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Estimating the economic costs of child marriage in the Arab region

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Estimating the economic costs of child marriage in the Arab region

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Key messages

- Eliminating child marriage in the Arab region would have a significant positive impact on economic growth. It is estimated that it could boost the region's economy by approximately 3 per cent per annum, adding a staggering $3 trillion between 2021 and 2050.

- Failure to address the issue of child marriage will result in substantial economic burdens for the Arab region, even with advancements in other socioeconomic, demographic and health measures. If child marriage rates persist, Algeria, Jordan, the State of Palestine, Sudan and Tunisia are projected to experience the highest cumulative GDP losses between 2021 and 2050.

- The prevalence of child marriage varies significantly across the region, with rates ranging from 1.5 per cent in Tunisia to 45.3 per cent in Somalia. Additionally, there are variations among provinces within each country. These variations underscore the crucial need for tailored policies and targeted interventions that effectively address and counteract the detrimental consequences of child marriage. Furthermore, Arab countries should strengthen their socioeconomic, population and health policies to mitigate the negative implications of child marriage on women.

- Ending child marriage also requires addressing the underlying structural determinants of gender inequality, such as countering discriminatory norms, improving access to quality education, promoting economic participation, providing health-care services, and supporting initiatives to end violence against women and girls. Taking swift action to address these factors will result in greater economic benefits.

- Arab countries can avert economic losses by prioritizing key channels, including promoting family planning and maternal and child health care to reduce high fertility and child mortality rates, ensuring access to education for girls both before and after marriage, and creating flexible labour market opportunities that encourage the active participation of women in economic activities.

Executive summary

Child marriage remains a prevalent global practice, with around one in five girls marrying before the age of 18 in 2022.[1] A considerable variation can also be seen across countries. Child marriage has been shown to have lifetime consequences for girls in terms of poor educational, health and economic outcomes, depriving them of their basic rights and leaving the next generation at a disadvantage. The issue has been aggravated by the COVID-19 pandemic and demands effective and conscious intervention, especially in the poorest countries that exhibit the highest rates of child marriage.[2] Despite a declining trend in child marriage, the current rate in the Arab region remains sizeable, with a wide variation across countries.[3] While the prevalence of child marriage across the Arab region has dropped from one in three to one in five females, progress has stagnated over the recent decade.[4] A growing volume of studies are increasingly demonstrating the negative effects of child marriage on a variety of developmental outcomes;[5] however, concerted efforts and resources to neutralize the practice remain inadequate across the Arab region. To stimulate greater efforts towards eliminating child marriage, the present study underlines the economic costs of child marriage and the key mechanisms for a number of Arab countries. The report offers essential insights into the economic consequences (cost of inaction) if child marriage is neglected in Arab countries. It serves as valuable material for advocacy efforts, aiming to draw governments' attention to this pressing problem.

Economic costs are channelled through demographic, social and health implications generated as a consequence of child marriage. Demographic implications comprise unwanted pregnancies and unsafe abortions that alter future population growth, mother and child survival, and reproduction. Social implications comprise the loss of educational attainment by girls who are married as children, which eventually harms the exercise of their basic rights, agency, decision-making ability, earning prospects, community support and empowerment in general. Health implications include adolescent pregnancies and births, and the high fertility and maternal morbidity and mortality rates for women marrying early. These implications, endured by girls who marry as children, might be direct or indirect, as well as monetary or non-monetary, for individuals and households and cumulated at the State level.

The Phase I report, developed by ESCWA, UNFPA ASRO, UNICEF MENARO and UN-Women (2023) and entitled "The cost of child marriage over the life cycle of girls and women: evidence from Egypt, Iraq, Jordan and Tunisia",[6] studied the costs of child marriage borne by women and girls in the Arab region. Building on the earlier report, Phase II of the study extends the findings to measure the "economic costs of child marriage" for 13 of the 22 Arab countries for which the relevant data is available. The study aims to report the economic costs of child marriage in terms of the percentage of gross domestic product (GDP) loss for Arab countries. It also theoretically discusses the multiple ways in which child marriage affects women and girls at the individual level with repercussions on their families and thereby the State.

Building on earlier work[7] and following a more robust procedure, the present report utilizes a wider spectrum of demographic, health, education and economic input indicators in the costing exercise, utilizing a life course perspective to project the economic cost of child marriage in the Arab region up to 2050 with the base year of 2001. It covers the entire productive timeline of a girl who married at the age of 15 around the year 2000. The data for

input indicators was compiled from multiple sources, primarily nationally representative household surveys, including the Demographic and Health Survey, the Multiple Indicator Cluster Survey and the Labour Force Survey.

Overall findings suggest that the percentage of GDP lost due to child marriage across 13 Arab countries in 2021 was 3.2 per cent and is expected to be 3 per cent in 2050. The cumulative GDP loss is anticipated to stand at around $3 trillion between 2021 and 2050. Regionally, in 2021, Algeria, the State of Palestine, the Sudan and Tunisia showed more than 4 per cent of GDP loss attributable to child marriage, while Qatar and the Syrian Arab Republic lost the lowest GDP (less than 1 per cent). Between 2021 and 2050, Algeria, Jordan, the State of Palestine, the Sudan, and Tunisia are estimated to lose the highest cumulative GDP attributable to child marriage if current child marriage rates persist.

It is important to note that the economic cost of child marriage not only depends on the rates of child marriage but also on the differences in demographic and socioeconomic outcomes between females married below 18 years of age and those married at 18 and above. Therefore, Algeria, Jordan and Tunisia will incur greater economic costs attributable to child marriage because they have greater fertility and educational differences across females married below 18 years of age than those married at 18 and above. On the other hand, countries like Iraq and Mauritania have higher child marriage prevalence rates, but the relative differences in fertility rates and educational levels between those married below 18 years of age and those married at 18 and above are not as high as in Algeria, Jordan and Tunisia, thus incurring lesser economic costs that are attributable to child marriage.

Our estimate (3.2 per cent in 2021 for the Arab region) is higher than earlier studies[8] covering emerging and developing countries (1 per cent) and South Asia, the Middle East and Africa (1.4 per cent). There could be two reasons for this discrepancy: (1) the difference in the geographical coverage across all three studies; or (2) the difference in the procedure of estimation and the number of input indicators considered for the model. The current study is more comprehensive in terms of indicators inputted for the model. However, the total GDP estimates across the 13 Arab countries from this study are in tune with the World Bank estimates for the respective countries.

In terms of policy implications, the present study highlights that the extent of child marriage significantly contributes to the failure of States in achieving their economic potential. The variations in the economic cost of child marriage, measured by GDP loss, within the Arab region stem from two key factors: the prevalence of child marriage and the effectiveness of countries' health-care and socioeconomic systems. It is imperative for Arab countries to take action in preventing child marriage and mitigating the associated demographic, health and economic impacts. By addressing critical channels such as promoting family planning and maternal and child health care to reduce high fertility and child mortality rates, ensuring access to education for girls before and after marriage, and creating flexible labour market opportunities to encourage women's participation in economic activities, countries can avert economic losses.

Contents

List of Tables

List of Figures

Abbreviations and acronyms

ANC	antenatal care
BMI	body mass index
DHS	Demographic and Health Survey
EICM	economic impacts of child marriage
EMDCs	emerging and developing countries
ERF	Economic Research Forum
ESCWA	Economic and Social Commission for Western Asia
FGM	female genital mutilation
GDP	gross domestic product
ICRW	International Center for Research on Women
IMR	infant mortality rate
LFS	Labour Force Survey
LSMS	Living Standards Measurement Study
MICS	Multiple Indicator Cluster Survey
MMR	maternal mortality ratio
PAPFAM	Pan Arab Project for Family Health
PNC	postnatal care
SDG	Sustainable Development Goal
U5MR	under5- mortality rate
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
UN-Women	United Nations Entity for Gender Equality and the Empowerment of Women
WDI	World Development Indicators
WHO	World Health Organization

Glossary

Antenatal care: Also called prenatal care, it is the care given to expectant mothers during the entire period of pregnancy, from conception to the beginning of labour.

Body mass index: A measure of body fat based on the height and weight of a person.

Child full immunization: Children are said to be fully immunized if they receive all due vaccines as per the national immunization schedule within the first year of birth.

Child marriage: Any formal marriage or informal union between a child under the age of 18 and an adult or another child.

DemProj module: DemProj, a demographic model in spectrum, is a computer programme for making population projections for countries or regions. DemProj projects the population for an entire country or region by age and sex, based on assumptions about fertility, mortality and migration.

Early marriage: Early marriage encompasses child marriage but also includes situations that do not qualify as child marriage, such as marriages in which one or both spouses may lack the capacity to give full and informed consent or may lack the capacity to consent to sex within a marriage.

Family planning: The conscious effort of couples to regulate the number and spacing of births through artificial and natural methods of contraception. Family planning connotes conception control to avoid pregnancy and abortion, but it also includes efforts of couples to induce pregnancy.

FamPlan module: The family planning model FamPlan projects family planning requirements needed to reach national goals for addressing an unmet need or achieving desired fertility.

Female genital mutilation: Procedures that involve altering or injuring the female genitalia for non-medical reasons.

Gender norms: Social and cultural notions and attitudes that govern the behaviour of people in society and restrict their gender identity into what is generally considered acceptable.

Gender-based violence against women: Any act of gender-based violence that results in, or is likely to result in, physical, sexual or psychological harm or suffering to women, whether occurring in public or private life.

Gross domestic product: The monetary value of final goods and services produced by a country's economy during a certain period.

Human capital: Economic value of the knowledge and skills of labour that impacts productivity.

Institutional delivery: Giving birth to a child in the health facilities in the area.

Intergenerational effects: The effects of or involving persons in different generations, as parents and children.

Labour force participation rate: The number of persons in the labour force as a percentage of the working-age population.

Life expectancy at birth: The average number of years that a newborn is expected to live if current death rates for a specific year in a given country do not change.

Maternal morbidity: Any short- or long-term health problems that are directly related to pregnancy and/or childbirth.

Maternal mortality ratio: The number of maternal deaths per 100,000 live births.

Mean age at marriage: The mean age of men or women at first marriage if subject throughout their lives to the age-specific marriage rates of first marriages only in a given year.

Mean years of schooling: The average number of completed years of education of a country's population aged 25 years and older, excluding years spent repeating individual grades.

Net migration: The number of immigrants minus the number of emigrants over a period.

Per capita GDP: Economic output per person of a country, calculated by dividing the total GDP by the population of the country.

Postnatal care: Care given to the mother and the newborn, immediately after childbirth and up to six weeks post-delivery.

RAPID module: Resources for the Awareness of Population Impacts on Development (RAPID) projects the social and economic consequences of high fertility and rapid population growth for sectors such as labour, education, health, urbanization and agriculture.

Sex ratio at birth: The number of live female births per 1,000 live male births.

Spectrum simulation model: A system of policy models that supports analysis, planning and advocacy for health programmes. It is used to project future needs and examine the effects of policy options.

Stunting: The impaired growth and development that a child experiences from poor nutrition, repeated infection and inadequate psychosocial stimulation.

Total fertility rate: The average number of children that would be born alive to a woman (or group of women) during her lifetime if she were to pass through her childbearing years conforming to the age-specific fertility rates of a given year.

Urbanization: The shift of human populations from rural to urban areas.

Wasting: Refers to acute malnutrition and is the result of recent rapid weight loss or the failure to gain weight. A wasted child is too thin for his or her height.

Background

Child marriage is defined as any formal marriage or informal union between a child under the age of 18 and an adult or another child. In 2015, the United Nations introduced the 2030 Agenda for Sustainable Development, with Sustainable Development Goal (SDG) 5 focused on achieving gender equality and women's empowerment by 2030 and calling for the universal eradication of child marriage under Target 5.3.

However, despite receiving legal and social attention globally, this practice remains a pervasive human rights violation.

Around 650 million women alive today were married before the age of 18, and most of them are located in the African and South Asian regions.

Over one in three girls in most countries in these regions still marry before turning 18 years old, and almost one in five bear their first child before the age of 18. The COVID-19 pandemic has only further accentuated the plight, as 10 million more girls, over and above 100 million, stand at risk of child marriage by 2030.

In the Arab region, around one in five girls marry before turning 18 years of age. Though the child marriage rate in the Arab region has been declining over the last 25 years, no signs of further progress have been observed in the past decade.

Child marriage often perpetuates a cycle of poverty, low education, high fertility and poor health, which hinders societies' economic and social development. In particular, it has a greater impact on girls, as the associated effects are long-term and often intergenerational.

Though child marriage may not lead to similar social and biological consequences for boys, it does coerce them to provide for the family prematurely and affects their career trajectory due to lack of education. Currently, at the global level, 115 million boys and men are wed before their 18th birthday, with most located in Central America.

This exercise is an extension of the earlier (Phase I) report drafted by the United Nations Economic and Social Commission for Western Asia (ESCWA), the United Nations Population Fund (UNFPA), the United Nations Children's Fund (UNICEF) and the United Nations Entity for Gender Equality and the Empowerment of Women (UN-Women) on "The cost of child marriage over the life cycle of girls and women: evidence from Egypt, Iraq, Jordan and Tunisia", which outlines the social, health and economic costs of marrying young at different stages of woman's life. The report found that child marriage has negative effects on female fertility, education, labour force participation and earnings, as well as on the health of the children born to these young mothers. Furthermore, child marriage tends to have direct implications on decision-making and the prevalence of domestic violence.

The Phase II report is a continuation of the previous exercise on costing child marriage with a special focus on the aggregate economic cost of child marriage. The study estimated the economic costs of child marriage for 13 countries in the Arab region.

1. Literature review

Global literature on child marriage is heavily skewed towards social, demographic and health implications. In particular, most of these studies have reported differences in health, education and employment outcomes for girls married before and after turning 18 years old. Few studies have documented the economic cost of child marriage, particularly the macroeconomic costs (e.g. percentage of GDP loss due to child marriage). The literature constraint is more significant for the Arab region than other regions of the world; thus, we have utilized both global and Arab region studies to build conceptual and analytical frameworks for the current study. We have organized the literature review into three sections: (1) drivers of child marriage; (2) economic costs; and (3) child marriage in the context of the Arab region.

Drivers: The documentation on child marriage consistently highlights several structural factors that generate and intensify child marriage, ranging from economic factors such as poverty and limited work opportunities; sociocultural factors such as education, social practices, religious beliefs, ethnicity, class and gender norms; and political factors such as instability, including conflict, displacement and natural disasters. All these factors jeopardize a girl's voice and autonomy, putting her in the loop of early marriage and its eventual consequences.[9] The poorest countries, regions and households often confront the greatest prevalence of child marriage,[10] with poor girls residing in rural regions as the most vulnerable.[11] Moreover, the lack of work opportunities for girls due to social norms and practices may cause parents to consider it unnecessary to invest in their schooling.[12]

"Structural determinants are the socioeconomic and political processes that structure hierarchical power relations, stratifying societies based on class, occupational status, level of education, gender, etc".

Solar and Irwin, 2010.

More often than not, as the growing evidence shows, the level of education tends to determine a girl's age at marriage; as such, lower education attainment is associated with a lower age at marriage. Furthermore, child marriage has been demonstrated to be deeply entrenched in social practices and traditions. Diverse settings serve as drivers for child marriage that are prevalent in respective set-ups, notably the practice of dowry or bride wealth, which can generate instant economic gains for a family;[13] community pressure to conform to societal norms;[14] using the marriage of girls to settle family disputes;[15] the fear of sexual harassment or sexual violence;[16] the desire to control girls' sexuality to avoid unwanted pregnancies or jeopardizing the family's

honour;[17] and internalized social norms whereby girls themselves desire to marry early due to perceived vulnerabilities and a lack of alternatives.[18]

Conflict and war impact women and girls in uniquely gendered ways, albeit varying based on the location, earnings, social set-up and cultural setting.[19] Conflict-induced instability generates fear of injury and death, escalates incidents of sexual violence, triggers food insecurity and deepens gender stereotypes. Such instability leads to a low mean age for females at the time of marriage, higher child marriage rates and low female literacy rates.[20] For families in conflict zones, child marriage becomes a negative coping mechanism to "save" the girl from perceived exploitation while conserving limited resources by passing responsibility for her to another household. Child marriage, therefore, can be interpreted as a social exchange of girls by the family to maximize their resources and safety nets.[21]

The economic costs of child marriage: Age at marriage is a significant determinant of population dynamics, given that it sets the foundation for forthcoming factors in deciding a girl's quality of life. While child marriage is widely addressed as a human and women's rights issue, lately, studies have highlighted and quantified the economic costs of child marriage (table 1).[22]

Table 1. Review of literature on multi-country estimates of economic costs of child marriage

Authors	Countries covered	Data and methodology	Main findings
Wodon and others, 2017	Bangladesh, Burkina Faso, the Democratic Republic of the Congo, the Republic of Congo, Egypt, Ethiopia, Malawi, Mali, Mozambique, Nepal, Niger, Nigeria, Pakistan, Uganda, Zambia	Demographic and health survey (DHS), living standards measurement study (LSMS), economic impacts of child marriage (EICM)/ regression analysis	Growth, health, education, labour force participation and decision-making: areas most negatively impacted by child marriage are fertility and population growth, education and earnings, and the health of the children born to young mothers. Eradicating child marriage would generate a global savings of approximately $4 trillion in annual welfare expenditures by 2030.
Mitra and others, 2020	76 emerging and developing countries (EMDCs)	International Monetary Fund, UNICEF, World Bank database/growth model	Economic growth: eradicating child marriage would significantly enhance economic growth – if child marriage were ended today, long-term annual per capita real GDP growth in EMDCs would rise by 1.04 percentage points.
Goli, 2016	India	Census of India, DHS and India human development survey	Demographic, health, education and economic outcomes: GDP loss for India due to child marriage is 1.7 per cent.

Source: Authors' compilation.
Note: Two studies that quantified the economic cost of child marriage have certain limitations, and this study attempts to address some of them. For instance, neither of these studies extensively covered the Arab region. While Wodon and others (2017) included only Egypt, Mitra and others (2020) studied EMDCs as a whole.

The economic cost of violence against women and girls (child marriage, in this case), defined in the UN-Women report "The costs of violence", is the direct and indirect tangible cost with a monetary value. These could be the private costs endured by young girls and their next generation, or public costs such as an increased burden on the government's health-care and education systems. The total costs tend to have a multiplier effect on GDP and economic development, triggering the vicious cycle of inter-generational poverty and inequality.

Child marriage directly lowers women's work prospects and financial returns due to low educational levels. At the same time, it indirectly increases the proportion of their unpaid household work resulting from higher lifetime fertility. To corroborate, Savadogo and Wodon (2017a) found that child marriage reduces earnings in adulthood for women marrying early by 9 per cent through its impact on education. In some countries, it has been noted to affect decision-making and bargaining power.

Therefore, economic costs are the closest channels affecting the GDP of a State through the low employment rate of women married as children, the low wage rate of their unskilled jobs, and lower earnings, savings and hence a lower tax generation for the State.

Child marriage in Arab countries: Like many other regions in the world, the Arab region has patriarchal norms whereby women are expected to prioritize their family before their own rights as individuals.

This includes the institutionalization of policies that work to preserve the patriarchal status quo that ultimately governs economic, political and social decision-making.

In the past decade, conflict has tended to drive the many instances of child marriage in the region, resulting in refugees and displaced families resorting to the practice to protect girls from sexual violence and thus safeguard the family's honour.

In some cases, child marriage is linked to kidnapping and trafficking by armed groups and militias; the Syrian Arab Republic and Iraq have recorded such instances of the abduction of girls.

In Jordan, child marriage incidents have increased since the onset of the conflict in the Syrian Arab Republic in 2011, particularly among Syrian refugees. For example, the rate of child marriage among Syrian girls in Jordan increased from 33.1 per cent in 2010 to 43.8 per cent in 2015, impacting their sexual and reproductive health in terms of untimely pregnancies, domestic violence, social alienation, mental health issues and a loss of work opportunities.

There is strong evidence of the relationship between child marriage and deep-rooted cultural beliefs and discriminatory gender norms in the Arab region. For instance, in Egypt, child marriage is linked with community notions related to female genital mutilation (FGM), while in the Syrian Arab Republic, young girls are persuaded to marry at a young age due to their sexual inexperience.

Poverty is another factor that engenders child marriage in countries such as Egypt, Libya, Somalia, the Sudan, the Syrian Arab Republic and Yemen.

The trend is also noted in Iraq, Jordan and Morocco, where girls in low-income families, viewed as a financial burden, were twice as likely to marry young than in wealthier households in 2006–2011.

A study on Syrian refugees in Egypt highlights that underperforming girls in

school were better off married, and girls interested in education were retained in school to continue their studies and had their marriages postponed.

Among other factors are a worsening economy and growing inflation rates that negatively impact the survival of low-income families, particularly with young women, in these regions.

Phase I of this exercise explored the costs of child marriage on women and girls in four Arab countries and is the only comprehensive study that has highlighted the social and health costs of child marriage at different stages of women's lives. Women and girls who are married young in Egypt, Iraq, Jordan and Tunisia experienced serious ramifications at each stage of life in terms of fertility, decision-making, education, autonomy, labour force participation and mortality rates of their children. Hence, Phase II builds on these findings to focus on the loss of income (or GDP) for the Arab region.

2. Objective of the study

In the Arab region, research has mainly focused on examining the prevalence of child marriage, identifying the social, economic and political factors that drive this practice, and investigating its harmful effects on girls and women. While the Phase I report established a link between child marriage and various outcomes related to demographics, health, education and the labour market, it did not quantify the economic losses that result from this practice for the State. To gain a better understanding of the actual short- and long-term economic costs that women, their families and the Government will bear, it is crucial to evaluate the impact of child marriage on the GDP of all Arab countries.

Therefore, the goal of this study is to conduct a cost analysis that measures the impact of child marriage on the GDP of countries, with the aim of strengthening the case for eradicating this practice in the region. The study advances recommendations to reduce the economic burden of child marriage by taking proactive steps to address the intermediate channels that contribute to economic implications.

The present study employs the spectrum-based simulation model and incorporates a wide range of input indicators to provide a detailed analysis of the demographic, social and macroeconomic costs associated with child marriage. Unlike Mitra and others (2020), the present study does not rely solely on a macro-regression model approach. Instead, its hierarchical and component simulation approach enables the inclusion of more input parameters and the estimation of a larger number of outcome indicators. Moreover, the model used in the study not only projects the cost of inaction on child marriage as a percentage of GDP loss but also includes other key demographic and health indicators up to 2050, covering the entire productive lifespan of a girl who was married at age 15 around the year 2000.

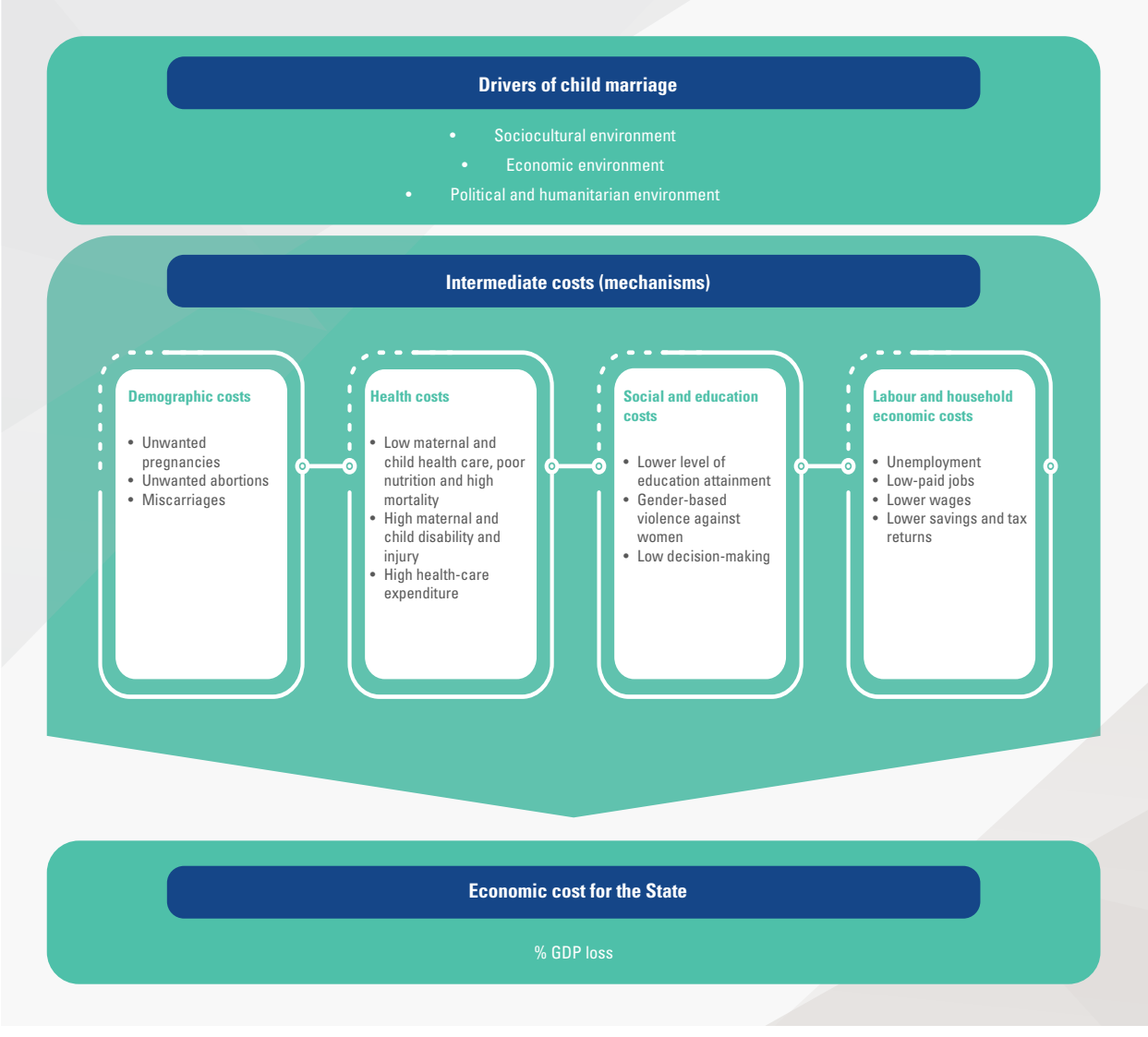
Conceptual framework: Mechanisms of the economic costs of child marriage

Child marriage incurs economic costs through multiple channels, as depicted in figure 1.

This practice has demographic implications such as high fertility levels, early childbirth

and population growth, which directly impact economic outcomes.[23] Child marriage also disrupts educational attainment, leading to limited decision-making ability, particularly in terms of reproductive choices, instances of gender-based violence against women and low labour force participation,[24] resulting in poor health status and low earnings. Poor health conditions and higher disability and mortality risks further exacerbate household financial conditions.[25] The effects of child marriage are also intergenerational, as they hinder the creation of human capital in future generations.[26] Poor wage earnings and household savings result in lower tax returns for the State, while poor health conditions lead to greater State spending on health care. Thus, the State economy is affected from both the savings and expenditure ends.[27]

Figure 1. Conceptual framework: Mechanisms of the economic costs of child marriage



Sources: Authors, adapted from Goli (2016); Wodon and others (2017); Mitra and others (2020); and Psaki and others (2021).

3. Data sources and methodology

A. Data sources

Comparatively, the Arab region lacks the availability of reliable and consistent data to measure and monitor child marriage and its causes and consequences. Recurrent conflicts and geopolitical issues in the region worsen the global periodic surveys critical for cross-country comparisons. Of the 22 countries that constitute the Arab region, only 13 countries had relevant data for the time period under consideration (2001–2020).[28] For the exercise of costing child marriage in this region, the data for the input indicators was collected and compiled from multiple sources for the period 2001–2020. The data sources used for analysis include: (i) demographic health surveys (DHS); (ii) multiple indicator cluster surveys (MICS); (iii) labour force surveys (LFS); (iv) United Nations World Population Prospects; (v) world development indicators (WDI); (vi) United Nations Model Life Table (West Asia Model); (vii) country-specific censuses from Arab countries; and (viii) official statistics of the respective Arab countries. The present study adopted interpolation[29] and extrapolation[30] methods to fill the data gaps between any years.

Globally, the DHS is the largest data source for population, health, human immunodeficiency virus (HIV) and nutrition and is internationally comparable and surveyed in about 90 countries. Some of the Arab countries have been covered under the DHS programme, such as Egypt (2014, special DHS in 2015), Jordan (2017/2018), Mauritania (2019–2021), Morocco (2003/2004), the Sudan (1989/1990), Tunisia (1988) and Yemen (2013).[31] The MICS is the largest source of reliable internationally comparable data on women and children globally and has been carried out once or more in 118 countries. The latest MICS within the Arab region are: Algeria (2018/2019), Egypt (2013/2014), Iraq (2018), Mauritania (2015), Oman (2014 restricted), the State of Palestine (2018/2019), Qatar (2012), Somalia (2011), the Sudan (2014), the Syrian Arab Republic (2006), Tunisia (2018) and Yemen (2006). Although the Pan Arab Project for Family Health (PAPFAM) is available in Libya, the study excluded Libya, due to a lack of information comparability in PAPFAM with the DHS and MICS, and Oman, due to a lack of access to the microdata. Overall, the study covers 13 Arab countries that have microdata from the latest available DHS or MICS.[32]

In addition, we collected information on employment and unemployment from

the WDI, LFS and official statistics of the respective countries. The total and projected population data were collected from the countries' censuses and United Nations World Population Prospects, respectively. The study used the most suitable model life table from two sets of standard model life table families[33] to derive a variety of mortality indicators and underlying mortality patterns for the estimation and projection of the population for each country. The data on the base year GDP in United States dollars ($), annual GDP growth rate (%), and urbanization (%) were collected from the WDI. In addition, education and health-related indicators were compiled from multiple data sources including DHS, MICS, censuses, and official statistics of the countries (see the details in annex table 1).

B. Approach

The linkage between child marriage and economic growth is not straightforward because it directly correlates with some "conventional" economic growth determinants such as fertility, education, health and employment, among others. Wodon and others (2017) outlined five main channels – health, education, fertility, labour force participation and decision-making – through which child marriage impacts economic growth. In their analytical model, Wodon and colleagues further consolidated these channels into human capital (i.e. education and health), as there is a significant overlap across these channels. Later, the study by Mitra and others (2020) also recognized the interdependence between health, education, economic growth and other intermediates operating under the costing exercise of child marriage.

Following Wodon and others (2017) and Mitra and others (2020), this study used four sets of parameters (i.e. demographic, health, education and economic) in the costing exercise of child marriage in a life course perspective. Child marriage is like a silhouette on lifetime outcomes, as it affects skill formation, health and economic consequences at all stages of life. In this study, by saying "life course", we mean the estimates are cumulative economic costs of child marriage associated with education, health and labour market losses, which operate at different stages of an individual life (box below). Moreover, several other intermediates – such as women's decision-making ability and gender-based violence against women – that influence economic outcomes were not included as separate variables because they are highly collinear with demographic, health, education and employment parameters. Nevertheless, within four broad sets of parameters (demographic, health, education and economic), the model used in this study includes other contingent factors such as age structure of the population and its drivers, economic status and its predictors, and the urbanization level of women's country of residence. Figure 2 explains the complete operational (or analytical) framework of the simulation model and the parameters used to estimate the economic costs of child marriage in the Arab region.

While the present study follows the simulation approach used by Wodon and others (2017), its analytical framework for estimating the economic costs of child marriage is slightly different and adheres to a more comprehensive procedure. We have extended the projection of the economic costs of child marriage for the Arab region up to 2050 with the base year of 2001. The period 2001 to 2050 is selected considering the working lifespan of around 50 years for a female married at the age of 15. For instance, in this model, a female

who married in the year 2001 at age 15 (base year for this study) is expected to live up to 65 years (up to 2050, a goalpost year for this study) as a worker or a non-worker. However, the input indicators are not available for all countries from 2001. In such cases, the base year has been chosen as per the availability of the data. The life-cycle approach

Life-cycle approach: A life-cycle approach is adopted to study all stages in a person's lifespan to understand the effects of skill formation at one stage upon subsequent stages in terms of human capital and health consequences.

Why is the life-cycle approach important for assessing the economic costs of child marriage?

Cunha and Heckman (2007) introduced the skill formation model to understand the effect of child marriage on a girl's human and social development across her lifespan because cognitive skills and health status acquired at one stage tend to influence the next stage.

Due to child marriage, the process of skill acquisition, mainly educational attainment, is distorted at the stage of adolescence, which consequently has lifetime repercussions on knowledge accumulation and health, particularly the psychosocial aspect of women's health, and the formation of human capital in general.

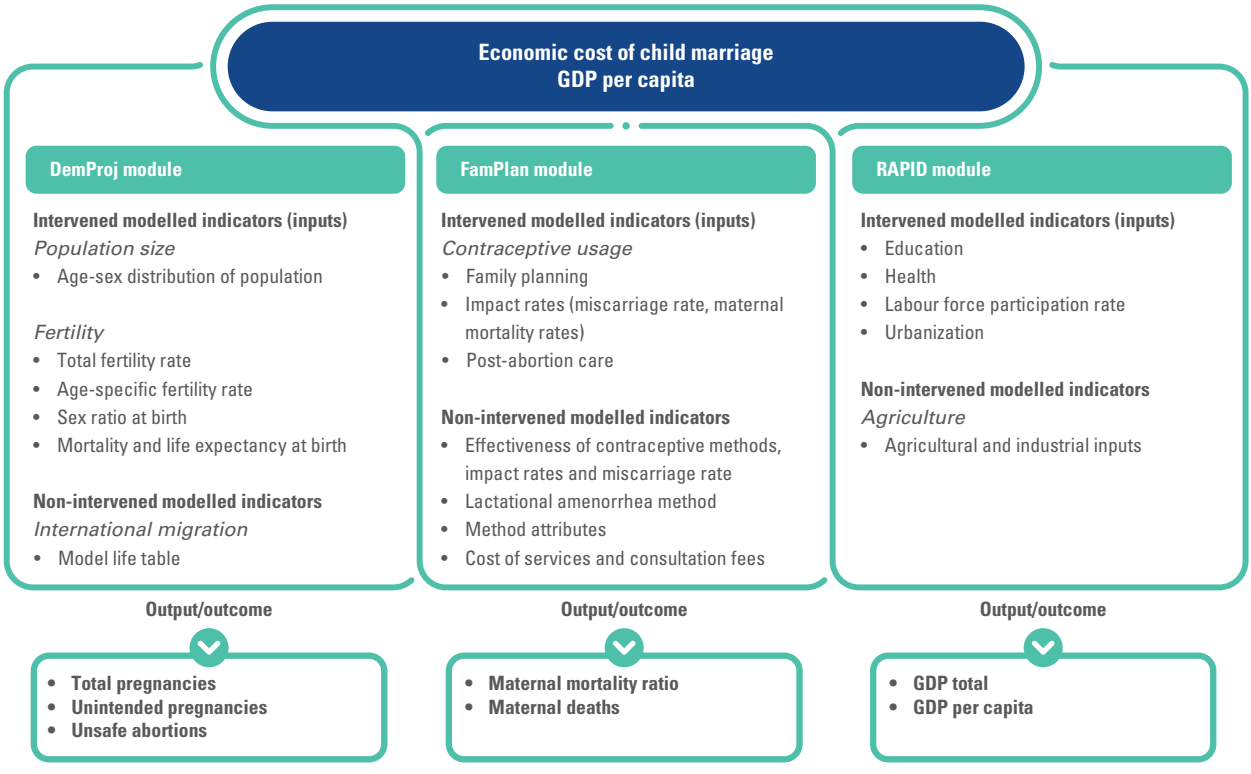
Child marriage affects the childbearing patterns of females, resulting in high fertility rates and lower gaps between childbirths, which risks their own and their children's lives. The negative effects are noted on a girl's psychosocial well-being, education completion and consequently her earning potential. The lack of educational attainment also restricts the intergenerational mobility of married adolescents. Additionally, these adolescent girls have low knowledge accumulation regarding contraception usage and sex-related infections that can seriously endanger their lives.[a]

The disadvantage of child marriage reflects in females' decision-making ability, in particular their reproductive choices and decisions related to their children's lives.[b] These disadvantages spill across life stages and generations, and the costs are borne by these women, their children as well as the society in which they live. Therefore, it is imperative to study the costs of child marriage through the life-cycle approach.

[a] Alderman and others, 2001; Corak, 2006; Black and Devereux, 2011; UNFPA, 2013.
[b] Kabeer, 1999, 2008.

The study used three key modules of the spectrum-based simulation approach: DemProj, FamPlan and RAPID (figure 2). DemProj stands for demographic projection module in the spectrum simulation model. It provides age-sex population base parameters and their projection for the simulation module. The projection function works on a set of assumptions about fertility, mortality and migration for goalpost years.

Figure 2. Analytical framework of the simulation model in the spectrum suite 6.19: Costing of child marriage in Arab countries



Source: Authors' compilation.

The FamPlan module stands for the projection of family planning parameters. Family planning inputs are needed to reach national goals for addressing unmet needs or achieving desired fertility. For this study, the family planning module provides necessary parameters that can predict probable differences in family planning indicators and their consequences for the fertility of child-married women and non-child married women.

Resources for the Awareness of Population Impacts on Development (RAPID) projects the social and economic consequences of high fertility and rapid population growth for such sectors as labour, education, health, urbanization and agriculture. For the simulation model, RAPID provides the differential probability of socioeconomic achievements of child-married and non-child married input and outcome indicators. A detailed explanation of these modules is presented in annex table 2.

The study also differs in terms of its outcome measures. We have provided macro-level demographic and health costs alongside the economic costs (GDP loss) for three different scenarios. These three scenarios include: (i) child marriage scenario – a hypothetical case where we assume all women across the Arab region are married below the age of 18; (ii) non-child marriage scenario – the best hypothetical case where we assume that all women across the Arab region are married at 18 years of age or above; and (iii) overall scenario (as usual scenario) – a case where the status quo continues, that is, child marriage continues to prevail at the current level in the Arab region.

1. Structure of the spectrum simulation model

The differences in the level of per capita income across countries can be examined by backward tracing to examine the child marriage status of a given population. This is based on the argument that in any given time, a girl married as a child would have faced demographic, health, education and labour force participation penalties that would have impacted her education, wages, income and savings, thereby having implications for economic growth and per capita GDP.[34] To estimate this, it is assumed that aggregate income can be represented by the Cobb-Douglas production function:

$$Y = M \times (A_w \times hc)^{\sigma} K^{1-\sigma} \quad (1)$$

Where Y is aggregate income; M is the residual total productivity factor; A_W is the number of workers; hc is human capital per worker; K is the aggregate physical capital; and is the elasticity of income with respect to aggregate human capital.

In log term, the equation can be specified as:

$$Iny = InM + \sigma lnA_w + \sigma lnhc + (1-\sigma)\, InK \quad (2)$$

We assume that human capital, in turn, is a function of education and health and is specified as:

$$Inhc = rE_w + \delta H_w \quad (3)$$

Where E_w is education completed in years; r is the returns to an additional year of education; H_w is the health; δ is the returns to an additional gain in health.

Substituting equation (3) into (2) produces the following equation:

$$Iny = InM + \sigma lnA_w + \sigma[rE_w + \delta H_w] + (1-\sigma)\, InK \quad (4)$$

The percentage effect on income due to a change in the rate of child marriage can be derived using the total differential of equation (4) for a fraction of the workforce at time t that was child married (CM_W) as:

$$\Delta lny_{(t)} = \sigma[r \frac{\Delta E_w}{\Delta CM_w} + \delta \frac{\Delta H_w}{\Delta CM_w}]\, \Delta CM_w \quad (5)$$

Where ΔIny is the difference in income at time t; σ is elasticity of income with respect to human capital; $\Delta E_w/\Delta CM_w$ is the loss in years of schooling due to child marriage; r is the average returns lost for an additional year of schooling unattained; $\Delta H_w/\Delta CM_w$ is the loss in health due to child marriage; and δ is the average labour market premium lost for additional unattained health outcomes.

2. Estimation of outcome indicators

Given these assumptions, we represent economic losses due to child marriage as a gap between GDP per capita in two scenarios (child marriage scenario and non-child marriage scenario) in the simulation modelling exercise:

$$Economic\ Loss = GDP\ Per\ Capita_{As\ Usual\ Scenario} - GDP\ Per\ Capita_{Child\ Marriage\ Scenario} \quad (6)$$

In other words, we can also predict economic gain by estimating the gap between per capita GDP in two scenarios (as usual scenario and child marriage scenario) in the simulation modelling exercise as:

$$Economic\ Gain = GDP\ Per\ Capita_{As\ Usual\ Scenario} - GDP\ Per\ Capita_{Child\ Marriage\ Scenario} \quad (7)$$

The aggregate production or GDP in our simulation model is estimated as:

$$GDP_{t,j} = GDP_{t-1,j} * (1 + Annual\ GDP\ Growth_{t,j}) \quad (8)$$

Where $GDP_{t,i}$ is the gross domestic product in time t under j^{th} scenario. Therefore, GDP per capita is projected as:

$$GDP\ Per\ Capita_{t,j} = GDP_{t,j} / Projected\ Total\ Population_{t,j} \quad (9)$$

Where $GDP\ Per\ Capita_{t,j}$ is the estimated GDP per capita in time t under j[th] scenario.

Economic cost as a percentage of GDP is estimated as follows:

$$= \left\{ \frac{\dfrac{(GDP\ Total_{Non\text{-}Child\ Marriage\ Scenario} - GDP\ Total_{Child\ Marriage\ Scenario})}{Time\ Interval}}{GDP\ Total_{As\ Usual\ Scenario}} \right\}$$

Where time interval is the interval between the base year to the respective time points of the estimation.

Economic cost for households is estimated as shown below:

$$= \frac{Economic\ Loss\ as\ Given\ in\ Equation\ (6)\ \ for\ a\ Country}{Number\ of\ Households\ in\ a\ Country} \quad (10)$$

Health-care cost for households is estimated as follows:

$$= \frac{Health\text{-}care\ Costs_{Child\ Marriage\ Scenario} - Health\text{-}care\ Costs_{Non\text{-}Child\ Marriage\ Scenario}}{Number\ of\ Households\ in\ a\ Country} \quad (11)$$

The spectrum simulation model estimates health-care costs based on average health-care spending inputs provided in the model. Differential health-care costs incurred by child married and non-child married women are derived based on differential risks to various maternal and child health-care problems. A detailed technical note about the methodology of computations is given in the Annex and in a supplementary file hyperlinked at the end of this report.

4. Constraints and limitations

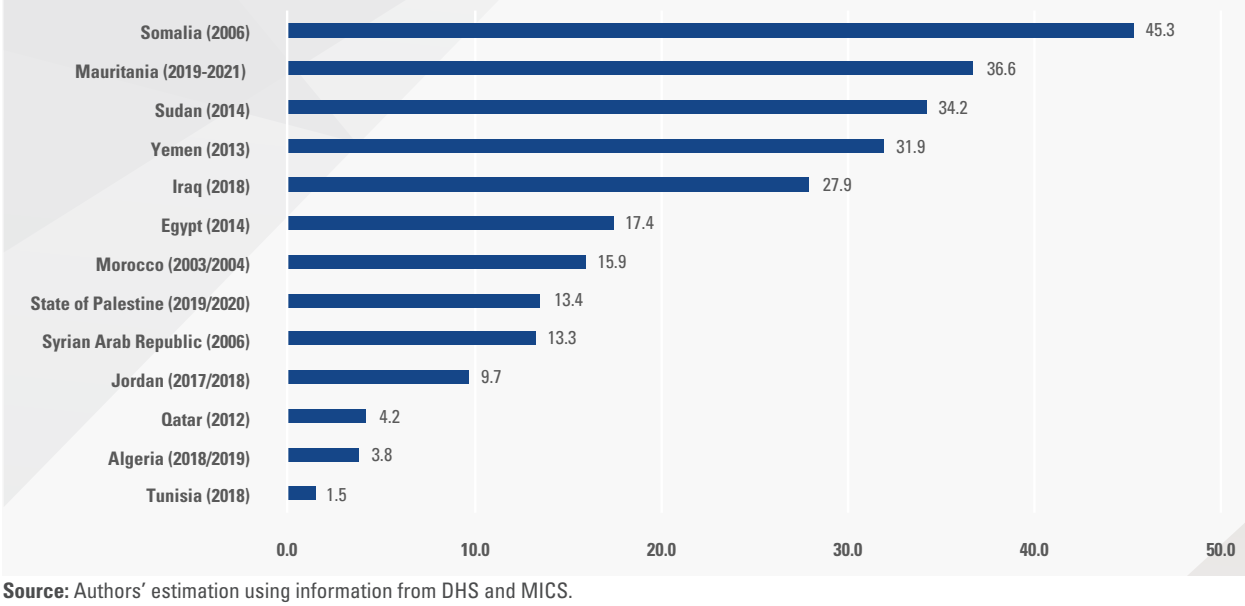
Despite implementing a robust approach to estimate the cost of child marriage, it is important to acknowledge the existence of certain data-related limitations and constraints in this research. The estimation of the economic consequences of child marriage utilizing a macro-level simulation model necessitates a wide range of input indicators, including population age-sex distribution,[35] fertility rates, contraceptive usage, mortality rates (such as infant mortality, under-5 mortality and maternal mortality), education levels, health status, labour force participation, urbanization, agriculture and GDP per capita. These input indicators are predominantly obtained from sources such as censuses, sample surveys like DHS, MICS and LFS, as well as vital registration and official statistics from respective countries. In this study, the most recent available data was utilized,[36] and extrapolation of input indicators was performed when required. It is important to note that the consequences of child marriage are intricate and hierarchical in nature. Consequently, any costing exercise conducted through a macro-level simulation model tends to underestimate rather than overestimate the true impact, as it is impossible to include all parameters directly and indirectly influenced by child marriage.

5. Prevalence of child marriage: National and sub-national patterns

The study presents the national and sub-national patterns of child marriage prevalence[37] for the 13 Arab countries included in this study (figures 3 and 4).[38] According to the United Nations World Population Prospects (2022), these 13 countries contribute 80 per cent of the population in the Arab region.

There is considerable variation in the prevalence of child marriage across the region and among provinces within each country. With 3.8 per cent of women married below 18 years of age at the national level in 2018/2019, Algeria is the second lowest in terms of the prevalence of child marriage among the countries investigated in this report. Despite the country's low prevalence of child marriage, there is considerable variation in the sub-national pattern. Across the seven regions in the country, the child marriage rate ranges from as low as 0.6 per cent in Nord Est to 6.2 per cent in Hauts Plateaux.

Figure 3. Prevalence of child marriage in Arab countries



Source: Authors' estimation using information from DHS and MICS.

As the most populous country in the Arab region, Egypt contributes around 24 per cent of the population. At the country level, child marriage prevalence stands at 17.4 per cent as at 2014. However, there are considerable variations among the provinces, with Fayoum, Beni Suef and Giza showing as high as 27 per cent, 26 per cent and 25 per cent, respectively, and Suez showing just 4.4 per cent of females married before the age of 18.

Iraq constitutes 9 per cent of the total population of the Arab region. In terms of the prevalence of child marriage, with 28 per cent of women married before 18 years of age, Iraq stands among the top five countries regionally. Moreover, the sub-national pattern indicates a significant variation across the 18 provinces. The child marriage rate is lowest in Duhok with 8.14 per cent and highest in Misan with 44 per cent. Najaf (37.2 per cent), Karbala (37 per cent), Thi-Qar (35 per cent), Basrah (33.5 per cent), Diala (32 per cent) and Nineveh (31 per cent) exhibit more than 30 per cent of women marrying before the age of 18, as at 2018.

With 9.7 per cent of females married below 18 years of age at the national level in 2017/2018, Jordan shows a moderate prevalence of child marriage in the region. Jordan also shows a considerable variation in the sub-national pattern of child marriage prevalence. Across the 12 governorates in the country, the child marriage rate ranges from as low as 3.27 per cent in Tafilah to 15.4 per cent in Mafraq.

In terms of the prevalence of child marriage, with 36.6 per cent of females married before the age of 18, Mauritania stands in second place among all the Arab countries considered for the study. Besides, the sub-national pattern also indicates a significant variation across the 14 regions. The child marriage rate is lowest in Nouakchott-Ouest at 16.5 per cent and highest in Guidimaka at 57.3 per cent. Gorgol (50.3 per cent), Hodh Ech Chargui (49.7 per cent), Assaba (46.2 per cent) and Hodh El Gharbi (43.7 per cent) depict more than 40 per cent of females marrying before age 18 as of 2019–2021.

The average child marriage rate in Morocco is 16 per cent as at 2003/2004. Within the country, the percentage of females married before the age of 18 varies from 7.7 per cent in Grand-Casablanca to 29.4 per cent in Laâyoune-Boujdou-Sakia Al Hamra.

With 13.4 per cent of females married below 18 years of age at the national level in 2019/2020, the State of Palestine shows a moderate prevalence of child marriage in the region. The State of Palestine also indicates a substantial difference in the sub-national pattern of child marriage prevalence. Across the 16 governorates, the child marriage rate ranges from as low as 5.3 per cent in Tulkarem to 22.8 per cent in North Gaza.

With an average of 4.2 per cent of females marrying before they are 18 years old in 2012, Qatar shows one of the lowest levels of child marriage prevalence in the Arab region. However, within the country, the percentage of females married before age 18 varies from 0 per cent in Al-Shamal and Al-Wakra to 13.36 per cent in Al-Daayen.

The average prevalence of child marriage in Somalia is 45.3 per cent, which is the highest among all the Arab countries included in this study. Across the regions, the prevalence of child marriage varies considerably. It ranges from 12 per cent in Awdal to 90 per cent in Middle Juba. Ten out of 18 regions in the country have more than the national average (i.e. 45 per cent and above).

The Sudan is the second largest country, contributing around 10 per cent of the population of the Arab region. At the country level, the child marriage prevalence rate in

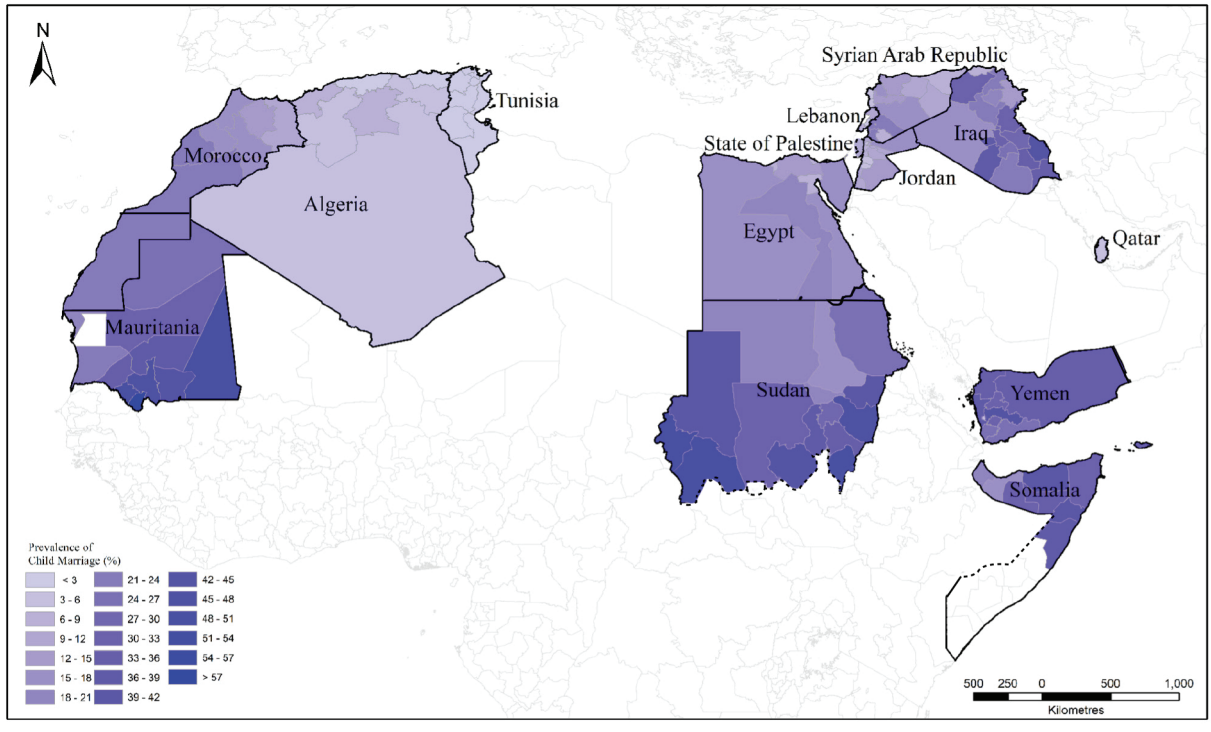
the Sudan stands at 34.2 per cent as at 2010. However, there are considerable variations in child marriage prevalence across 18 states, ranging from 56 per cent in Central Darfur to 17.6 per cent in River Nile. South Darfur (52.3 per cent), Blue Nile (49.6 per cent), El Gadarif (47.5 per cent), East Darfur (46.3 per cent), West Darfur (45 per cent), South Kordofan (43.7 per cent) and Kassala (40.6 per cent) have over 40 per cent of females marrying before they are 18 years old.

With an average of 13.3 per cent of females marrying before 18 years as at 2012, the Syrian Arab Republic shows a moderate child marriage prevalence in the Arab region. However, within the country, the percentage of females married before the age of 18 varies from 4.7 per cent in Tartus to 26 per cent in Quneitra.

At the country level, with an average child marriage rate of 1.5 per cent as at 2018, Tunisia shows the lowest prevalence among the 13 Arab countries included in this study. Even within the country, the percentage of females married before the age of 18 does not vary significantly.

With an average of 32 per cent of females marrying before 18 years as at 2013, Yemen stands in the top five countries in terms of child marriage prevalence in the Arab region. Also, the country shows huge sub-national variation across its 21 governorates. The percentage of females married before age 18 varies from 50.5 per cent in Dhamar to 10 per cent in Aden. Besides Dhamar, three other governorates (Al-Jawf, Al-Mhweit and Raymah) show a child marriage prevalence rate of more than 40 per cent.

Figure 4. Prevalence of child marriage at the provincial level in selected Arab countries



Source: Authors mapped using macro data from DHS and MICS.

6. Key mechanisms of the economic costs of child marriage

Both in its conceptual and empirical model, the study presents several mechanisms through which child marriage induces economic costs for a country. Following the assertion made by Wodon and others (2017) that "the impacts of child marriage are large for fertility, population growth, education as well as labour market outcomes", the present chapter empirically discusses these key indicators, which are also the critical mechanisms for the economic costs of child marriage in the simulation model of the study. Also, with the support of previous studies on the subject from another geographical context, the chapter discusses how fertility, infant mortality, education, women's labour force participation, and household economic and health costs are endogenous to several other indicators, as exhibited in the conceptual and empirical model used for estimating the economic costs of child marriage in this study.

A. Fertility differences by age at first marriage

One of the known determinants of economic growth is population growth.[39] Population growth is greatly influenced by fertility rates. High fertility rates are a key implication of child marriage. High fertility also reflects the high number of both unwanted pregnancies and births. A higher number of births is a mechanism through which child marriage affects the State economy.[40] The study thus analyses the fertility differences in association with the age at first marriage for a thorough understanding of the phenomenon. Though age at first birth is also indicative of the same, the study avoids using it owing to a high endogeneity between age at first marriage and first birth.[41]

Table 2. Total fertility rate by women's age at first marriage in Arab countries

Countries	Age at first marriage		Total
	Below 18 years	18 years and above	
Algeria (2018/2019)	4.1	1.9	2.8
Egypt (2014)	4.9	2.5	3.5
Iraq (2018)	4.1	3.2	3.6
Jordan (2017/2018)	3.7	2.0	2.7
Mauritania (2019–2021)	6.6	4.5	5.2
Morocco (2003/2004)	4.4	2.2	2.5
State of Palestine (2019)	5.6	2.6	3.8
Qatar (2012)	2.2	1.8	2.0
Somalia (2006)	7.7	5.8	6.7
Sudan (2014)	7.2	3.8	5.2
Syrian Arab Republic (2006)	4.5	3.2	3.8
Tunisia (2018)	3.3	1.3	2.1
Yemen (2013)	5.8	4.0	4.4

Source: Authors' estimation using information from DHS and MICS.

Total fertility rate (TFR) is a key measure of fertility that refers to the average number of children born per woman over their lifetime. In table 2, we show the TFR differences across females married below 18 years of age and for those who married at 18 and above. The findings suggest considerable but varying fertility differences for females married below 18 years and those married at 18 years and above across the 13 Arab countries. For instance, in Algeria, females married below age 18 have a TFR of 4.1 compared to only 1.9 among those married at 18 years and above. The largest fertility differences by age at first marriage are found in Tunisia where females married below 18 years of age have 2.5 times higher fertility than their counterparts. Among other countries, Egypt, the State of Palestine and Morocco have more than double the fertility rates among females married below 18 years of age compared to those married at age 18 and above. Despite having higher fertility rates, Mauritania, Iraq, Yemen and the Syrian Arab Republic show lesser fertility differences by age at first marriage. In contrast, the Sudan and Somalia have higher fertility rates and higher differences by age at first marriage. The least differences are found in Qatar and Iraq.

B. Infant mortality differences by age at first marriage

Population health is also a recognized human capital factor of economic growth that expresses its impact both directly and indirectly. Population health directly determines the quality of human capital, while it has an indirect bearing on economic growth through its influence on population growth.[42] The infant mortality rate (IMR) and under-5 mortality rate (U5MR), which refer to child deaths below 1 year and below 5 years per 1,000 live births, respectively, are sensitive population health indicators. These are not only key measures of child health but also for maternal and child health care. Mortality among infants and children is higher among adolescent mothers compared to their counterparts married above the age of 18.[43] This generates from multiple avenues such as the young mother's malnutrition affecting the children's nutritional status, her restricted decision-making regarding reproductive choices and access to health care, limited agency and mobility, and low knowledge attainment on the matters of contraception and sexually transmitted infections.[44] The IMR and U5MR differences across females married below 18 years of age and those married at 18 and above are shown in table 3.

Table 3. Infant mortality differences by women's age at first marriage in Arab countries

Countries	Infant mortality rate (IMR)			Under-5 mortality rate (U5MR)		
	Age at first marriage		Overall	Age at first marriage		Overall
	Below 18 years	18 years and above		Below 18 years	18 years and above	
Algeria (2018/2019)	27	16	17	30	18	19
Egypt (2014)	25	21	22	31	26	27
Iraq (2018)	24	22	23	27	25	26
Jordan (2017/2018)	20	16	17	22	19	20
Mauritania (2019–2021)	35	30	33	43	38	41
Morocco (2003/2004)	45	38	40	51	46	47
State of Palestine (2019/2020)	15	11	12	18	13	14
Qatar (2012)	8	6	7	10	8	9
Somalia (2006)	138	54	86	217	84	135
Sudan (2014)	57	47	52	76	60	68
Syrian Arab Republic (2006)	19	17	18	23	21	22
Tunisia (2018)	15	13	14	18	15	17
Yemen (2013)	47	39	43	57	48	53

Source: Authors' estimation using information from DHS and MICS.

The findings suggest sizeable but varying IMR and U5MR differences for females married below 18 years of age and those married at 18 years and above across the 13 Arab countries included in this study. For instance, Somalia has the largest difference (2.6 times) in IMR among females married below 18 years of age compared to those married at 18 years and above. In Algeria, the childhood mortality rates among females married below the age of 18 are almost double those of women who were married above age 18. The rest of the countries have a difference in childhood mortality rates ranging from 1 to <2, with children of females married below 18 years of age faring worse for all the countries compared to women married at the age of 18 years and above. A similar pattern of differences by age at first marriage is also found in the case of U5MR.

C. Educational differences by age at first marriage

Education is a key human capital measure that predicts economic growth.[45] Disruptions in the educational attainment of child-married women are widely recognized in the literature. Females married below 18 years of age are less likely to enter higher education compared to women married at higher ages.[46] Lower educational levels for women bring poor social and economic outcomes not only to the individual but to the respective households and the State as well.[47] Thus, education is a mechanism through which child marriage may affect the State economy. Table 4 presents educational differences by age at first marriage. Findings suggest considerable but varying differences in higher education across women married below 18 years of age and those above 18 years of age. For instance, in countries like Algeria and Morocco, the difference in higher education among females married below 18 years of age and those who married at the age of 18 and above is 20 and 67 times, respectively, while the differences are the least in Qatar (2 times) and Iraq (5 times). Other countries, such as Egypt, Somalia, the Sudan, the Syrian Arab Republic and Yemen, show higher educational attainment ranging among women married at and above 18 years of age compared to females married below 18 years of age. Differences in the education levels for Jordan, Mauritania, the State of Palestine and Tunisia are around seven times on average, with women married at the age of 18 and above faring better in all these countries.

Table 4. Education level by women's age at first marriage in Arab countries

Countries	Age at first marriage	Education level			
		Pre-primary or none	Primary and lower secondary	Higher secondary and above	Total
Algeria (2018/2019)	Less than 18 years	30.0	68.8	1.2	100.0
	18 years and above	9.9	65.5	24.6	100.0
	Total	10.6	65.6	23.7	100.0
Egypt (2014)	Less than 18 years	40.9	58.1	1.0	100.0
	18 years and above	17.7	63.6	18.7	100.0
	Total	24.0	62.1	13.9	100.0

Countries	Age at first marriage	Education level			
		Pre-primary or none	Primary and lower secondary	Higher secondary and above	Total
Iraq (2018)	Less than 18 years	19.3	73.4	7.3	100.0
	18 years and above	11.9	51.9	36.2	100.0
	Total	13.6	56.9	29.5	100.0
Jordan (2017/2018)	Less than 18 years	3.8	90.8	5.4	100.0
	18 years and above	1.8	54.3	43.9	100.0
	Total	2.2	61.9	35.8	100.0
Morocco (2003/2004)	Less than 18 years	75.7	24.2	0.1	100.0
	18 years above	42.9	50.4	6.7	100.0
	Total	50.0	44.7	5.3	100.0
Mauritania (2019–2021)	Less than 18 years	43.0	56.6	0.4	100.0
	18 years and above	27.0	69.6	3.4	100.0
	Total	32.8	64.9	2.3	100.0
State of Palestine (2018)	Less than 18 years	0.6	92.0	7.4	100.0
	18 years and above	0.5	53.0	46.5	100.0
	Total	0.5	65.4	34.1	100.0
Qatar (2012)	Less than 18 years	9.7	59.0	31.3	100.0
	18 years and above	2.6	37.9	59.5	100.0
	Total	3.0	39.2	57.8	100.0
Somalia (2006)	Less than 18 years	66.4	33.4	0.1	100.0
	18 years and above	56.0	43.0	1.1	100.0
	Total	60.2	39.1	0.7	100.0
Sudan (2010)	Less than 18 years	49.8	49.3	1.0	100.0
	18 years and above	22.8	61.4	15.8	100.0
	Total	32.0	57.3	10.7	100.0
Syrian Arab Republic (2006)	Less than 18 years	17.3	81.3	1.4	100.0
	18 years and above	13.7	71.5	14.8	100.0
	Total	14.2	73.0	12.8	100.0
Tunisia (2018)	Less than 18 years	23.5	73.6	2.9	100.0
	18 years and above	7.5	66.4	26.0	100.0
	Total	8.0	66.7	25.4	100.0
Yemen (2006)	Less than 18 years	71.2	28.2	0.6	100.0
	18 years and above	56.3	36.9	6.8	100.0
	Total	66.2	31.1	2.7	100.0

Source: Authors' estimation using information from DHS and MICS.
Note: Figures are reported for women in the age group 15–49 years.

D. Workforce participation rate by age at first marriage

The workforce participation rate of a population has a direct bearing on a household and country's economic prospects, while child marriage has an effect on the individual's participation in the labour market.[48] Even so, a male's labour force participation increases after marriage while a female's declines. The ILOSTAT, using data from 107 countries, has revealed that men have a higher level of participation in the labour force than females, while this gender gap is worsened for married men and women.[49] Furthermore, childbearing also decreases the participation among females.[50] Table 5 presents the differences in participation in the labour market by married females below 18 years of age and women married at 18 years and above for those in the age group of 15-49 years for five Arab countries. The findings suggest considerably low but varying differences in the workforce participation rate for females married below 18 years of age compared to those married at 18 years and above. For instance, the workforce participation rate for females married below 18 years of age in Algeria is nearly three times less with reference to those married at 18 years and above. Even in Morocco and Egypt, the differences in women's workforce participation rate are considerably low for females married below 18 years of age compared to those married at 18 years and above. Furthermore, Mauritania and Yemen also exhibit a lower workforce participation rate for females married below 18 years of age compared to those married at 18 years and above.

Table 5. Workforce participation rate by women's age at first marriage in Arab countries

Countries	Age at first marriage		Total
	Below 18 years	18 years and above	
Algeria (2018/2019)	2.2	7.5	6.9
Egypt (2014)	11.7	17.8	16.1
Jordan (2017/2018)	5.9	16.7	14.5
Mauritania (2019–2021)	23.6	27.6	25.6
Morocco (2003/2004)	13.5	21.4	18.4
Yemen (2013)	9.8	12.4	10.9

Sources: Authors' estimation using information from DHS (as data pertaining to workforce participation is not collected in MICS).
Note: Workforce participation information for other Arab countries is not available. Figures are reported for women in the age group 15–49 years.

7. Economic costs

A. Macroeconomic costs: GDP lost due to child marriage

Table 6 shows the percentage of GDP lost due to child marriage across the 13 Arab countries included in this study. In 2021, Algeria lost the highest percentage of GDP (5.1 per cent), while Qatar lost the lowest percentage of GDP (0.1 per cent). Ten countries lost over 2 per cent of their GDP, with the State of Palestine, the Sudan and Tunisia losing over 4 per cent (4.3 per cent, 4.9 per cent and 4.3 per cent, respectively). The remaining three countries had lower than 2 per cent of their GDP lost due to child marriage, with only Qatar and the Syrian Arab Republic below 0.5 per cent (0.1 per cent and 0.3 per cent, respectively).

It is important to note that the economic cost of child marriage not only depends on the rates of child marriage but also on the differences in demographic and socioeconomic outcomes between females married below 18 years of age and those married at 18 years and above. Therefore, Algeria, Jordan and Tunisia will incur greater economic costs attributable to child marriage because they have greater fertility and educational differences across females married below 18 years of age than those married at 18 years and above. While, for countries like Iraq and Mauritania, despite having higher child marriage prevalence rates, the relative differences in fertility rates and education levels between those married below 18 years of age and those married at 18 years and above are not as high as those in Algeria, Jordan and Tunisia, thus incurring lesser economic costs that are attributable to child marriage.

Given the model used in this costing exercise, the trends remain more or less the same in the projected years. In 2050, the Sudan is projected to lose the highest percentage of its GDP (5.1 per cent), while Qatar is projected to lose the lowest at 0.1 per cent. Eight countries are projected to lose over 2 per cent of their GDP due to child marriage, with the average being 4.06 per cent. The remaining five countries – Iraq, Mauritania, Qatar, Somalia and the Syrian Arab Republic – are forecasted to lose less than 2 per cent of their respective GDP, implying that good socioeconomic and health resources could help avoid the high economic costs of child marriage.

The estimated economic cost of child marriage for the Arab region stood at 3.2 per cent in 2021 and will be 3 per cent in 2050.

Table 6. Economic costs: Percentage of GDP lost due to child marriage in Arab countries

Countries	2001	2006	2011	2016	2021	2026	2031	2036	2041	2046	2050
Algeria				6.0	5.1	4.5	4.1	4.1	4.4	4.6	4.8
Egypt				3.7	3.4	3.1	2.9	2.8	2.9	3.0	3.2
Iraq					1.3	1.3	1.2	1.1	1.1	1.1	1.2
Jordan		4.3	3.6	3.2	3.3	3.5	3.6	3.7	3.8	4.0	4.1
Mauritania					3.5	3.0	2.6	2.3	2.2	2.0	2.0
Morocco		4.0	3.7	3.3	3.2	3.2	3.3	3.5	3.6	3.7	3.9
Qatar				0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Somalia			2.6	2.4	2.1	1.9	1.8	1.8	1.9	1.9	1.8
State of Palestine			5.1	4.7	4.3	3.9	3.8	3.8	3.9	4.1	4.2
Sudan			5.7	5.2	4.9	4.7	4.5	4.5	4.7	4.9	5.1
Syrian Arab Republic			0.3	0.3	0.3	0.2	0.2	0.2	0.3	0.3	0.3
Tunisia				4.4	4.3	4.0	3.7	3.7	4.0	4.3	4.6
Yemen				3.7	3.2	2.8	2.6	2.5	2.5	2.6	2.6
Arab region					3.2						3.0

Source: Authors' estimation using the spectrum-based simulation approach.

In absolute terms (table 7), child marriage had an economic impact of $40.7 billion in 2021, and this figure is expected to increase to a cumulative total of $3 trillion by 2050. Among the countries analysed, Egypt had the highest economic cost in 2021, reaching $91.3 billion, while Mauritania had the lowest cost at $0.6 billion. Looking ahead to 2050, the Sudan is projected to have the highest cumulative economic cost due to child marriage, estimated at $18,784 billion, whereas Mauritania is expected to maintain its position with the lowest cumulative economic cost at $66.6 billion.

The prevalence of child marriage has greater economic relevance for countries with high rates of child marriage and fertility, and poor health-care services, such as Algeria, Jordan, the State of Palestine, Somalia, the Sudan and Yemen. Across the 13 Arab countries, the total GDP estimates presented in this study align with the World Bank estimates for the respective countries.[51]

Table 7. Economic costs: Absolute difference in GDP for child marriage and non-child marriage scenarios, 2001–2050 (Billions of dollars)

Countries	2001	2006	2011	2016	2021	2026	2031	2036	2041	2046	2050
Algeria				41.8	70.1	198.3	513.4	1,334.1	3,491.2	8,770.4	1,7758.5
Egypt				25.9	91.3	241.4	554.5	1,250.7	2,931.4	7,037.3	14,235.7
Iraq					9.0	41.1	117.2	292.3	709.5	1,732.5	3,547.1
Jordan		2.9	10.4	19.9	30.8	49.9	83.8	149.9	289.6	605.3	1,150.4
Mauritania					0.6	2.2	4.6	8.7	17.3	35.8	66.6
Morocco		12.7	34.9	51.6	74.0	193.1	493.8	1,226.8	2,975.2	7,069.1	13,953.2
Qatar			0.6	4.7	8.7	24.7	64.5	166.0	420.9	1,035.9	2,079.7
Somalia				0.8	1.5	6.5	24.0	79.0	237.9	654.7	1,379.7
State of Palestine		0.0	0.5	1.3	2.3	3.7	6.2	11.3	22.4	46.3	85.3
Sudan			5.3	34.0	18.6	82.5	310.0	1,051.9	3,232.5	8,932.5	18,784.0
Syrian Arab Republic		0.0	4.0	0.7	1.7	6.8	27.0	99.7	326.1	933.2	1,967.1
Tunisia			0.0	10.4	19.2	43.7	92.6	204.5	485.0	1,183.2	2,414.6
Yemen				5.4	5.5	13.9	31.8	73.6	171.6	400.5	789.1
Arab region					40.7						2,920.5

Source: Authors' estimation using the spectrum-based simulation approach.

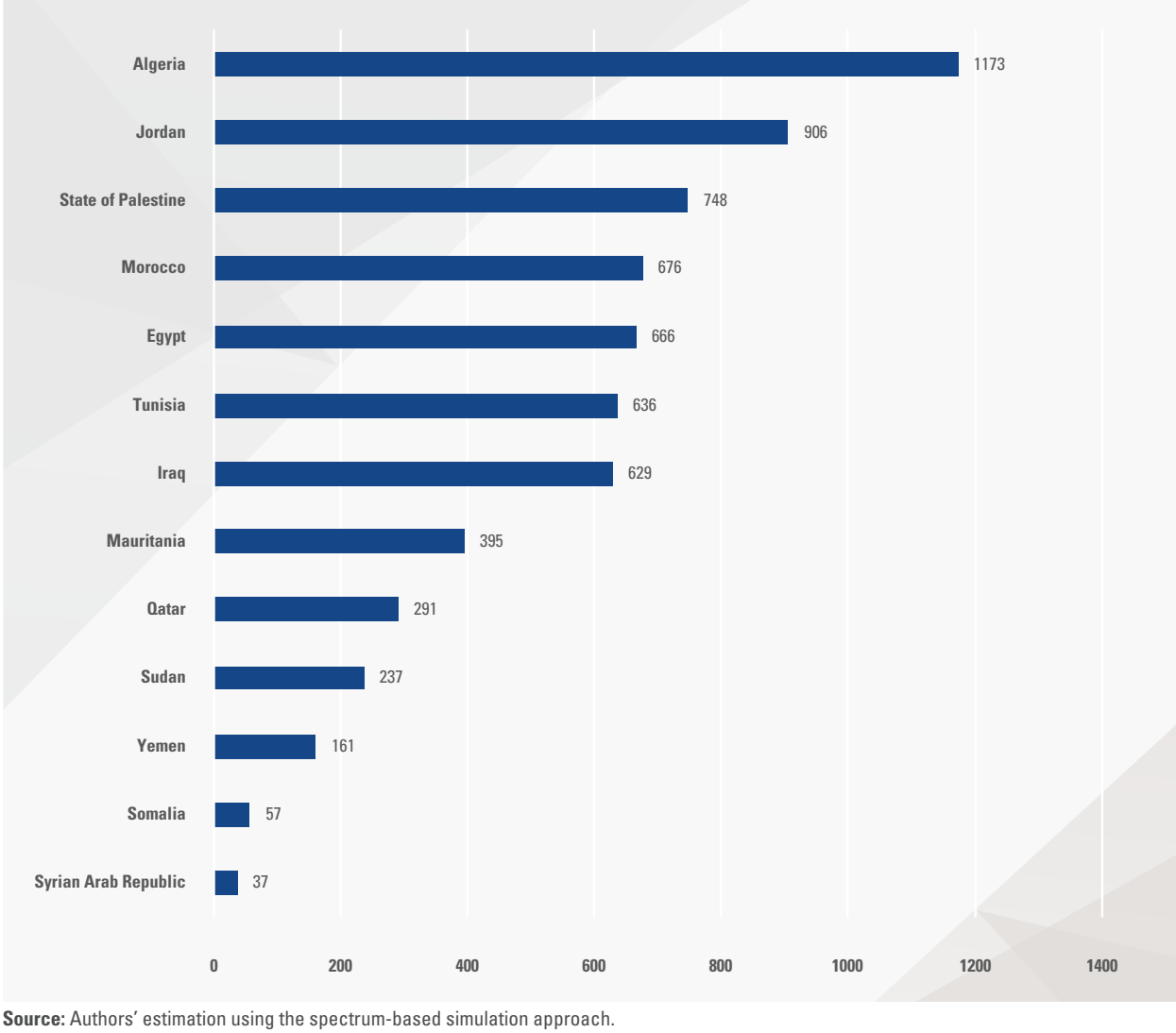
B. Household economic and health-care costs of child marriage

As explained through the conceptual framework of this study, a part of the economic cost of child marriage for countries influences the household as well. Households with a woman married as a child experience greater income loss both through wages as well as excess health-care expenditures. Earlier, Wodon and others (2017), as well as Wodon and Yedan (2017b), demonstrated that the economic participation and wage earnings for females married at early ages are significantly less compared to their

counterparts married at higher ages. Wages have a significant bearing on household earnings.

This section provides an analysis of the average annual economic costs borne by households[52] and the private health-care costs[53] associated with child marriage. The findings presented in figure 5 indicate that households in most Arab countries face significant average annual economic costs. For example, seven Arab countries (Algeria, Egypt, Iraq, Jordan, Morocco, the State of Palestine and Tunisia) show average economic costs exceeding $600 per household, with Algeria having the highest cost at $1,173 and the Syrian Arab Republic having the lowest at $37.

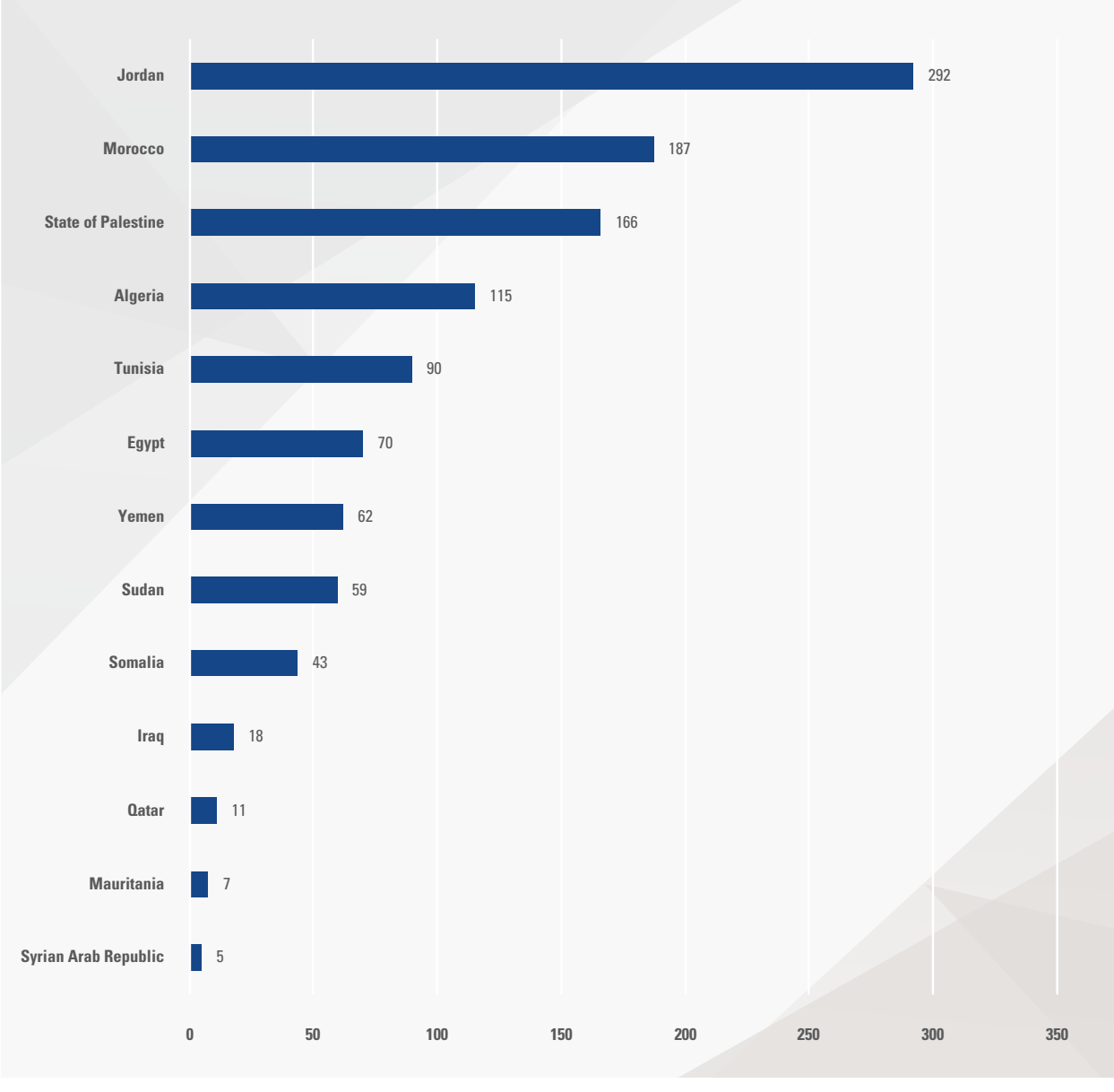
Figure 5. Average annual economic cost per household attributable to child marriage, 2021 (Dollars)



Source: Authors' estimation using the spectrum-based simulation approach.
Note: The absolute economic cost due to child marriage not only depends on the level of its prevalence but also on the economies of scale and socioeconomic, demographic and health policies of the country. Usually, larger economies tend to have a greater elasticity of costs due to prevalence of child marriage. Thus, the association between prevalence of child marriage and absolute GDP cost due to child marriage may not be strong.

The estimated average annual health-care costs for households also show considerable variation among the countries. The range spans from $292 in Jordan to a mere $5 in the Syrian Arab Republic. Additionally, only four countries (Algeria, Jordan, Morocco, and the State of Palestine) have household health-care expenditures exceeding $100 per year (figure 6).

Figure 6. Average annual health cost per household attributable to child marriage, 2021 (Dollars)



Source: Authors' estimation using the spectrum-based simulation approach.
Note: The absolute health cost due to child marriage not only depends on the level of its prevalence but also on the economies of scale and the cost of health-care services in the country.

8. Conclusion

Child marriage has been shown to have lifetime consequences for girls regarding poor educational, health and economic outcomes, depriving them of fundamental rights and leaving the next generation at a disadvantage.[54] The issue has been aggravated by the COVID-19 pandemic and demands effective and conscious intervention, especially in the poorest countries, which exhibit the highest rates of child marriage. A growing volume of studies are increasingly demonstrating the harmful effects of child marriage on varied aspects of development outcomes.[55] However, concerted efforts and resources to neutralize the practice remain inadequate across the Arab region. To stimulate efforts towards ending child marriage, the present study presents the economic costs of child marriage and its key mechanisms.

The respective economic costs of child marriage for 13 Arab countries have been estimated from 2001 to 2050. However, the timeline varies for a few countries due to the non-availability of data. The estimated economic cost of child marriage in terms of total GDP and the percentage of GDP lost provide compelling evidence that child marriage induces enormous and exponential economic costs for the Arab region. The GDP lost due to child marriage across 13 Arab countries is estimated at 3.2 per cent for 2021 and projected to be 3 per cent in 2050, with the cumulative GDP loss around $3 trillion during the forecasted period. Country-wise, Algeria and the Sudan were estimated to lose the highest percentage of GDP due to child marriage in 2021, while Qatar lost the lowest rate of GDP.

On the other hand, in 2050, the Sudan (5.1 per cent), Algeria (4.8 per cent) and Tunisia (4.6 per cent) are projected to lose the highest GDP due to child marriage if the current rate persists. The country-level differentials in the economic costs of child marriage in terms of GDP loss are both due to the level of child marriage and endowment factors such as the quality of health care and the socioeconomic system. It is possible that, despite similar child marriage rates, some countries have managed to control the damage caused by child marriage through better health-care and socioeconomic systems, thus reflected in the lower percentages of GDP loss. And some countries, such as the Sudan, have not experienced a significant difference in demographic and socioeconomic outcomes between females married below 18 years of age and those married at 18 years and above. Thus, economic costs solely attributable to child marriage are relatively less despite having a higher prevalence of child marriage and inferior demographic and socioeconomic outcomes in the country.

At the outset, the study finds that the economic cost of child marriage is substantial across the Arab region. Our estimate (3.1 per cent in 2021 for the Arab region) is slightly on the higher side compared to the 1.05 per cent reported by Mitra and others (2020) in the case of EMDCs and the 1.44 per cent noted by Wodon and others (2017) in the case of South Asian, Middle Eastern and African countries. The higher side estimate from the current study can be attributed to a greater number of components (i.e. direct and indirect costs) considered for the estimation. The estimated economic cost of child marriage in this study accounts for several direct and indirect costs, as shown in the analytical framework (figure 2). The economic cost due to child marriage not only depends on the level of its prevalence but also on the economies of scale and the country's socioeconomic, demographic and health policies.

From a policy perspective, the study suggests that Arab countries can increase their GDP around 3 per cent by eliminating child marriage. It is important to note that the current study does not engage in detailed empirical analyses of all the pathways through which child marriage impacts the economy of a State and intervention strategies to eliminate child marriage because they are widely documented in the existing literature. Along with its conceptual framework, a synthesis of the empirical evidence found in this study in the context of previous literature provides insights into the mechanisms through which child marriage induces economic costs for a State and also provides possible intervention strategies to overcome this consequence.[56] The critical mechanisms identified are demographic, social and health implications. Demographic implications comprise unwanted pregnancies and unsafe abortions that alter future growth, survival and/or reproduction.[57] Social implications include the loss of educational attainment by girls who are married as children, which eventually harms the exercise of their basic rights, agency, decision-making ability, earning prospects, community support and empowerment in general.[58] Health implications include the high fertility rates of females marrying early and higher maternal morbidity and mortality rates.[59] These implications, endured by girls who marry early, might be direct or indirect, as well as monetary or non-monetary, for individuals and households and are cumulated at the State level.[60]

In conclusion, the present study advances the suggestions put forward by Asha George and others (2020) that eliminating child marriage also requires addressing the structural determinants of gender inequality. The sooner a Government acts to eradicate child marriage, the greater the economic savings. Although the financial costs should not be the only reason for investing in the end of this practice, it certainly is a paramount concern. Arab countries must strengthen their social, economic, population and health policies to ensure greater gender equality in education, health and labour market outcomes. Moreover, financing to eliminate child marriage ensures human rights.

9. Policy recommendations

The present chapter sets out policy recommendations for Arab countries based on the research and analysis undertaken for this study, along with other available evidence. The study advances the premise that Arab Governments need to act on two fronts: (1) eliminating child marriage; and (2) neutralizing the negative impacts of child marriage at the individual and household levels. It is well known that ending child marriage is crucial to advancing gender equality; therefore, Governments must address the structural determinants of gender inequality. Hence, countries must tackle harmful gender roles, norms and power relations by adopting holistic and multifaceted policies, as discussed below.

A. Design targeted strategies for curtailing or eliminating child marriage in the Arab region

Child marriage persists in the region, highlighting its localized nature and the need for targeted interventions. High-prevalence countries (over 10 per cent) should develop prevention strategies, focusing on "hotspot" areas (provinces, governorates or regions). These efforts should be accompanied by programmes that challenge harmful norms and discrimination, along with the vigilant implementation of nationwide child protection policies and legislation, including closing loopholes related to child marriage. Recent systematic reviews indicate that cash incentive programmes have effectively reduced child marriage rates in various countries.[61] Therefore, Arab countries could consider adopting similar initiatives to address this issue.

B. Neutralize the adverse impacts of child marriage

Countries should adopt a comprehensive and multifaceted approach to address the adverse effects of child marriage and create an empowering environment for females. This approach should include: (1) strengthening family planning and maternal and child

health-care policies to reduce unintended pregnancies, births and avoidable child deaths to lessen the population growth and thereby curtail the economic cost of child marriages in the region; (2) focusing on reducing the fertility and educational differences for girls married before and after turning 18 years old, mainly for countries that experience higher economic costs due to child marriage despite having lower child marriage prevalence; (3) being proactive with educational sector policies to ensure the continuation of girls' education before and after marriage, particularly alternative learning opportunities after marriage or while pregnant; and (4) developing and implementing flexible labour market policies that support and allow more women to enter the labour market before and after marriage.

C. Strengthen data collection on child marriage and its impacts

To effectively address the problem of child marriage in the Arab region, it is crucial to ensure the collection of reliable and disaggregated data on key indicators. Countries should establish systematic data collection processes to gather accurate and up-to-date information. This can be accomplished by developing comprehensive databases using administrative data systems or conducting sample surveys. Such initiatives will facilitate a deeper understanding of the immediate and long-term effects of child marriage on women, girls, their families, communities and the overall society.

D. Promote multi-stakeholder initiatives for greater financial sustainability

Estimating the economic impact of child marriage is a means to address the short-, medium- and long-term effects of child marriage while adopting a human rights-based approach. Investing in initiatives to eliminate child marriage not only upholds human rights but also makes economic sense. In this regard, it is crucial for Governments to collaborate with a wide range of stakeholders to secure sustainable funding opportunities and work towards eradicating this harmful practice in the region.

Annex

Table A.1 Data sources and variables in costing exercise

Data source	Countries	Indicators	
Demographic Health Surveys (DHS)	Egypt (2014),a Jordan (2002, 2017/2018), Mauritania (2019–2021), Morocco (2003/2004), Yemen (2013)	Marriage	Age at first marriage, percentage of women in union
		Age at first birth	Mean age at first birth
		Fertility level	Total fertility rate, age-specific fertility rate, age and birth order, birth interval
		Contraception use	Contraceptive prevalence rate, method mix and source mix, percentage of sterility, unmet needs, method attributes (average age of acceptance of permanent method, average duration of use of long-term and short-term method which are non-permanent in nature)
		Maternal health care/Morbidity	Percentage of births with high risk, miscarriage rate, maternal mortality ratio
			Pregnancies wanted later, unwanted pregnancies, postpartum insusceptibility, unintended pregnancies terminated/ induced abortions
		Child health	Infant mortality rate, under-5 mortality rate
Multiple Indicator Cluster Surveys (MICS)	Algeria (2018/2019), Iraq (2018), State of Palestine (2018/2019), Qatar (2012), Somalia (2006), the Sudan (2014), Syrian Arab Republic (2006), Tunisia (2018)	Marriage	Age at first marriage, percentage of women in union
		Age at first birth	Mean age at first birth
		Fertility level	Total fertility rate, age-specific fertility rate, age and birth order, birth interval
		Contraception use	Contraceptive prevalence rate, method mix and source mix, sterility, unmet needs, method attributes (average age of acceptance of permanent method, average duration of use of long-term and short-term method which are non-permanent in nature)
		Maternal health care/Morbidity	Percentage of births with high risk, miscarriage rate, maternal mortality ratio
			Pregnancies wanted later, unwanted pregnancies, postpartum insusceptibility, unintended pregnancies terminated/ induced abortion
		Child health	Infant mortality rate, under-5 mortality rate

Census of the Arab countries	Algeria (2018), Egypt (2006), Iraq (2009), Jordan (2004), Mauritania (2013), Morocco (2004), State of Palestine (2017), Qatar (2010), Somalia (2002/2003 Survey and Population Estimation Survey (PESS), 2014), the Sudan (2008), Syrian Arab Republic (2004), Tunisia (2014), Yemen (2004)	Population	Total population, age-specific population
United Nations	Algeria, Egypt, Iraq, Jordan, Mauritania, Morocco, State of Palestine, Qatar, Somalia, the Sudan, Syrian Arab Republic, Tunisia, Yemen (respective years)	Population prospectus	Projected population
		Model Life Table	United Nations Model Life Table
World Development Indicators (WDI), World Bank and Labour Force Surveys (LFS)		GDP growth rate	GDP, annual growth rate in GDP
		Urbanization	Percentage of population living in urban areas, percentage of urban population in a major city, persons per urban household
		Education	Primary/secondary level school: age at entry; enrollment rate (percentage); students per school teacher; students per school; recurrent expenditure per school student (dollars)
		Employment	Labour force participation rate: male and female
		Migration	Net migration
		Agriculture	Arable land (million hectares), base year production of major crop (thousand metric tons), annual growth in production of major crop (percentage), annual per capita consumption of major crop (kilograms)
Global Health Observatory, World Health Organization (WHO)		Life expectancy	Life expectancy at birth: male and female
			Health workforce
			(Population per doctor, population per hospital bed, population per nurse, population per health centre, population per hospital)
			Annual health expenditure per person

Official and private statistics and reportsb,c,d	Algeria, Egypt, Iraq, Jordan, Mauritania, Morocco, State of Palestine, Qatar, Somalia, the Sudan, Syrian Arab Republic, Tunisia, Yemen (respective years)	Family planning	Expenditure (cost and fee), effectiveness, impact rates
		Post-abortion care	Percentage of abortions that are legal, percentage of illegal abortions that need treatment, percentage of maternal deaths due to abortion, relative risk of mortality for untreated versus treated abortions, cost per abortion complication treated, cost for family planning counselling/ service per case

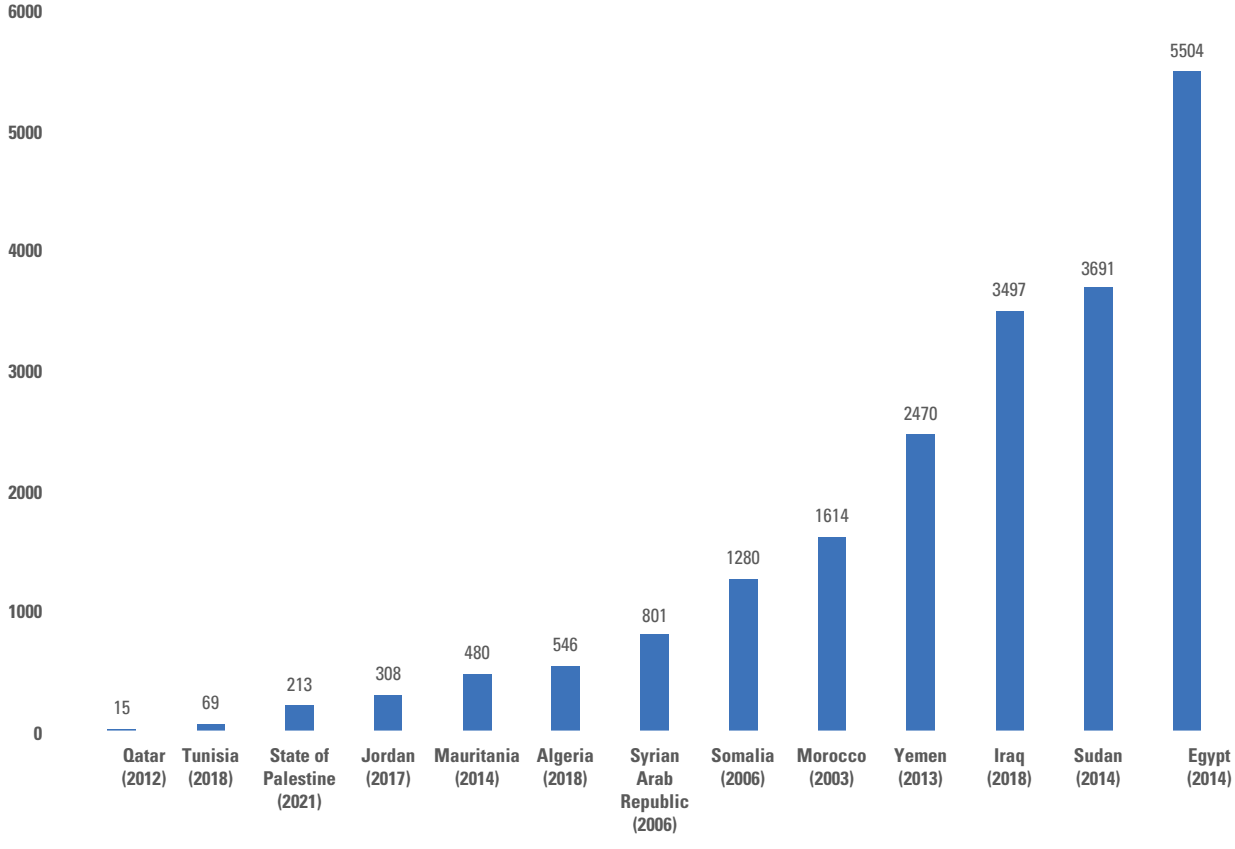
Sources: Inner City Fund (ICF), (2000–2020); United Nations Children's Fund (UNICEF), (2011–2014); The World Bank Group (2000–2021); World Health Organization (WHO) (2000–2020); United Nations (2022b).

a A more recent version of the Egypt Family Health Survey was launched in 2021 but is not included in this report due to the timing.

b Rana and Goli, 2017.

c Guttmacher Institute,2021.

Figure A.1 Total number of women who married before age 18 in Arab countries (in thousands)



Source: Estimated using a triangulation of DHS, MICS and United Nations Population Prospects.

Table A.2 Methodological note: Detailed explanation of methods and assumptions in DemProj, FamPlan and RAPID modules of spectrum-based simulation approach

Estimation of input indicators and assumptions

The study used three key modules of the spectrum-based simulation approach: DemProj, FamPlan and RAPID. The input indicators and their assumptions in these three modules are described below.

DemProj module

Population projections

Population projection is a scientific tool that integrates various components of change to project future population and composition. For the projection of population for the Arab region from 2001 to 2050, the DemProj module of the spectrum projection function has been used. The population of 2001 has been used as the base year for the projection. This study used 2001 as a base year which allows for evaluating the validity and suitability of the model by comparing the projected and actual populations for the period 2001–2021.

Age-sex distribution of a population

The age-sex distribution of the population for the base year is compiled from the censuses of the respective countries and the World Population Prospects, updated by the United Nations. For a high-quality base year input, the age-sex disaggregated data obtained for the base year from the respective country censuses have been adjusted for non-sampling errors, and those who did not state their correct age have been distributed proportionately across other age groups.

Fertility levels

In this study, fertility levels are measured by a widely used indicator of fertility: total fertility rate (TFR). The trajectory of fertility for the Arab region is the most contested component in its population projections. Keeping this in mind, the study used standard methods for deriving TFR levels for all three different scenarios for both base year and goal post year. This method comprises three steps: (1) The study estimates fertility differences for three different scenarios (i.e. child marriage scenario, non-child marriage scenario, and overall scenario (as usual scenario)) in the base year using microdata from the surveys; (2) the study considers the TFR level for the goalpost year (i.e. 2050) from the median variant projection of World Population Prospects (2019) for the "as usual" scenario; and (3) the study derives the TFR level for child marriage scenario by subtracting the base year difference between the child marriage scenario and the as usual scenario. Similarly, for the non-child marriage scenario, the study derives the TFR level for the child marriage scenario by adding the base year difference between the child marriage scenario and the as usual scenario.

Age distribution of fertility

With significant improvement in family planning and consequent fertility decline in countries, a definite shift in the age distribution for births is also observed. However, such a shift varies for child married women compared to non-child married women. We estimate the age-specific fertility rate for the women in age-group 15–49 years from 2001 to 2021 using survey data from the respective Arab countries. DemProj routinely optimizes the distribution of births as per the imputed assumption of the TFR. Thus, under the usual fertility scenarios, the distribution of births post-optimization process is mainly concentrated in the age group of 24–34 years, whereas a significant decline in births is observed in women aged below 20 and above 40 years. However, this distribution varies significantly for child married women compared to non-child married women. This study used three separate age distributions of fertility for three different scenarios (i.e. scenario of child married women, non-child married women, and total women or as usual scenario) assumed for the model.

Sex ratio at birth

Country-level sex ratio at birth approximations in the model for all three scenarios are estimated from the microdata, while the projected figures for the goalpost year in the case of the "as usual" scenario are adopted from World Population Prospects (2019). Keeping the difference found in microdata for sex ratio at birth estimates for child married and non-child married mothers constant up to the goalpost year, the study derives the sex ratio at birth estimates for the child marriage scenario by subtracting the difference found in the base year from the median variant sex ratio at birth estimate for the respective countries from the World Population Prospects (2019). Similarly, for the non-child marriage scenario, we have added the difference found in the base year from the median variant sex ratio at birth estimate for respective Arab countries from the World Population Prospects (2019).

Life expectancy at birth

Construction of a life table for populations with no or the least number of child marriages and those with the highest number of child marriages would be the ideal condition to derive the life expectancy at birth differences across the women who married below age 18 and those who married at 18 and above. However, construction of the life table for these sub-populations is not only a tedious job but also time- and resource-consuming. This study derived life expectancy at birth estimates for three different scenarios based on the experience of two different sets of geographies: the life expectancy at birth levels in provinces with the least number of child marriages are assumed to have the standard as non-child married women, while the life expectancy at birth of countries with the highest number of child marriages are assumed to have the standard as child married women. For the overall or as usual scenario, we considered a country's overall life expectancy at birth value of females.

Model life tables

The study used the Coale-Demeny model life table West regional patterns for underlying mortality patterns for estimation and projection. Previous literature suggests that mortality estimates using the West model have been more consistent in comparison with actual data for Arab countries (Stover, Heaton and Ross, 2006).

International migration

Migration is the third-most important component of population projection. The country-specific international migration (along with refugee population) is estimated using censuses, World Development Indicators of the World Bank and other official statistics.

Single-year age estimates of population, fertility and mortality

The spectrum simulation procedure also requires inputs of single-year age estimates of population, fertility and mortality rates and thus necessitates a transformation of estimates from a five-year age cohort to a single-year age. The base year population in the five-year age group has been converted into single-year age population using Beers's (1945) methodology. Following the same methodology, age-specific mortality rates, age-specific fertility rates and age-specific net migration rates have been split into a single-year age distribution. For the subsequent years, the population is projected using the cohort component method as follows:

$$P_{a,s,t,j} = P_{a-1,s,t-1,j} + 0.5 * (Mig_{a-1,s,t-1,j} + Mig_{a,s,t,j}) - Death_{a,s,t-1,t,j}$$

where $P_{a,s,t,j}$ is the population of a particular sex s at age a, at time t under the j^{th} scenario. $Mig_{a,s,t,j}$ refers to the migrant population of a particular sex s at age a, at time t under the j^{th} scenario. The $Death_{a,s,t-1,t,j}$ indicates the number of persons of a particular sex s that died at age a, between midyear and midyear under the j^{th} scenario, which is given as follows:

$$Death_{a,s,t-1,t,j} = P_{a-1,s,t-1,j} + 0.5 * (Mig_{a-1,s,t-1,j} + Mig_{a,s,t,j}) * (1 - (Survi_{a-1,a,s,t-1,j} + Survi_{a-1,a,s,t,j}) * 0.5)$$

where $Survi_{a-1,a,s,t,j}$ indicates age-specific survival rates between age a-1 and a for the person of a particular sex (s = male or female). Once the male and female populations between two time periods have been estimated, it becomes important to estimate the number of births that occurred between two midyears. The mathematical formula for estimation of births is given as follows:

$$B_{t,t-1,j} = \sum_{a=15}^{49} [Fp_{a,t-1,j} + Fp_{a,t,j} * 0.5] * [TFR_{t-1,j} + TFR_{t,j}] * 0.5 * [ASFR_{a,t-1,j} + ASFR_{a,t,j}] * 0.5$$

where $Fp_{a,t,j}$ is the female population at age a and time t and $ASFR_{a,t,j}$ is the age-specific fertility rate corresponding to age a at time t in the j^{th} scenario.

On multiplying the number of births by the corresponding sex ratio at birth, the number of male and female births is estimated. The births are then multiplied by their corresponding survival functions and placed in the initial age group 0–1 year. So, the population in the age group 0–1 is given as follows:

$$P_{0,s,t,j} = (P_{0,s,t-1,j} + P_{0,s,t,j}) * 0.5 * Survi_{0,s,t,j}$$

The population in the age zero bracket is replaced and projections for the subsequent years are carried out using the same iterative procedure until the final projection year is reached.

FamPlan module

This module is very useful in the sense that it captures various demographic and health parameters of the costing model for a country, especially in the context of child marriages and reproductive age group women. The key dimensions include fertility and use of different family planning methods, the impact of family planning, demographic events, fertility-related risks, mortality rates, post-abortion care, and associated costs and revenues. The spectrum module DemProj is integrated with other modules such as FamPlan and RAPID (Stine and Schmitz, 2013). Unlike other modules, FamPlan is an impact assessment module linked with DemProj that undertakes assumptions for reaching the family planning and fertility goals in a country. Specifically, it integrates the age-sex disaggregated population obtained from DemProj and applies it to two data types: first, the proximate determinant of fertility, and second, programme characteristics such as methods and source mix of modern contraception. The approach here is based on achieving desired fertility rates. The estimation in FamPlan is based on the famous proximate determinant of fertility framework (Bongaarts, 1978; Bongaarts and Stover, 1986; Bongaarts and Potter, 2013). The desired fertility levels and corresponding trajectories are provided in the DemProj and FamPlan modules (as explained in the previous section on DemProj). The goal for each year for the identified jth scenario (j=1 for TFR of child married women; j=2 for TFR of overall women; j=3 for TFR of non-child married women) until the final year is estimated as follows:

$$TFR_{t,j} = TFR_{2001} - (TFR_{2001} - TFR_{g}) \times PercentReductiont,k$$

where $TFR_{g,j}$ is the value of TFR at the end years (2050) in j^{th} scenario, and percentage reduction refers to the gap between actual TFR and TFR at the goalpost year of 2050. However, we assume that the differences in TFR across the three scenarios are persistent till the goalpost year, 2050. So, once the TFR at year t is estimated, the corresponding prevalence of contraception is computed from the proximate determinant frameworks as follows:

$$C_{prev,t,j} = (1 - TFR_{t,k,j} / (C_{m,t,j} \times C_{i,t,j} \times C_{a,t,j} \times C_{s,t,j} \times TF)) / (1.08 \times C_{eff,t})$$

where $C_{prev,t,j}$ = contraceptive prevalence at time t; $C_{m,t}$ index of marriage; $C_{i,t}$ index of insusceptibility; $C_{a,t}$ index of abortion; $C_{s,t}$ index of sterility; TF is total fecundity; and $C_{eff,t}$ the average effectiveness of all contraceptive methods at time t.

Proximate determinants of fertility

The proximate determinants of fertility include a set of behavioural and biological variables that have a direct impact on the fertility outcome. These include the percentages of women who are married or in a union, postpartum insusceptibility, total abortion rate and sterility. For the base year of the projection, i.e. 2001, the values for the percentage of women who are married or in a union and the duration of postpartum insusceptibility have been estimated from the survey data for three different scenarios, and the values between the surveys have been interpolated. The percentage of women who will be married or in a union in 2050 is assumed to be lower than the percentage in 2001 because of the increasing median age at marriage. Similarly, postpartum insusceptibility is assumed to be lower than the estimate in 2001 because of a decreasing trend in the duration of breastfeeding practices. The total abortion rate and sterility remain the same

as those estimated for India throughout the projection period (Stover, Heaton and Ross, 2006) because these values are less likely to change over time.

Contraceptive method mix and source mix

Contraceptive method mix refers to the percentage of contraceptive users by a method to the total number of users. Thus, the sum of the contraceptive methods is 100 per cent. The method mix has been calculated from contraceptive users as reported in microdata from the surveys. For the base year, the estimates from the respective country survey data have been used. During the inter-survey period, the values are interpolated using the linear interpolation method. For the year 2050, a contraceptive method mix has been taken from the developed countries for the overall scenario, but differences observed between child married and non-child married women are retained for the goalpost year as well. Values between 2021 and 2050 are filled with the interpolated estimates obtained for all contraceptive methods separately and the corresponding method mix and users of each method. It can be expressed as follows:

$$CP_{a,m,t,j} = MethodMix_{a,m,t,j} \times CP_{a,t,j}$$

where $CP_{a,m,t}$ is the contraceptive prevalence for a particular method m among users of age a at time t under j^{th} scenario; $MethodMix_{a,m,t}$ refers to the share of all users using specific method m, at time t; and $CP_{a,t}$ contraceptive prevalence among users aged a at period t.

Also, the numbers of users of each method are estimated by multiplying method-specific prevalence $CP_{a,m,t}$ with married women of the reproductive age group.

$$USERs_{a,m,t,j} = CP_{a,m,t,j} \times MWAR_{a,t,j}$$

where $USERs_{a,m,t}$ refers to users of a particular method m among users of age a at time t and $MWAR_{a,t}$ married women of reproductive age a at time t.

The source mix is the percentage of contraceptive users who receive their services from different sources. The sum of the source mix is 100 per cent. For this study, the sources are defined as public, private and non-governmental organizations (NGOs). The information from 2001 to 2021 on the source mix is collected and estimated from the microdata. For the information during the inter-period projection, the values have been interpolated: various sources p for contraceptive method m is computed as follows:

$$USERs_{a,m,p,t,j} = USERs_{a,m,t,j} \times SourceMix_{m,p,t,j}$$

where $USERs_{a,m,s,t,j}$ is the number of methods that users of reproductive age a at time t rely upon source s for specific contraceptive method m under scenario j; $SourceMix_{m,p,t,j}$ refers to the share of users receiving specific contraceptive method m from sources s at time t under j^{th} scenario. For the final year of the projection (2050), the share of public sources has been reduced, and the share of private sectors and NGOs has been increased based on the current scenario in developed countries. Thus, over the year, expenditure on family planning may be reduced in the

public sector and the share may be increased in both the private sector and NGOs in the future. Thus, the source of contraceptive methods in the final year of the projection may be equivalent to that of developed countries.

Child survival

The inputs for child survival are needed for the base year, i.e. 2001. The indicators for child survival include the percentage of births with any risk involved, the infant mortality rate (IMR) and under-5 mortality rate (U5MR) in the survey years, the relation of risky births to contraceptive use, the relation of IMR to risky births and the relation of under-5 mortality to risky births. Using microdata, the IMR, U5MR and percentage of risky births have been estimated for three scenarios: child married women, non-child married women and overall women. All coefficients for the relationships are assumed to be the default (Stover, Heaton and Ross, 2006).

Cost of services and consultation fees

The cost of services on contraceptive methods is taken from country-specific official reports for the year 2001. The "regression" option of the FamPlan module allows for the projection of future costs per user assuming a certain relationship. It assumes that the cost of services will decrease with an increased number of users or acceptors for a particular method (Stover, Heaton and Ross, 2006). The consultation fees for the contraceptive methods are varied across the sources of supply. The public sector supply is free of cost. The fees for NGOs are assumed to be half of those of the private sector because NGOs are generally non-profit organizations while health institutions are for-profit. The consultation fees for male and female sterilization may be equivalent to those for a C-section delivery, which are estimated by using country-specific microdata. The fees for other modern methods of contraception are collected from the country-specific official reports on health statistics.

Method attributes

Method attributes refer to the durability of each contraceptive method. For the limiting methods, the average age of female and male sterilization is considered to be 26 years throughout the projection period. For long-acting reversible contraceptive methods, the average durations for Implanon (implant), copper T intrauterine device (IUD) and levonorgestrel-releasing intrauterine system (LNG-IUS) are two years five months, four years six months and three years three months, respectively. The method attributes for the short-term contraceptive methods are defined as the number of units required for one-year protection of a couple. The number of units for condoms, daily pills (one cycle), injectables (Depo-Provera for three months) and the lactational amenorrhea method are 120, 4, 15 and 0.3, respectively.

Lactational amenorrhea method

Lactational amenorrhea method is a one-time input for the base year (one-time entry). The percentage of women who use the lactational amenorrhea method by months has been estimated from the survey data of the respective countries.

The effectiveness of contraceptive methods, impact rates and miscarriage rate

The information on the effectiveness of contraceptive methods has been taken as standard rates proposed by Stover, Heaton and Ross (2006) based on observation of the data from global experiences. All indicators of impact rates (one-time entry) have been either estimated from the country-specific microdata, or taken from official statistics of the respective countries. The miscarriage rate varies between 10 per cent and 20 per cent across the globe (Stover, Heaton, and Ross, 2006). For the Arab region, at the base year (one-time entry), this rate is considered to be 15 per cent (0.15).

Post-abortion care

The percentage of legal abortions has been calculated from the sex ratio of each decennial census assuming that the imbalanced sex ratio at birth is the result of illegal abortions. The percentage of legal and illegal abortions that require treatment is taken from published reports (Cohen, 2009; Singh and others, 2018). The percentage of maternal deaths due to abortion (5.9 per cent) is taken from a study by Say and others (2014). The annual expenditure for post-abortion care at the base year of projection (single entry) is assumed to be the same as the cost of postnatal care and delivery cost reported in the previous studies (Cohen, 2009). The cost per abortion complications treated is assumed to be the same as in the Cohen (2009 references). The cost of annual family planning counselling or service per case has been assumed to be the same as the fees for medical consultation in the previous studies (Singh and others, 2018). The cost of abortion complications treated and family planning counselling or service fees are adjusted with inflation for the following years and deflated for the previous years during the projection period.

Distribution of fertility-related risk

The distribution of fertility-related risk is represented by the percentage of women at different age groups and birth order and by the percentage of children at groups of birth interval. These percentages have been estimated from the country-specific microdata.

RAPID module

The RAPID module of the spectrum simulation model is an organized tool for estimating the workforce and economic outcomes aiming to meet the desired social and economic goals in a country. At the same time, it also provides the socioeconomic requisites to enable achieving various country-specific targets within the stipulated time frame. In the RAPID module, we use the projected age-sex population totals and other demographic parameters from the DemProj for different sectors such as the economy, health, education agriculture and urbanization. We discuss two major aspects (education and health) of the RAPID module in detail under the three costing projection scenarios.

Economic input indicators

For the RAPID module, we included an array of economic input indicators and those also recognized by previous eco-demographic studies as critical factors of determining and predicting a country's economy (Coale and Hoover, 1958; Barro, 1991; Lee, Mason and Miller, 2000; Bloom, Canning and Sevilla, 2001; Kelley and Schmidt, 2005). Our model includes the labour force participation rate for males 10–14 years old, labour force participation rate for males 15–64 years old, labour force participation rate for females 10–14 years old, labour force participation

rate for females 15–64 years old, GDP at the base year (one-time entry) in USD and percentage annual growth rate in GDP. The labour force participation rates for both males and females 10–14 years old are obtained from different census rounds, with 2001 as the base year; the estimates of the labour force participation rate obtained from the census rounds have been duplicated for the inter-census period. Among both male and female children 10–14 years old, we assume labour force participation rate to be 0.01 per cent in 2050, considering child labour may reduce to nearly zero under the best scenario as a result of the accelerated effort to eradicate child labour in the Arab region. Among the males 15–64 years old, under the best scenario, the labour force participation rate is assumed to be 86 per cent in 2050 despite the current trend showing a stagnation or decline. This is also equivalent to the labour force participation rate level in developed countries (World Bank, 2021). The highest labour force participation rate for females worldwide is observed in developing countries such as the United Republic of Tanzania and Zimbabwe, where it has reached approximately 79 per cent; for the developed countries, the labour force participation rate is approximately 65 per cent (World Bank, 2021). Since we always use developed nations as a benchmark, we assume that Arab countries will reach a labour force participation rate of 65 per cent in 2050. The assumption concerning the GDP growth rate is the most complex and uncertain process considering that it is the most volatile indicator that depends on several economic, political, health elements and related shocks. In the light of the past growth trajectory and current growth rate, we have set short-term growth targets. The goalpost, meanwhile, has been set based on the GDP growth rate of large developed economies. Hence, the annual growth rate in 2050 has been assumed to be 4 per cent, with an initial growth rate of 8 per cent until 2035, 7 per cent until 2045 and 6 per cent until 2050. Similarly, the total GDP for the base year is taken from the official statistics of the respective countries. However, all the above said economic inputs are estimated for three different scenarios: child married women, non-child married women and as usual.

Educational input indicators

The educational input indicators for the RAPID module consider the age of entry into school (one-time entry), the number of years of schooling (one-time entry), the enrolment rates of schools (in percentages), the number of students per teacher, and the number of students per school separately for both primary and secondary schools. The age of entry into primary and secondary schools at the base year (2001) is 5 and 11 years, respectively. The number of years of schooling is five years each for both primary and secondary schools. The gross enrolment ratio is collected from country-specific official statistics. For 2050, the gross enrolment ratio is assumed to be 100 per cent for both primary and secondary schools, since, after more than four decades, almost all children in Arab countries are expected to enrol in schools up to the secondary level. The statistics on the number of students per primary and secondary school are obtained from country-specific official statistics. The student-to-teacher ratio is assumed to be 13, as observed among the developed countries. However, all the above said economic inputs are estimated for three different scenarios: child married women, non-child married women and as usual.

Health input indicators

The indicators of health for inputs in the RAPID module are population per doctor, population per nurse, population per health centre, population per hospital, population per hospital bed and annual health expenditure. The statistics on the population per doctor, nurse, health centre, hospital and hospital bed during 2001–2050 are taken from the World Development Indicators

database (World Bank, 2021). For the year 2061, the statistics have been taken from developed countries, as Arab countries may achieve an equivalent health infrastructure in the next four decades (World Bank, 2021). The annual health-care expenditure per capita for the year 2014–2015 is taken from the National Health Accounts of the respective Arab countries. The amount includes the expenditure from public and private sectors and donations from international agencies. For the estimates for the projected years until 2050, the expenditure has been adjusted with the current rate of inflation. However, all the above said health inputs are estimated for three different scenarios: child married women, non-child married women and as usual.

For more details, see supplementary material.

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Endnotes

1 UNICEF, 2022a.

2 Landini, 2021.

3 UNICEF MENARO and the International Center for Research on Women (ICRW), 2017.

4 UNFPA, 2020.

5 Wodon, 2017a, 2017b, 2017c, 2017d; Wodon and Yedan, 2017a, 2017b, 2017c, 2017d.

6 UN-ESCWA and others, 2023.

7 Wodon and others, 2017; Mitra and others, 2020.

8 Ibid.

9 Gemignani and Wodon, 2015; Goli, 2016; Girls Not Brides, 2019; Greene and Stiefvater, 2019; Psaki and others, 2021; Singh, Goli and Singh, 2022.

10 Jensen and Thornton, 2003; ICRW, 2006; UNICEF, 2022.

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12 Mathur, Greene and Malhotra, 2003; Santhya, Haberland and Singh, 2006; Wodon and others, 2017; Chakravarty, 2018.

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19 Swiss and others, 1998; Malemo Kalisya and others, 2011; Mer and Flicourt, 2015; McAlpine, Hossain and Zimmerman, 2016; United Nations General Assembly, 2022.

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22 ICRW, 2018; UN-Women, 2021.

23 Goli and others, 2021.

24 Wodon and others, 2017; Mitra and others, 2020.

25 Wodon, 2017a, 2017b, 2017c.

26 Cunha and Heckman, 2007; Wodon, Nguyen and Tsimpo, 2016.

27 Goli and others, 2021; Wodon and Yedan, 2017a, 2017c, 2017d.

28 Namely, Algeria, Egypt, Iraq, Jordan, Mauritania, Morocco, the State of Palestine, Qatar, Somalia, the Sudan, the Syrian Arab Republic, Tunisia and Yemen.

29 Interpolation is the procedure for deriving a value between two known values within a sequence of values.

30 Extrapolation refers to reckoning an unknown value based on extending a known sequence of values.

31 For the Sudan and Tunisia, we have used the latest MICS data.

32 Bahrain, the Comoros, Djibouti, Kuwait, Lebanon, Libya, Oman, Saudi Arabia and the United Arab Emirates have

been excluded from the analyses due to a lack of available comparable data sets.

33 Coale and Demeny, 1966; Coale and Guo, 1989; United Nations, 1982.

34 A detailed methodology is available in the annex.

35 The population age-sex distribution used in the modelling also incorporates refugee populations.

36 Countries, namely Bahrain, the Comoros, Djibouti, Kuwait, Lebanon, Libya, Oman, Saudi Arabia and the United Arab Emirates, have been excluded, as the data is either unavailable or, if available, is incomplete or not available for the latest years.

37 Defined as "percentage of women (aged 20–24 years) married or in union" before age 18.

38 The total number of women who married under the age of 18 in these countries is reported in the annex (figure 1).

39 Wodon and others, 2017; Mitra and others, 2020; Goli and others, 2021.

40 Onagoruwa and Wodon, 2017a, 2017b, 2017c.

41 Goli, Rammohan and Singh, 2015.

42 Wodon and others, 2017; Mitra and others, 2020; Goli and others, 2021.

43 Wodon, 2017c.

44 Raj and others, 2010; Nasrullah and others, 2014; Wodon, 2017d; UN-ESCWA and others, 2022.

45 Wodon and others, 2017; Mitra and others, 2020.

46 Field and Ambrus, 2008; Nguyen and Wodon, 2015a, 2015b; Wodon, Nguyen and Tsimpo, 2016.

47 Chaaban and Cunningham, 2011; Khanna, Verma and Weiss, 2013; Smith and Haddad, 2015; Wodon, 2017b.

48 Wodon and Yedan, 2017b.

49 ILO, 2020.

50 Tiwari, Goli and Rammohan, 2022.

51 The total GDP ($404.14 billion) of Egypt from the World Bank for the year 2021 is in line with the projected total GDP estimates of the study ($386.98 billion). Similarly, the World Bank GDP estimates for 2021 for Jordan ($45.24 billion), Mauritania ($8.23 billion), Morocco ($132 billion), Yemen ($21.06 billion), Algeria ($167.98 billion), Iraq ($207.89 billion), Qatar ($179.57 billion), the State of Palestine ($18.04 billion), Somalia ($7.29 billion), the Sudan ($34.33 billion), and Tunisia ($46.84 billion) also align with the projected total GDP estimates from the study for the respective countries ($46 billion, $8 billion, $117 billion, $22 billion, $152 billion, $224 billion, $161 billion, $19 billion, $7 billion, $34 billion, and $44 billion, respectively). The World Bank GDP estimates for the Syrian Arab Republic, as available for 2018 ($21.45 billion), are also aligned with our 2016 estimates of $20 billion.

52 Estimated as: average economic cost per household attributable to child marriage = average economic cost per child marriage household (minus) average economic cost per non-child marriage household.

53 Also calculated as the difference between child marriage household and non-child marriage household.

54 Wodon and Yedan, 2017a.

55 Wodon and others, 2017; Savadogo and Wodon, 2017b; Mitra and others, 2020.

56 Wodon and others, 2017; Mitra and others, 2020.

57 Wodon, 2017a, 2017b, 2017c, 2017d.

58 Goli, 2016; Wodon, Nguyen and Tsimpo, 2016.

59 Wodon, Nguyen and Tsimpo, 2016; Wodon and Yedan, 2017a, 2017c, 2017d.

60 Goli, 2016; Wodon, 2017d; Wodon and Yedan, 2017b.

61 Malhotra and Elnakib, 2021.

The present study explores the critical issue of child marriage, which has profound lifelong implications for girls' education, health and economic outcomes. Despite a declining trend, child marriage continues to be prevalent in the Arab region, affecting around one in five girls who marry before the age of 18, with varying levels observed across countries. The study plays a crucial role in advocating for attention to this urgent problem by presenting the economic costs of child marriage in 13 Arab countries. The findings emphasize that child marriage has demographic, social and health implications, resulting in direct and indirect monetary and non-monetary impacts at the individual, household and State levels.

To provide a comprehensive assessment, the study employs a wide range of indicators and projects economic costs up to the year 2050. The findings suggest a GDP loss of 3.2 per cent in 2021 due to child marriage, with a cumulative loss of approximately $3 trillion between 2021 and 2050. The report underscores the need for comprehensive action, including family planning, health care, education and labour market opportunities for women, to prevent child marriage and alleviate its adverse economic consequences. Such measures are crucial in safeguarding the well-being and future prospects of young girls and contributing to the region's sustainable development.

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