life course. Chapter 2 considers that the primary inequality generated by these institutions is that of gender and gender inequalities have the potential to differentiate the life courses of men and women in such a way that women may suffer from factors that create disadvantages at each life stage that they go through. These factors may be influenced by intermediary forces that either attenuate or depress the effect of these factors or operate independently on life stages.

The social context however may differ by historical time period or across different societies/countries (Mayer 2004a) thereby altering the manner in which gender inequality shapes factors and intermediary forces at each life stage (Ryder 1965, Mayer 2004a). Chapter 2 takes account of historical time by assessing how the (elderly) missing women phenomenon may vary by birth cohorts. Chapter 3 takes measure of how the social context differs across societies by assessing the female deficit across different regions of Asia (to examine how the social context shapes gender inequality across countries that have relatively similar and very different social norms and institutions as in the case of East and Southeast Asia for example) and different countries within these regions of Asia (to take measure of the intercountry heterogeneity in norms and institutions even in countries that may have similar social norms and to assess how such heterogeneity influences the elderly missing women phenomenon).

Chapters 2 and 3 describe an endogenous life course framework where the factors and forces affect different life stages in a relatively predictable manner and the continuity of regular transitions prevails over disorderly turning points (Diewald, Goedicke and Mayer 2006). However, systems upheavals, may alter existing configurations of social inequalities and channel lives in a new direction. Chapter 4 takes account of these system upheavals in the context of the elderly missing women phenomenon by using the example of the special case of Pakistan and assessing how these events may have had a different impact on different life stages (Pavalko and Elder 1990) and the net impact of sex ratios on the elderly population.

Finally, given the cross country variations in the manner in which factors, intermediary forces and exogenous shocks affect the elderly missing women phenomenon, chapter 5 compares patterns of these causal mechanism across different countries to evaluate the generative apparatus that instigate differences in sex ratios in old age at the global level (Mayer 2004b). Such a comparison not only allows the timing, turning points and direction of change in these causal mechanisms to be evaluated but may also uncover the reason behind cohort differences (as identified in chapter 2) and allow the disadvantages (from factors, forces and shocks) in different life stages to be compared simultaneously.

In interpreting the results of these chapters', limitations need to be addressed in three spheres: the relationship between the chronological and social dimensions of time, the identification of an ideal reference standard and the nature of data.

The introduction elucidates that the chronological and social dimensions of time are embedded in the life stages in chapter 2. While the chronological notion of time is capture by the biological timetable that governs the progression of individuals from infancy to adulthood to old age (Neugarten and Datan 1996), the demarcation of life stages and more importantly the attribution of factors that cause disadvantages within these life stages are conditional upon the social dimension of time and therefore the rites of passage that mark individual transition from one stage to the next (Neugarten and Datan 1996). However, these rites of passage may vary across societies and countries because of the manner in which age rules and preferences are inculcated in laws, social policies and the organization of social institutions (Setterston and Mayer 1997). The example of the old age category may be used to shed light on this. Events such as retirement, the marriage of children or becoming a grandparent often imply that an individual has entered the old age category. However, the age at which individuals achieve these rites of passage may be variable across societies. For example, the average life expectancy at birth (both sexes) for Zimbabwe is 55 years and for the entire Sub-Saharan African region is 57 years whereas the average life expectancy at birth for Jordan is 73.8 years and for the entire Western Asian region is 72.7 years (UNDESA). Therefore, as people are expected to have shorter lives in Zimbabwe than in Jordan they may achieve the rites of passage that allow them to enter the elderly category at an earlier age in the former than in the latter Hence, in applying the factors across the life stage to assess the elderly missing women phenomenon in specific countries some degree of cross-national sensitivity is required to first assess how the chronological dimension of time in a given country matches the social dimension of time (Setterston and Mayer 1997).

The identification of the elderly missing women phenomenon across the countries of Asia in chapter 3 requires the use of an ideal benchmark against which to compare the existence of the phenomenon. This is one of the earliest problems of missing women literature with the pioneering authors (i.e. Sen 1990, Coale 1991 and Klasen 1994) debating the ideal reference standard to be used to calculate the number of missing women in the total population. This issue of an ideal standard is apparent at the time of birth as well where one would expect that in the absence of intervention, sex ratios would approach the same biologically normal levels across different countries. However, not only does the biological standard differ across populations (e.g. populations of Sub-Saharan Africa or African American descent have lower sex ratios at birth) but also the sex ratio at birth is connected with the life expectancy of the population such that populations with higher life expectancies may be expected to have higher sex ratios at birth (Klasen 1994). Of course literature corrects for these discrepancies but the problem here remains that if the ideal standard of comparison at the earliest life stage varies, the benchmark for subsequent life stages would be imprecise. This may be especially evident in the young adult and adulthood stages where women's reproductive role predisposes them to certain risks that men are not exposed to which makes it difficult to disentangle excess female mortality from this channel from normal levels of mortality (Anderson and Ray 2010). For example, it seems incredulous that in any country maternal mortality (or the cumulative disadvantages thereof) could fall to zero and some reference mortality rate would be needed (Anderson and Ray 2010). To overcome such pitfalls, the world sex ratio (for the total and elderly populations) has been used as the standard of comparison for Asian countries as it would compensate for higher sex ratios in some countries with lower sex

ratios in other countries and provide an average for comparison across all ages. Therefore, the world sex ratios as the standard of comparison is the optimal solution for countries across Asia.

The analysis in chapters 4 and 5 necessitates a discussion on the nature of the data. In chapter 4, the availability of longitudinal data would make it easier to evaluate the impact of demographic shocks for Pakistan or for any other country. In the case of Pakistan for example, the ability to follow a birth cohort from the time of Partition would allow the exact timing of mortality impact by gender for a given conflict or disaster to be assessed and make it easier to trace the deficit in the elderly population today to past events. Further, the availability of longitudinal data may be especially useful to evaluate the case of Malaysia, for example, where chapter 3, shows that the female deficit persists only in the elderly population till the year 2050. Hence, longitudinal data, for birth cohorts forming the elderly population in 2015 may show why this deficit suddenly emerges in the elderly population and may provide avenues for its rectification in future generations of the elderly in Malaysia. For both countries, longitudinal data may also allow the mortality selection effect to be identified. Mortality selection is the change in cohort composition over age as frailer members die leaving an increasingly robust low mortality cohort (Wrigley-Field 2013). This implies that the factors and forces from earlier stages in life would eliminate the more susceptible population and reduce cohort mortality in later life (Hobcraft, Menken and Preston 1982). As a result, the cohort which was initially disadvantaged appears to be better off than before the elimination (Ferraro and Shippee 2009). Hence, in countries affected by the elderly missing women phenomenon, women who reach old age are both those that survived a lifetime of disadvantages and those that experienced a life relatively free of these disadvantages. It would be expected that as the population continues to age, the latter would form an even greater proportion of the population. Longitudinal data would therefore allow the identification of the life stage that is most heavily responsible for the masculinization of current cohorts of the elderly population. Unfortunately, in the case of Pakistan, longitudinal data is not available.

The analysis in chapter 5 may point towards the need to include variables in the analysis that are directly related to the well-being of women in old age. It is however to be noted that data measuring the quality of life of the elderly at the global level is very difficult to come by especially when disaggregated by gender (Bennett and Zaidi 2016). Although the millennium development goals have created a revolution in data collection and availability at the global level (as discussed in chapter 5), the analysis in chapter 5 shows that this is limited to the younger life stages (childhood, young adulthood and adulthood) with old age being mostly neglected. However, the situation may change with the implementation of the post-2015 sustainable development goals. Unlike the millennium development goals, the sustainable development goals (with the target of being achieved by 2030) explicitly address older people and ageing as a key element of development (Bennett and Zaidi 2016, UN 2016). Hence, Chapter 5 makes use of the best variables from the available pool of data to attain its results.

The discussion therefore makes clear that an elderly missing women phenomenon exists across various countries in Asia due to the culmination of factors and forces in different life stages and can best be evaluated within the life course perspective. This brings to the fore the question of actions that can be taken to eliminate the female deficit in old age. Existing literature is replete with the example of the exceptional case of South

Korea in the management of its female deficit at birth and hence the elimination of the missing women phenomenon (e.g. Chung and Das Gupta 2007). However, the case of South Korea is not directly applicable to other countries because as evident from Chapter 3, all countries displaying the deficit, with the exception of China and India, do so at later stages in life only. While South Korea was able to nip the evil in the bud, other countries like Bhutan or Jordan have to eliminate it at all stages of life simultaneously to eliminate the deficit in old age. However, what the example of South Korea does show is that a change in social norms is the key behind simultaneously tackling this deficit at all life stages. Therefore, a revolution in social norms is necessary to destroy the institutions of patriarchy, patrilocality, patrilineality dowry etc. so that the roots of son preference, daughter devaluation and female subordination can be excised. These norms are rooted in the various socially defined benefits offered by men in their roles as sons, husbands, fathers and community members and are partly embedded in the financial benefits they confer as beneficiaries of these roles. Therefore, one effective mechanism to temper the elderly missing women phenomenon may be the introduction of social pensions.

Social pensions constitute a variety of cash transfers to older people that are non-contributory in nature (i.e. do not require employment or income contributions), often do not require the elderly to withdraw from the labor force and are contingent on the elderly meeting specific age and income requirements (Barrientos 2015). Hence, elderly women may be in a unique position to benefit from social pension schemes due to the large proportion of their lives spent in caregiving role (signifying their absence from the labor market) and their general propensity to participate in the informal labor market (as noted in chapter 2), both of which preclude their access to contributory pension schemes (Vlachantoni and Falkingham 2012). The provision of social pensions to elderly women may help alleviate the elderly missing women phenomenon and therefore the missing women phenomenon via three mechanisms: First, by reducing the consequences of financial vulnerabilities faced by elderly women (Barrientos and Lloyd-Sherlock 2002). Second, via the multiplier effect the provision of social pensions to elderly women may have on women at earlier life stages residing in the households of elderly women (Barrientos and Lloyd-Sherlock 2002). Third, via the change in social norms that the first two effects have the potential to generate. As discussed in chapter 2, many of the life stage factors that weaken the survival chances of women in old age, even when women have sons, are associated with women's absent financial autonomy especially upon the death of their husbands. Hence, social pensions may not only provide women with cash flow resources for daily survival and health expenditure but also, in societies where widows have weak inheritance rights, may provide a collateral for women to remain within the joint family system as elderly women's social pensions may be their contribution to the joint pool of family resources. Social pensions may also relieve the disadvantages elderly women face via the burden of care argument For example, Ardington et al. (2010), using data from the Cape Area Panel Study (2002-2006), find evidence from urban South Africa which suggests that although elderly residing in poorer households are more likely to take in orphaned grandchildren, the foster care grant provided by the South African government and the additional cash transfers made by surviving children as a result of fostering grandchildren diminishes the burden of care on the elderly. The authors find that care responsibilities of an orphaned child do not have any impact on grandparent's self-reported health problems, level of depression and regularity of work. Therefore, they conclude that cash transfers may be one way to reduce the deleterious effects associated with the burden of care

responsibilities on the elderly. The multiplier effect of elderly women receiving social pensions is, as discussed in chapter 2, not only the result of women's general propensity to spend a greater proportion of their income on household well-being but also of women investing their income on the well-being of female members of the household. Evidence for both effects has been elaborated in chapter 2 but may be obvious from Duflo (2003)'s evaluation of the effect of social pensions received by grandmothers versus grandfathers in South Africa. The author finds that massive expansion in 1990 of the cash transfer program in South Africa increased the number of children living with a pension recipient. However, the benefits for female children on all three malnutrition indicators (discussed in chapter 5) is significantly higher than for female children when pension is received by elderly women versus elderly men (Duflo 2003). Although this could point towards many confounding factors (e.g. initial poorer health of girls, investment of elderly male income in other spheres such as education), the author concludes that it points to the general result that elderly women are more likely to invest in the well-being of female members of the household. Finally, one of the reasons behind patriarchal norms is the notion that sons provide financial care for parents in old age (Guilmoto 2009). If the elderly in general are assured of a regular cash flow in old age regardless of their labor force participation, daughter discrimination at the childhood stage or the pressure on wives to have sons in the young adulthood stage may be reduced. Furthermore, the receipt of social pension as a source of income by elderly women would elevate their position at the household level. The multiplier effects would further weaken the institution of patriarchy: if elderly women have a greater propensity to invest in the nutrition and education of female children and in the reproductive and non-reproductive health issues of young adult women in the household. Therefore, the effect of social pensions may be similar to that of change in social norms in South Korea (discussed in chapter 2) except it operates in the reverse direction (i.e. starting from the oldest life stage) and reaps benefits for women in all preceding life stages.

Some countries in Asia have already started to implement social pension programs for the elderly. These range from general social assistance programs that provide support for all individuals and households in poverty (e.g. Sri Lanka), pension programs targeting older people specifically through a separate program component (as in the case of Kazakhstan that provides social pensions to the elderly residing in households existent at the poverty level that constitute of children), programs targeted specifically at older people as distinct from other types of social assistance (e.g. in the case of Vietnam, Philippines, Bangladesh and India) or programs that provide a minimum pension to individuals above a certain age but require some level of basic contribution (e.g. in the case of Nepal; Barrientos 2012). It is evident that many of the Asian countries, identified in chapter 3, experiencing the elderly missing women phenomenon do not benefit from these social pension programs. It would be necessary to implement the third type of program in these countries to ensure that the elderly, and especially elderly women attain the benefits of social pension and that the resultant effects are allowed to operate at the societal level. However, it is to be noted that even in the countries where this third program has been implemented, coverage is far from universal. For example, in India social pension programs only cover 7-10% of the eligible elderly population and in Bangladesh it is limited to a fixed number of beneficiaries in a given administrative unit (i.e. the 15 poorest elderly of the administrative unit; Barrientos 2012). It will perhaps take years before the effects of

social pensions can penetrate the grass root levels of society and alter the social norms but if they are ever to do so, their universal coverage needs to be ensured.

Social pensions alone however will not be sufficient in reversing the missing women phenomenon across the different life stages. Effective legislation may be required to overcome some of the most extreme factors. The role of legislation has been touched upon in chapter 2, for example in terms of the two child policy in China (and hence improving the sex ratios at birth) and the honor killing law in Pakistan (and reducing the number of missing women in young adulthood). As shown in chapter 5, laws in association with domestic violence, sexual harassment, rape and especially divorce and widow inheritance present a relatively high correlation with the sex ratios of the population (total/elderly) and reduce the preponderance of men in the population (total/elderly). As with the case of social pensions however, these laws would take time to be effective and may in fact be more difficult to implement than social pensions. The general immutability of inheritance laws for example is embedded in their traditional and religious origins as a result of which constitution alone may not be able to modify existing practices that have deeply grounded spiritual roots. Nevertheless, many laws such as those against honor killings, domestic violence and female genital mutilation may be successful if enforced effectively. However, their effective enforcement again requires a change in norms i.e. the recognition by law enforcement agencies that women should not be subjected to such practices so that those who do subject them to these practices pay a heavy price. The presence of effective laws and the change in norms may reinforce each other so that social norms on unacceptability of such practices on the one hand may ensure the implementation of laws while the presence of strict laws might over time erode such practices due to the heavy penalty associated with these conventions.

The problem of course is that for many countries across Asia the stage is already set for an elderly missing women phenomenon in the future. As Chapter 3 shows, many countries in South Asia and the Middle Eastern part of Western Asia display a female deficit in their total population that is not driven by a female deficit in old age but rather female deficits in the late childhood, young adulthood and adulthood life stages. As these cohorts move into the elderly category in the future, the deficit will continue to be apparent in old age. As the projection results for chapter 3 show, while the number of countries that display a female deficit in old age falls (mostly due to a reduction in the number of countries displaying the female deficit as a cohort effect in Southeast Asia), the proportion of elderly in the countries that are expected to continue to display a deficit in old age will rise. The best case scenario for these countries is therefore to not allow the female deficit at each life stage to exceed its current level. While social pensions and legislation might change norms in the long run, a more immediate route towards elevating the position of women is to create awareness of the threat of the elderly missing women phenomenon. Perhaps the easiest way to do this is to highlight the deleterious consequences of a female deficit in old age for elderly men i.e. the caregiving implication for elderly men. As discussed in chapter 2, widow versus widower mortality is higher because women are expected to live longer than men and because male rates of remarriage are higher than female (Bennett 1997). However, if the shortage of females increases as women get older, elderly men will not be able to find women to marry and hence to provide care for them. This is all the more worrisome for them in light of the changing household structure, which as discussed in Chapter 2 is moving away from the traditional joint family system to a nuclear family

system (Bongaarts and Zimmer 2002). In a nuclear family system, elderly men and women are left to rely on each other with the caregiving implications of elderly men falling on their wives. In the absence of wives however men will be left to rely on themselves or enter old age nursing homes. Creating awareness about this dilemma may be one way to arrest the contribution of different factors and forces across the life course to the growth in the female deficit and allow wives and mothers to be regarded with greater value. This argument is similar to bare branches phenomenon in China where, as explained in Chapter 2, the inability of young men to find wives may reduce/eliminate the motivation of parents to sex select in favor of sons and thereby allow sex ratios at birth to normalize (Guilmoto 2009). However, the case of elderly missing women is significantly more complicated as it requires the position of women across several life stages to be elevated simultaneously.

It would therefore appear that the elderly missing women phenomenon will persist for some decades to come. This creates avenues in each of chapters 2, 3, 4, and 5 for further investigation and understanding of the phenomenon to aid in better management of the issue.

Chapter 2 considers gender as the primary source of inequality that differentiates the life courses of men and women and may create disadvantages for each life stage of women. However, it does not consider differentiations amongst the life courses of women. Such a differentiation would allow social inequalities other than gender (e.g. education, income, urban or rural residence, social class etc. – some of which are discussed as intermediary forces in chapter 2) to interact with gender to generate distinct life courses for women contingent upon the nature of inequalities. This may be understood within the framework of intersectionality theory. Intersectionality theory places social identities as the principal ingredients of social relations with these social identities mutually constituting, reinforcing and naturalizing each other (Shields 2008). The term mutually constitute implies that one category of social identity such as gender takes its meaning from another category of social identity such as education or social class. The terms reinforce implies that individuals whose social identities are being formed are actively engaged in this formulation alongside the imputation of their identities. The term naturalize means that the meaning of the different social identities is self-evident to one another (Shields 2008). Intersections may create oppression or opportunity and may create social stratification (Shields 2008). In the context of missing women, gender may simultaneously interact with education, income, rural-urban residence, social class etc. to create graded levels of marginalization. These graded levels of marginalization would differentiate life courses amongst women as a result of which the disadvantages suffered by each category of differentiated women would be different. For example, the factors that create disadvantages at each life stage of educated women in urban areas may differ from those of uneducated women in rural areas. Evaluating the missing women phenomenon in this way would allow multiple axes of oppression other than gender alone to be examined and an evaluation of how disadvantages develop as a result of these multiple axes of oppression (Shields 2008). It may also allow for an identification of which type of women are immune not only from a given disadvantage at given life stage but also from the missing women phenomenon at a particular life stage and in all life stages because of course not all women in a country exhibiting the elderly missing women phenomenon are affected by the factors and forces that lead to missing women. This allows an investigation of how social positions and group memberships overlap (Shields 2008) and extends the elderly

missing women phenomenon beyond the experience of gender to other overlapping and reinforcing mechanisms in society (Samuels and Ross-Sheriff 2008).

Chapter 3 may be extended by exploring the elderly missing women phenomenon in Africa. Although Africa today is the youngest continent in the world (Bloom, Canning and Sevilla 2003) and it will be some decades before the bulk of the population enters old age, there are two reasons to suspect why the elderly missing women phenomenon may pose a serious threat for some African nations. First, Sen (1990) identified Asia and Africa to be the two continents where the missing women phenomenon persists and subsequent authors also point to regions and countries in Africa where the phenomenon may prevail. For example, Klasen and Wink (2003) point to the existence of the phenomenon in North Africa (Tunisia and Algeria) and most recently Bongaarts and Guilmoto (2015) point to Nigeria and Sub-Sharan Africa. Furthermore, while Sub-Saharan Africa has been somewhat touched upon in literature, neither of the countries therein nor the remaining countries of Africa have been exhaustively assessed in terms of the missing women or elderly missing women phenomenon. It is worth noting that an examination of female deficit in Asia revealed that the majority of countries in the Asian Middle East display the worst female deficit in their total and elderly populations. As the Middle East and North African (MENA) countries are often grouped together to assess and resolve their sociodemographic and political issues (World Bank, "World" 2016), the MENA countries of Africa may also exhibit high female deficits in their total and elderly populations. Second, as discussed in chapter 2, in the current population of Africa, HIV is a formidable cause of missing women due to its direct impact on female mortality in the 15 to 44 age category (hence in the young adulthood and adulthood stages; Anderson and Ray 2010) and its indirect impact on elderly women via the burden of care argument. This alone gives cause for the elderly missing women phenomenon to persist on the continent. However, in the decades to come, this may worsen as the consequences for elderly women may come via the direct impact of HIV as well when the 15 to 44 age category enters old age (Bock and Johnson 2008) and transfers the female deficit in the young adulthood and adulthood categories to the elderly category. Hence, in future cohorts of the elderly, in Sub-Saharan Africa at least, the problem of elderly missing women is expected to be substantially high.

Chapter 4 may be extended by evaluating the effect of demographic shocks (e.g. conflict and natural disasters) on countries other than Pakistan. One country which could be particularly interesting in this regard is Bangladesh. As chapter 3 shows Bangladesh also has large numbers of missing women in its total and elderly populations and like Pakistan did not experience the fertility decline and sex selection revolutions (Bongaarts and Guilmoto 2015) that may confound the effect of demographic shocks on sex ratios of the population (total/elderly). Furthermore, the analysis of Pakistan shows that conflicts in Pakistan did not affect the civilian population of the country but that their impact has been restricted to the immediate participants of the conflict (i.e. the men fighting the wars). As these immediate participants were not very large in number, the total impact had not been large enough to affect the sex ratios of the population. The situation may be different for Bangladesh. The creation of Bangladesh in 1971 itself was an event that engulfed the whole nation and indiscriminately affected all the men, women and children in the population Akmam (2002). This was followed by a major famine from 1974 to 1975 which had different impacts on the mortality rates of females and males in different life stages

(Dyson, "Part II" 1991). These two events alone may have played an instrumental role in shaping the sex ratios of the total and elderly populations in Bangladesh today. Furthermore, as the results from chapter 3 show, in 2015 the missing women phenomenon in the total population of the country in 2015 is driven by a female deficit in the 50+ population. It addition, the projection results of the chapters show that by 2030 the elderly missing women phenomenon in Bangladesh may allow for a possible cohort effect interpretation (i.e. the female deficit in the elderly population in 2030 and 2050 will not be accompanied by a female deficit in the total population). An analysis of historical events in the country may elucidate the causes behind the cohort effect in the 50+ population in 2015 and the elderly population in 2030 and 2050.

Finally, Chapter 5 may be expanded by deploying the variables used therein via a Multiple Correspondence Analysis (MCA) approach. According to Roux and Rouanet (2006) MCA is a technique that "displays the rows and columns of the data table – where rows represent individuals (i.e. countries) and columns represent categories of variables – in a low dimensional space, so that proximity in the space indicates similarity of categories and of individuals." To employ this technique, the variables in chapter 5 will first have to be separated into two types: active variables and supplementary variables. In a first step MCA would be employed to the active variables which will be taken to be all the independent variables used in the OLS regression model of chapter 5. This would necessitate the transformation of these variables into nominal binary variables so that the data may be represented by a C by K matrix where C refers to the number of countries and K the categories that represent the different response options for each variable (e.g. in the case of total fertility rate the categories would pertain to low, medium or high rates of fertility). MCA may then be applied to this data matrix to obtain a simultaneous representation graph. This graph is obtained by first identifying the inter-country variability i.e. countries are distinguished from each other in terms of the categories they identify themselves with, so that countries that identify themselves along similar categories have small distances (e.g. high fertility countries may be grouped together) whereas countries that do not share many similar categories have large distances between them. An important feature captured by MCA is that of rarity so that even if countries do not share many similar categories but share a rare category may be mapped close to each other. The distances between countries in terms of the categories they represent is mapped on a two dimensional Cartesian plane, the axes of which represent the maximal degree of variability amongst the countries. Similarly, in a second step, the association between the categories of the qualitative variables can be captured. Here, MCA defines the link between categories so that variables are associated with each other if one category of the variable is connected with categories of another variable (e.g. the categories of low fertility, low maternal mortality and low communicable disease prevalence may be grouped together). The distance between these categories may again be captured on a two dimensional Cartesian plane which maximizes the variability amongst the categories. When these two graphs are put together the simultaneous representation graph is obtained. The two diagonal axes along this simultaneous representation graph may be used on the one hand to separate the variables that are associated and not associated with the masculinization of the sex ratios of the population and on the other hand to create distinctions amongst the variables that are associated (or not associated) with the masculinization of the population. This may be used, for example, to assess whether the results are different for variables that represent the factors, forces and/or exogenous shocks. It is to be noted that variables closer to the origin are more significant in

explaining the masculinization of sex ratios than variables further away from the origin. The supplementary variables may now be added to the analysis. While the active variables are qualitative in nature, the supplementary variables may be quantitative. Therefore, the supplementary variables used here could be the sex ratios of the total and elderly populations. These supplementary variables are mapped on to the simultaneous representation graph to allow a visualization of which variables contribute most to the feminization or masculinization of the population and hence may allow an accurate depiction of not only the variables that are the most significant contributors to the elderly missing women phenomenon but also those that are responsible for generating the extreme outlier countries of the Middle East (Husson, Le and Pagès 2010).

In a nutshell, the results of this research allow four conclusions to be drawn about the missing women and elderly missing women phenomena. First, although the main focus of existing literature is on missing women at birth and during childhood, the missing women phenomenon persists at all age groups and yields its worst manifestation in the elderly age group as this presents the culmination of the female deficit and survival disadvantage from all preceding life stages. Second, an inaccurate geographical specificity persists in missing women literature. Many countries in South Asia and almost all countries of the Middle Eastern region of Asia are ignored in an analysis of missing women literature although the total and elderly populations of these countries, especially the latter, present the largest female deficits of all countries on the Asian continent. Third, an analysis of demographic shocks in the special case of Pakistan shows that the elderly missing women phenomenon may not be attributable to exogenous forces (conflicts or disasters) in the country and factors across the life course need to be given greater weightage in explaining the causal mechanism. Finally, an empirical analysis of the variables that are representative of the causal factors, forces and exogenous shocks confirms the first three results and lends credence to the relevance of theoretical underpinnings behind the factors and forces across the life course. Merged together, these results show for the first time that the life course perspective is the ideal theoretical framework within which to evaluate the elderly missing women phenomena.

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Appendix

Figure A.1: Missing women in East Asia (2030)

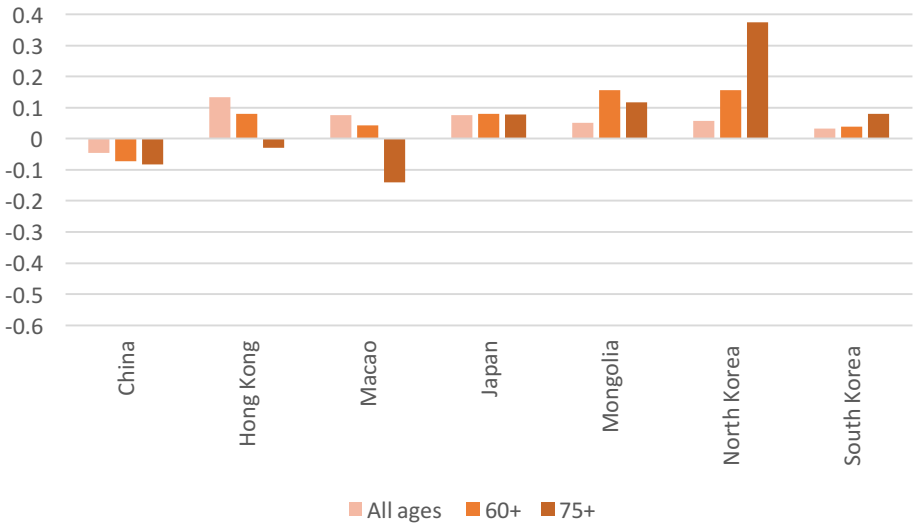

Figure A.2: Missing women in Southeast Asia (2030)

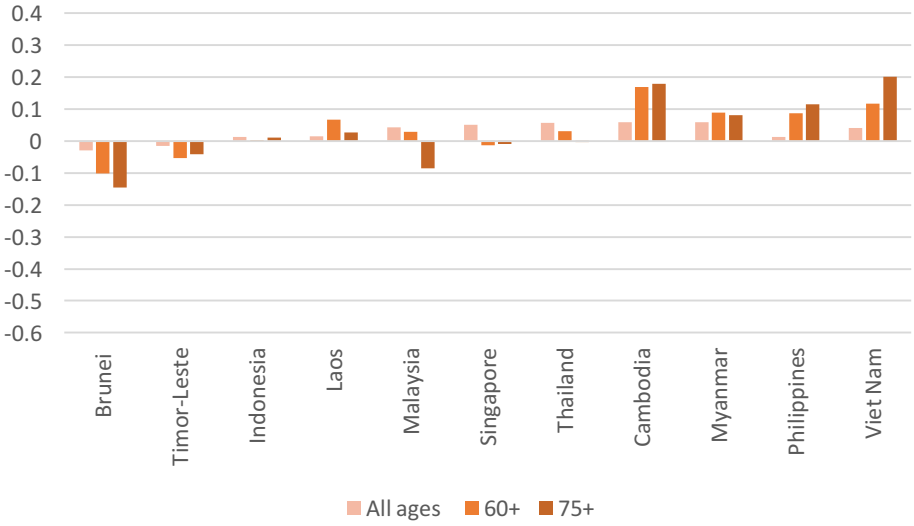

Figure A.3: Missing women in South Asia (2030)

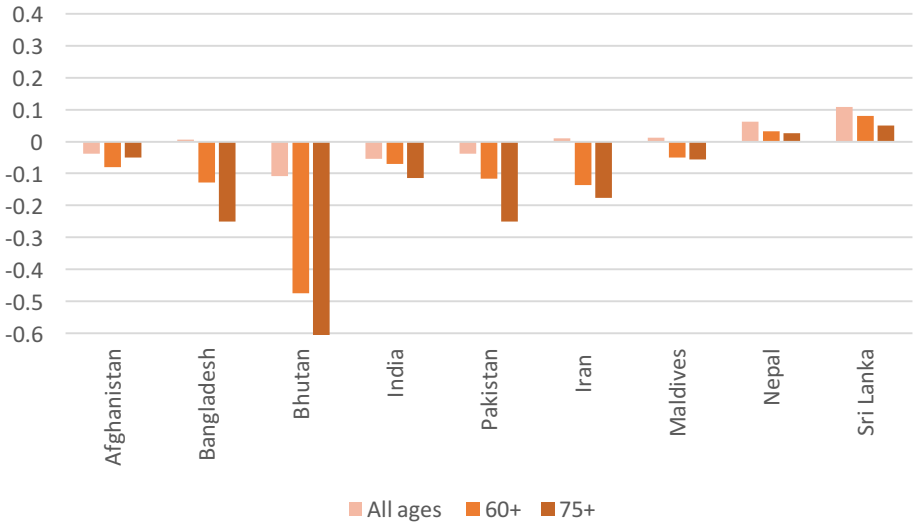

Figure A.4: Missing women in Central Asia (2030)

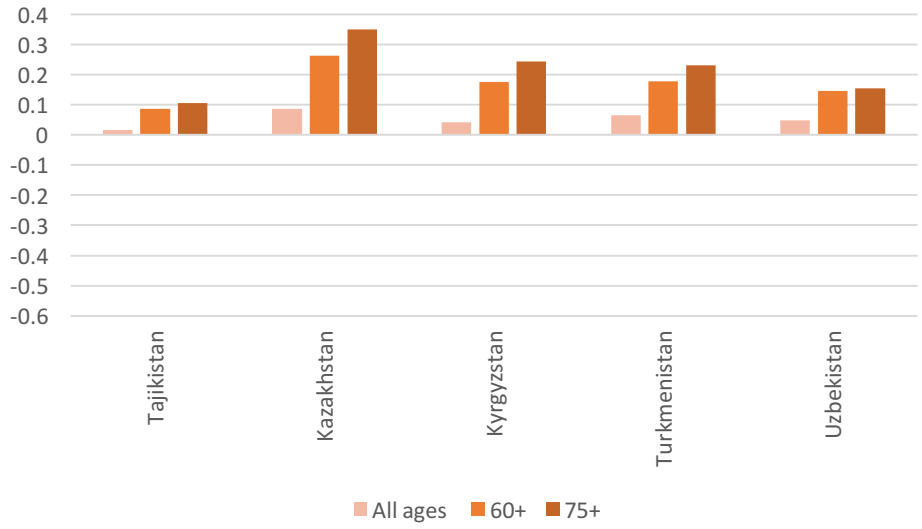

Figure A.5: Missing women in non-GCC Western Asia (2030)

Figure A..6: Missing women in GCC Western Asia (2030)

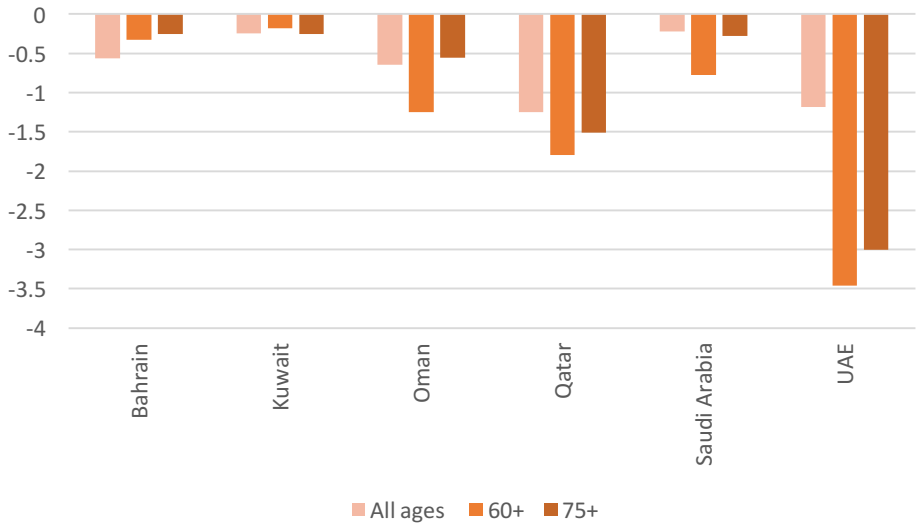

Figure A.7: Missing women in East Asia (2050)

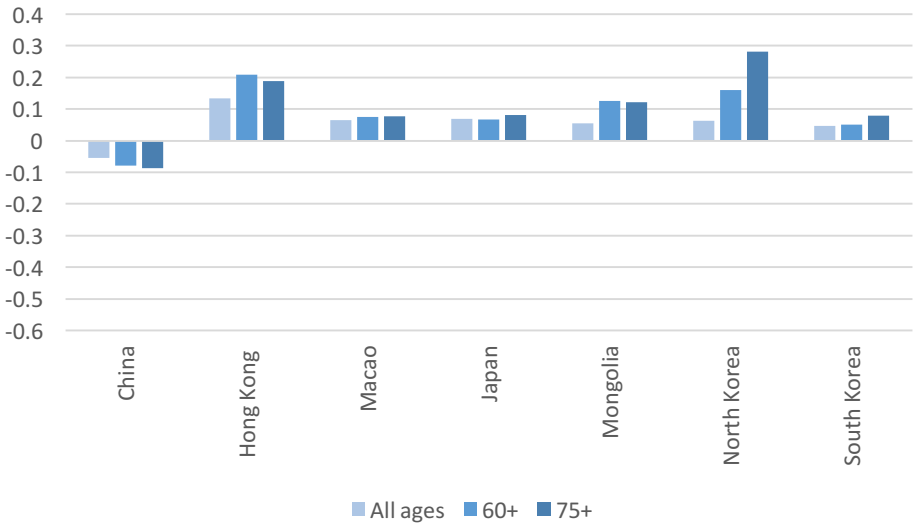

Figure A.8: Missing women in Southeast Asia (2050)

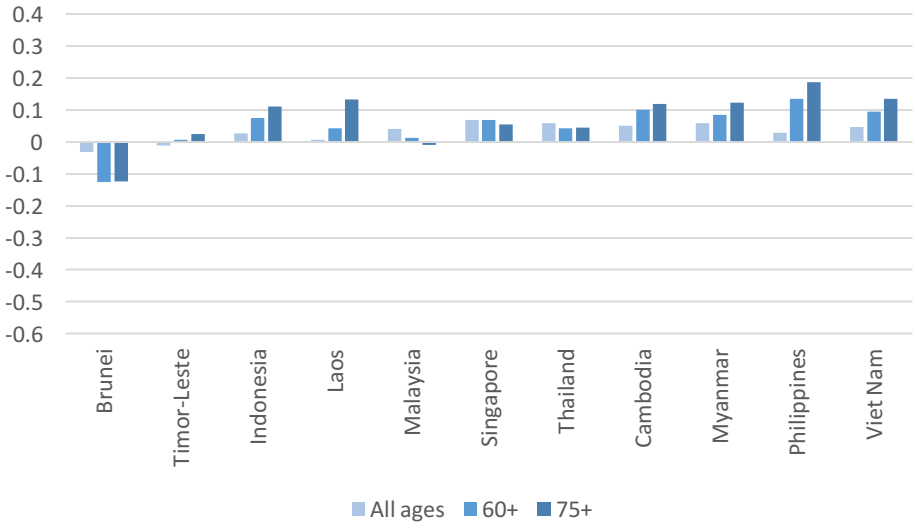

Figure A.9: Missing women in South Asia (2050)

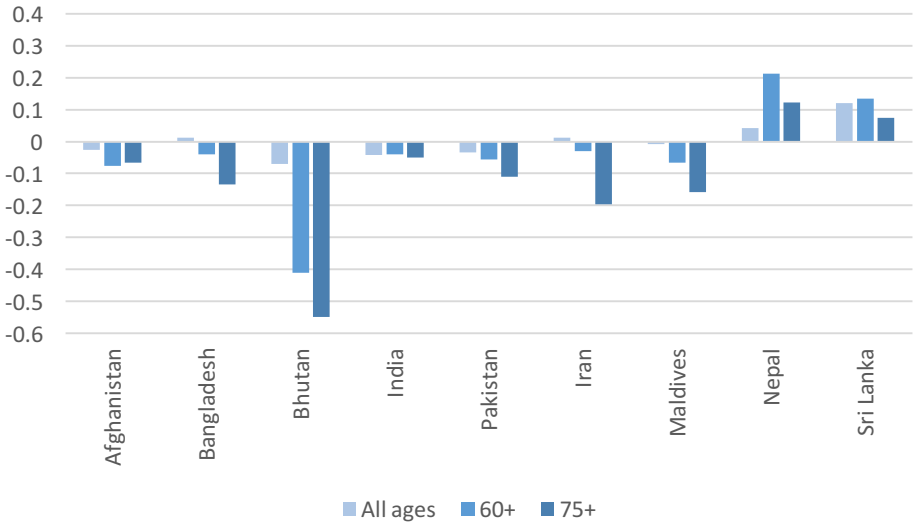

Figure A..10: Missing women in Central Asia (2050)

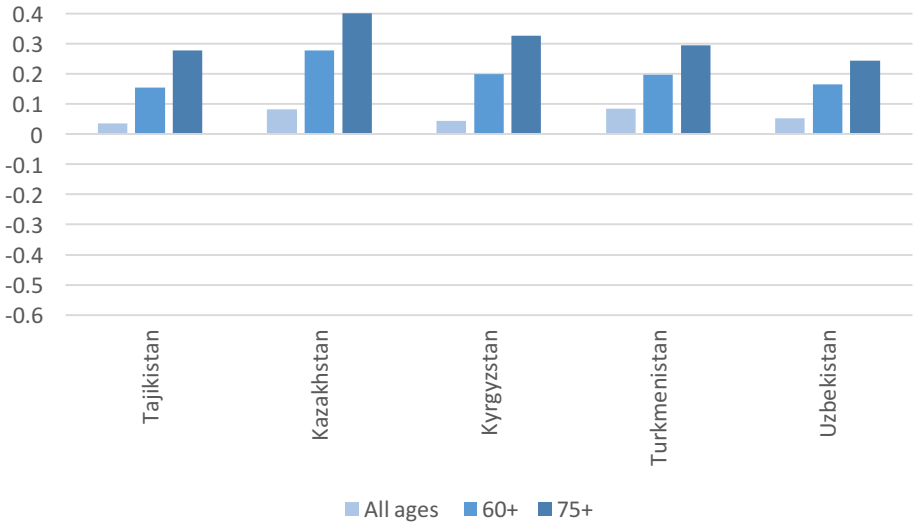

Figure A..11: Missing women in non-GCC Western Asia (2050)

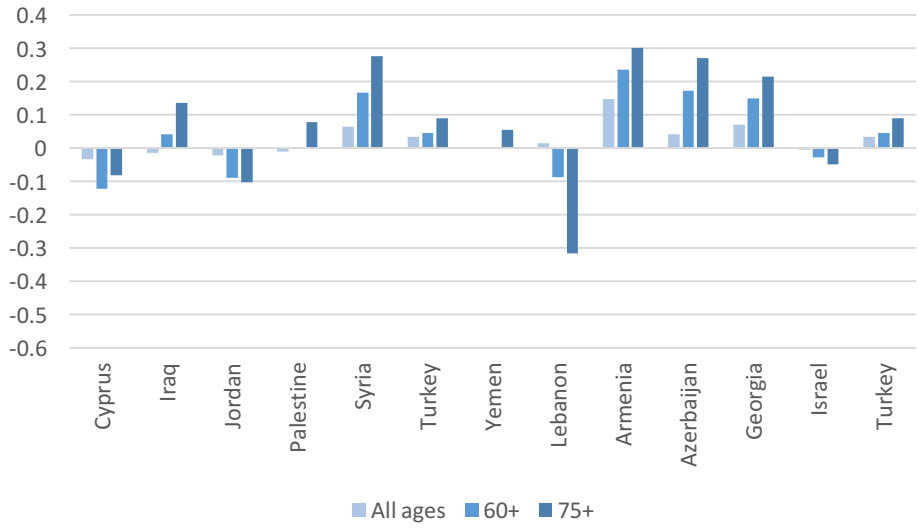

Figure A.12: Missing women in GCC Western Asia (2050)

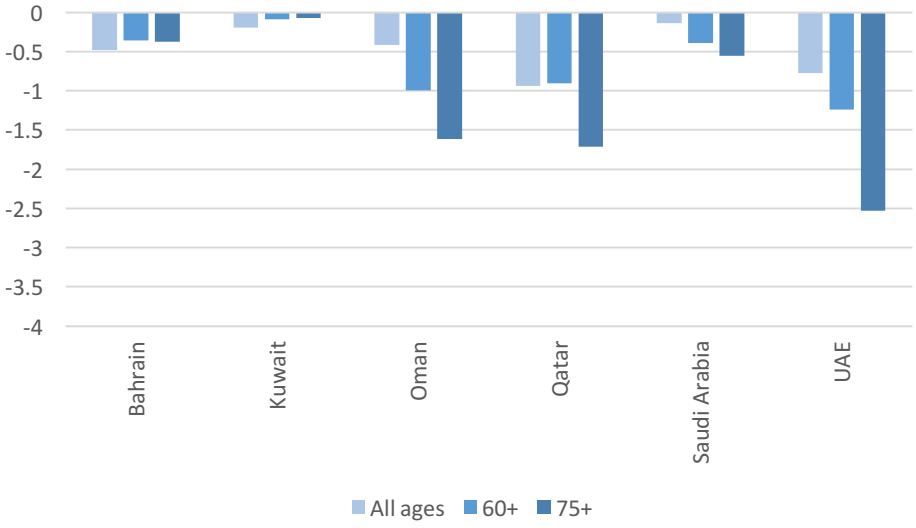

Table A–1

Pearson's product moment correlation coefficients		
	S.R. Total Pop.	***S.R. Elderly Pop.***
1. Economic development indicators		
GNI	-0.00	-0.00
GNI/capita	0.41*	0.37*
GINI Index	0.15	0.09
Urban/rural population	0.54*	0.40*
Public Health Expenditure	-0.17	-0.12
Sanitation Access	0.08	0.04
Gender Development Index	-	-
2. Population composition indicators		
Migrants (female/male)	-0.49*	-0.44*
Ratio of dependency ratios	-0.22*	-0.22*
Buddhists	-0.02	0.00
Christians	-0.23*	-0.24*
Folk religious adherents	-0.05	-0.01
Hindus	0.13	0.13
Jews	-0.01	-0.01
Muslims	0.27*	0.28*
Other religious adherents	-0.01	-0.02
Unaffiliated religious adherents	-0.15*	-0.18*
3. Legislative environment		
Laws on rape	-	-
Laws on domestic violence	-	-
Laws on sexual assault	-	-
Laws on widow inheritance	-	-
Laws on divorce	-	-

Female legislators/managers/senior officials	-0.36*	-0.38*
Female National Assembly Seats	-0.18*	-0.15*
4. Childhood indicators		
Stunting (female/male)	-0.16	-0.10
Wastage (female/male)	0.02	0.02
Underweight (female/male)	-0.05	-0.01
Infant mortality (female/male)	0.07	0.06
Under five mortality (female/male)	0.06	0.07
5. Non-reproductive indicators		
Female age at first marriage	-0.02	-0.04
Contraceptive prevalence (ages 15-49)	-0.17*	-0.20*
Anaemia (non-pregnant women)	0.08	0.09
Access to public space	-	-
6. Reproductive indicators		
Abortion	-	-
Skilled health staff (at time of birth)	0.04	-0.02
Availability of prenatal care	0.02	-0.03
Anaemia (pregnant women)	0.01	0.06
Total fertility rate	0.01	0.03
Adolescent fertility rate	-0.07	-0.01
Neonatal mortality rate	-0.06	0.00
Maternal mortality rate	-0.06	0.00
7. Disease environment		
COMM	-0.13	-0.18*
Communicable disease deaths	-0.03	0.00
Non-communicable diseases deaths	-0.04	0.08
Injury deaths	0.37*	0.37*

HIV deaths (female/male)	-0.08	-0.05
8. Survival expectations		
Life expectancy at birth (female/male)	-0.27*	-0.37*
Life expectancy at 60 (female/male)	-0.24*	-0.38*
HALE at birth (female/male)	-0.31*	-0.43*
HALE at 60 (female/male)	-0.17*	-0.29*
Mortality ages 15 to 60 (female/male)	0.14	0.21*
9. Education indicators		
Female literacy rates (ages 15+)	0.03	-0.05
Female 15+: no education	0.01	0.06
Female 15+: primary education	-0.08	-0.05
Female 15+: secondary education	0.01	-0.05
Female 15+ tertiary education	0.02	-0.01
Female 60+: no education	0.15	0.20*
Female 60+: primary education	-0.10	-0.09
Female 60+: secondary education	-0.12	-0.18*
Female 60+: tertiary education	-0.06	-0.10
10. Labor force indicators		
Employment ratio (female/male)	-0.26*	-0.26*
Labor force primary education (f/m)	-0.19*	-0.16
Labor force secondary education (f/m)	0.20*	0.13
Labor Force tertiary education (f/m)	0.28*	0.21*
11. Demographic shocks		
Incidents >1000 deaths	-	-
Battle related deaths (non-state)	0.18	0.07
Battle related deaths (state)	0.06	0.03
Battle related deaths (total)	-0.00	0.00

Refugee origin	-0.00	-0.00
Total disaster deaths	0.01	0.03
Total disaster affected	0.02	0.04

*Coefficients with an asterisk (*) are significant at 5%

** A dash (-) indicates that the coefficient was not calculated because the data for the variable is ordinal.

Table A–2: Correlation Matrix

	HIV(f//m)	Marriage	TFR	ADOFR	Contraceptive	B.Skilled	Prenatal	LE60	HALE60	HALEbirth
HIV(f//m)	1									
Marriage	-0.37	1.00								
TFR	0.67	-0.57	1.00							
ADOFR	0.54	-0.66	0.79	1.00						
Contraceptive	-0.46	0.39	-0.76	-0.49	1.00					
B.Skilled	-0.56	0.58	-0.75	-0.63	0.66	1.00				
Prenatal	-0.31	0.41	-0.43	-0.35	0.44	0.71	1.00			
LE60	-0.44	0.31	-0.49	-0.44	0.38	0.45	0.29	1.00		
HALE60	-0.35	0.26	-0.52	-0.38	0.35	0.52	0.43	0.58	1.00	
HALEbirth	-0.27	0.20	-0.35	-0.33	0.37	0.40	0.33	0.59	0.56	1.00
LEBirth	-0.39	0.25	-0.47	-0.43	0.40	0.48	0.36	0.67	0.59	0.82
Surv60	0.62	-0.42	0.72	0.63	-0.56	-0.65	-0.41	-0.65	-0.53	-0.63
IMR(f/m)	0.24	0.01	0.15	0.08	-0.19	-0.22	-0.21	-0.28	-0.31	-0.47
U5MR(f/m)	0.45	-0.20	0.42	0.31	-0.40	-0.48	-0.40	-0.44	-0.42	-0.57
GNI/capita	-0.38	0.39	-0.38	-0.40	0.16	0.41	0.22	0.09	0.22	-0.02
Comm	-0.48	0.38	-0.54	-0.49	0.26	0.45	0.29	0.42	0.41	0.27
sanitation	-0.63	0.53	-0.78	-0.72	0.62	0.81	0.45	0.49	0.44	0.32
Urban/Rural	-0.17	0.12	-0.13	-0.15	0.01	0.14	0.05	-0.11	0.01	-0.11
litratio	-0.54	0.47	-0.69	-0.56	0.66	0.71	0.57	0.39	0.51	0.49
DEPRatio	-0.48	0.47	-0.64	-0.50	0.46	0.49	0.32	0.51	0.47	0.35
Anemia	0.50	-0.40	0.60	0.51	-0.68	-0.54	-0.35	-0.41	-0.29	-0.54
NNMR	0.63	-0.56	0.79	0.68	-0.70	-0.76	-0.59	-0.51	-0.38	-0.37
MMR	0.66	-0.49	0.80	0.73	-0.67	-0.67	-0.39	-0.47	-0.40	-0.35
EMPRATIO	0.18	-0.25	0.20	0.29	-0.12	-0.17	0.05	-0.05	0.17	0.25
EMPFEM	0.25	-0.40	0.30	0.38	-0.14	-0.29	-0.05	-0.16	0.02	0.13
DNonComm	-0.71	0.53	-0.88	-0.76	0.65	0.76	0.45	0.59	0.50	0.31
Dcomm	0.72	-0.52	0.89	0.76	-0.67	-0.77	-0.44	-0.57	-0.46	-0.31

Table A–3: Correlation Matrix

	LEBirth	Surv60	IMR(f/m)	U5MR(f/m)	GNI/capita	Comm	Sanitation	Urban/Rural	litratio	DepRatio
LEBirth	1.00									
Surv60	-0.83	1.00								
IMR(f/m)	-0.43	0.27	1							
U5MR(f/m)	-0.59	0.50	0.92	1.00						
GNI/capita	0.08	-0.28	0.03	-0.11	1.00					
Comm	0.33	-0.55	0.06	-0.14	0.22	1.00				
sanitation	0.48	-0.74	-0.14	-0.40	0.47	0.51	1.00			
Urban/Rural	-0.07	-0.07	0.05	-0.01	0.85	0.04	0.17	1.00		
litratio	0.46	-0.55	-0.32	-0.53	0.32	0.34	0.65	0.11	1.00	
DEPRatio	0.44	-0.63	-0.01	-0.21	0.21	0.80	0.54	-0.02	0.39	1.00
Anemia	-0.52	0.61	0.25	0.45	-0.22	-0.36	-0.58	-0.07	-0.69	-0.44
NNMR	-0.46	0.73	0.18	0.46	-0.44	-0.55	-0.77	-0.18	-0.67	-0.61
MMR	-0.51	0.73	0.17	0.43	-0.39	-0.44	-0.80	-0.13	-0.66	-0.48
EMPRATIO	0.12	0.14	-0.25	-0.15	-0.24	-0.02	-0.39	-0.10	0.00	0.05
EMPFEM	0.03	0.22	-0.23	-0.10	-0.21	-0.25	-0.44	-0.03	-0.11	-0.18
DNonComm	0.53	-0.82	-0.11	-0.40	0.38	0.66	0.87	0.10	0.60	0.68
Dcomm	-0.54	0.83	0.13	0.41	-0.43	-0.60	-0.88	-0.15	-0.62	-0.63

Table A–4: Correlation matrix

	Anemia	NNMR	MMR	EMPRATIO	EMPFEM	DNonComm	Dcomm
Anemia	1.00						
NNMR	0.68	1.00					
MMR	0.57	0.78	1.00				
EMPRATIO	0.09	0.18	0.34	1.00			
EMPFEM	0.14	0.26	0.37	0.91	1.00		
DNonComm	-0.56	-0.82	-0.83	-0.32	-0.42	1.00	
Dcomm	0.58	0.83	0.86	0.36	0.43	-0.99	1.00

* For the correlation matrices in Table I-2, I-3 and I-4 the following abbreviations are used: Marriage for female marriage age; TFR for total fertility rate; ADOFR for Adolescent fertility rate; Contra for contraceptive prevalence rate between ages 15 to 49; B.Skilled for births attended by skilled health staff; Prenatal for prenatal care; LE60 for ratio of female to male life expectancy at 60; HALE60 for ratio of female to male healthy life expectancy at 60; LEbirth for ratio of female to male life expectancy at birth; Surv60 for ratio (female/male) of adult mortality rates between ages 15 and 60; IMR and U5MR for female to male ratio of infant and under five mortality rates; COMM for ratio of non-communicable to communicable diseases; DepRatio for ratio of dependency ratios; Anemia for anemia in reproductive age groups (pregnant and non pregnant); NNMR and MMR for neonatal and maternal mortality rates; EMPRATIO for employment to population ratio; EMPFEM for ratio of female employment to female population; D.NonComm for deaths by non communicable diseases; DComm for deaths by communicable diseases.

Table A–5

Factor analysis				
Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	12.66	9.85	0.60	0.60
Factor2	2.80	1.19	0.13	0.73
Factor3	1.62	0.45	0.08	0.81
Factor4	1.16	0.25	0.06	0.87
Factor5	0.92	0.24	0.04	0.91
Factor6	0.68	0.10	0.03	0.94
Factor7	0.58	0.18	0.03	0.97
Factor8	0.40	0.06	0.02	0.99
Factor9	0.35	0.16	0.02	1.00
Factor10	0.19	0.02	0.01	1.01
Factor11	0.16	0.05	0.01	1.02
Factor12	0.11	0.06	0.01	1.03
Factor13	0.05	0.01	0.00	1.03
Factor14	0.04	0.03	0.00	1.03
Factor15	0.01	0.01	0.00	1.03
Factor16	0.00	0.01	0.00	1.03
Factor17	-0.01	0.01	0.00	1.03
Factor18	-0.02	0.01	0.00	1.03
Factor19	-0.03	0.02	0.00	1.03
Factor20	-0.04	0.01	0.00	1.03
Factor21	-0.06	0.02	0.00	1.02
Factor22	-0.07	0.01	0.00	1.02
Factor23	-0.08	0.02	0.00	1.02
Factor24	-0.10	0.01	0.00	1.01
Factor25	-0.11	0.02	-0.01	1.01
Factor26	-0.13	-	-0.01	1.00

Table A–6

Unrotated Factor loadings and uniqueness				
Variable	FEMCAP	EARLY SURV	ECON DEV	Uniqueness
Female marriage age	0.60			0.57
Contraceptive prevalence	0.73			0.47
Total fertility rate	-0.90			0.17
Adolescent fertility rate	-0.78			0.35
Births skilled health staff	0.84			0.27
Prenatal care	0.57			0.65
Neonatal mortality rate	-0.88			0.20
Maternal mortality rate	-0.85			0.26
Anaemia reproductive age	-0.71			0.49
COMM	0.61			0.47
Communicable disease deaths	0.93			0.08
Non-communicable disease deaths	-0.93		0.07	
HIV (female/male)	-0.71			0.48
Life expectancy at 60 (f/m)	0.64			0.46
HALE at 60	0.60			0.56
Adult mortality ages 15 to 60 (f/m)	-0.87		0.21	
Literacy ratio (f/m)	0.77			0.20
Female employment ratio		-0.46		0.67
Ratio of dependency ratios	0.68			0.40
Sanitation	0.87			0.20
Life expectancy at birth (f/m)	0.67	-0.52		0.27
HALE at birth (f/m)	0.55	-0.62		0.31
Infant mortality rate (f/m)		0.72	0.40	0.23
Child mortality rate (f/m)	-0.58	0.61		0.16
GNI/capita	0.43	0.48	-0.62	0.20
Urban/rural		0.41	-0.70	0.32