Demographic profiles of five countries in Southern Africa and implications for the demographic dividend

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Contents

I. Introduction

Relative to other countries in sub-Saharan Africa, the five countries of Southern Africa (Botswana, Lesotho, Namibia, South Africa, and Swaziland) have tended to experience earlier and more rapid demographic transitions, as well as more significant HIV/AIDS epidemics than encountered elsewhere on the continent[1]. In combination, these two factors bring particular dynamics to bear on the current and projected demographic structures in those countries. The consequent relatively slow rates of population growth currently observed and the effects of the epidemic on dependency ratios means that the likelihood and magnitude of a demographic dividend in Southern Africa will be somewhat different to that anticipated in other parts of the developing world.

To advance understanding of the effects of these demographic pasts, presents and futures on the developmental prospects in the region, this paper provides essential background information and data on demographic diagnostics and future demographic trends in the Southern African region. The report is structured in eight sections. Section II provides a brief overview of the literature on the determinants of demographic change, together with a brief summary of the empirical evidence – such as it exists – on demographic trends in the region to date. Section III describes the data used in the five country-specific sections (Sections IV through VIII) in which the projected demographic dynamics in those countries are explored in detail. Section IX presents a comparative overview of some of the indicators presented in the country-specific sections, comparing the five countries against each other, as well as against the following regional groupings: sub-Saharan Africa; the lower and upper middle income countries; the BRICS and high-income OECD nations; East Africa. Section X draws together the most important insights from the data and analyses presented.

II. Literature review

This section very briefly considers the essential literature on the determinants of demographic change. Each of the three components of that change are considered separately, In each case, the 'global' literature on the causes and determinants of that change are discussed, before moving on to consider regional specificities that may also be in play in determining demographic change in Southern Africa.

A. Demographic transition and the demographic 'dividend'

The idea of the "demographic transition" has been around for nearly a century and is used as a heuristic to describe, in the most general terms, how a population's birth and death rates change over time. The simplest description of the demographic transition is that offered by (Demeny 1968:504): "In traditional societies, fertility and mortality are high. In modern societies, fertility and mortality are low. In between, there is demographic transition". Stylistically, the demographic transition can be represented as in Figure 1. Prior to the onset of the demographic transition, it is argued, fertility and mortality rates tend to be high and of roughly equal magnitude, meaning that (in the absence of migration), population growth will be slow. At the onset of the demographic transition, mortality rates (particularly those of children and young adults) begin to decline, typically before fertility rates do, leading to an increasing rate of growth

[1] The notable exception to this generalisation is Zimbabwe which, although classified by the United Nations as an East African country, shows strong demographic similarities to its Western and Southern neighbours, Botswana and South Africa

in the population. This increase continues for some time after fertility rates begin to decline until the pace of decline in fertility rates exceeds that of the decline in mortality rates, and the rate of increase in the size of the population slows. Eventually, according to the theory, a new equilibrium is attained when fertility and mortality rates are again approximately equal, albeit at a much lower level than that pertaining at the start of the transition.

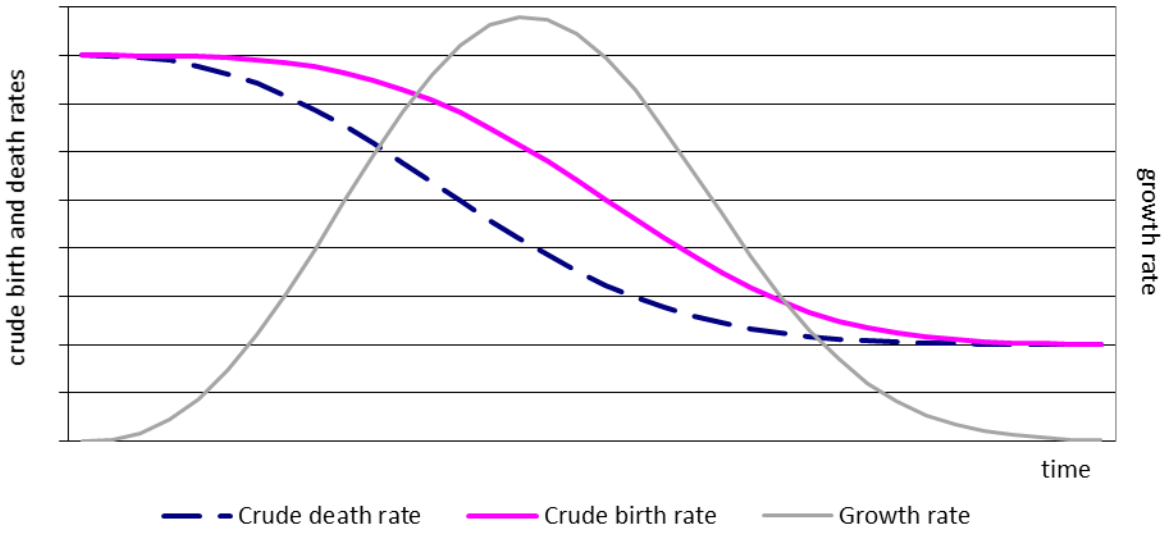

Figure 1 Stylised representation of the demographic transition

The theory of demographic transition has been subjected to extensive and significant criticism (see, for example Mason (1997) and Szreter (1993)). Some of these flaws are demonstrated by the absence of scales on either x- or y-axes in Figure 1.This is intentional, as the theory of demographic transitions lacks predictive ability as to the timing of the transition (when it begins; how long the process takes), the end point of the transition, or the rates of population growth to be experienced during the transition. Some countries have progressed extremely rapidly through the demographic transition (e.g. South Korea achieved a transition in around 25 years), while others – including, as we shall see, South Africa – have yet to complete their demographic transition half a century or more after they started. Nevertheless, the idea of a demographic transition still offers a useful typification of how countries evolve demographically. (Szreter 1993; Mason 1997)

More recently, the demographic transition has secured a new lease of life through the notion of the demographic 'dividend'. Early, influential, writing on the topic (e.g. Bloom, Canning and Sevilla (2002) and Mason (2007)) argued that, as countries progress through the transition, the age structure of the population changes, from being a relatively young population (with a large proportion of the population under the age of 15) to a relatively old population (with a significant proportion of the population aged over 65). In between, it is argued, there is a demographic 'sweet spot' (or 'demographic window of opportunity') where the proportion of the population of working age (i.e. those between 15 and 65) reaches a maximum. Under certain conditions (one of which is the relatively full employment of that segment of the population, or at the minimum the ability of the economy to productively absorb new entrants into the labour market so as to keep unemployment rates constant), it is argued this relative concentration of the population within the economically active ages provides the opportunity for more rapid and sustained

economic growth. This is the 'first' demographic dividend, and – by definition – it is transient in nature.

It is further argued, however, that a 'second' demographic dividend may emerge from the savings and capital accumulation of the labour force while working, which can be used to fund consumption in old age as well as capital investment. This 'second' dividend is argued to be more durable than the first.

Three metrics are commonly applied in assessing the prospects for a (first) demographic dividend. The first two are the youth dependency ratio, measured as the ratio of the population aged under 15 relative to that between the ages of 15 and 64; and the aged dependency ratio, the ratio of the population aged 65 and over relative to the population aged 15-64. Usually, these ratios are expressed per hundred population, and their sum gives a total dependency ratio – a measure of the overall ratio of dependents to those of working age in a population.

The third metric is the 'demographic window' defined by United Nations (2004) to be open when the proportion of the population under the age of 15 is less than 30 per cent, and the proportion of the population aged 65 and over is less than 15 per cent. The demographic window is represented stylistically in Figure 2. In the period before 1986, the proportion of the population under the age of 15 exceeds 30%; in the period after 2020, the proportion of the population aged 65 and over exceed 15%. In between those dates, there is a demographic window, during which the proportion of both young and elderly people in the population is low, with a concomitantly larger proportion of the population that is of working age.

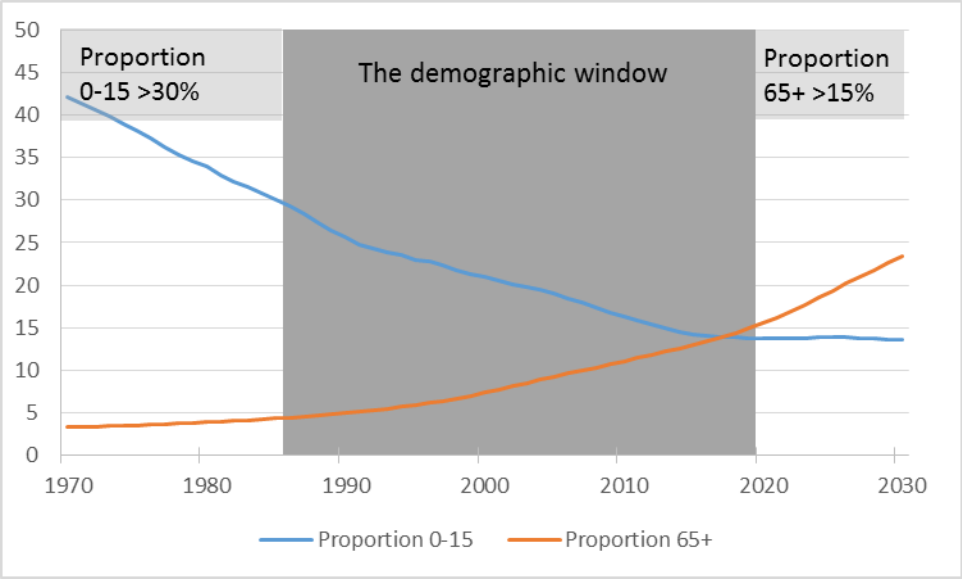

Figure 2 Stylised representation of the 'demographic window'

All three metrics are derived for the Southern African countries covered in this report.

B. Fertility

1. General theories

There is no single theory of how and why fertility changes as a society proceeds through the demographic transition, nor is there general agreement even on how many distinct such theories have been proposed (Hirschman 1987; van de Kaa 1996; Mason 1997). The broad explanations

invoked include the decline in in child mortality resulting in greater numbers of children surviving to adulthood; the shift in economic value of children, largely brought about by the introduction and expansion of compulsory education; diffusion of new ideas and ideational change regarding both contraceptive use and family formation; as well as structural and economic changes in the societies in question.

Regardless of what the underlying, distal, causes of fertility change might be, there is general agreement that those distal causes can only affect fertility through a limited number of 'proximate determinants'. These determinants, first set out by Davis and Blake (1956) and refined and simplified by Bongaarts (1978; 1982), are behavioural factors that directly affect fertility. In Bongaarts' formulation, the four most important of these are the use of contraception, the prevalence, type and age-pattern of marriage, the extent of post-partum infecundability arising from breastfeeding and post-partum abstinence as culturally-sanctioned practices, and the incidence of termination of pregnancy. Of these four, in almost all circumstances, and intuitively obviously, modern-contraceptive use plays the biggest role in modifying fertility levels in a population.

Regarding contraceptive use, the dominant paradigm for most of the last 50 years has been that contraception is used for two distinct purposes: to limit the number of children borne to a couple, or to space children contingent on the age of the currently-youngest child. More recently, this simple binary classification has been challenged as it has been argued that couples may have other motivations for making use of contraception, specifically that couples may use contraception to postpone further childbearing (which clearly is neither limiting nor spacing) until some future point in time (Timæus and Moultrie 2008). As described in the following section, this attribution of more complex fertility intentions has particular relevance for sub-Saharan Africa and Southern Africa particularly.

2. Regional specificities

There are two aspects that are of especial importance in understanding the past, present, and possible future course of fertility trends and patterns in Southern Africa.

The first relates to women's use of contraception. Fertility in South Africa, for example, began falling in the 1960s as the then apartheid-government sought to make family planning more widely available to its population, a policy borne out of the realisation that the African population fertility and population growth rates far exceeded those of White South Africans. Despite a family planning programme lauded by Caldwell and Caldwell (1993) as being 'super-Asian' in its intensity, the decline in fertility rates was hardly exceptional, falling from around 6 children per woman in the 1960s to 4.3 children per woman in the late 1980s. Nevertheless, what is most noteworthy, is that the pace of fertility decline in South Africa was markedly slower than might have been expected given the rapid expansion of family planning programmes and commensurate rapid uptake of modern contraception in the country. The rapid lengthening of birth intervals in the country from the 1960s onwards, largely independent of either women's birth cohort or the number of children borne, is consistent with the postponement hypothesis: women in South Africa were using contraception neither to limit nor space their births. With the possible exception of Namibia, which was to all intents and purposes a fifth South African province before independence, other countries in the region had less effective family planning programmes. Nevertheless, a similar phenomenon has been observed, albeit with birth intervals somewhat shorter than the median birth intervals in excess of 60 months observed in South Africa, in all countries in the region, and across sub-Saharan Africa more generally (Moultrie, Sayi and Timæus 2012). The pattern of birth intervals lengthening largely independently of age

or parity effects is not found elsewhere in the developing world. Unsurprisingly, the uptake of modern methods of contraception is almost entirely responsible for the increase in birth intervals: median birth intervals have remained almost constant (as expected) among non-contracepting women across sub-Saharan Africa while those intervals have increased markedly among contracepting women. With typically much higher use of modern contraception in Southern Africa relative to other parts of the sub-continent, this process of lengthening birth intervals has been more dramatic than elsewhere.

The possible reasons for the widespread adoption of postponement as a family building strategy in sub-Saharan Africa have been described elsewhere (see, for example, Johnson-Hanks (2007) and Moultrie and Timæus (2014)), with an important contributor being the relatively higher insecurity and uncertainty that operates at both individual and institutional levels in the region. The implications of this for the future course of African fertility declines suggest that without extensive and far-reaching efforts to improve social and political institutions in sub-Saharan Africa, postponement may continue to be a significant family building strategy. In turn, this has implications for the future course of fertility decline, as contraception used for this purpose will result in slower declines in fertility than might be encountered if women used contraception for family limitation at relatively low numbers of children borne (Timæus and Moultrie 2013). The very rapid declines in fertility observed, for example, in East Asia as they proceeded through their demographic transitions are unlikely to be realised.

The second regional specificity relates to the impact of HIV/AIDS. While the major demographic effect of the disease is on mortality, as described in a subsequent section, infection with the disease has an impact on fertility too. Biologically, it is now understood that infection with HIV may inhibit conception and successful carrying of a foetus to term; while behaviourally, the public health interventions to encourage couples to use barrier methods (mostly, condoms) during sexual intercourse to avert infection might also have a knock-on effect on conception. Hard evidence on this is hard to come by, not least of all because of the difficulties in setting up natural, controlled, experiments to collect the data, and the absence of a strong counterfactual as to what fertility levels might have prevailed had there not been the epidemic. Nonetheless, the little evidence in this regard suggests a rather limited effect of HIV on fertility: in a study among non-contracepting women in Uganda in the 1990s, Zaba and Gregson (1998) suggest that the level of total fertility may reduce by about 0.4% for every 1% of the general female population infected. On this heuristic, should 15% of the general female population be infected with HIV, the impact on total fertility would be of the order of 6%. If total fertility was 5 children per woman without HIV, the resultant effect would be a TFR of around 4.7 children. Other studies, e.g. du Plessis (2003) and United Nations (2002) also reached the same conclusion about the rather small effect of HIV on fertility, a finding further confirmed by Juhn, Kalemli-Ozcan and Turan (2013). Where contraceptive use is relatively high, as is the case in South Africa and several other countries in the region, the effect on the level of total fertility would be even smaller. With such a limited effect on fertility, the effects of ARVs in reducing viral loads, and hence the fertility-suppressing biological effects of infection, the roll-out of ARVs will have a negligible effect on fertility dynamics in the future.

C. Mortality

1. General theories

Unlike fertility, the theories of mortality decline inhabit the realm of biomedicine rather than sociology. Advancements in medical care and the treatment of disease, together with improved

nutrition, education and sanitation account almost entirely for the general reduction in mortality over the last few centuries (see, for example, Grundy (2005)). However, it is also the case that reductions in child and infant mortality have the greatest impact on population-level metrics such as e_0, the life expectancy at birth, and it is in this area where much of the attention on population health interventions has been focussed, as can be seen from the targets for reducing the mortality of children under the age of five that were set as part of the Millennium Development Goals.

2. Regional specificities

Despite difficulties in improving and upgrading state health, infrastructure and education facilities, substantial progress was made in reducing infant, child and adult mortality in the countries of Southern Africa up until the 1980s. The spread of the HIV epidemic, which has remained concentrated in East and Southern Africa, resulted in significant reversals in mortality from the mid-1980s onwards, especially among children and adults of prime economic age.

The development of antiretroviral therapies together with specific interventions to avert mother-to-child transmission of HIV in utero and postpartum has played a hugely important role in reducing (and almost eliminating) HIV-related mortality among children, and delaying or deferring HIV-related mortality among adults.

In addition to its direct effect, HIV has also played a significant role as a co-factor in spread of tuberculosis. Furthermore, a downstream consequence of the epidemic has been to compound the uncertainty surrounding estimates of mortality in the region. Civil registration and vital statistics systems are, with the exception of South Africa, substantially incomplete: this has meant that empirical estimates of mortality have had to be derived largely from survey data (such as the Demographic and Health Survey, which has been able to provide reasonably robust estimates of child mortality, especially at a national level) or from the application of the suite of 'indirect techniques' for demographic estimation (Moultrie, Dorrington, Hill *et al.* 2013). However, most of these methods of estimating mortality suffer from extensive biases arising from the ways in which a generalised HIV epidemic violates the assumptions required for the methods to work well.

Estimates of mortality, therefore, are frequently based on the results of demographic and epidemiological models, as described in Section III.

D. Migration

1. General theories

Migration is, and has long been, the least understood, least well measured, and least theorised of the three principal demographic forces. General patterns of migration, including the gravitational and age-selective nature of migration was identified over a hundred years ago by Ravenstein (1889). Furthermore, while fertility and mortality patterns can be expected to exhibit strong regularities over time, the same cannot be said of migration. Sudden and capricious policy changes and economic booms and busts (neither of which lend themselves to accurate modelling or quantification) can fundamentally change the extent (and even the direction) of migration patterns in a very short period of time.

While these limitations are very real, at a national level migration plays a comparatively trivial role in shaping long-term population trends.

2. Regional specificities

Despite the general inability to accurately measure migration – a task made more difficult given the paucity of reliable data on the topic that is collected – some demographers (see Adepoju (2011), for example) have sought to develop awareness and understanding of migration trends in sub-Saharan Africa. Attention is drawn to the role of migration and mobility in contributing to the initial spread of HIV along the trucking routes of East Africa (which explains in part the much lower levels of prevalence identified in Namibia, for example) and to the education-specific context of much migration in the region (where, for example, South Africa simultaneously loses skilled labour to the developed countries while acting as a magnet for skilled labour from poorer countries in the region).

III. Data used

This section describes the data used in the preparation of the country-specific tabulations and representations that appear in the following five sections. There are of course, many other sources of data that might be used to shed light on past or current demographic and socio-economic dynamics: data from censuses, Demographic and Health Surveys (DHS), Multiple Indicator Cluster Surveys (MICS), Living Standards and Development Surveys and the like. These are not used in the analyses that follow for two principal reasons.

First, the United Nations Population Division routinely draws on the results of those surveys to establish demographic parameters for use in their population projections. Estimates of fertility and mortality, for example, are incorporated into their projection models of fertility and mortality trends.

Second, a significant proportion of these data sets are not in the public domain. Most census data from countries in the region are not made publicly available, and several countries in the region have only conducted a single DHS (e.g. South Africa, in 1996, and Botswana in 1988). The paucity of reliable empirical data is the biggest challenge facing demographers in the region.

A. World Population Prospects (2012 revision)

The data used here are drawn mostly from the 2012 Revision of the United Nations Population Division World Population Prospects. The WPP is a comprehensive set of population projections, from 1950 to 2100[2]. The projections take into account historical trends in fertility, mortality and migration, and projects these forward, taking into account the population sizes reported from censuses or population registers.

The procedure used in producing the projections is described in detail in UN Population Division (2014). For countries affected by HIV/AIDS, the effects of the epidemic are taken into account by using the Spectrum suite of models (produced by The Futures Group) to provide additional inputs into their projections. Neither the international migration, nor the HIV/AIDS-related output from Spectrum is released by the UN Population Division in the World Population Prospects. However, these models (one for each country) are made available by UNAIDS[3] on

[2] While the World Population Projections extend to 2100, results are presented here only up to 2050. There are two reasons for this. First, any cohort-component population projections past 2050 will be subject to significantly wider uncertainty, making the results increasingly illustrative. Second, the output relating to HIV/AIDS from the Spectrum models that form part of this study do not go that far into the future.

[3] Available via http://www.unaids.org/en/dataanalysis/datatools/spectrumepp2013

request to researchers. Accordingly, the data on HIV/AIDS and international migration are extracted from the inputs (international migration) and outputs (from the AIDS Impact Module, AIM) of the Spectrum model currently used by the United Population Division. Due to slight differences in how the two projections interface and how results are prepared by the United Nations Population Division for release into the public domain, there are discrepancies between the demographic outputs produced by the two different models. For the purposes of this report, however, the differences should be regarded as being immaterial.

The modelling of demographic and epidemiological dynamics associated with HIV is extremely complex. Widely different results can, and are, produced by different models. However, of the extant models, only Spectrum has been parameterised for, or applied to, all the countries in Southern Africa. However, as with the discussion on migration above, future developments in terms of HIV-related demography are highly uncertain: a cure, vaccine, or new or improved treatments for those infected may be developed, would fundamentally alter the presumed demographic implications associated with infection with the virus. Similarly, assumptions about the regularity and efficacy of other interventions (e.g. promotion of condom use; male circumcision; information and education campaigns) would also shape the modelled effects of the epidemic. Finally, roll-out of treatment, and – crucially – survival post-infection by age, cohort, period, duration of infection, and stage of initiation of treatment should all be taken into account.

While a counterfactual of what the population structure of these countries would look like has the HIV/AIDS epidemic not occurred is only of academic interest, the effect of the epidemic on the population structure of the countries of Southern Africa has been, and will continue to be, dramatic.

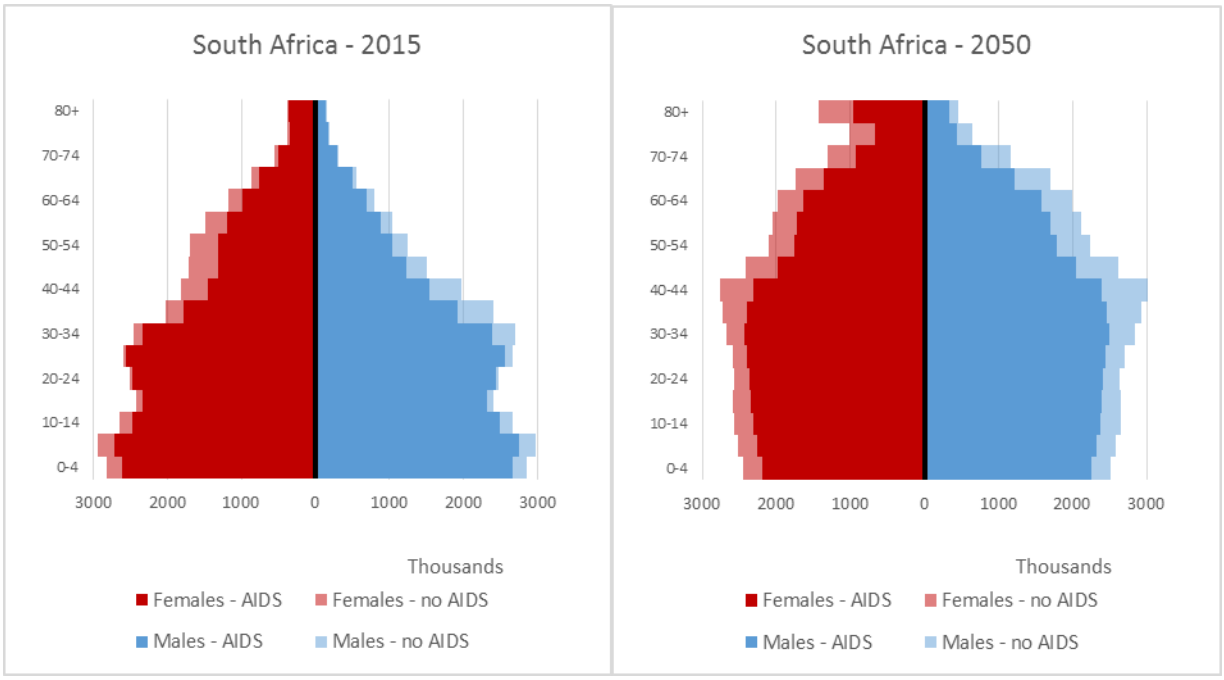

Figure 3Population pyramids for South Africa in 2015 and 2050 as they might have been without HIV/AIDS

Figure 3 shows the population pyramids for South Africa in 2015 and 2050, as projected by the 2012 WPP, and adjusted to reflect the situation had there not been an HIV/AIDS epidemic. In both years, the population of working age would have been quite markedly larger in the absence of the epidemic. On one level, this might be thought to reduce the demographic dividend quite

considerably, particularly once the economic implications of morbidity and mortality are taken into account. On another level, however, in the absence of sustained reductions in unemployment, the additional population may not have been economically active in any event. The exact balance between these opposing forces is almost impossible to quantify.

The World Population Prospects, however, do not allow for subnational projections, or projections for specific population groups (as might be desirable in the case of South Africa, where there are enduring systemic inequalities in demographic and socio-economic variables based on race).

B. Population projections by level of educational attainment

This report also makes use of another data source to be able to better illustrate the human capital aspects of the projected populations of the five countries of the Southern African region. Over the last decade or so, Wolfgang Lutz and colleagues at IIASA have developed population projections that take into account anticipated changes in schooling enrolment, grade progression and completion. These projections make use of an earlier release of the WPP (the 2010 revision). While there are some noticeable differences between the 2010 and 2012 revisions (see box), this is not of particular importance here as the output from the IIASA projections provide output that allow the extraction of the population distribution by level of education, sex, age group and year.

While the IIASA projections present scenarios (based on different variants of the World Population Prospects and expected future educational developments), in this report we only make use of their Scenario 2, their 'medium scenario' – which is based on the medium variant of the World Population Prospects, and the Global Education Trend (GET) – which reflects "a Bayesian model that estimates the medium future trajectory in education-specific progression rates to higher levels from the cumulative experience of all countries over the past 40 years" (KC and Lutz 2014:5).

BOX: Summary of important differences between the 2010 and 2012 WPP

According to the documentation provided with the 2012 WPP, the differences between the two sets of projections come down to four factors: "

- The 2012 Revision used the same stochastic model for fertility projection that was used in the 2010 revision with only one modification: the AR1 model used for low-fertility countries was estimated using a Bayesian hierarchical model, and future long-term fertility levels were more data-driven and country-specific. The medium-fertility variant in the 2012 Revision corresponds to the median of 60,000 projected country trajectories.
- The 2012 Revision used two new stochastic models to project life expectancy at birth for all countries not significantly affected by the HIV/AIDS epidemic: the first model used a Bayesian hierarchical approach for modelling the rate of mortality improvement for women by level of life expectancy at birth. A second model was used to project the gender gap in life-expectancy conditionally on the level of female mortality. The medium-mortality variant in the 2012 Revision corresponds to the median of 100,000 projected country trajectories by sex.
- The 2012 Revision used new age-specific patterns of mortality improvement by level of mortality to project mortality patterns for countries with reliable recent mortality data by age and sex.
- In the 2012 Revision, the impact of HIV/AIDS on mortality was modelled explicitly for 39 countries where HIV prevalence among persons aged 15 to 49 was at one time equal to, or greater than, two per cent between 1980 and 2011. The 2012 Revision no longer includes the AIDS scenarios named No-AIDS, high-AIDS and AIDS-vaccine."

(UN Population Division 2014:40)

The IIASA projections include a number of scenarios that allow evaluation of alternative future scenarios of education levels in a population. However, owing to the highly complex feedback mechanisms – which affect fertility, mortality and migration patterns – it is not possible to incorporate meaningfully output from scenarios other than their default projection into the WPP projections. A particular limitation, though not in itself hugely important, in the IIASA models is that the volume of migration incorporated into their model is not itself education-specific. In some contexts, migration may comprise the less-skilled moving to take on menial jobs (e.g. Bangladeshi construction workers in the Middle East), or – conversely – may comprise the more highly skilled moving to more developed countries for economic reasons. While it has been noted that volumes of international migration are seldom material in the context of national population dynamics, the differential loss or gain of skilled labour through migration may have a more disproportionate impact on economic growth and human capital development prospects.

C. World Urbanization Prospects

The final data source that is used in this project is the data from the United Nations Population Division World Urbanization Prospects (2014 Revision). Unfortunately, the data from the WUP are not disaggregated by age or sex, so only a national trend in urbanization can be presented. These data provide a small, but important, insight into the change in the spatial distribution of the total population in future.

IV. Botswana

A. Population and crude rates of fertility and mortality, 1950-2050

The essential changes in the population of Botswana between 1950 and 2050, as indicated by the historical and projected data in the WPP, are evident from Figure 4.

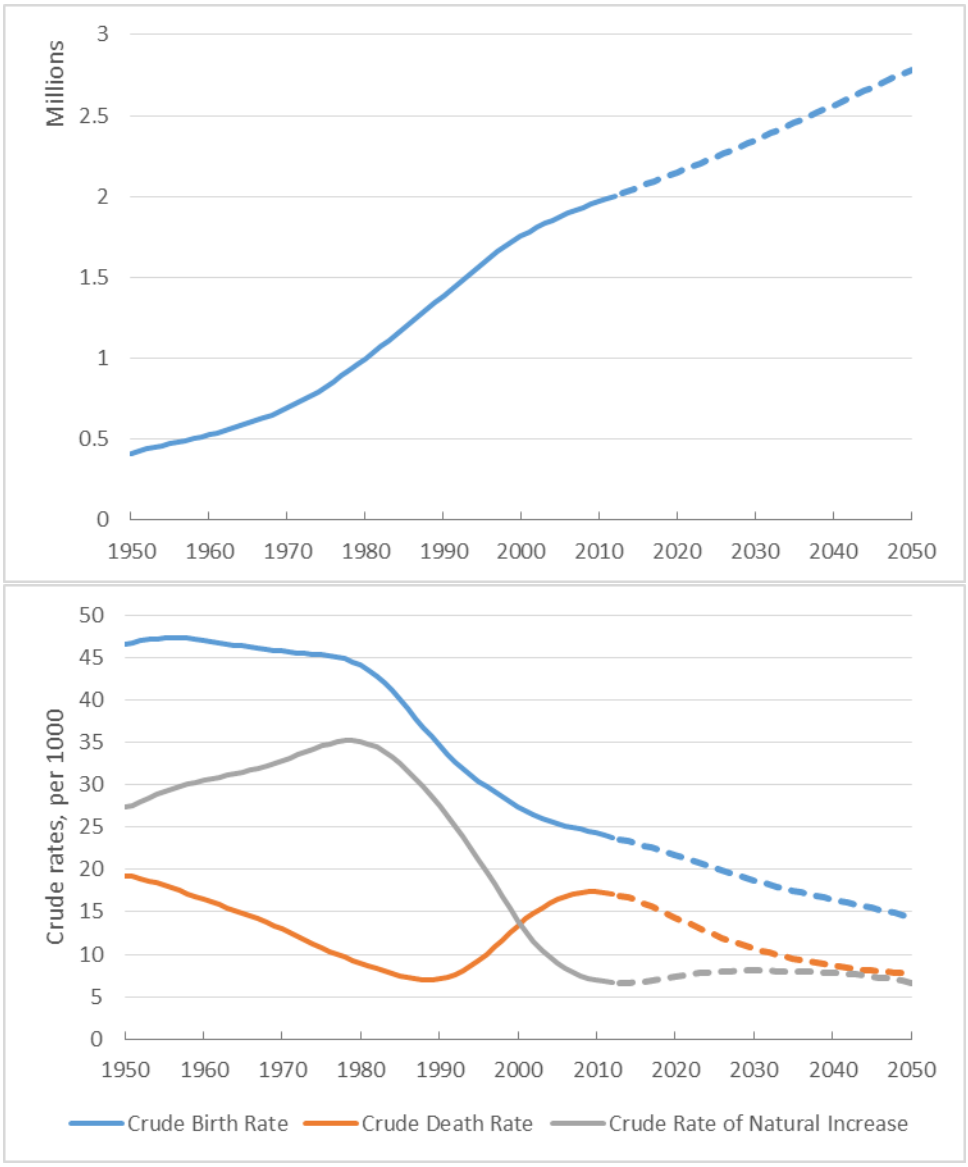

Figure 4 Total population (top panel), and crude rates of birth, death and natural increase (bottom panel), Botswana 1950-2050

Note: Dotted segments represent projected data

The population has increased from just under half a million people in 1950 to 2.06 million in 2015 and is projected to reach 2.78 million by 2050. As can be seen from the second panel of Figure 4, the rate of natural increase in the population increased sharply between 1950 and the mid-1980s, before declining rapidly thereafter. During this time, the population has experienced a significant demographic transition, as indicated by the decline in crude death rates up until 1990 (initially slowly up until the 1980s, thereafter faster) and the start of the decline in crude birth rates in the late 1970s. The rate of natural increase (the difference between the crude birth and crude death rates) reached a peak of around 3.5 percent per annum in the late 1970s just before fertility began to fall, and had stabilised at around 0.7 per cent per annum by 2015. The projections assume very similar patterns of change in the crude birth and death rates, resulting in almost constant growth of around 0.8 per cent per annum over the next 35 years.

The effect of HIV/AIDS-related mortality on the crude death rate is clearly visible after 1990, with the crude death rate more than doubling between 1990 and 2010.

As mentioned in the literature review, future trends in migration are almost unknowable. The WPP assumes, however, that Botswana will be a net recipient of international migrants. In the five years from 2015-2019, the WPP assumes 20 000 immigrants into the country, falling to 10 000 immigrants in each subsequent five year period between 2020-2024 and 2045-49.

The United Nations Population Division's World Urbanization Prospects anticipates that Botswana will urbanise gradually, with 57.4 per cent of the population in urban areas in 2015 increasing to 69.9 per cent urban by 2050.

B. Demographic indicators for Botswana, 1950-2050

Figure 5 presents the most important demographic indicators for the population of Botswana over the period 1950-2050.

In terms of fertility (top panel of Figure 5), the total fertility rate began to early 1970s, with the number of births remaining almost constant at around 48 000 births per annum between 1980 and 2015. Over this same period, the total fertility rate fell from approximately 6.2 to 2.5 children per woman. Total fertility is assumed to reach the commonly (although not entirely accurately) regarded replacement level of 2.1 children per woman in 2030 and to decline still further thereafter. By 2050, the total fertility rate is expected to have fallen to 1.8 children per woman. The number of births each year, which has direct implications for health care and education systems, is expected to decline markedly, from around 47 500 births per annum in 2015 to around 40 000 births per annum by 2050.

Infant and child mortality[4] in Botswana fell by approximately two-thirds between 1950 and 1990. The risk of child death increased over the 1990s, mostly as a result of AIDS (specifically as a consequence of the vertical transmission of HIV from mothers to children) before declining again after 2000. Infant and under five mortality is projected to fall by a further 60 per cent between 2015 and 2050, to 11.4 and 13.5 deaths per 1000, respectively.

With the decline in child mortality up until 1990, life expectancy at birth increased by 15 and 16 years respectively for men and women. With the advent of HIV/AIDS, life expectancy at birth decreased dramatically between 1990 and 2005, to levels previously experienced in the mid-1950s. The trend in life expectancy also reveals the significant reversal in adult mortality experienced, with life expectancy at birth only expected to regain the levels achieved prior to the HIV/AIDS epidemic by around 2035, and to be around 70 years by 2050.

[4] The measure of infant mortality is ${}_1q_0$, the probability of a birth dying before his or her first birthday. The measure of child mortality is ${}_5q_0$, the probability of death between birth and the age of five years.

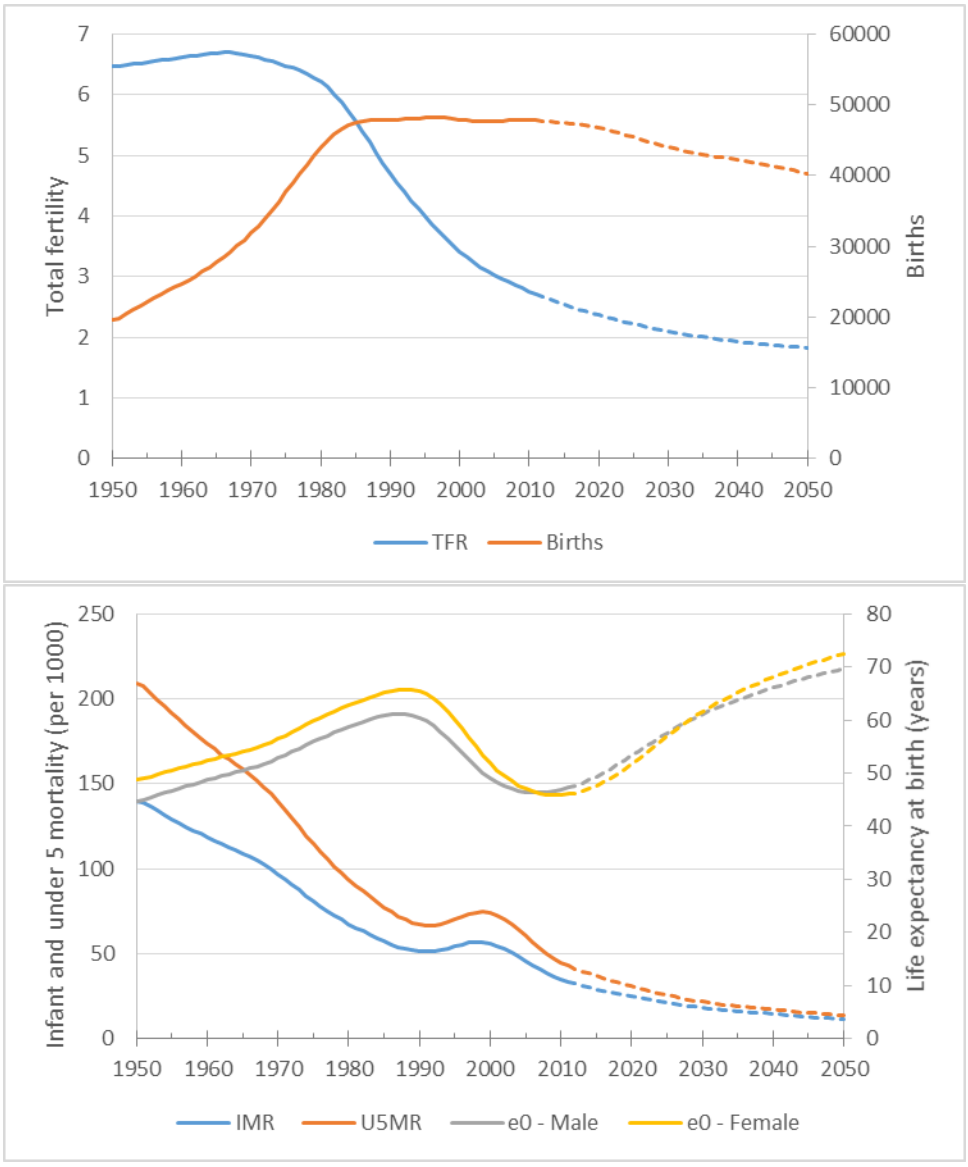

Figure 5 Measures of fertility (top panel) and mortality (bottom panel), Botswana 1950-2050

Note: Dotted segments represent projected data

Figure 6 shows the (period) probability of a 15 year old surviving to age 65 in Botswana over the century from 1950-2050. Having decreased up until the early 1990s, the period effects of HIV/AIDS are clearly evident after 1990, with this measure of adult mortality only falling to its pre-AIDS level by 2050.

The added burden of mortality experienced by adult women (as a consequence of both higher rates of infection with HIV, as well as lower non-AIDS mortality) is clear in the brief expected reversal of the usual mortality advantage that women have over men.

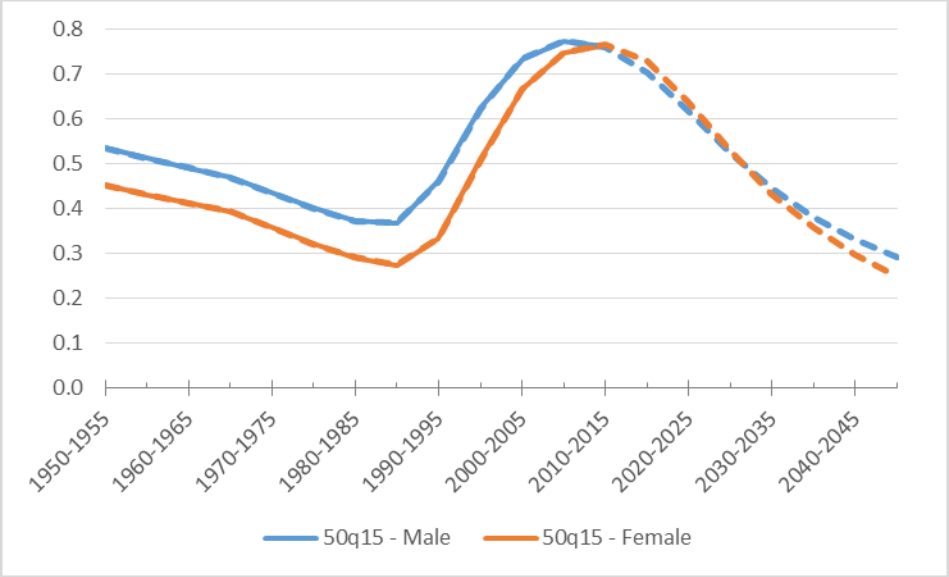

Figure 6 Trend in the probability of a 15 year dying before the age of 65, 50q15, by sex, Botswana 1950-2050

Note: Dotted segments represent projected data

C. The changing age-sex structure of the population of Botswana, 1950-2050

The age structure of the population of Botswana has changed dramatically over the 65 years between 1950 and 2015, from being typical of a high-population growth country, to one that is substantially through the demographic transition as indicated by the roughly constant numbers in the population under the age of 35 in 2015 (Figure 7). Above age 40, the effects of the past high rates of growth (those aged 40 and over in 2015 would have been borne in 1975 or earlier) and HIV on the population, are visible.

From 2030 onwards, the population pyramid for Botswana shows increasingly the effects of the lower fertility, mortality and population growth described above. The base of the pyramid begins to shrink, with the population increasingly concentrated in the age groups 20-40.

AIDS-free projections on the same basis as used in the 2012 WPP are not available, so the counter-factual scenario of what the population of Botswana might have looked like without the epidemic cannot be readily investigated.

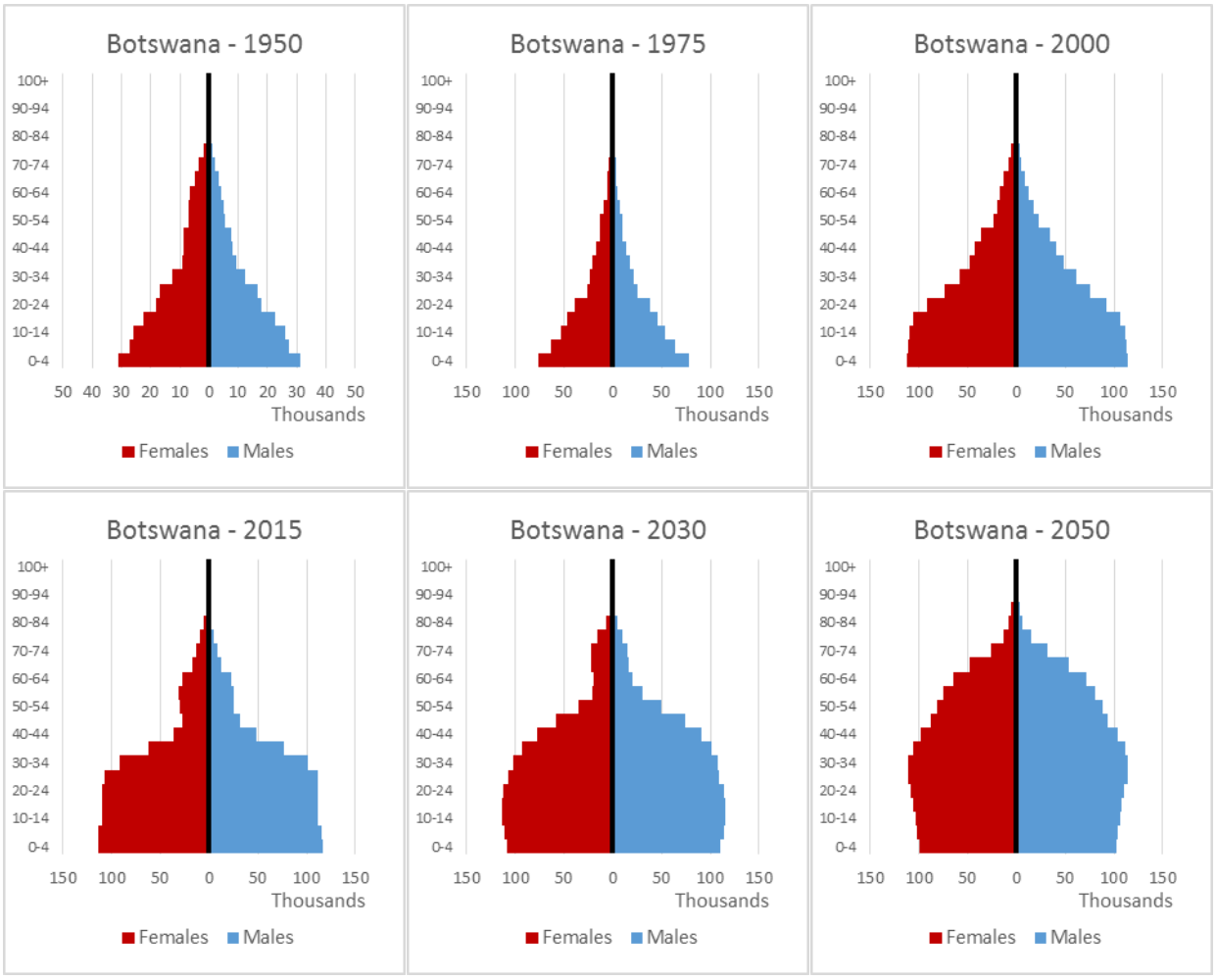

Figure 7 Population pyramids, Botswana 1950, 1975, 2000, 2015, 2030 and 2050

Note: Dotted segments represent projected data

D. HIV prevalence and AIDS-related mortality, 1975-2050

According to the default Spectrum model incorporating the effects of HIV and AIDS used by UNAIDS, HIV prevalence among adults of both sexes aged 15-49 in Botswana is expected to decline from over 20 per cent in 2015 and to stabilise at around 7.5 per cent in 2050 (Figure 8).

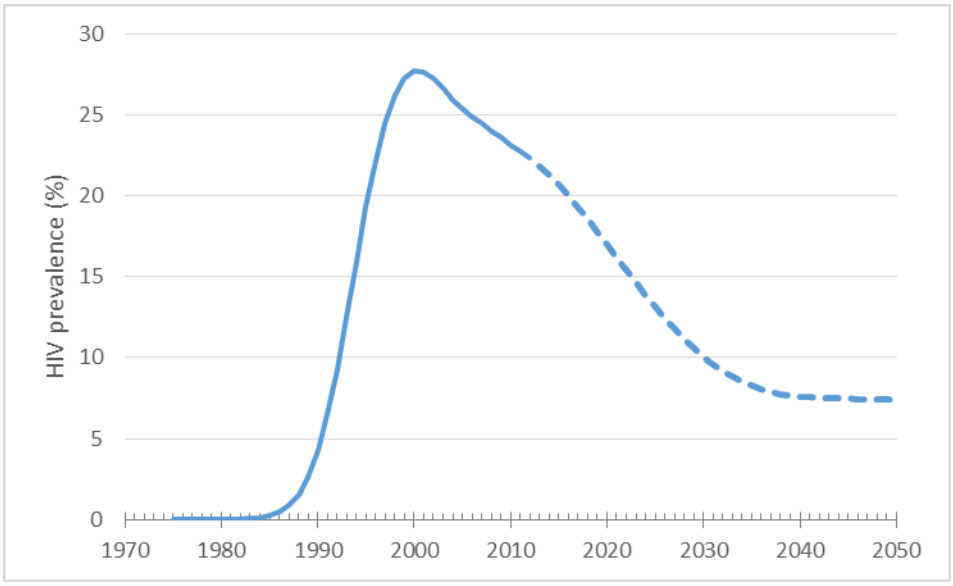

Figure 8 HIV prevalence among adults aged 15-49 (both sexes), Botswana 1975-2050

Note: Dotted segments represent projected data

In line with this modelled decline in prevalence, the proportion of all deaths that is attributable to HIV/AIDS (as distinct from all deaths among those who are HIV positive) is also expected to fall from over a third in 2015, to less than twenty per cent by 2050 (Figure 9). The projected component of the data is obviously highly sensitive to the assumptions made about treatment and survival on treatment.

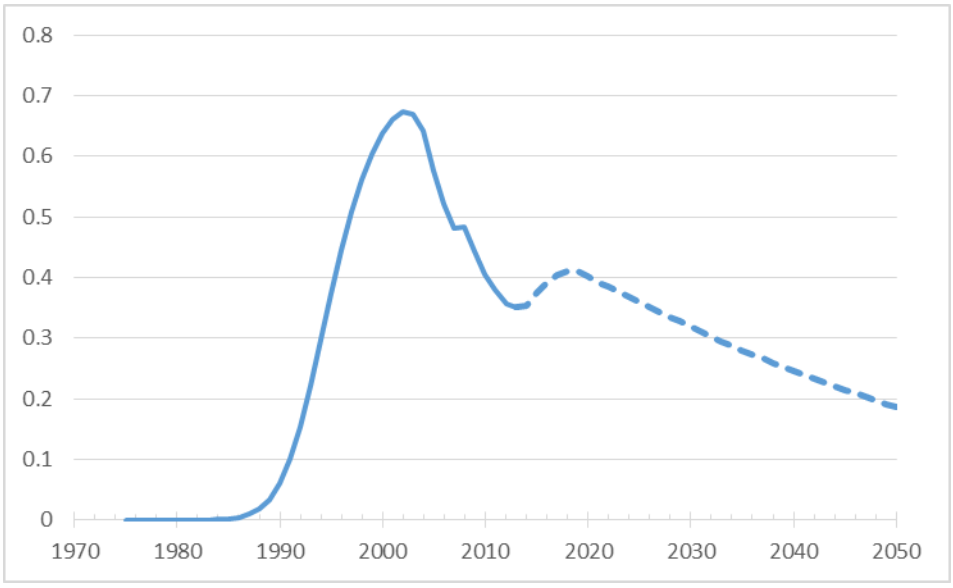

Figure 9 Proportion of all deaths attributable to HIV/AIDS, Botswana 1975-2050

Note: Dotted segments represent projected data

E. Dependency ratios and the demographic dividend

With the change in the population structure described in the previous section, dependency ratios will show marked changes over the period from 1950 to 2050 (Figure 10). The maximum dependency ratio was in the mid-1960s, with over 100 dependents (young and elderly) per 100 population aged 15-64. The overall dependency ratio (represented by the combined height of the two series) will decline from 58.3 dependents per 100 adults aged 15-64 in 2015 to a minimum of 41.6 in 2044, before starting an upwards trend. This reversal, it can be seen is directly attributable to the increasing share of the elderly in the population. The dependency ratio among the youth is expected to fall monotonically over the period. By these metrics, the demographic dividend will become increasingly evident for some time to come.

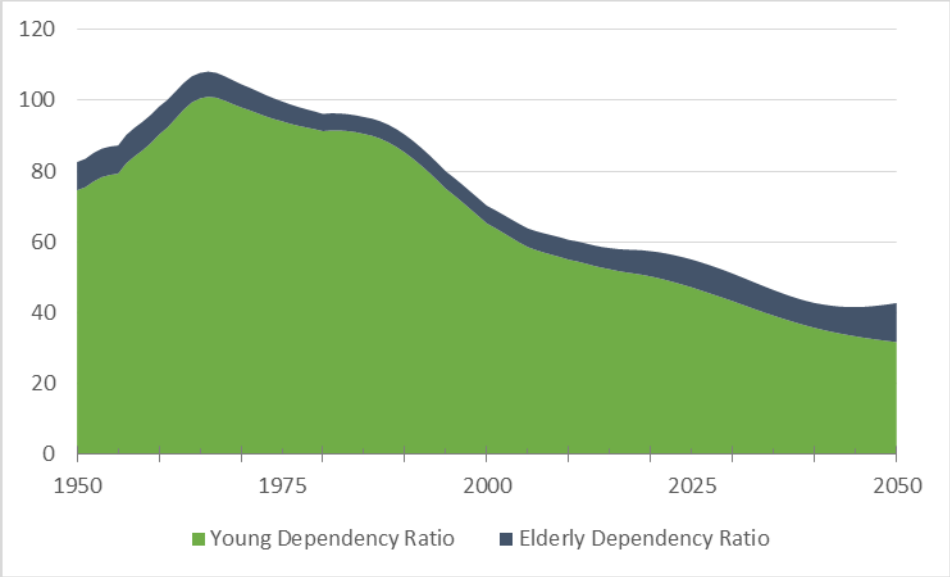

Figure 10 Young, old and total dependency ratios, Botswana 2015-2050

If, instead, one uses the more restrictive definition of the 'demographic window' (United Nations 2004), it can be seen that the World Population Prospects projections suggest that the 'window' will open in 2027, when the proportion of the total population under the age of 15 falls below 30 per cent (Figure 11). According to this definition and based on the data up to 2100 from the 2012 WPP, the 'demographic window' will remain open to 2069 (not shown).

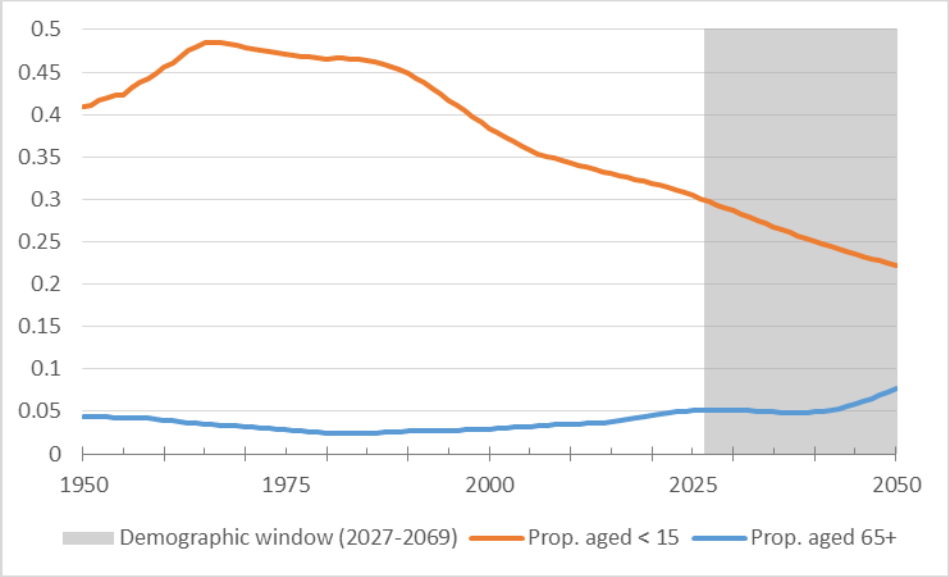

Figure 11 The demographic window, Botswana 1950-2050

F. Profile of the working age population by educational attainment

As described in Section III, data on projections by level of education produced by IIASA can be combined with the data from the World Population Prospects for the period 2010-2050. In Figure 12 we present population pyramids for Botswana that demonstrate the projected composition of the population by educational attainment for the population aged between 15 and 64.

Between 2020 and 2050, it is expected that the overall human capital stock will increase as the proportion of the population with only a primary education falls dramatically, and the proportion of the population (of either sex) with secondary or post-secondary education increases.

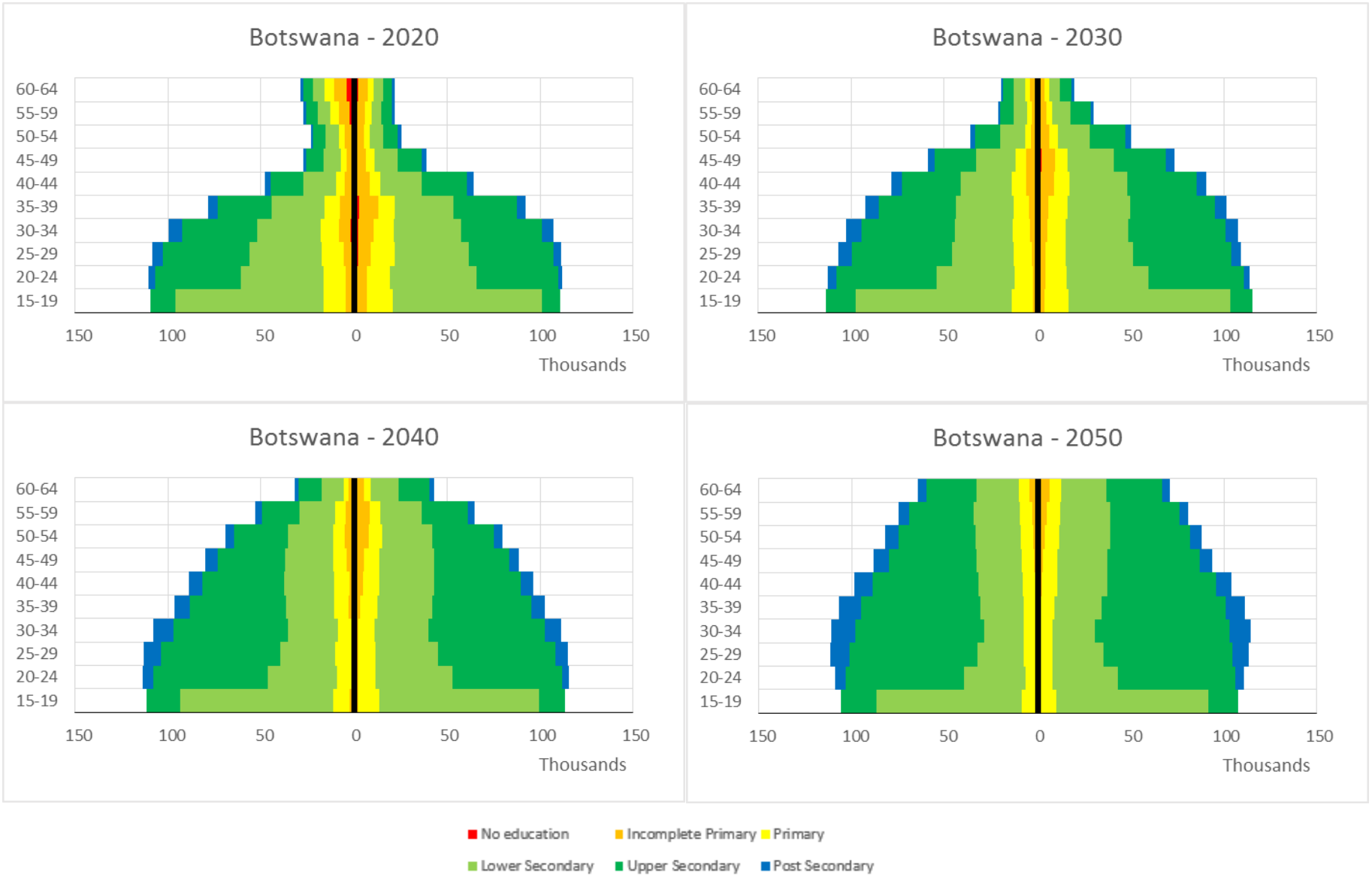

Figure 12 Population pyramids for Botswana by educational attainment, 2020-2050

G. Ageing

A further aspect of demographic change in Botswana over the next 35 years to be considered is the proportion of the population aged over 65, over 70 and over 75. This gives important information about the cost implications for social welfare systems should they exist, be expanded, or instituted.

While it should be borne in mind that the proportion of the population that is elderly is affected by changes in fertility and mortality at younger ages in earlier periods, Figure 13 shows that the proportion of the population aged 65 and over is expected to increase rapidly after 2040, rising from around 5 per cent of the population in 2040 to almost 8 per cent by 2050. (The start of the substantial increase in those aged 65 and over occurs in 2040, representing the cohort born in 1975). As the population ages further after 2050, the proportion of the population aged 70 and over, and 75 and over, will begin to increase faster than the proportion of the population aged 65 and over.

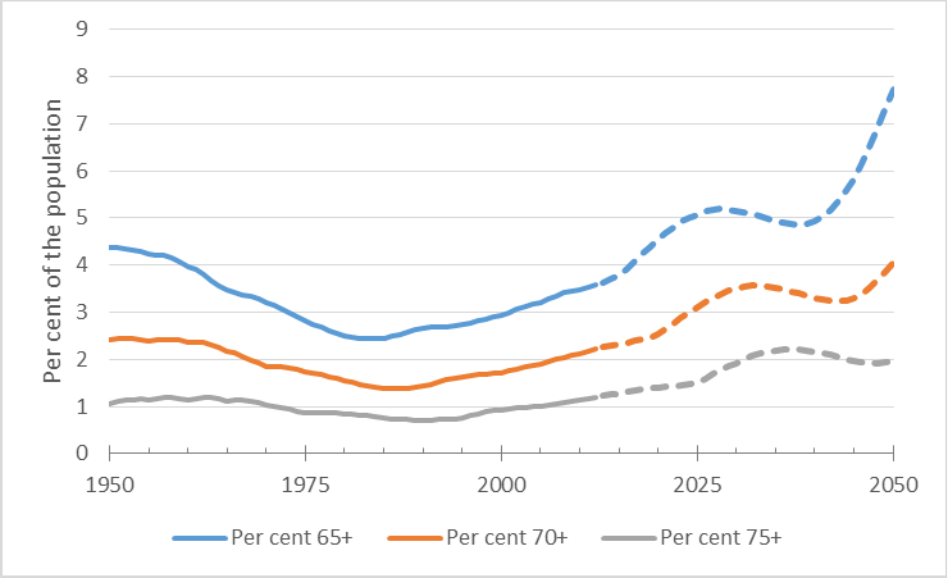

Figure 13 Proportion of the population aged over 65, over 70 and over 75, Botswana 1950-2050

Note: Dotted segments represent projected data

V. Lesotho

A. Population and crude rates of fertility and mortality, 1950-2050

The essential changes in the population of Lesotho between 1950 and 2050, as indicated by the historical and projected data in the WPP, are evident from Figure 14.

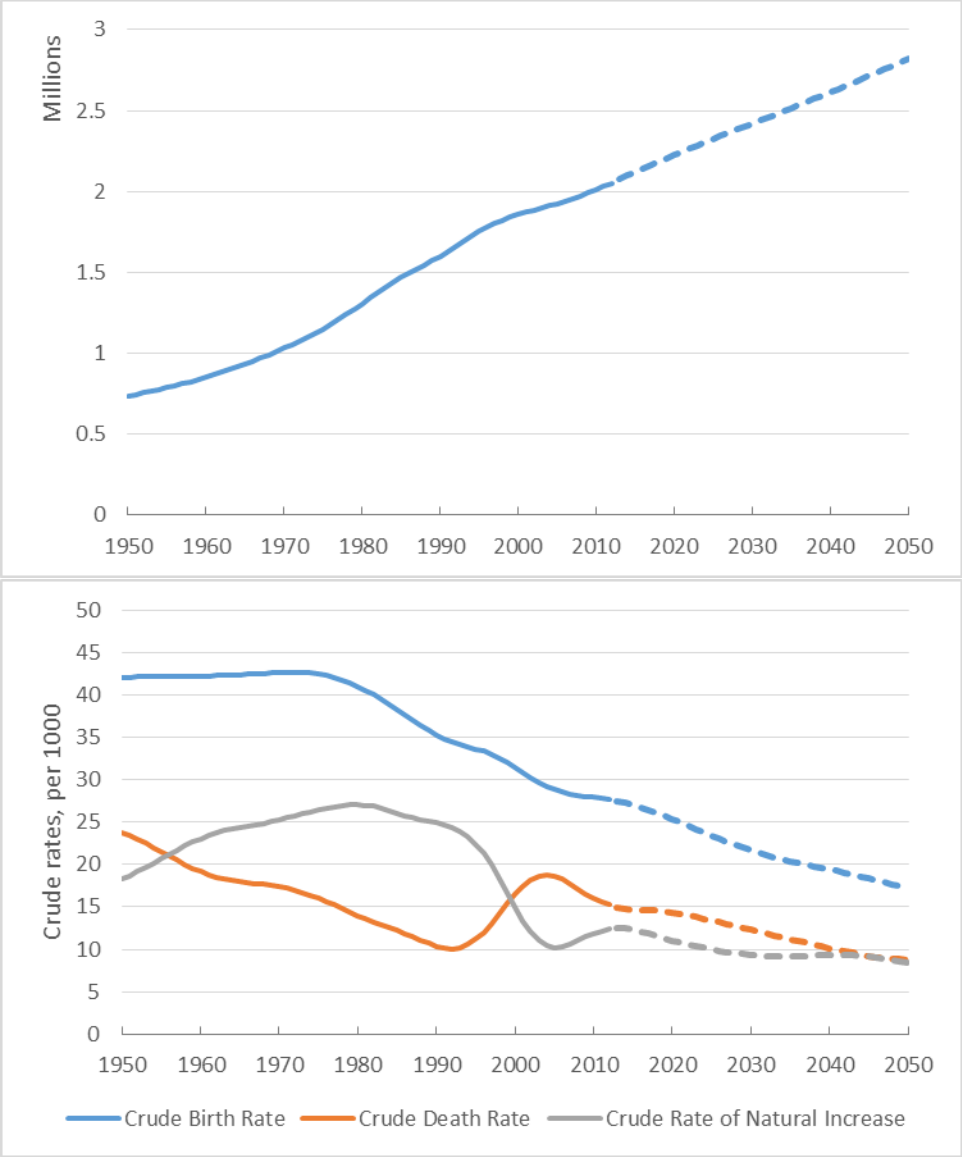

Figure 14 Total population (top panel), and crude rates of birth, death and natural increase (bottom panel), Lesotho 1950-2050Note: Dotted segments represent projected data

The population of Lesotho has increased from 0.74 million people in 1950 to 2.12 million in 2015 and is projected to reach 2.82 million by 2050, a very similar trajectory to Botswana over the next 35 years. As can be seen from the second panel of Figure 14, the rate of natural increase in the population increased sharply between 1950 and 1980, before declining rapidly from the mid-1990s. During this time, the population has experienced a significant demographic transition, as indicated by the decline in crude death rates up until 1993 and the start of the decline in crude birth rates in the late 1970s. The rate of natural increase (the difference between the crude birth and crude death rates) reached a peak of around 2.7 per cent per annum in 1980. In 2015 the population was growing at around 1.2 per cent per annum. The projections assume very similar patterns of change in the crude birth and death rates, resulting in almost constant growth of around 1.0 per cent per annum over the next 35 years.

The effect of HIV/AIDS-related mortality on the crude death rate is clearly visible between 1992 and 2004, with the crude death rate increasing by 86 per cent over this period.

The WPP assumes that Lesotho will be a net loser of international migrants in the coming years, with approximately 20 000 people emigrating from the country in every five year period from 2010-2015 through to 2045-2050.

The United Nations Population Division's World Urbanization Prospects anticipates that the urban population of Lesotho will increase substantially, with 27.3 per cent of the population in urban areas in 2015, increasing to 46.7 per cent urban by 2050. Despite this urbanization, Lesotho is expected to remain a predominantly rural country, even by 2050.

B. Demographic indicators for Lesotho, 1950-2050

Figure 15 presents the most important demographic indicators for the population of Lesotho over the period 1950-2050.

In terms of fertility (top panel of Figure 15), the total fertility rate began to decline in the late 1970s. The total fertility rate fell from 5.6 to 2.9 children per woman between 1978 and 2015. Future fertility decline is expected to be slow – total fertility will fall below 2.1 children per woman only in 2045 according to the 2012 WPP. The number of births each year is expected to decline by approximately 15% between 2015 and 2050, from around 57 000 births per annum in 2015 to around 48 500 births per annum by 2050.

By 2050, the total fertility rate is expected to fall to 2.0 children per woman.

Infant and child mortality in Lesotho fell by approximately 60 per cent between 1950 and 1990. The risk of child death increased from the mid- 1990s, mostly as a result of AIDS (specifically as a consequence of the vertical transmission of HIV from mothers to children) before declining again a decade later. Infant and under five mortality is projected to fall by a further 60 per cent between 2015 and 2050, to 20.1 and 25.4 deaths per 1000, respectively.

The decline in mortality up until the mid-1990s saw substantial gains in life expectancy at birth, which increased by approximately 20 years for both men and women relative to that which prevailed in 1950. With the advent of HIV/AIDS, life expectancy at birth decreased dramatically between 1990 and 2005, to levels previously experienced in the late-1950s. The trend in life expectancy also reveals the significant reversal in adult mortality experienced, with life expectancy at birth only expected to regain the levels achieved prior to the HIV/AIDS epidemic in the late 2030s, and to still be less than 70 years for both men and women by 2050.

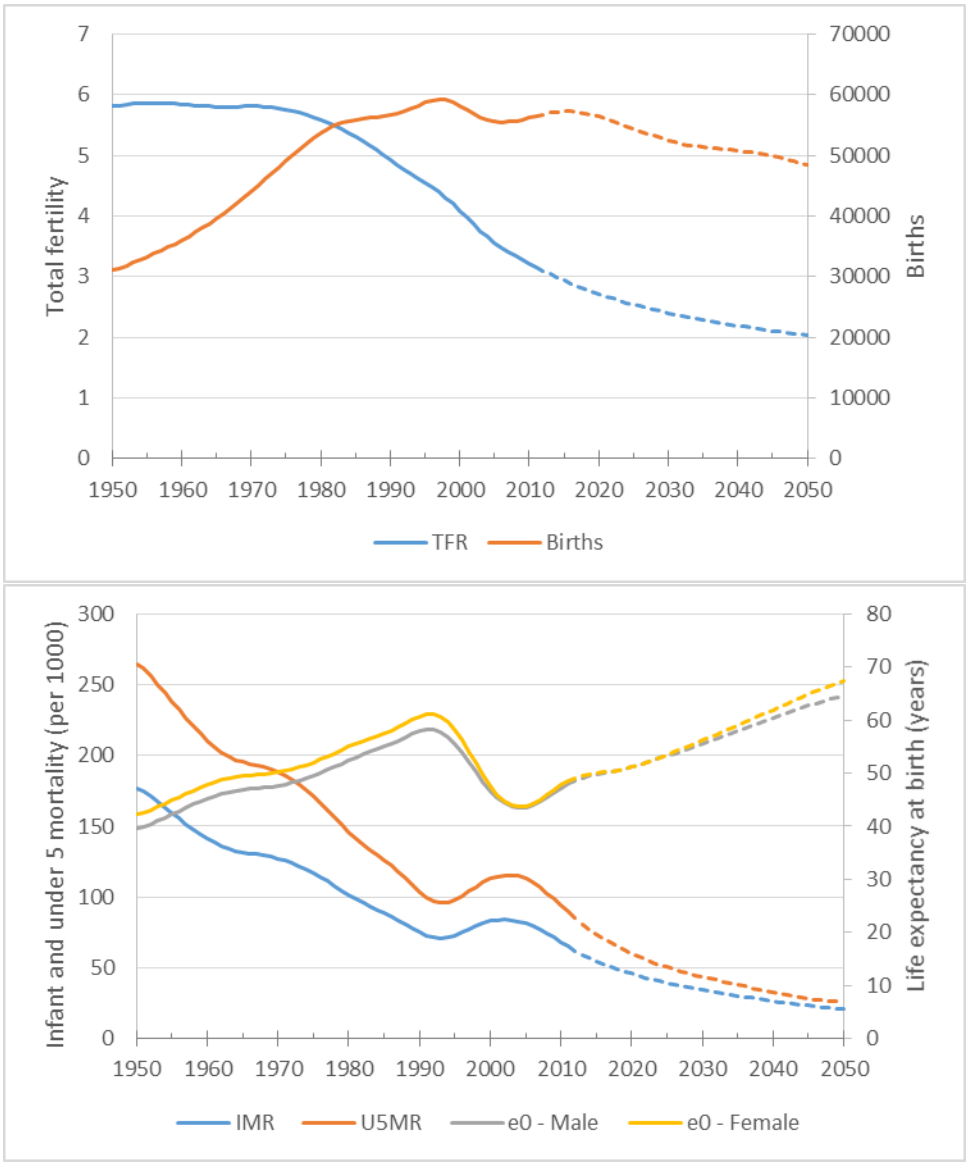

Figure 15 Measures of fertility (top panel) and mortality (bottom panel), Lesotho 1950-2050

Note: Dotted segments represent projected data

Figure 16 shows the (period) probability of a 15 year old surviving to age 65 in Lesotho over the century from 1950-2050. Having decreased in almost linear fashion up until the early 1990s, the period effects of HIV/AIDS are clearly evident in the very sharp increase between 1995 and 2005. By 2050, adult male mortality while be at its pre-AIDS level, while female mortality will still be a little higher than it was some 60 years earlier.

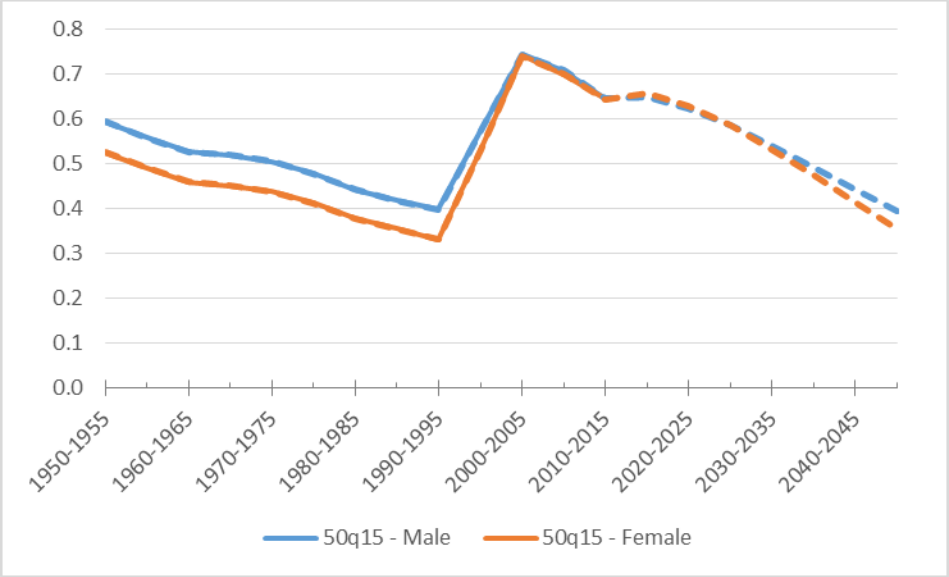

Figure 16 Trend in the probability of a 15 year dying before the age of 65, 50q15, by sex, Lesotho 1950-2050

Note: Dotted segments represent projected data

C. The changing age-sex structure of the population of Lesotho, 1950-2050

The progress of the population of Lesotho through the demographic transition is indicated by the change in the age-sex structure of the population between 1950 and 2015 (Figure 17). The effects of male labour migration to the South African mines is evident in the population pyramid for 1975, while the effects HIV/AIDS mortality is clear in the 'hollowing-out' between ages 40 and 60 in the population pyramid for 2015. By 2050, Lesotho's demographic transition will be largely complete.

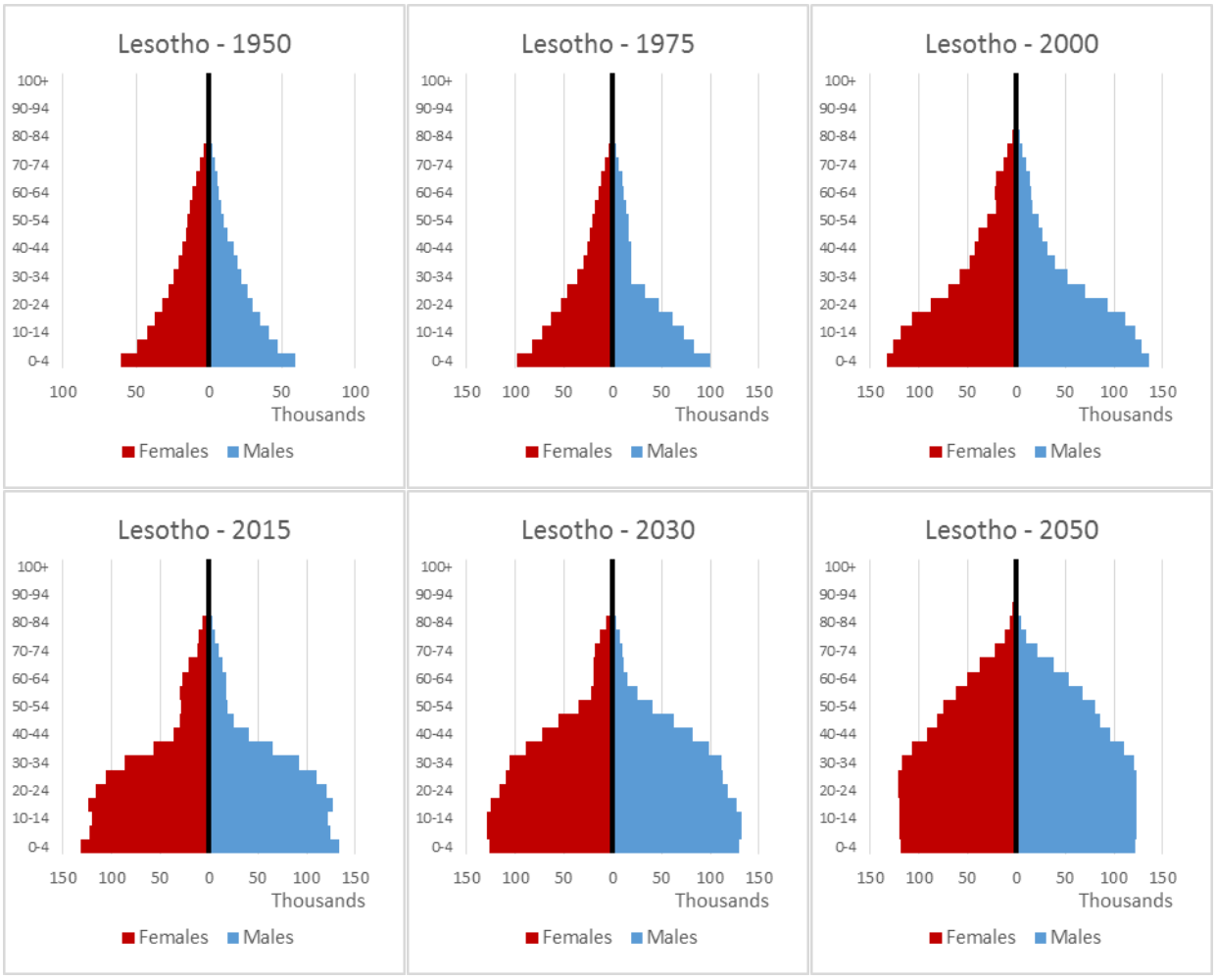

Figure 17 Population pyramids, Lesotho 1950, 1975, 2000, 2015, 2030 and 2050

D. HIV prevalence and AIDS-related mortality, 1975-2050

According to the default Spectrum model incorporating the effects of HIV and AIDS used by UNAIDS, HIV prevalence among adults of both sexes aged 15-49 in Lesotho is close to its expected maximum in 2015, and is expected to decline from 23 per cent in 2015 and to stabilise at around 15 per cent in 2050 (Figure 18).

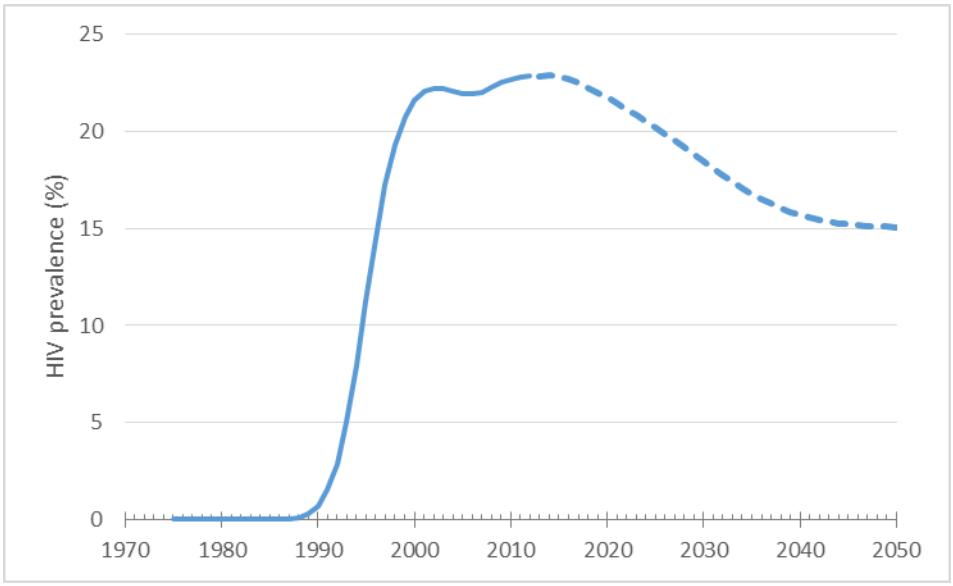

Figure 18 HIV prevalence among adults aged 15-49 (both sexes), Lesotho 1975-2050

Note: Dotted segments represent projected data

In line with this modelled decline in prevalence, the proportion of all deaths that is attributable to HIV/AIDS (as distinct from all deaths among those who are HIV positive) is also expected to fall from approximately a half in 2015, to 25 per cent by 2050 (Figure 19). The projected component of the data is obviously highly sensitive to the assumptions made about treatment and survival on treatment.

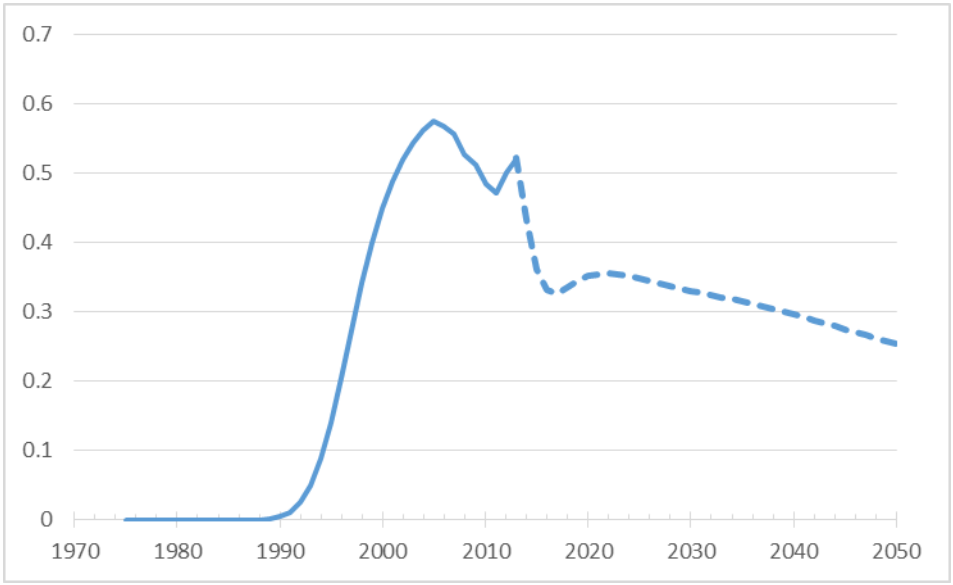

Figure 19 Proportion of all deaths attributable to HIV/AIDS, Lesotho 1975-2050

Note: Dotted segments represent projected data

E. Dependency ratios and the demographic dividend

With the change in the population structure described in the previous section, dependency ratios will show marked changes over the period from 1950 to 2050 (Figure 20). The maximum dependency ratio was in 1981, with 96.3 dependents (young and elderly) per 100 population aged 15-64. The overall dependency ratio (represented by the combined height of the two series) will decline from 66.1 dependents per 100 adults aged 15-64 in 2015 to a minimum of 45.8 in 2047, before starting an upwards trend. This reversal, it can be seen is directly attributable to the increasing share of the elderly in the population. The dependency ratio among the youth is expected to fall monotonically over the period. By these metrics, the demographic dividend will become increasingly evident for some time to come.

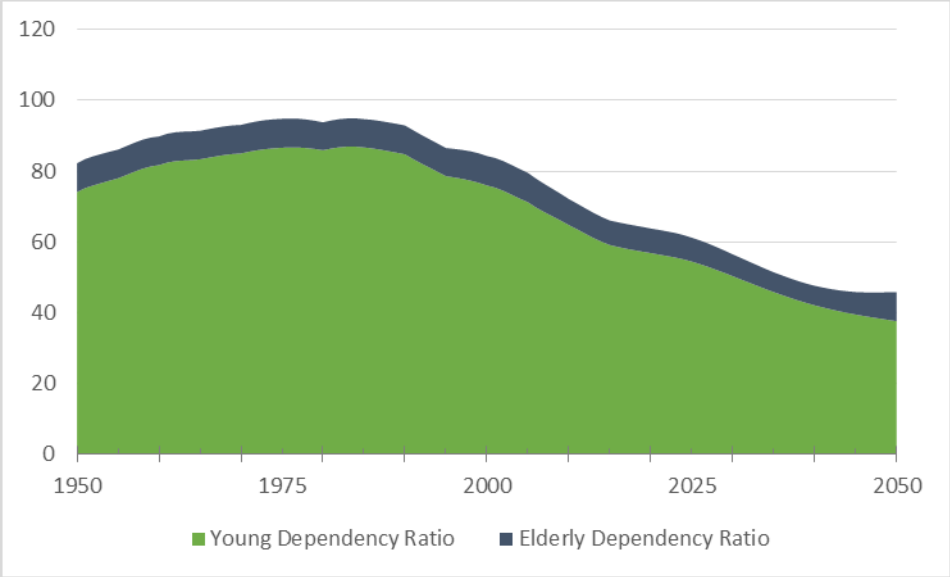

Figure 20 Young, old and total dependency ratios, Lesotho 2015-2050

Using the more restrictive definition of the 'demographic window' the World Population Prospects projections suggest that the 'window' will open in 2036, when the proportion of the total population under the age of 15 falls below 30 per cent (Figure 21). According to this definition and based on the data up to 2100 from the 2012 WPP, the 'demographic window' will remain open to 2082 (not shown).

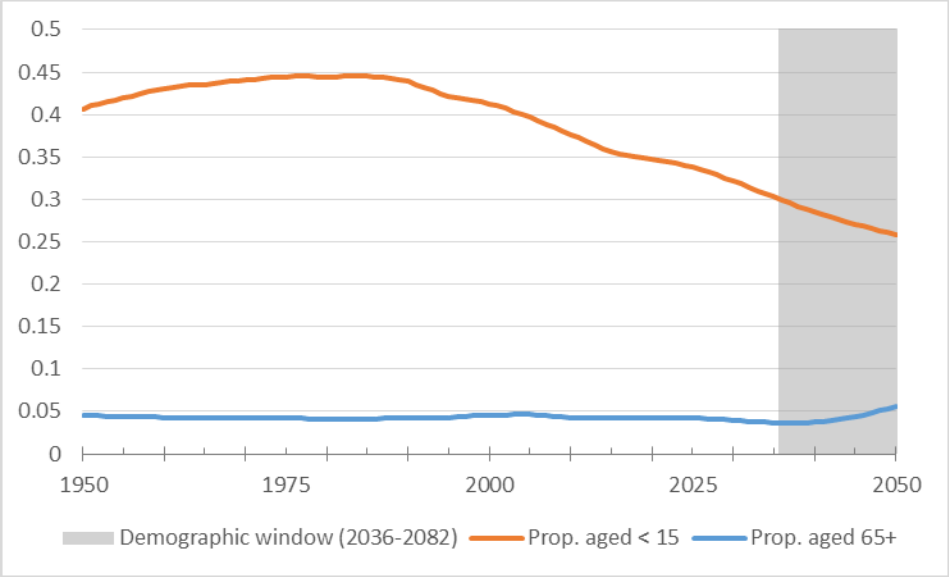

Figure 21 The demographic window, Lesotho 1950-2050

F. Profile of the working age population by educational attainment

As described in Section III, data on projections by level of education produced by IIASA can be combined with the data from the World Population Prospects. In Figure 22 we present population pyramids for Lesotho that demonstrate the projected composition of the population by educational attainment for the population aged between 15 and 64.

Even by 2050, it is projected that a significant proportion of the population of Lesotho will have less than upper secondary education. This will have significant implications for labour market dynamics, and for the ability of the country to capture any putative demographic dividend.

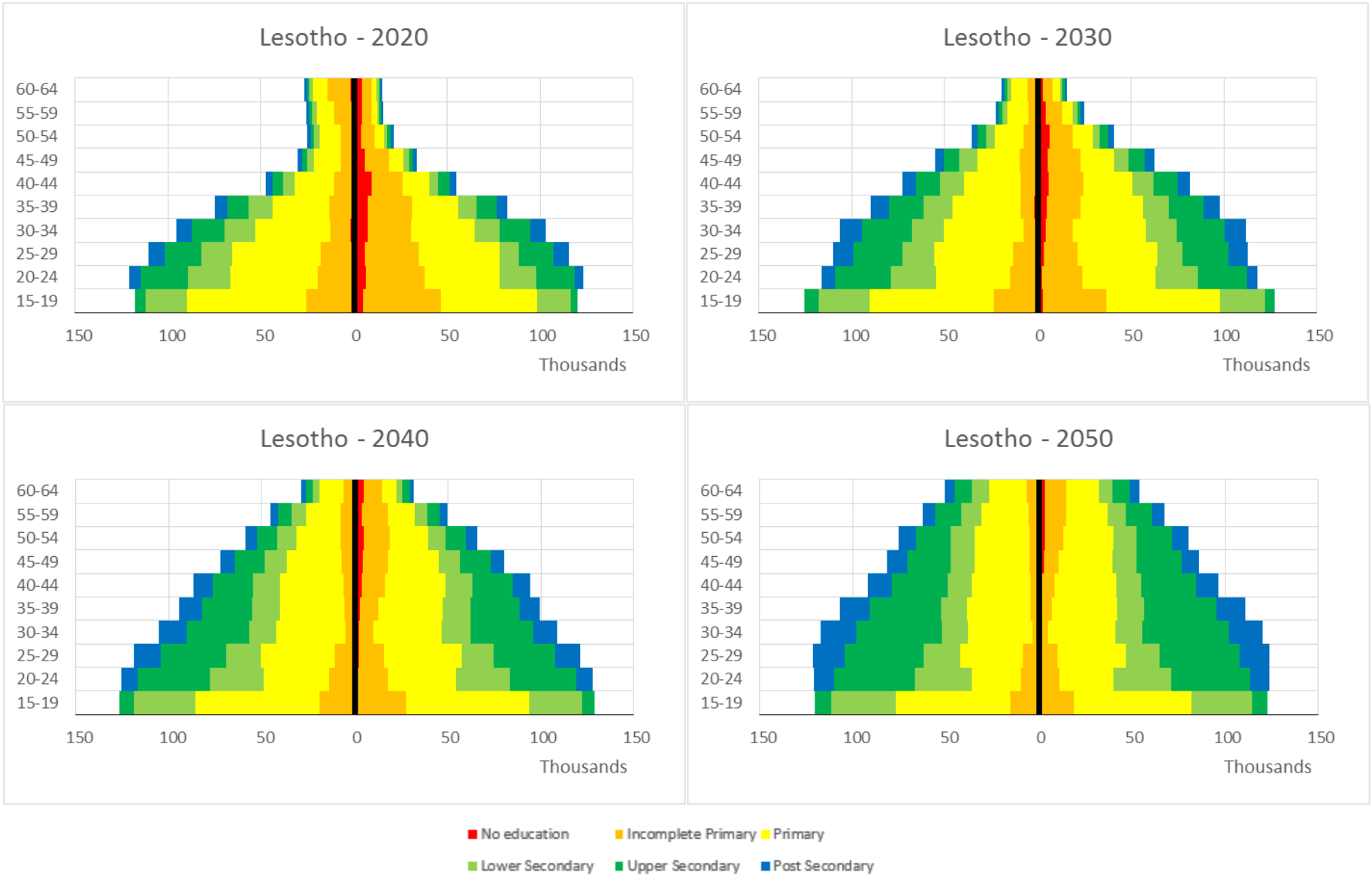

Figure 22Population pyramids for Lesotho by educational attainment, 2020-2050

G. Ageing

A further aspect of demographic change in Lesotho over the next 35 years to be considered is the proportion of the population aged over 65, over 70 and over 75. This gives important information about the cost implications for social welfare systems should they exist, be expanded or instituted.

While it should be borne in mind that the proportion of the population that is elderly is affected by changes in fertility and mortality at younger ages in earlier times, Figure 23 shows that the proportion of the population aged 65 and over is expected to increase rapidly after 2040, rising from under 4 per cent of the population in 2040 to 5.6 per cent by 2050.

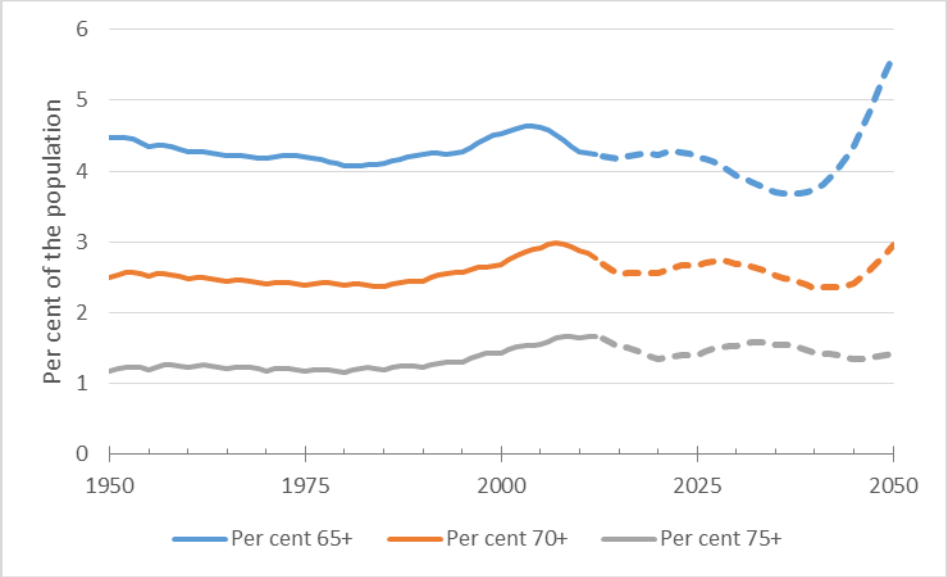

Figure 23 Proportion of the population aged over 65, over 70 and over 75, Lesotho 2015-2050

Note: Dotted segments represent projected data

VI. Namibia

A. Population and crude rates of fertility and mortality, 1950-2050

The essential changes in the population of Namibia between 1950 and 2050, as indicated by the historical and projected data in the WPP, are evident from Figure 24.

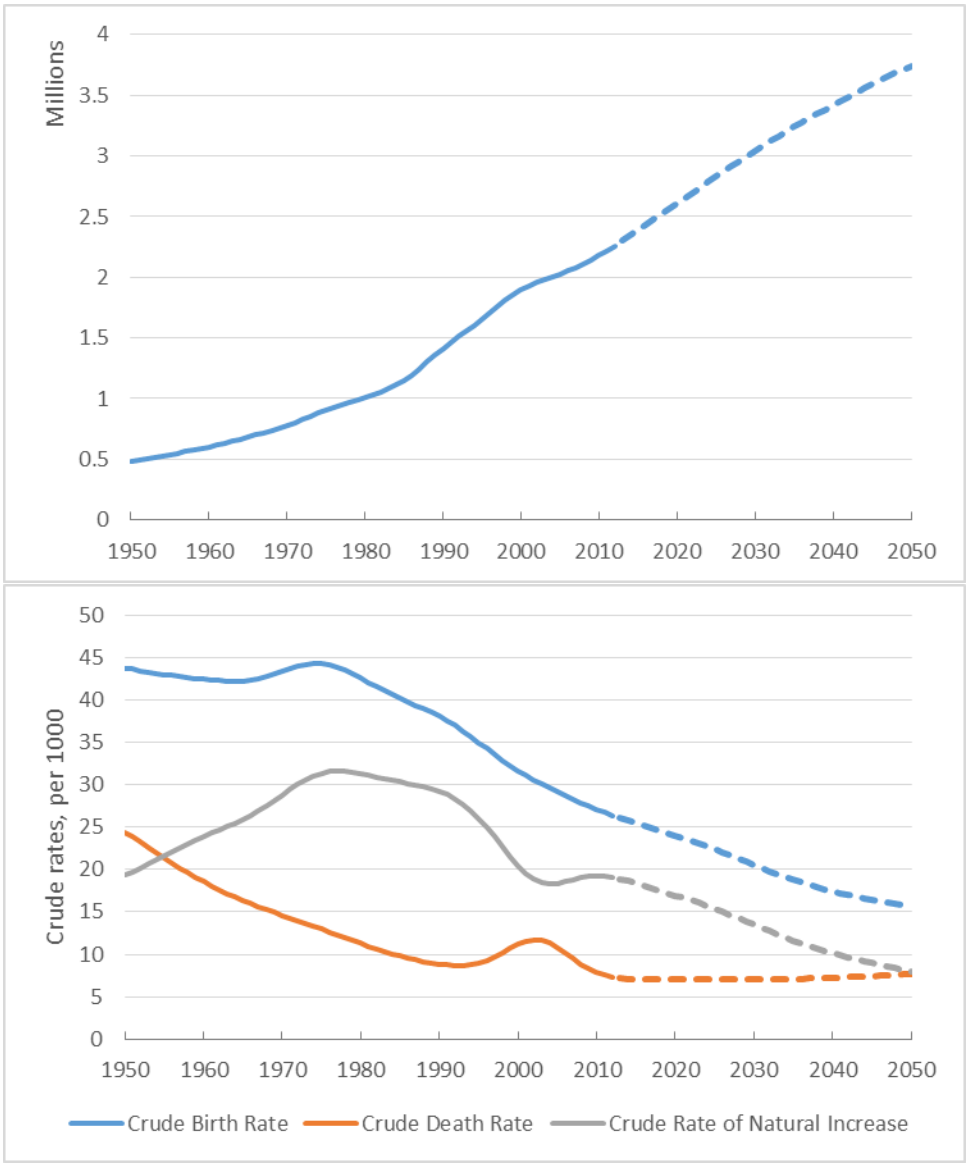

Figure 24 Total population (top panel), and crude rates of birth, death and natural increase (bottom panel), Namibia 1950-2050

Note: Dotted segments represent projected data

The population of Namibia has increased from half a million people in 1950 to 2.39 million in 2015 and is projected to reach 3.74 million by 2050. Despite the fact that crude birth rates have been falling since the late 1970s and crude death rates since before 1950, the gap between crude birth and death rates has remained substantial, leading to substantial rates of population growth up until the mid-1980s. The rate of natural increase (the difference between the crude birth and crude death rates) reached a peak of around 3.2 per cent per annum in 1978. In 2015 the population was growing at around 1.8 per cent per annum. A relatively small increase in crude death rates associated with HIV/AIDS is evident in the late 1990s and early 2000s which resulted in the crude rate of natural increase remaining more or less constant between 2000 and 2010. The crude birth rate is projected to fall considerably over the period 2015 to 2050 while crude death rates are expected to remain low and stable at around 7 deaths per 1000 population, resulting in a continued decline in growth rates to around 0.8 per cent per annum in 2050.

The WPP assumes that international migration to and from Namibia will be negligible through to 2050, with an estimated 3 000 net emigrants from the country in the period from 2015-2020, and no net migration thereafter.

The United Nations Population Division's World Urbanization Prospects anticipates that the population of Namibia will continue to urbanize, with 46.7 per cent of the population in urban areas in 2015, increasing to 67.8 per cent urban by 2050.

B. Demographic indicators for Namibia, 1950-2050

Figure 25 presents the most important demographic indicators for the population of Namibia over the period 1950-2050.

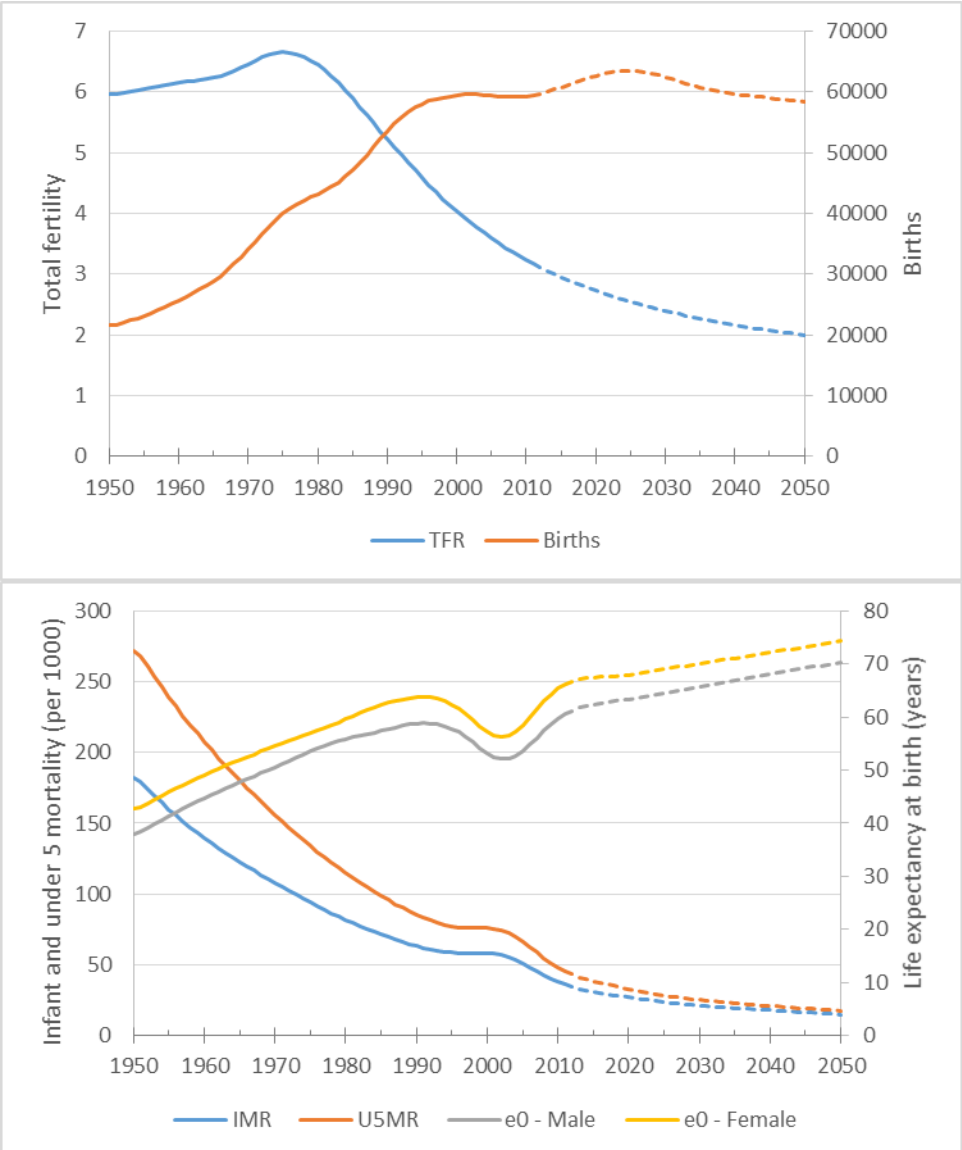

Figure 25 Measures of fertility (top panel) and mortality (bottom panel), Namibia 1950-2050

Note: Dotted segments represent projected data

In terms of fertility (top panel of Figure 25), the total fertility rate began to decline in the mid-1970s. The total fertility rate fell from 6.7 to 2.9 children per woman between 1975 and 2015. Future fertility decline is expected to be slow – total fertility will fall below 2.1 children per woman only in 2044 according to the 2012 WPP. The number of births each year is expected to remain roughly constant at around 60 000 per annum between 2015 and 2050, with the decline in fertility being almost exactly offset by the growth in the population. Total fertility in 2050 is expected to be 2.0 children per woman.

Infant and child mortality in Namibia fell by approximately 70 per cent between 1950 and 2000. The pace of decline was attenuated around the turn of the millennium as a result of AIDS (specifically as a consequence of the vertical transmission of HIV from mothers to children), although this reversal was less marked than for other countries in the region due to the lower HIV prevalence in the country. Infant and under five mortality is projected to fall by a further 60 per cent between 2015 and 2050, to 14.8 and 17.4 deaths per 1000, respectively.

The decline in mortality up until the mid-1990s saw substantial gains in life expectancy at birth, which increased by approximately 20 years for both men and women relative to that which prevailed in 1950. Around the turn of this century, life expectancy at birth fell by around 6 years as a result of HIV/AIDS before recovering to pre-AIDS levels by 2008. Further gains are expected in the period up till 2050, when life expectancy at birth is projected to be 70.3 years for men and 74.3 years for women.

Figure 26 shows the (period) probability of a 15 year old surviving to age 65 in Namibia over the century from 1950-2050. Having decreased in almost linear fashion up until the early 1990s, the period effects of HIV/AIDS are clearly evident in the very sharp increase between 1995 and 2005, although adult mortality is already assumed to be back at pre-AIDS levels. By 2050, adult male mortality while be significantly lighter than at present.

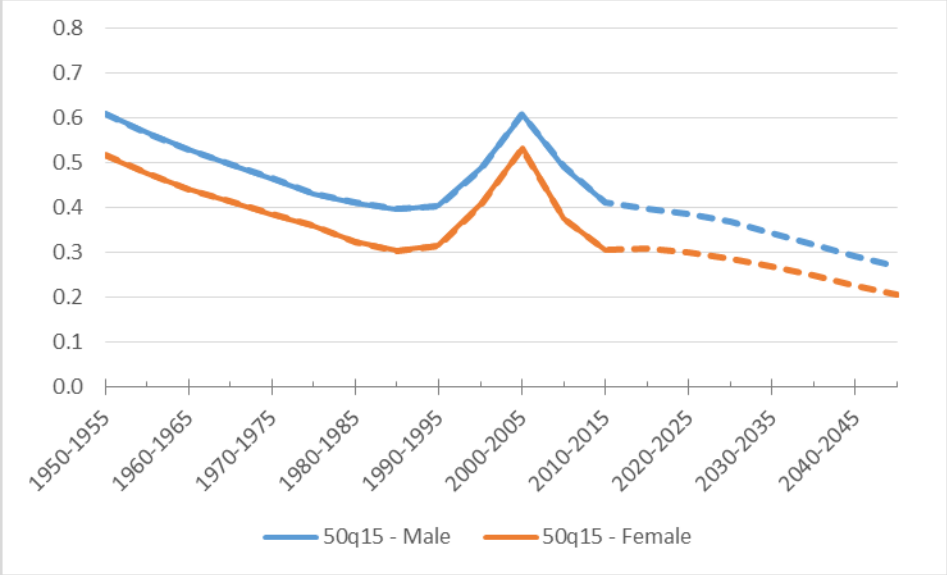

Figure 26 Trend in the probability of a 15 year dying before the age of 65, 50q15, by sex, Namibia 1950-2050

Note: Dotted segments represent projected data

C. The changing age-sex structure of the population of Namibia, 1950-2050

The progress of the population of Namibia through the demographic transition is indicated by the change in the age-sex structure of the population between 1950 and 2015 (Figure 27), with the effects of the declines in fertility and mortality becoming evident by 2015. By 2050, Namibia's age-sex structure is projected to be heavily weighted towards adults between the ages of 20 and 50, which might provide the basis for capturing some portion of a demographic dividend.

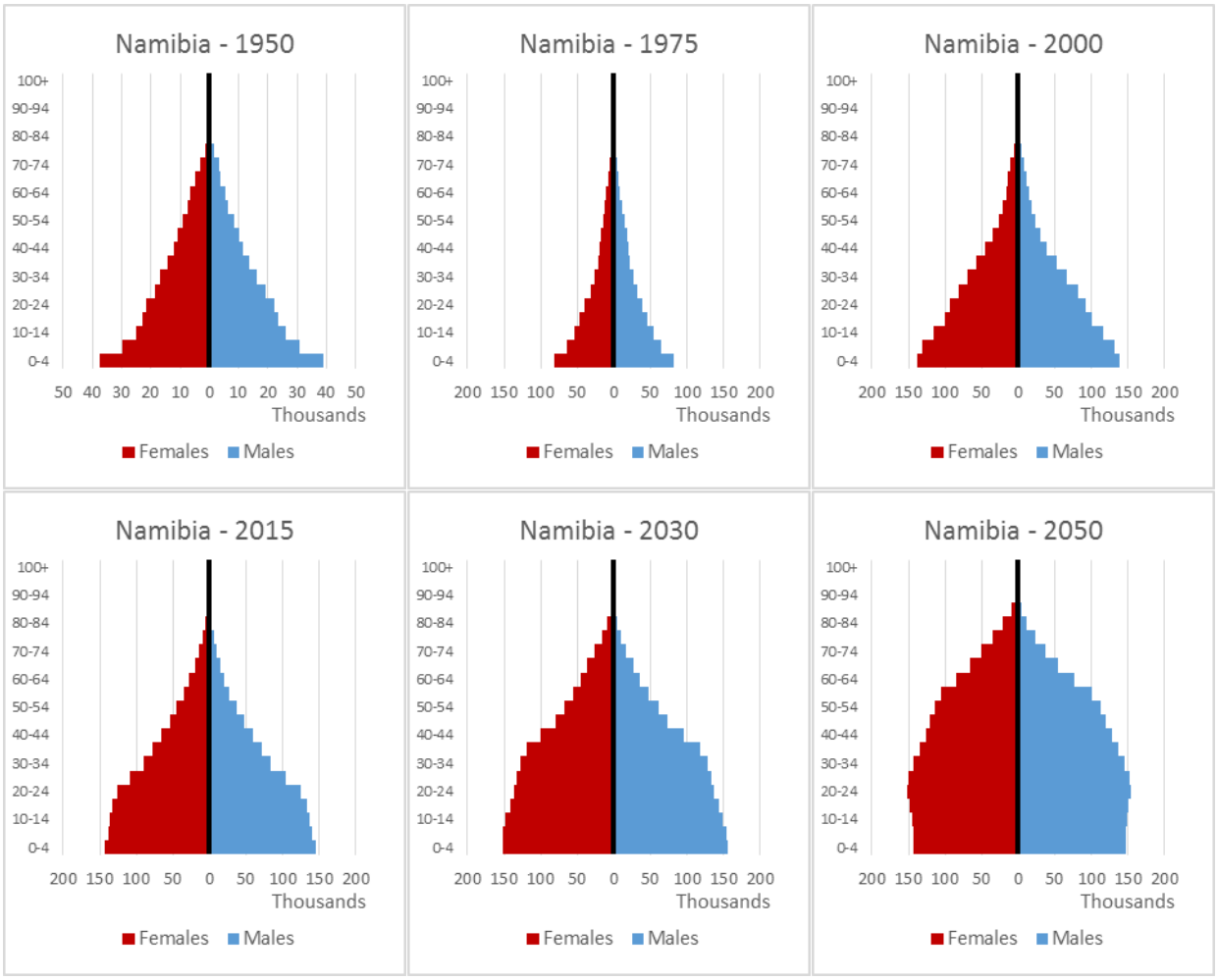

Figure 27 Population pyramids, Namibia 1950, 1975, 2000, 2015, 2030 and 2050

D. HIV prevalence and AIDS-related mortality, 1975-2050

According to the default Spectrum model incorporating the effects of HIV and AIDS used by UNAIDS, HIV prevalence among adults of both sexes aged 15-49 in Namibia has already passed its peak (17 per cent in 2003), and is expected to decline from 14.0 per cent in 2015 to 5.6 per cent by 2050 (Figure 28).

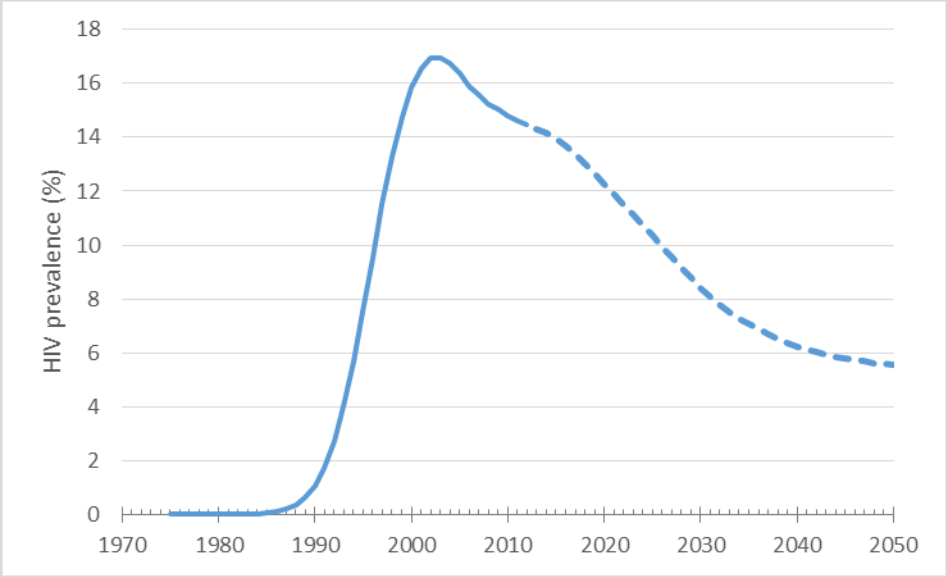

Figure 28 HIV prevalence among adults aged 15-49 (both sexes), Namibia 1975-2050

Note: Dotted segments represent projected data

In line with this modelled decline in prevalence, the proportion of all deaths that is attributable to HIV/AIDS (as distinct from all deaths among those who are HIV positive) is also expected to fall very steeply, from 22 per cent in 2015 to under 4 per cent by 2050 (Figure 29).

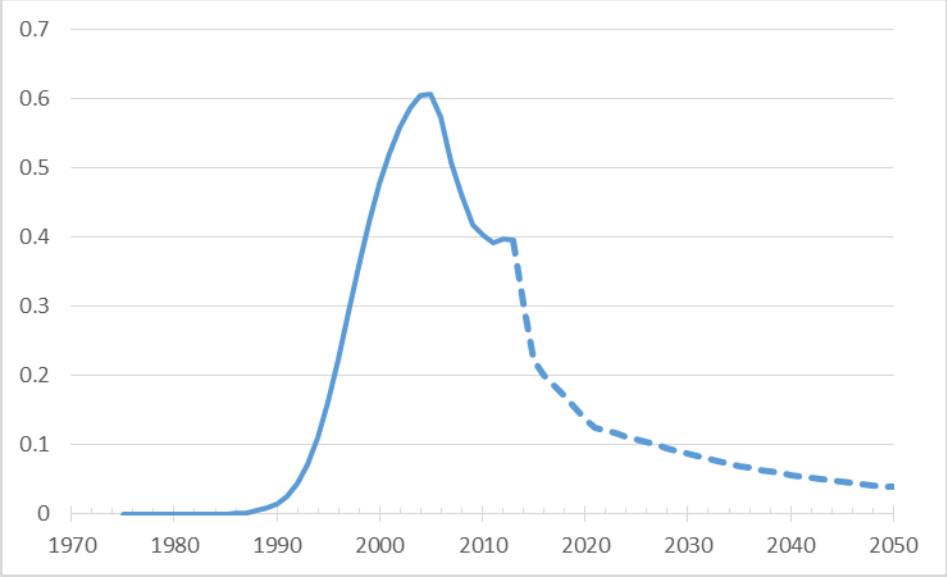

Figure 29 Proportion of all deaths attributable to HIV/AIDS, Namibia 1975-2050

Note: Dotted segments represent projected data

E. Dependency ratios and the demographic dividend

With the change in the population structure described in the previous section, dependency ratios will show marked changes over the period from 1950 to 2050 (Figure 20). The maximum dependency ratio was in 1984, with 102 dependents (young and elderly) per 100 population aged 15-64. The overall dependency ratio (represented by the combined height of the two series) will decline from 62.9 dependents per 100 adults aged 15-64 in 2015 to 46.4 by 2050. Dependency ratios will begin to increase shortly after 2050, as the rising proportion of the population that is elderly will begin to more than compensate for the reduction in the proportion of children under the age of 15.

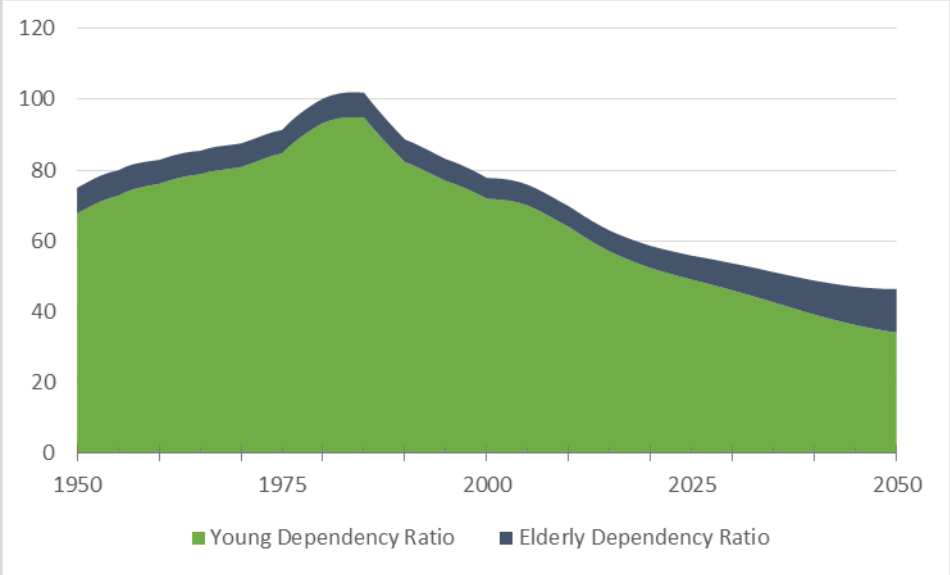

Figure 30 Young, old and total dependency ratios, Namibia 2015-2050

Using the more restrictive definition of the 'demographic window' the World Population Prospects projections suggest that the 'window' will open in 2030, when the proportion of the total population under the age of 15 falls below 30 per cent (Figure 31). According to this definition and based on the data up to 2100 from the 2012 WPP, the 'demographic window' will remain open to 2070 (not shown).

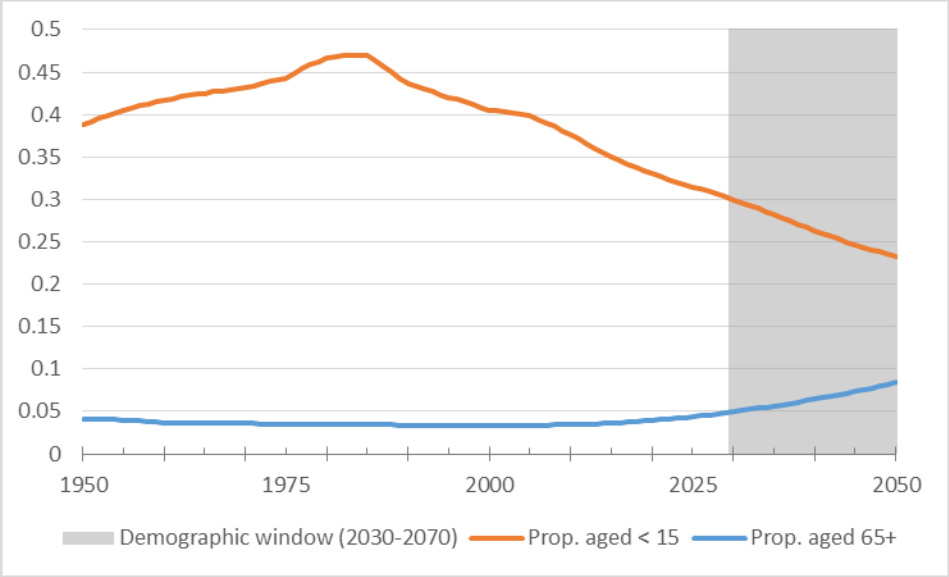

Figure 31 The demographic window, Namibia 1950-2050

F. Profile of the working age population by educational attainment

As described in Section III, data on projections by level of education produced by IIASA can be combined with the data from the World Population Prospects. In Figure 32we present population pyramids for Namibia that demonstrate the projected composition of the population by educational attainment for the population aged between 15 and 64.

Between 2030 and 2050, it is expected that the overall human capital stock will increase as the proportion of the population with only a primary education falls dramatically, and the proportion of the population (of either sex) with secondary or post-secondary education increases.

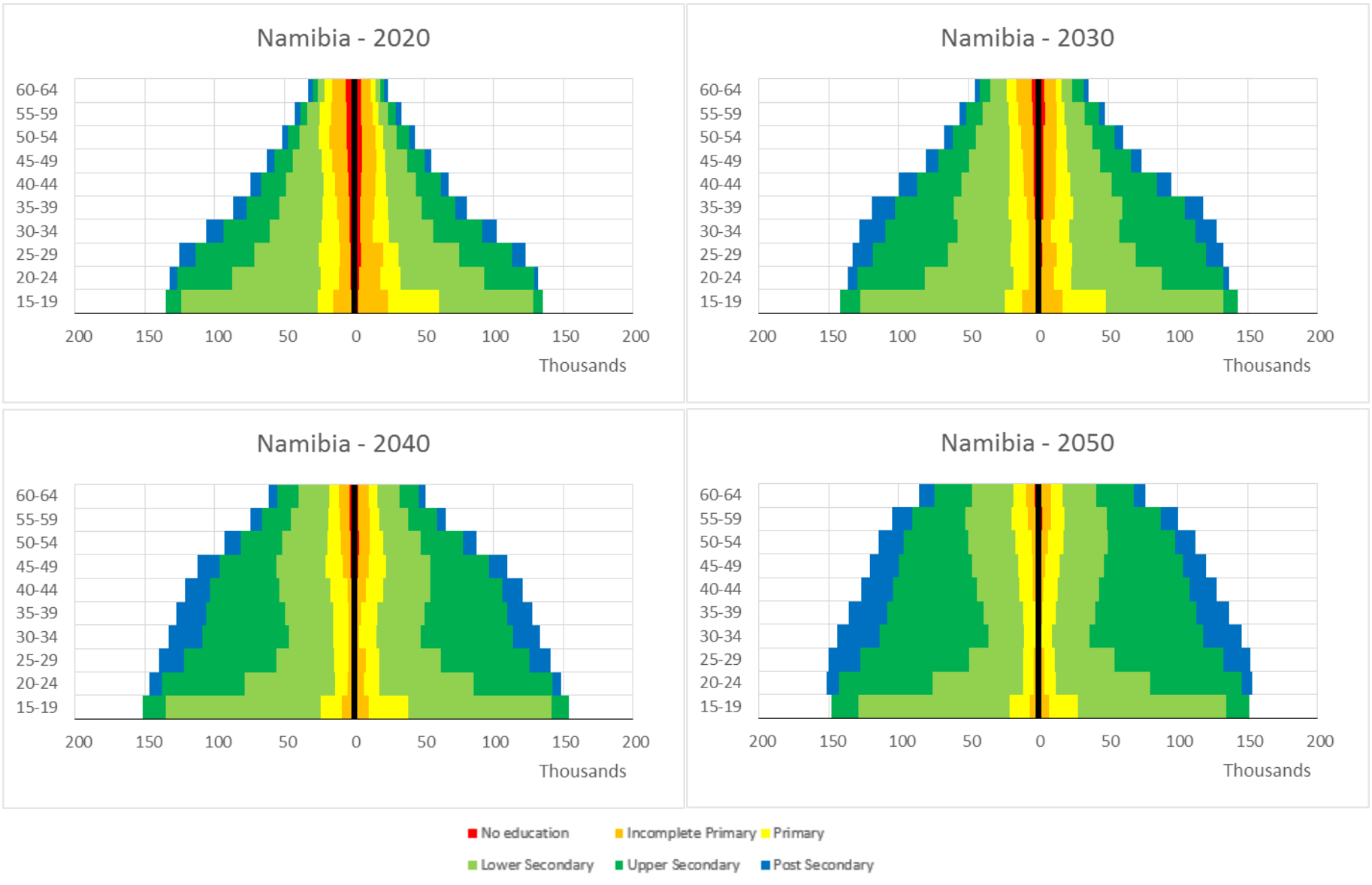

Figure 32Population pyramids for Namibia by educational attainment, 2020-2050

G. Ageing

A further aspect of demographic change in Namibia over the next 35 years to be considered is the proportion of the population aged over 65, over 70 and over 75. This gives important information about the cost implications for social welfare systems should they exist, be expanded or instituted.

While it should be borne in mind that the proportion of the population that is elderly is affected by changes in fertility and mortality at younger ages in earlier times, Figure 33 shows that the proportion of the population aged 65 and over is expected to increase rapidly over from 2015 the entire period, rising from around 3.6 per cent of the population in 2040 to 8.4 per cent by 2050. Unlike most of the other countries in the region, there will be substantial growth in the population aged 70 and over, as well as aged 75 and over, in part a reflection of lower past AIDS-related mortality, and higher probabilities of survival in adulthood.

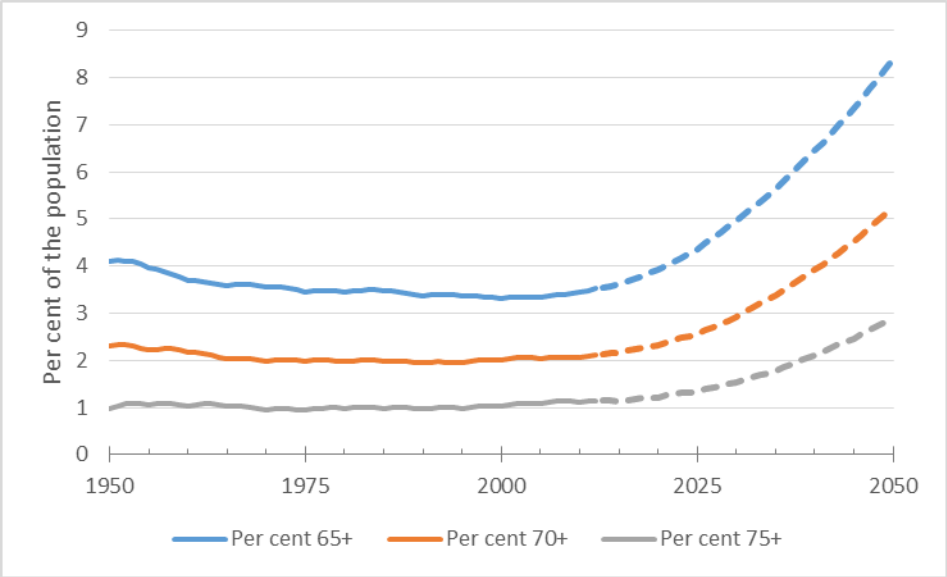

Figure 33 Proportion of the population aged over 65, over 70 and over 75, Namibia 2015-2050

Note: Dotted segments represent projected data

VII. South Africa

A. Population and crude rates of fertility and mortality, 1950-2050

The essential changes in the population of South Africa between 1950 and 2050, as indicated by the historical and projected data in the WPP, are evident from Figure 34.

The population of South Africa has increased from 13.68 million people in 1950 to 53.49 million in 2015 and is projected to reach 63.41 million by 2050. Crude birth rates and crude death rates have both been falling since before 1950, but at almost the same pace, resulting in an almost-constant rate of natural increase of around 2.4 per cent per annum between 1950 and the late 1980s. The rate of natural increase then fell rapidly through to 2005, brought about by rising mortality due to HIV/AIDS. Since 2005, mortality rates have begun to fall while crude birth rates have continued their downward trend. The crude rate of natural increase is 0.7 per cent per annum in 2015, and is expected to more than halve to 0.3 per cent per annum by 2050.

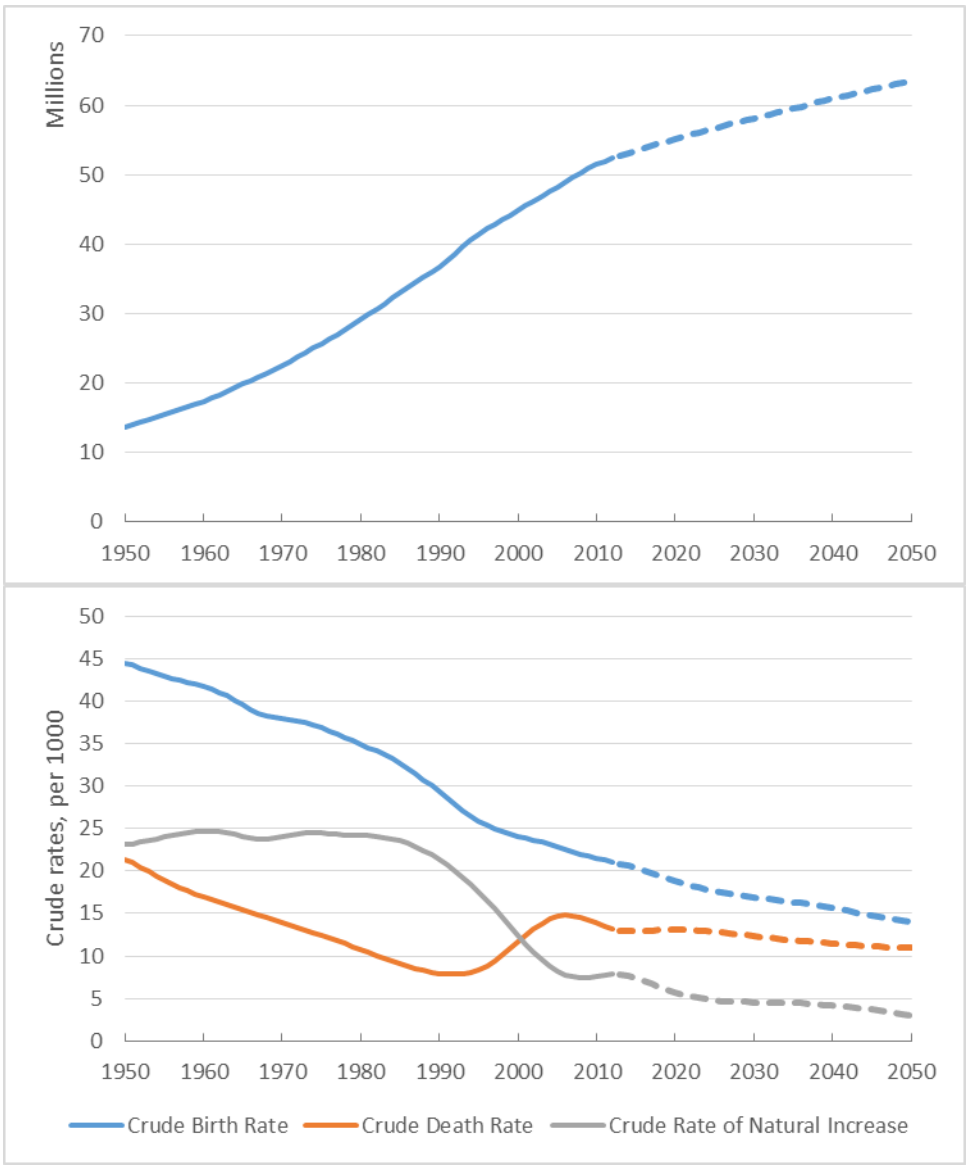

Figure 34 Total population (top panel), and crude rates of birth, death and natural increase (bottom panel), South Africa 1950-2050

Note: Dotted segments represent projected data

The WPP assumes 100 000 emigrants out of the country in the years 2015-2020, followed by immigration of 100 000 people in each subsequent five year period between 2020-2024 and 2045-49. It is unclear on what basis the WPP made this assumption.

South Africa is the most urbanized country in the region, and this is expected to remain the case through to 2050. The United Nations Population Division's World Urbanization Prospects anticipates that South Africa will continue to urbanise gradually, with 64.8 per cent of the population in urban areas in 2015 increasing to 77.4 per cent urban by 2050.

B. Demographic indicators for South Africa, 1950-2050

Figure 35 presents the most important demographic indicators for the population of South Africa over the period 1950-2050.

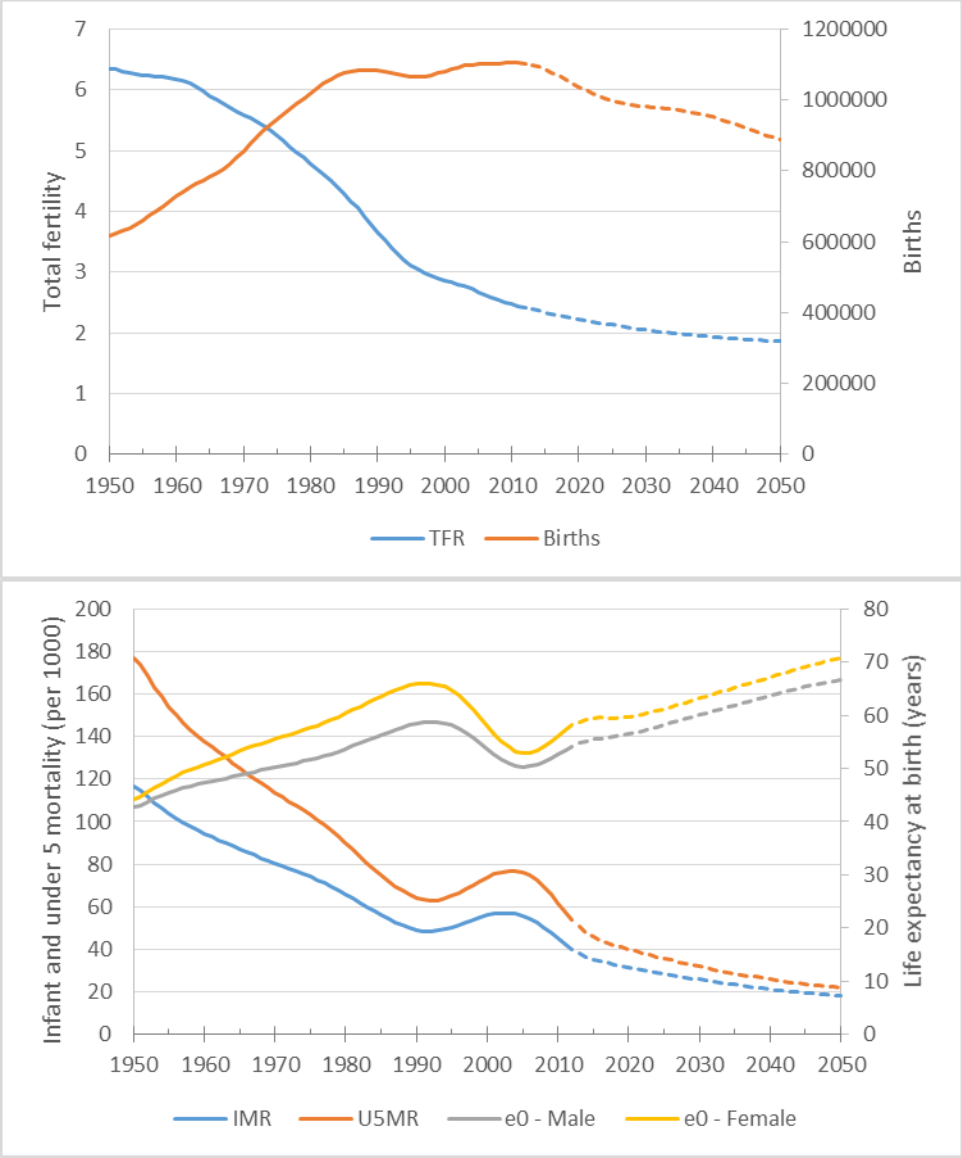

Figure 35 Measures of fertility (top panel) and mortality (bottom panel), South Africa 1950-2050

Note: Dotted segments represent projected data

In terms of fertility (top panel of Figure 35), the total fertility rate has been declining since the mid-1950s, falling from 6.4 in 1950 to 2.3 children per woman in 2015. Future fertility decline is expected to be slow – total fertility will fall below 2.1 children per woman in 2027 according to the 2012 WPP, and will be 1.9 children per woman by 2050. The number of births each year has reached its maximum (1.10 million in 2010) and is projected to decrease to 0.89 million per annum by 2050.

Infant mortality in South Africa fell by approximately 60 per cent between 1950 and 1990, while child mortality declined by two thirds over the same period. The rapid spread of HIV in the

1990s reversed that trend, and both measures increased notably through to 2005, after which the decline again resumed. By 2010, both measures were at the level they were before the effects of HIV/AIDS became apparent. Infant and under five mortality is projected to fall by a further 50 per cent between 2015 and 2050, to 18.1 and 21.8 deaths per 1000, respectively.

The decline in mortality up until the mid-1990s saw substantial gains in life expectancy at birth, although rather noticeably less so for men (15 years) than for women (22 years). The effect of HIV/AIDS precipitated a decrease in life expectancy at birth of around 8 years for men and 14 for women (again, reflecting both the higher prevalence in women as well as their lower non-AIDS mortality). Gains of 11 years in life expectancy are expected among both men and women between 2015 and 2050, when life expectancy at birth is projected to be 66.8 and 70.9 years respectively.

Figure 36 shows the (period) probability of a 15 year old surviving to age 65 in South Africa over the century from 1950-2050. Having decreased in almost linear fashion up until the early 1990s (and with the greater gains in female mortality noted above again evident), the period effects of HIV/AIDS are clearly evident in the dramatic increase between 1995 and 2015, especially among women. Male mortality is expected to regain its pre-AIDS level around 2030, while female mortality will only return to pre-AIDS levels around 2050.

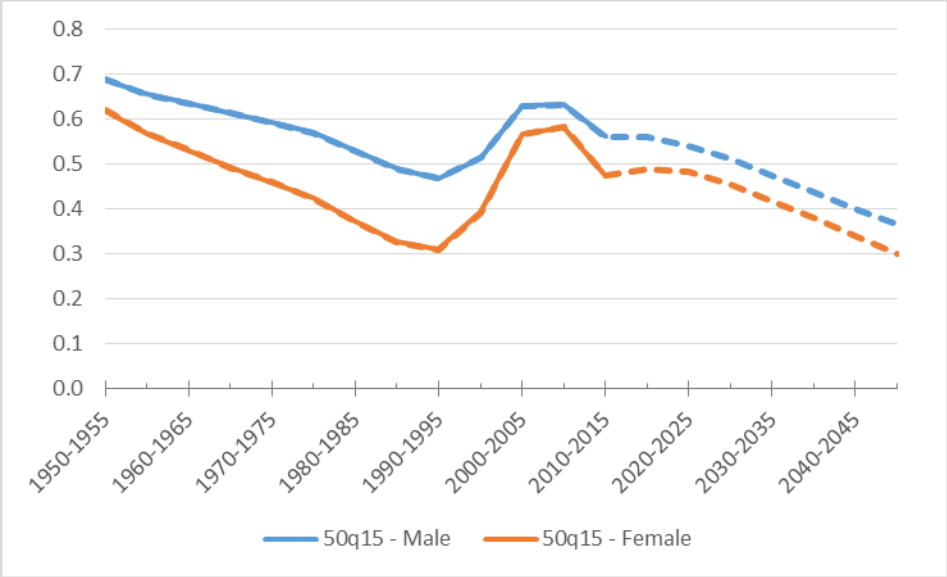

Figure 36 Trend in the probability of a 15 year dying before the age of 65, 50q15, by sex, South Africa 1950-2050

Note: Dotted segments represent projected data

C. The changing age-sex structure of the population of South Africa, 1950-2050

The progress of the population of South Africa through the demographic transition is indicated by the change in the age-sex structure of the population between 1950 and 2015 (Figure 37) with the effects of the declines in fertility and mortality becoming evident by 2010. The somewhat odd pattern at the younger ages of the population distribution for 2015 is borne out by the results of the most recent census conducted in South Africa in 2011, and is a reflection of the decreased number of births around the turn of the millennium. By 2050, South Africa's age-sex structure is

projected to be heavily weighted towards adults between the ages of 20 and 50, which might provide the basis for capturing some portion of a demographic dividend.

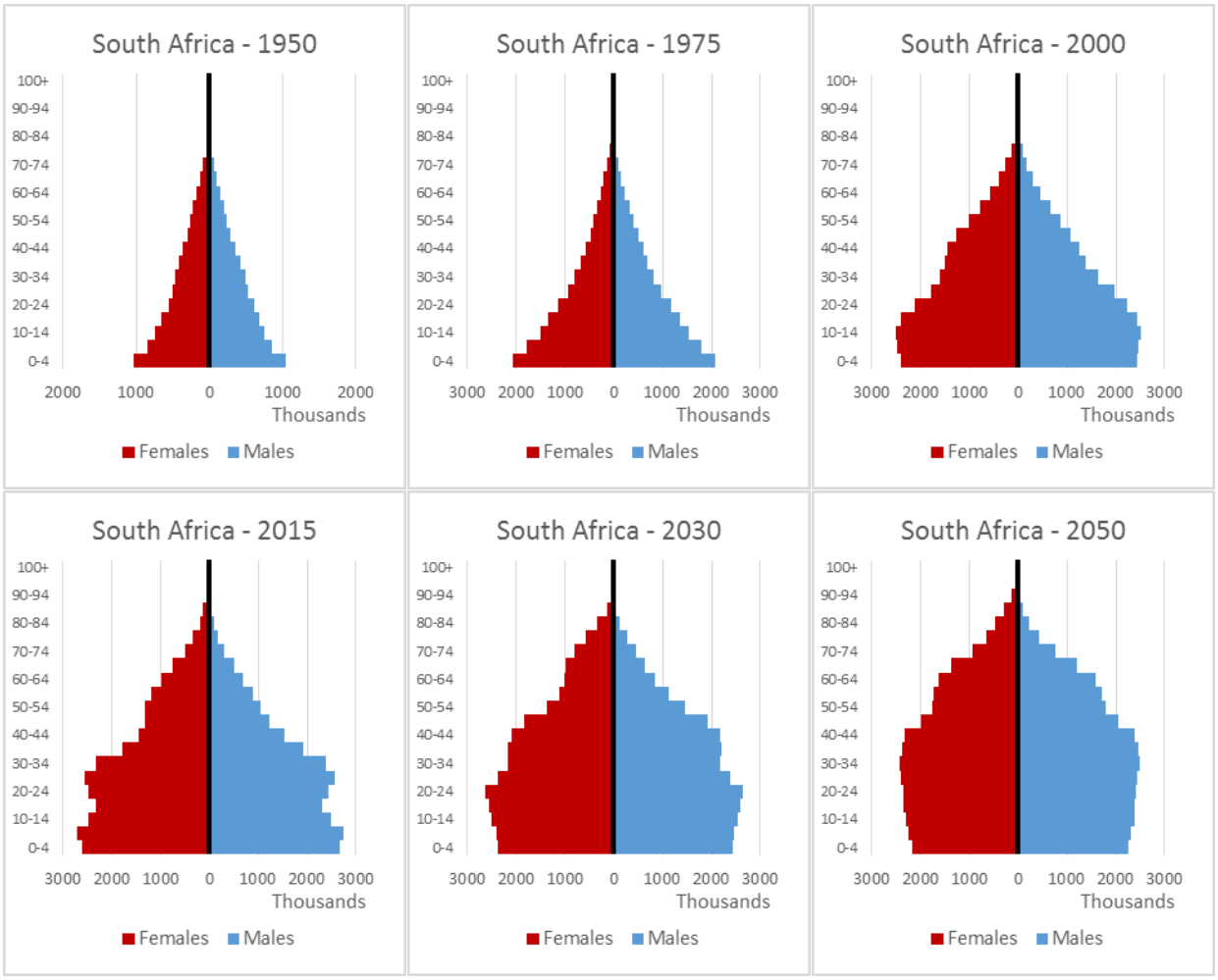

Figure 37 Population pyramids, South Africa 1950, 1975, 2000, 2015, 2030 and 2050

D. HIV prevalence and AIDS-related mortality, 1975-2050

According to the default Spectrum model incorporating the effects of HIV and AIDS used by UNAIDS, HIV prevalence among adults of both sexes aged 15-49 in South Africa is close to its peak, and is expected to decline slowly from 19.2 per cent in 2015 to 15.4 per cent by 2050 (Figure 38). The slight increase in prevalence expected in the next few years reflects the combined still-high rates of incidence, as well as the effect caused by the widespread roll-out of ART in the country, thus contributing to the population of HIV-infected people.

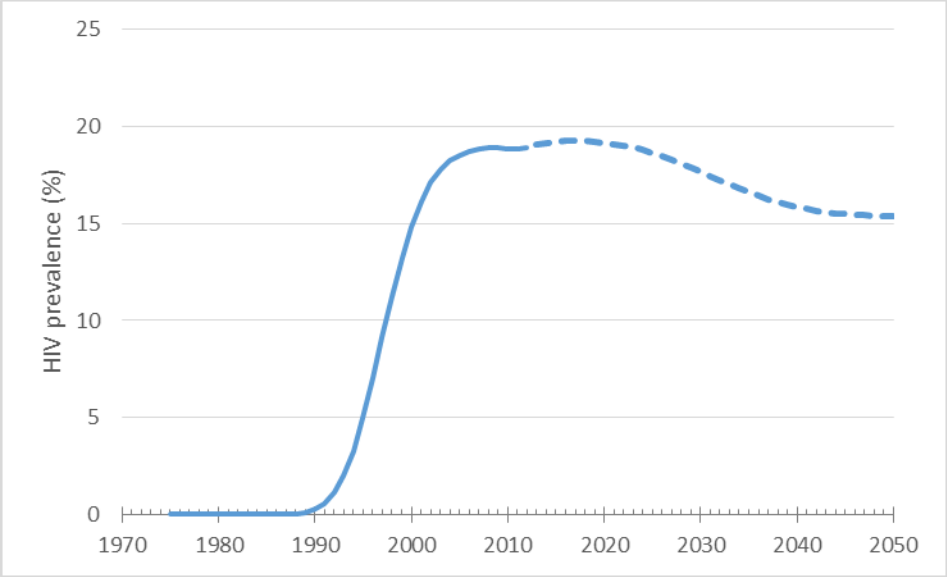

Figure 38 HIV prevalence among adults aged 15-49 (both sexes), South Africa 1975-2050

Note: Dotted segments represent projected data

Consistent with this small change in prevalence expected over the coming decades, the proportion of all deaths that is attributable to HIV/AIDS (as distinct from all deaths among those who are HIV positive) is expected to fall slowly from 29.8 per cent of all deaths in 2015 to 23.5 per cent by 2050 (Figure 39).

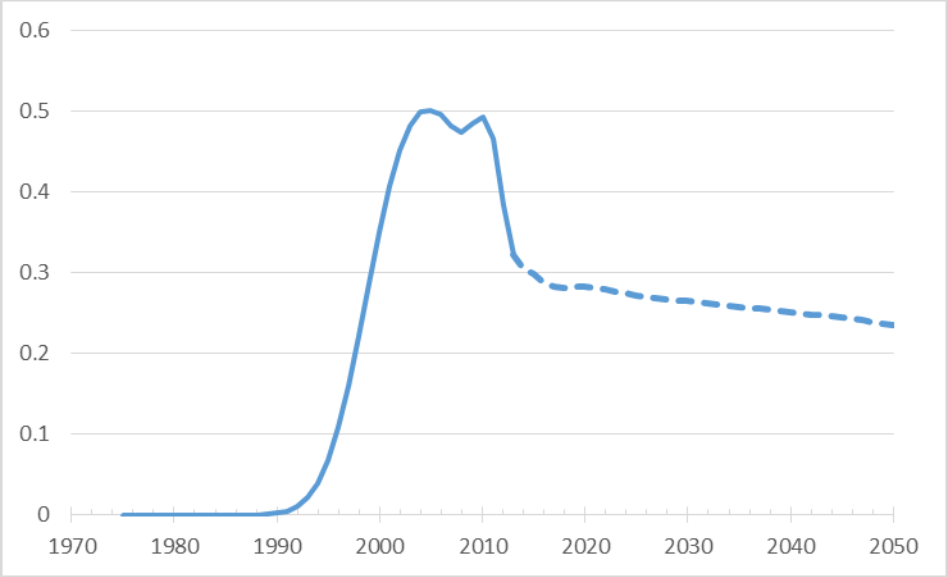

Figure 39 Proportion of all deaths attributable to HIV/AIDS, South Africa 1975-2050

Note: Dotted segments represent projected data

E. Dependency ratios and the demographic dividend

Past and projected dependency ratios in South Africa reflect the decline in fertility, and the gradual reduction in adult mortality after 2005 (Figure 40). The maximum dependency ratio was in 1966, with 84 dependents (young and elderly) per 100 population aged 15-64. The overall

dependency ratio (represented by the combined height of the two series) will decline from 53.9 dependents per 100 adults aged 15-64 in 2015 to 47.3 by 2050 having reached a minimum of 46.3 in 2044. As can be observed, the slow pace of decline in dependency ratio is driven by the substantial increase in the proportion of the population that is elderly, which almost completely offsets the reduction in the population of young people.

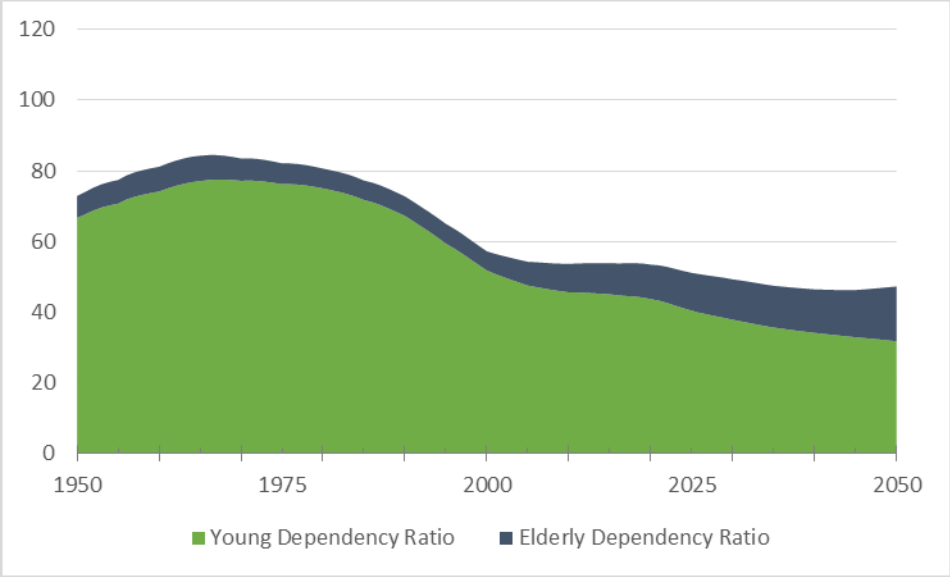

Figure 40 Young, old and total dependency ratios, South Africa 2015-2050

Perhaps not surprisingly given the slow change in the country's population structure, using the more restrictive definition of the 'demographic window' the World Population Prospects projections suggest that the 'window' has – unlike any other county in the region – already opened in 2009 (Figure 41). According to this definition and based on the data up to 2100 from the 2012 WPP, the 'demographic window' will remain open to 2069 (not shown).

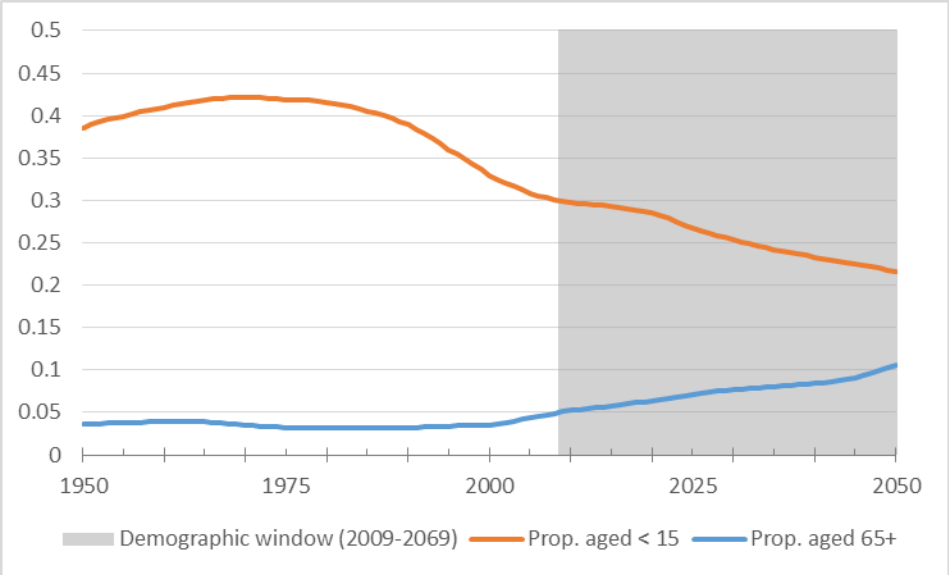

Figure 41 The demographic window, South Africa 1950-2050

F. Profile of the working age population by educational attainment

As described in Section III, data on projections by level of education produced by IIASA can be combined with the data from the World Population Prospects. Figure 42 presents population pyramids for South Africa that demonstrate the projected composition of the population by educational attainment for the population aged between 15 and 64.

Between 2020 and 2050, it is expected that the overall human capital stock will increase as the proportion of the population with only a primary education falls dramatically, and the proportion of the population (of either sex) with upper secondary or post-secondary education increases. By 2050, the vast majority of the working age population will have upper secondary or post-secondary education.

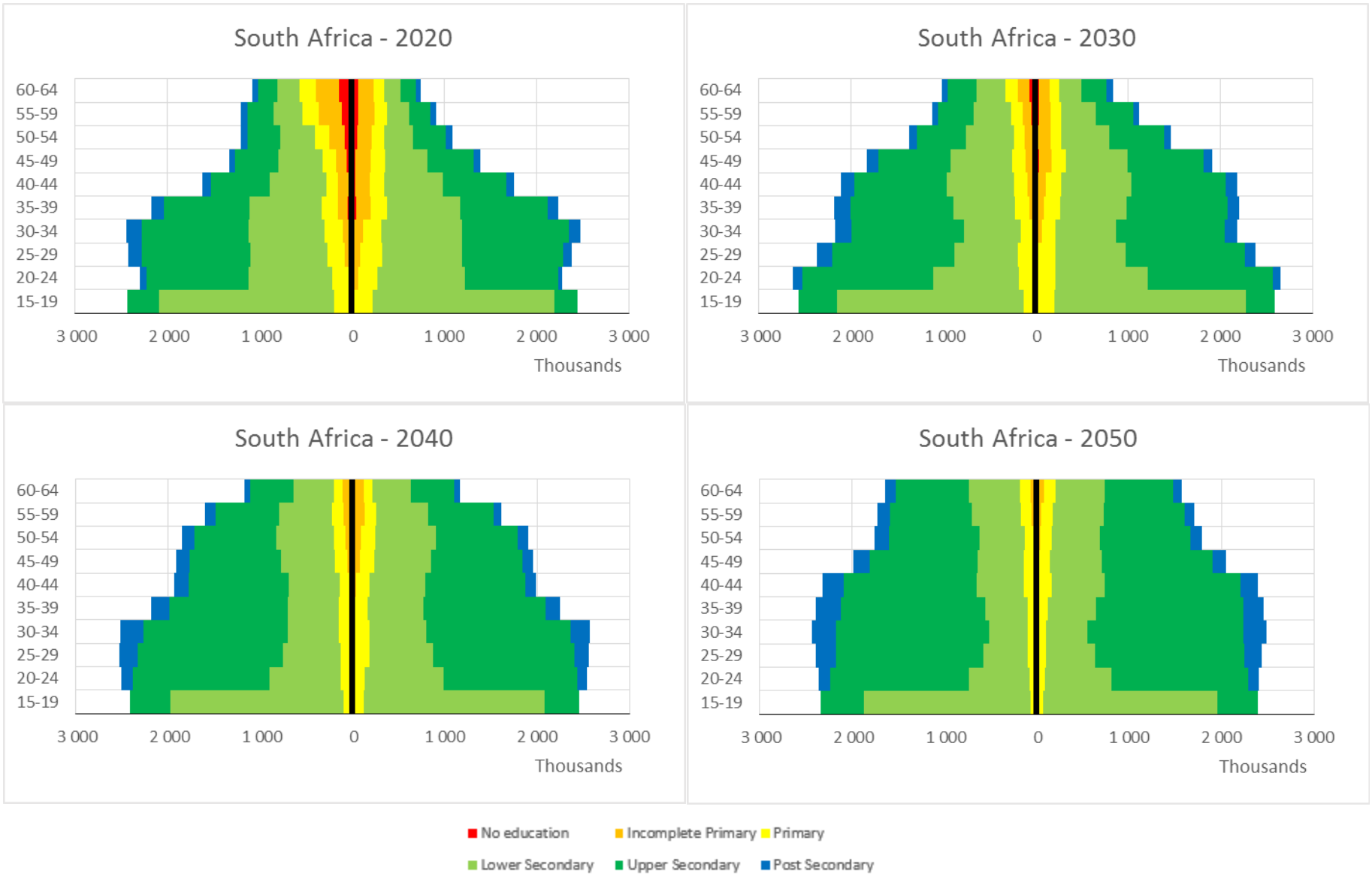

Figure 42Population pyramids for South Africa by educational attainment, 2020-2050

G. Ageing

A further aspect of demographic change in South Africa over the next 35 years to be considered is the proportion of the population aged over 65, over 70 and over 75. This gives important information about the cost implications for social welfare systems should they exist, be expanded or instituted.

While it should be borne in mind that the proportion of the population that is elderly is affected by changes in fertility and mortality at younger ages in earlier times, Figure 43 shows that the proportion of the population aged 65 and over has already begun to increase rapidly and is expected to increase dramatically in the future: from nearly 6 per cent of the population in 2015 to 10.5 per cent by 2050. The proportion of the population aged 75 and older is expected to almost double over the period.

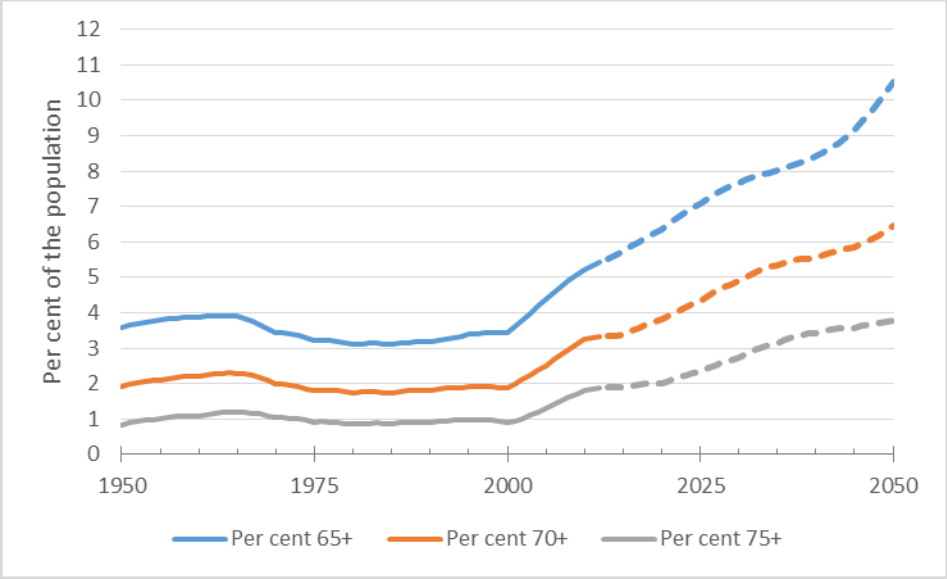

Figure 43 Proportion of the population aged over 65, over 70 and over 75, South Africa 1950-2050

Note: Dotted segments represent projected data

VIII. Swaziland

A. Population and crude rates of fertility and mortality, 1950-2050

The essential changes in the population of Swaziland between 1950 and 2050, as indicated by the historical and projected data in the WPP, are evident from Figure 44.

The population of Swaziland has increased from 0.27 million people in 1950 to 1.29 million in 2015 and is projected to reach 1.82 million by 2050. The country experienced a rapid rise in its growth rate between 1950 and the late 1980s (when it reached a maximum of 3.6 per cent per annum in 1986), brought about by the decline in crude death rates while crude birth rates remained largely unchanged. The demographic transition commenced rather late in Swaziland, brought about by a sustained fall in the crude birth rates beginning in the late 1980s. Crude death rates rose in the 1990s and the early years of this century as a consequence of HIV/AIDS, but have been declining again since 2004. The crude rate of natural increase is 1.5 per cent per

annum in 2015, and is expected to fall further to stabilise at around 1.0 per cent per annum between 2030 and 2050.

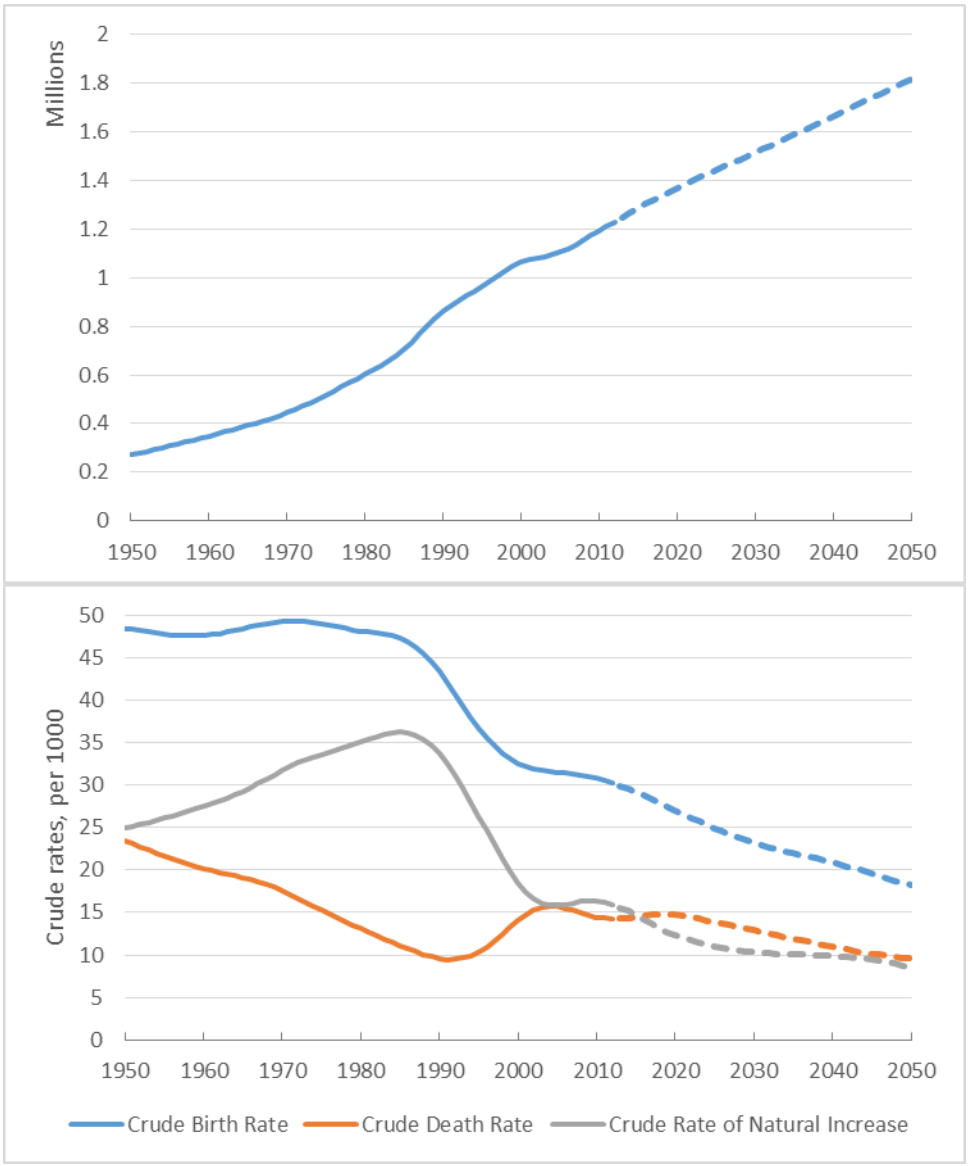

Figure 44 Total population (top panel), and crude rates of birth, death and natural increase (bottom panel), Swaziland 1950-2050

Note: Dotted segments represent projected data

The WPP assumes 6 000 emigrants will leave the country in each five year period from 2015-2020 through to 2045-2050.

Limited urbanisation is projected for Swaziland for the period 2015 to 2050: the United Nations Population Division's World Urbanization Prospects suggests that 21.3 per cent of the country's population lived in urban areas in 2015, and that this would increase to 28.8 per cent by 2050.

B. Demographic indicators for Swaziland, 1950-2050

Figure 35 presents the most important demographic indicators for the population of Swaziland over the period 1950-2050.

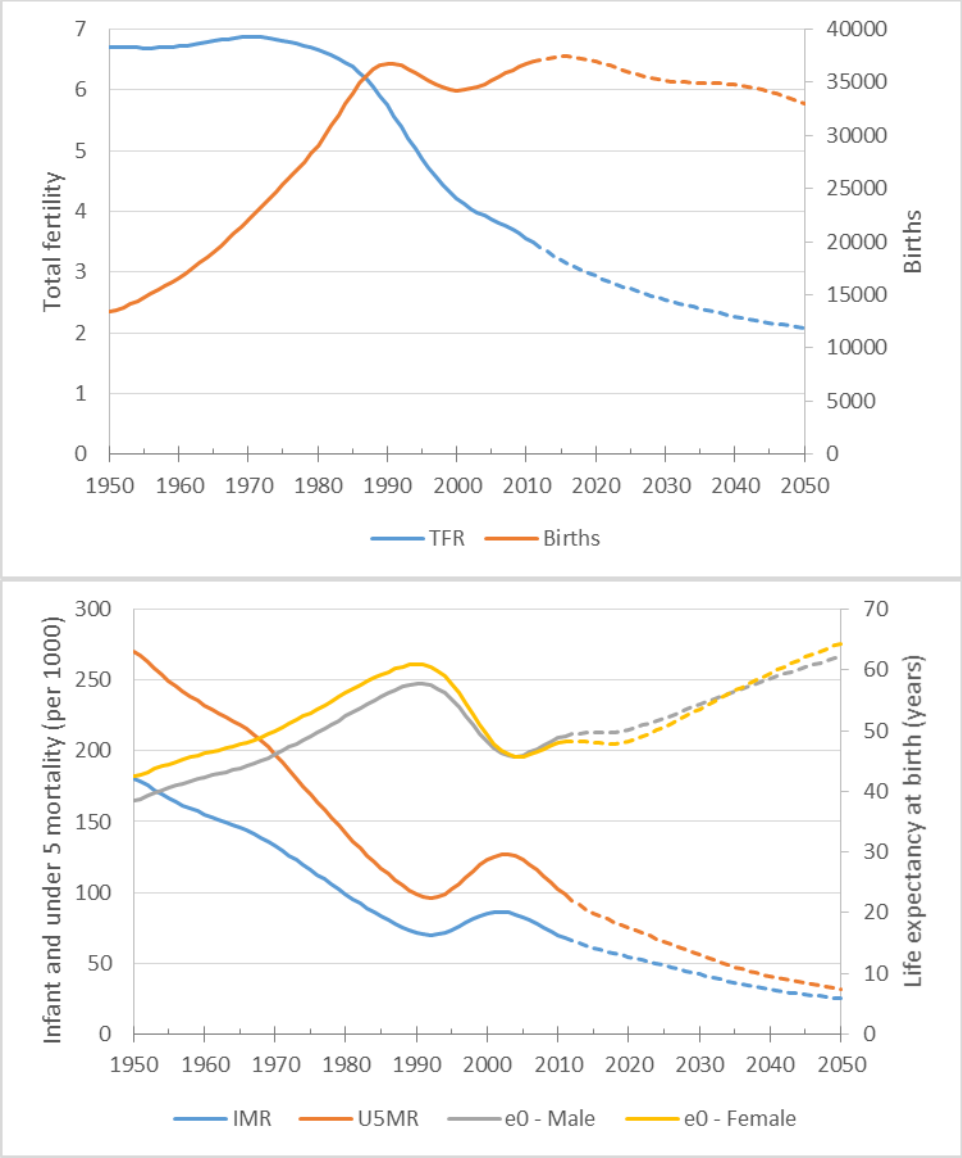

Figure 45 Measures of fertility (top panel) and mortality (bottom panel), Swaziland 1950-2050

Note: Dotted segments represent projected data

In terms of fertility (top panel of Figure 45), the total fertility rate began to decline in the mid-1970s and has fallen from 6.7 children per woman in 1950 to 3.2 in 2015. Future fertility decline is expected to be slow – total fertility will fall below 2.1 children per woman in 2027 according to the 2012 WPP, and will be 1.9 children per woman by 2050. The number of births each year is projected to decrease by around 10 per cent between 2015 and 2050, from approximately 37 000 to 33 000.

Both infant and child mortality in Swaziland fell by over 60 per cent between 1950 and 1990. The rapid spread of HIV in the 1990s reversed that trend, and both measures increased notably

through to 2005, after which the decline again resumed. By 2010, both measures were at the level they were before the effects of HIV/AIDS became apparent. Infant and under five mortality is projected to fall by a further 60 per cent between 2015 and 2050, to 25.0 and 31.7 deaths per 1000, respectively.

The decline in mortality up until 1990 saw substantial gains in life expectancy at birth of around 19 years for men and 18 for women (to 57.8 years for men, and 61.0 years for women). The effect of HIV/AIDS precipitated a sharp decrease in life expectancy at birth to around 46 years. The WPP indicates that pre-AIDS levels of life expectancy at birth are expected only around 2039. Life expectancy at birth in 2050 is projected to be 62.2 and 64.4 years respectively.

Figure 46 shows the (period) probability of a 15 year old surviving to age 65 in Swaziland over the century from 1950-2050. Having decreased in almost linear fashion up until 1990, the period effects of HIV/AIDS are clearly evident in the dramatic increase after 1990. Adult mortality levels are not projected to regain their pre-AIDS levels before 2050. Also noteworthy is the inversion of the female mortality advantage over an extended period between 2010 and 2035.

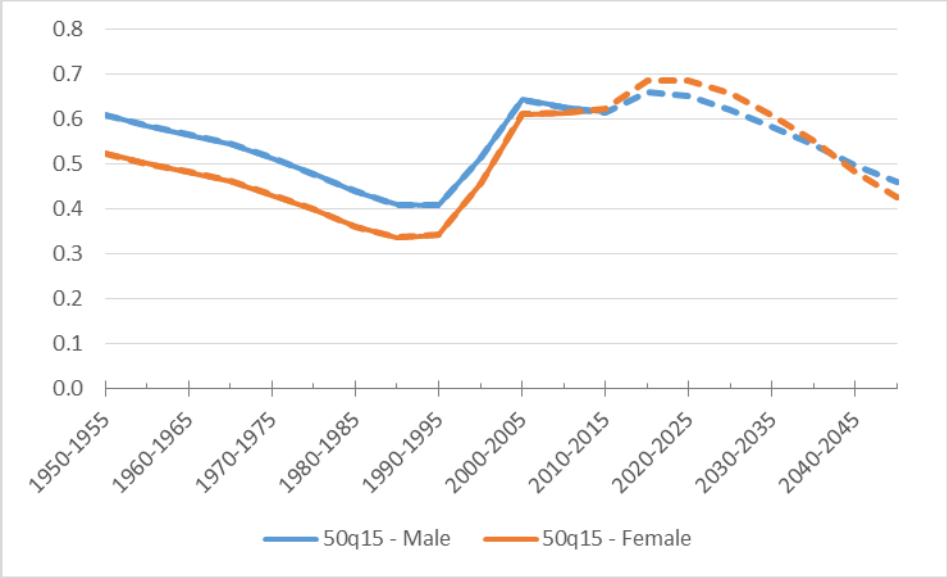

Figure 46 Trend in the probability of a 15 year dying before the age of 65, 50q15, by sex, Swaziland 1950-2050

Note: Dotted segments represent projected data

C. The changing age-sex structure of the population of Swaziland, 1950-2050

The progress of the population of Swaziland through the demographic transition is indicated by the change in the age-sex structure of the population between 1950 and 2015 (Figure 47) with the effects of the declines in fertility and mortality becoming evident by 2000. High levels of male out-migration are evident in the data for 1985. By 2050, Swaziland's age-sex structure is projected to be heavily weighted towards those under 30, although a significant proportion of the population will still be aged less than 15.

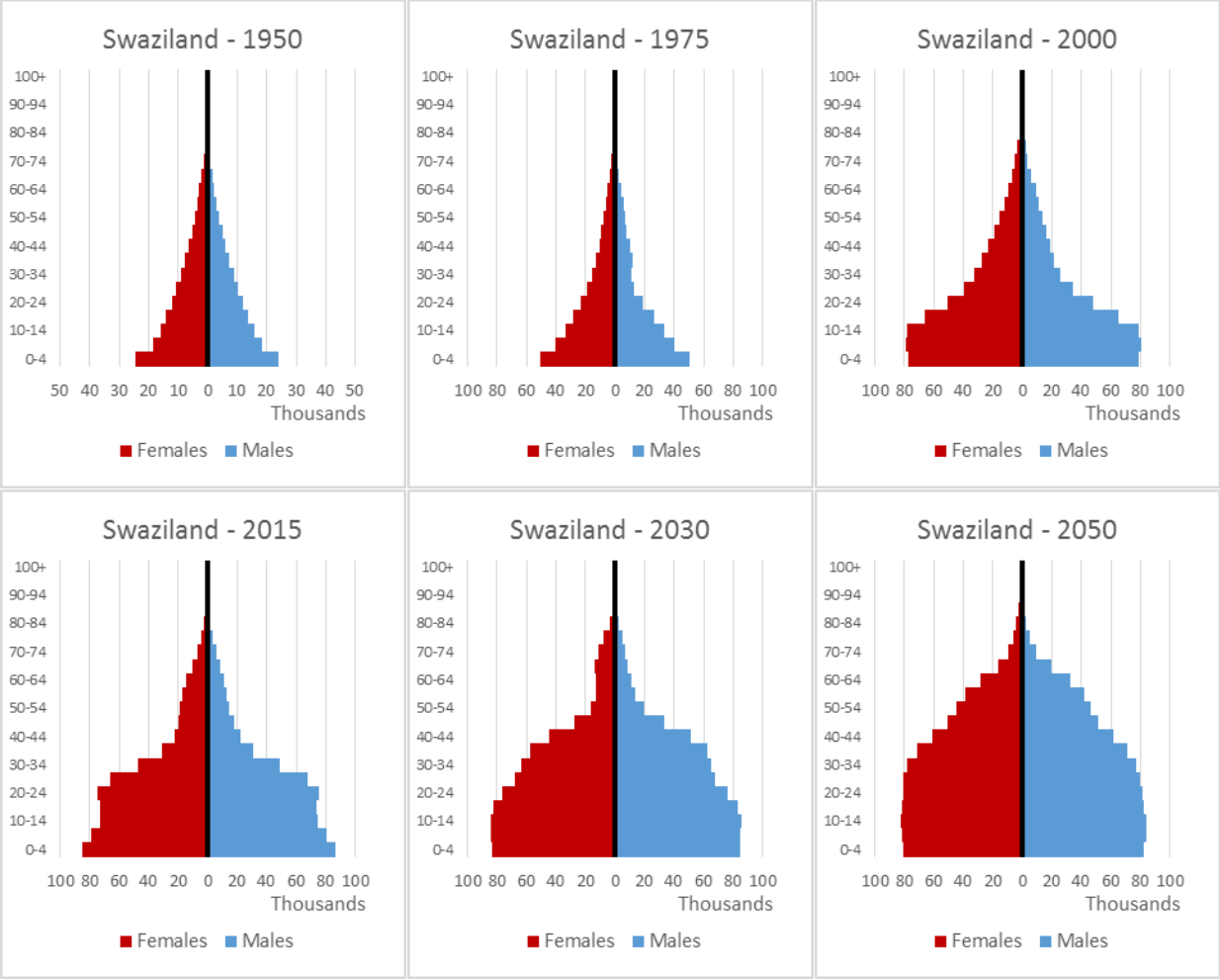

Figure 47 Population pyramids, Swaziland 1950, 1975, 2000, 2015, 2030 and 2050

D. HIV prevalence and AIDS-related mortality, 1975-2050

According to the default Spectrum model incorporating the effects of HIV and AIDS used by UNAIDS, HIV prevalence among adults of both sexes aged 15-49 in Swaziland has passed its peak, and is expected to decline slowly from 26.8 per cent in 2015 to 14.1 per cent by 2050 (Figure 48).

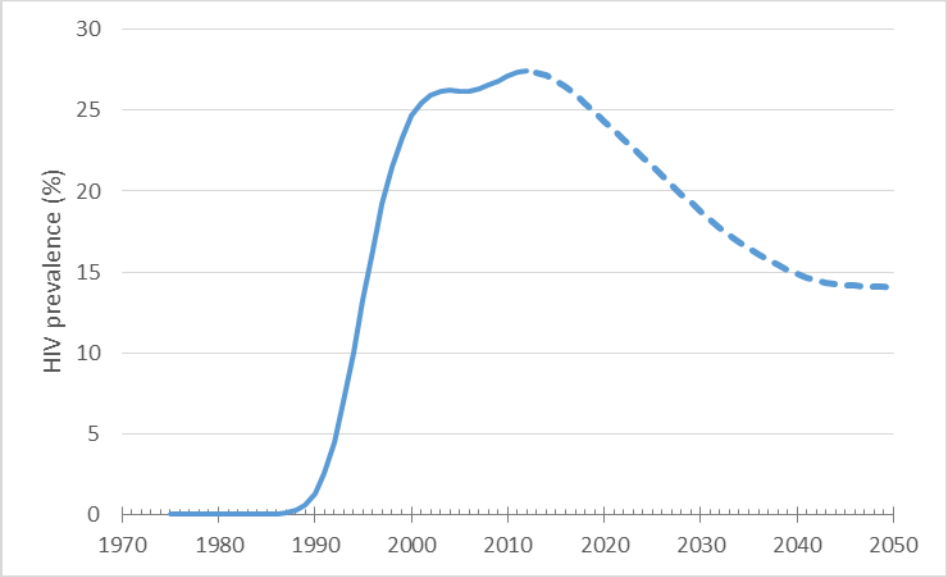

Figure 48 HIV prevalence among adults aged 15-49 (both sexes), Swaziland 1975-2050

Note: Dotted segments represent projected data

The changes in prevalence expected over the coming decades are consistent with the proportion of all deaths that is projected to be attributable to HIV/AIDS (as distinct from all deaths among those who are HIV positive), is expected to fall from 41.2 to 30.3 per cent of all deaths between 2015 and 2050 (Figure 49).

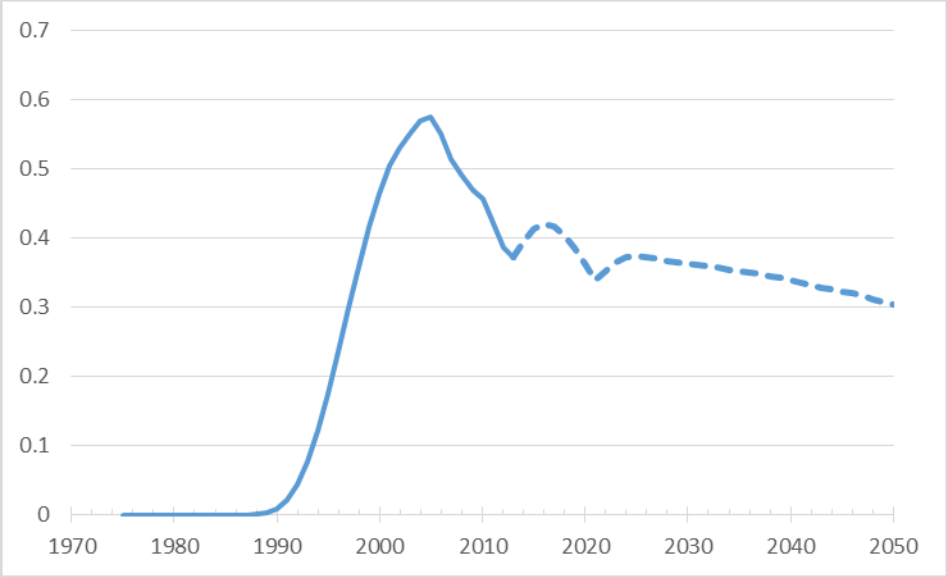

Figure 49 Proportion of all deaths attributable to HIV/AIDS, Swaziland 1975-2050

E. Dependency ratios and the demographic dividend

Past and projected dependency ratios in Swaziland reflect the decline in fertility, and the gradual reduction in adult mortality after 2005 (Figure 50). The maximum dependency ratio was in 1983, with 107 dependents (young and elderly) per 100 population aged 15-64. The overall dependency ratio (represented by the combined height of the two series) will decline

substantially from 69.1 dependents per 100 adults aged 15-64 in 2015 to 46.1 by 2050. This decline is almost entirely attributable to the decline in young dependency ratio.

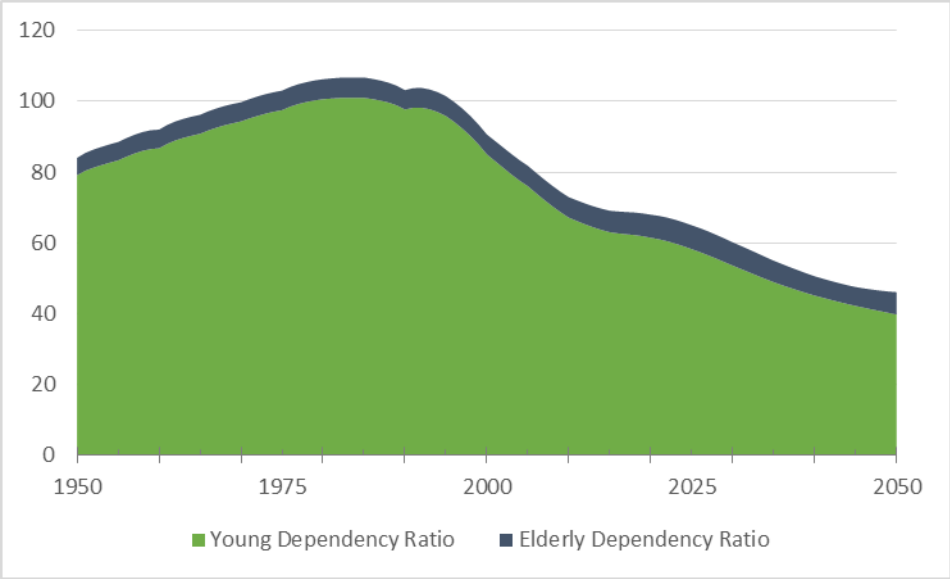

Figure 50 Young, old and total dependency ratios, Swaziland 2015-2050

Furthermore, the World Population Prospects projections suggest that the 'demographic window' will open last of the five countries in the region, in 2040. (Figure 51). According to this definition and based on the data up to 2100 from the 2012 WPP, the 'demographic window' will remain open to 2086 (not shown).

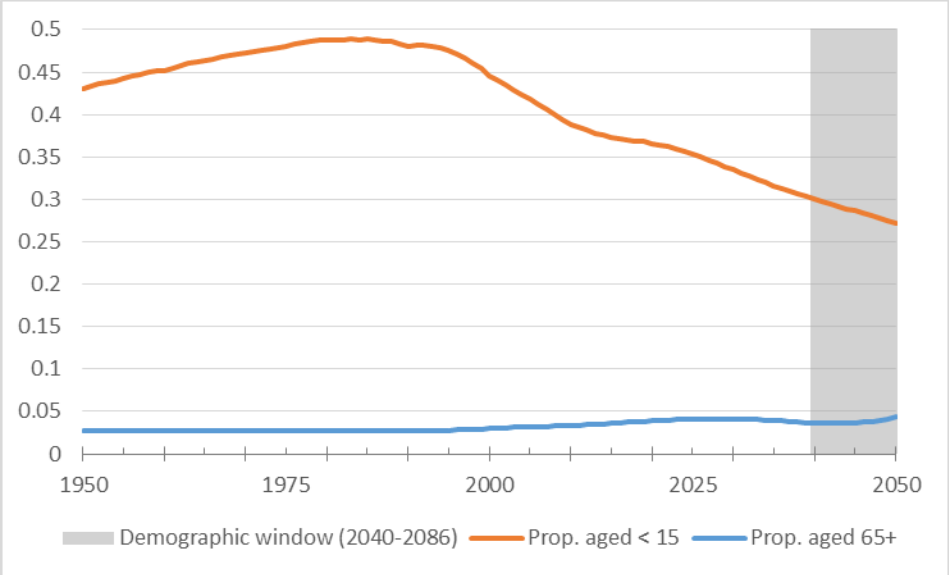

Figure 51 The demographic window, Swaziland 1950-2050

F. Profile of the working age population by educational attainment

As described in Section III, data on projections by level of education produced by IIASA can be combined with the data from the World Population Prospects. Figure 52 presents population

pyramids for Swaziland that demonstrate the projected composition of the population by educational attainment for the population aged between 15 and 64.

Between 2020 and 2050, it is expected that the overall human capital stock will increase as the proportion of the population with only a primary education falls dramatically, and the proportion of the population (of either sex) with upper secondary or post-secondary education increases. By 2050, the vast majority of the working age population will have upper secondary or post-secondary education.

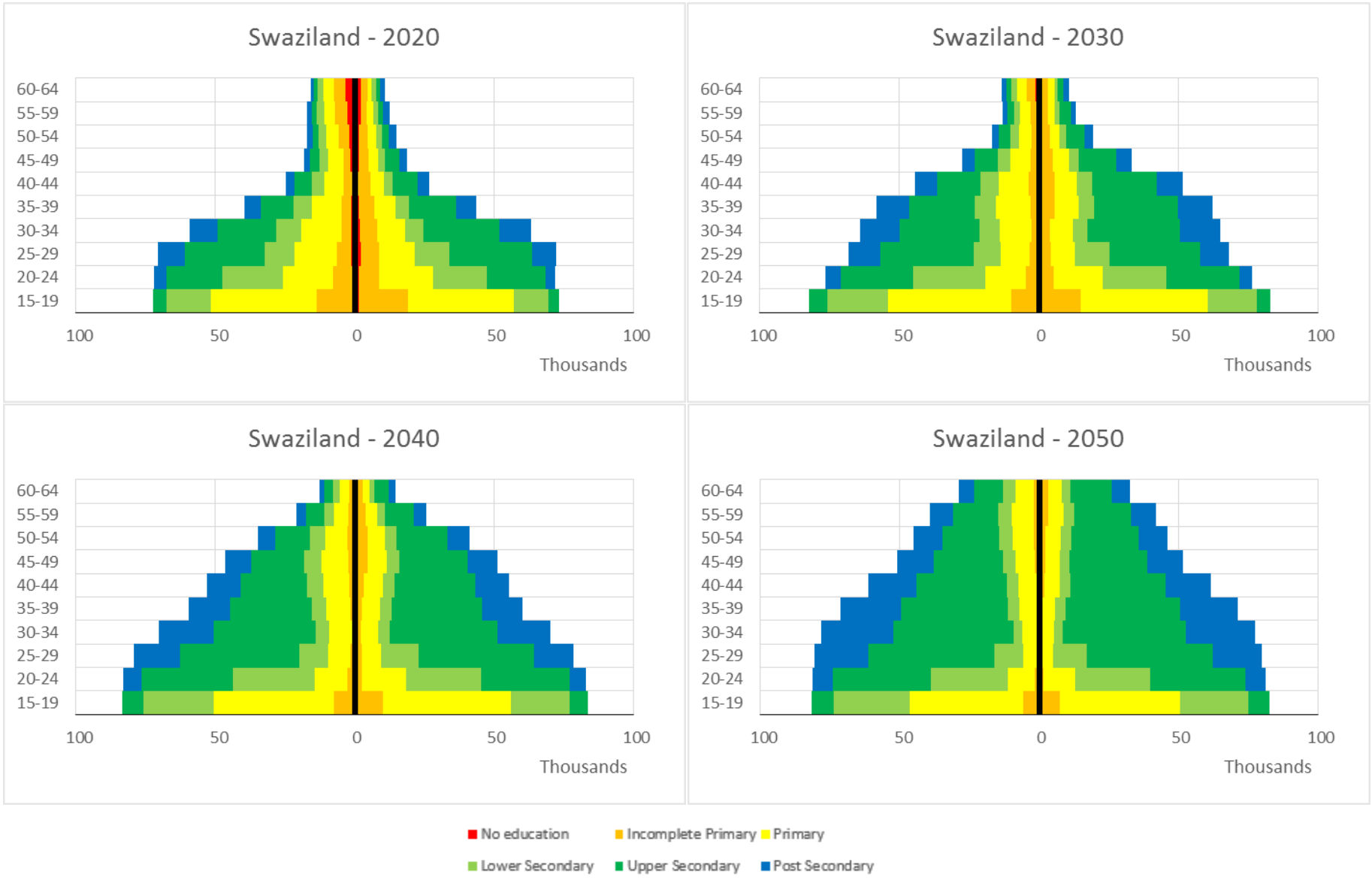

Figure 52Population pyramids for Swaziland by educational attainment, 2020-2050

G. Ageing

A further aspect of demographic change in Swaziland over the next 35 years to be considered is the proportion of the population aged over 65, over 70 and over 75. This gives important information about the cost implications for social welfare systems should they exist, be expanded or instituted.

While it should be borne in mind that the proportion of the population that is elderly is affected by changes in fertility and mortality at younger ages, Figure 53 shows that the proportion of the population aged 65 and over is not expected to show much change over the period. The proportion of the population of Swaziland that is elderly is expected to remain small.

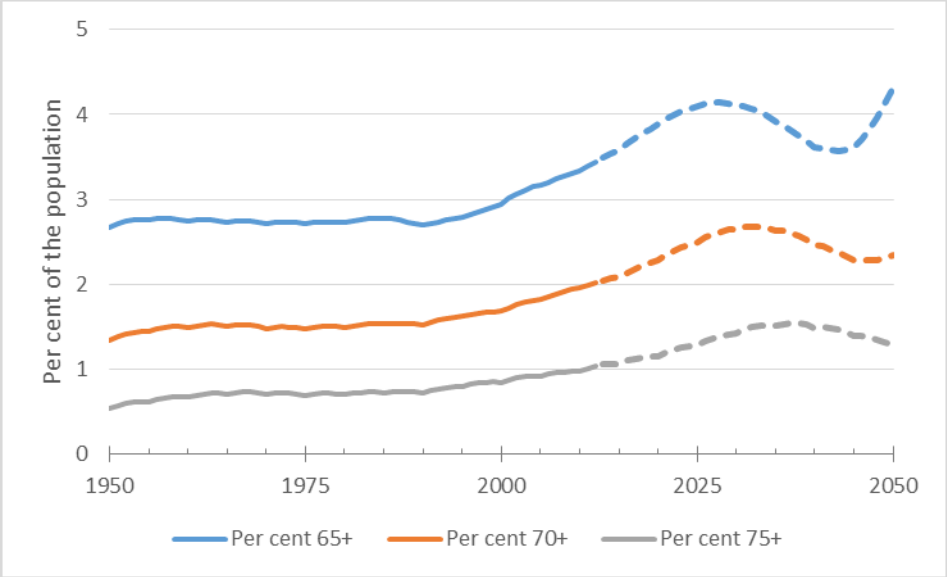

Figure 53 Proportion of the population aged over 65, over 70 and over 75, Swaziland 2015-2050

Note: Dotted segments represent projected data

IX. Cross-national and cross-regional comparisons

The data presented in the preceding five sections for each of the constituent countries of Southern Africa have indicated how the age-structural transition may play out over the coming decades. The ongoing demographic transition may contain the seeds for a demographic dividend. Bloom, Canning and Sevilla (2002) argue that the demographic dividend has two distinct components – the first being the change in the age structure of the population described above; the second (predicated on the first) arising from the savings and accumulation of capital during the period of the first demographic dividend which may capacitate ongoing economic growth long after the first demographic dividend has passed (Mason 2007). The first dividend is structural and is – to all intents and purposes – inevitable (although Mason and Lee (2012) make the point clearly that the more drawn out that process of age-structural transition is, the more muted the first demographic dividend will be). As shown in Figure 41, South Africa's first demographic transition, is expected to last some 60 years, from 2009 to 2069.

Past rates of population growth in the five countries of Southern Africa were significantly higher than those in sub-Saharan Africa and the lower middle income countries (the top panel of Figure 54), setting in place demographic momentum that has and will impede future demographic

change in those five countries. Only South Africa (a higher middle income country[5]) stands out, while the slow pace of demographic change in sub-Saharan Africa suggests that any demographic dividend at all may prove elusive. The lower panel of Figure 54 compares the five Southern African countries with higher middle income countries, the high-income OECD and BRICS countries, as well as East Asia. Again, the more dramatic population growth of the Southern African countries stands out.

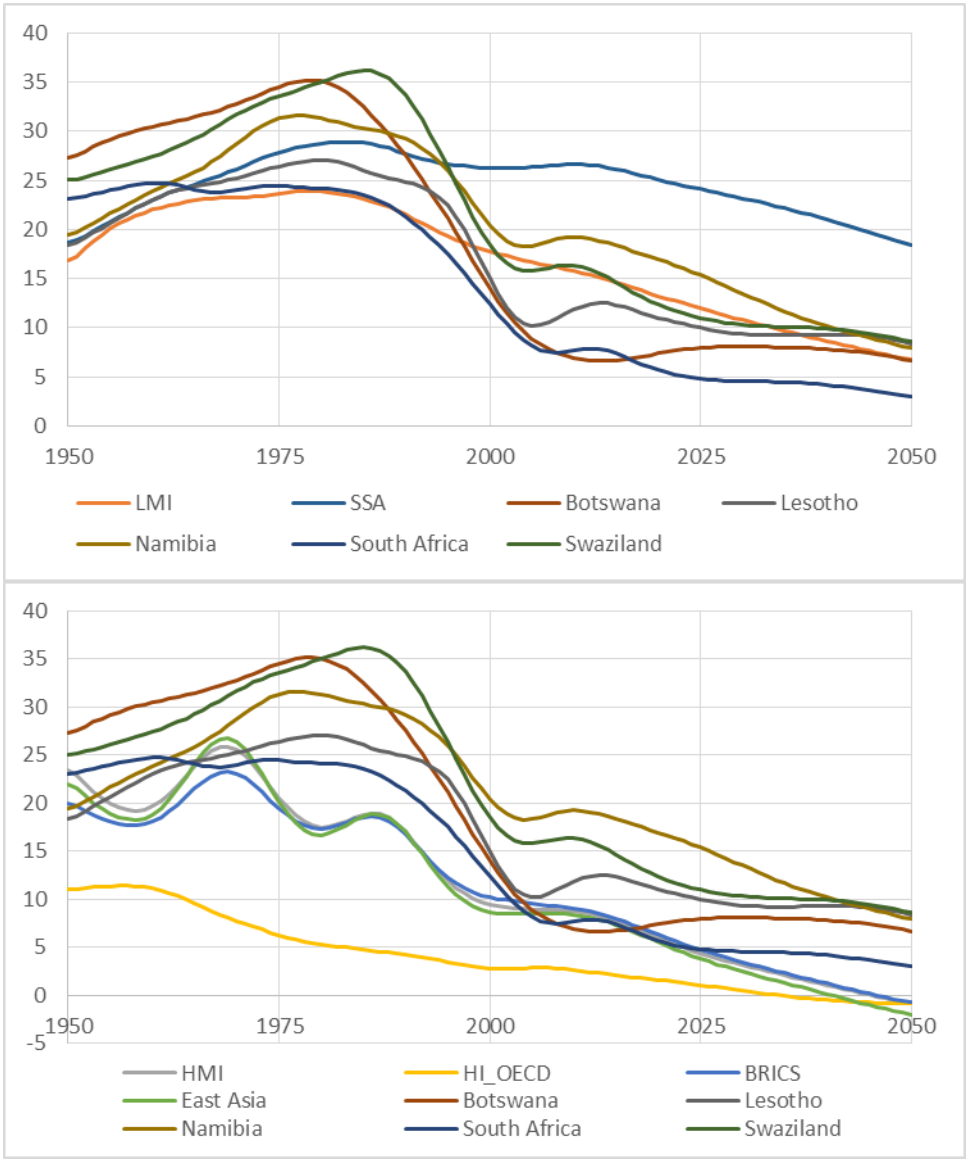

Figure 54 Crude rates of natural increase, five countries of Southern Africa compared with low middle income countries and sub-Saharan Africa (top panel) and high middle income countries, the high income OECD countries, the BRICS nations and East Asia (lower panel)

Since population growth is directly connected to the proportion of a population that is either young or elderly, the effects of these different population growth trajectories on the demographic window are similarly direct.

[5] The classification of countries follows the World Bank's classification system, available at http://data.worldbank.org/about/country-and-lending-groups

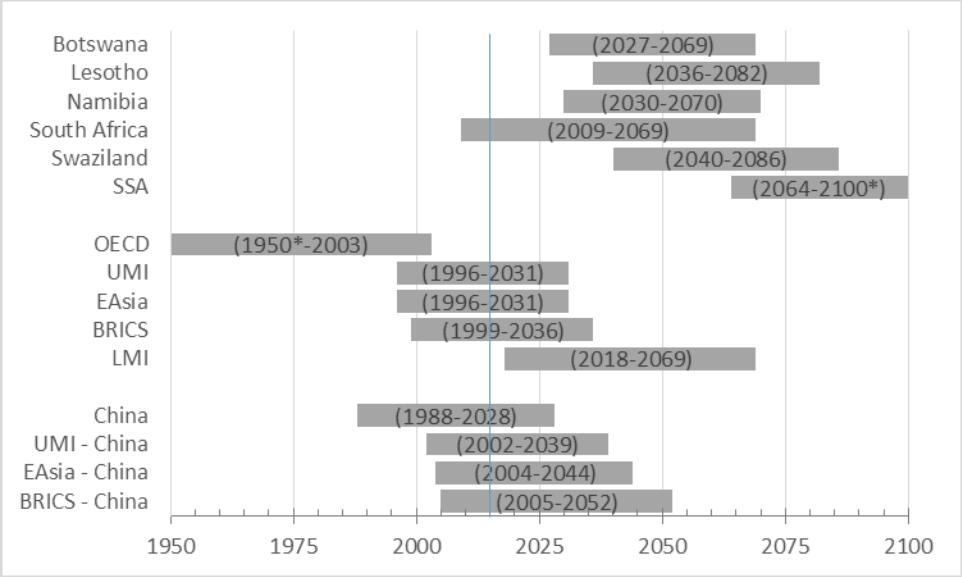

Figure 55 Periods when the demographic window is open, five countries of Southern Africa and other comparator regions.

Note: An asterisk next to a date indicates the window is open before or after the period covered by the 2012 WPP dataset.

Figure 55 shows a timeline of the opening of the demographic window. Of the five Southern African countries, the demographic window is presently open only in South Africa. Other countries' windows will open more than a decade hence. For comparison's sake, the demographic windows for the OECD countries, the upper and lower middle income countries, East Asia and the BRICS are shown. China is presented separately, and included from the data on the upper middle income, East Asia and BRICS countries in the final panel of the figure on account of China's population size and distinctive demographic structure brought about by the 'one-child' policy. What is remarkable about the data presented in this figure, too, is that it is immediately evident that the demographic window will, in general, open much later and for longer in sub-Saharan Africa and the five Southern African countries. This does not augur well for the capturing of the first demographic dividend: by way of counter-example, South Korea's demographic window lasted a mere 33 years.

The South Korean case is instructive for other reasons too. Applying the IIASA educational data to the population data from the 2012 WPP for South Korea in 2020 shows the profile of that population by age, sex and educational attainment towards the end of the demographic window. In stark contrast to the data presented for each of the Southern African countries earlier, Figure 56 indicates that, towards the end of the demographic window, levels of human capital in South Korea in 2020 are much higher than any of the Southern African country in 2050. These differences will almost certainly compromise the capturing of a demographic dividend in the countries in the region.

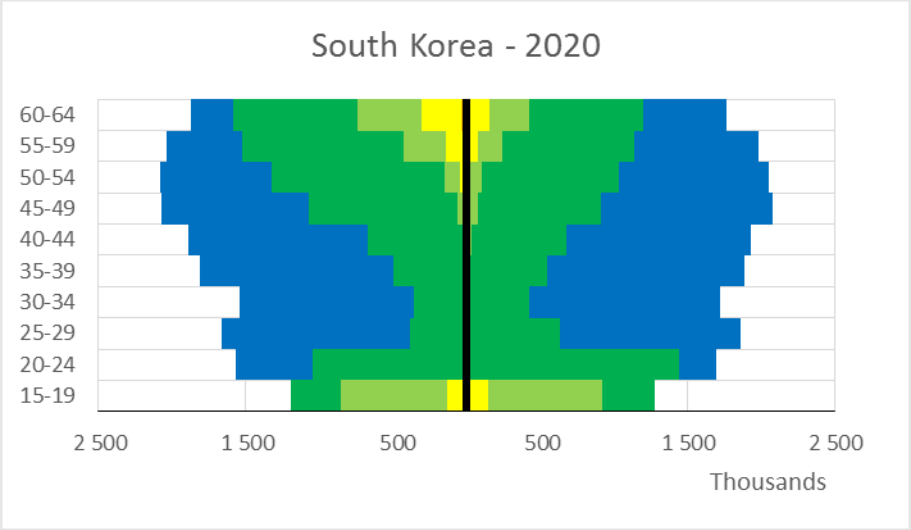

Figure 56Population pyramid for South Korea by educational attainment, 2020

The second demographic dividend may well prove even more elusive in many developing countries.

X. Conclusions

The nature of demographic transition, characterised as it is by the movement from a younger population structure to one that is older, is one of the principal determinants of whether a demographic dividend may be realised. During this transition, populations will pass through a 'Cinderella' period – neither too young nor too old, where the proportion of the population that is of working age is close to its maximum.

But the oft-cited maxim that 'demography is destiny' overstates the importance of demography in the quest for development. Other things matter, and account for a more significant component of development and economic growth: the existence and stability of development- and growth-reinforcing social and political institutions; the level of education in a population; policies that encourage the retention of skills in that population rather than encouraging the international migration of skilled labour to more developed and more receptive countries, to name but some. Indeed, one of the earliest papers on the demographic dividend (Bloom, Canning and Sevilla 2002) suggested that only between 25 and 40 per cent of East Asia's economic miracle can be attributed to purely demographic factors. Differently put, between 60 and 75 per cent of that growth is explained by factors other than demography.

High levels of unemployment; poor prospects for higher earnings (due, for example, to the inadequacies of the education system or inefficiencies in the labour market); and the use of current income to cover current consumption (either for the earner, or for dependents who themselves may be in the economically active age range but who are not themselves economically active) may all attenuate the level of saving and capital formation, especially in the developing world.

These factors have been recognised in recent macro-economic studies conducted across the developing world (Mason and Lee 2012), as well as in South Africa (Oosthuizen 2014; in press). At the very least, the National Transfer Accounts model that is used in such studies should seek to take into account the changing educational profile of the populations and economies being modelled and the savings and wealth that is generated disproportionately by education (as a

proxy for income). Mechanisms to integrate the kind of work undertaken by IIASA into these models should be explored.

Such an exercise would be a challenge, not only because of the greater complexity demanded of the models used but also because the data requirements to parameterise such modified models far exceed the capacity and reliability of the extant data to do so. However, there may be cause for hope. The proposed Data Revolution for Sustainable Development (United Nations 2014) is seeking to set in place new methods and vehicles for collecting and harnessing data for development while simultaneously capacitating national statistical systems across the globe.

The time is right for doing so: as was shown in the previous section, the demographic window for the first demographic dividend is closing in many parts of the world. Based on the 2012 WPP, lower middle income countries, the least developed countries, and most of sub-Saharan Africa (South Africa being the clear exception from the data presented earlier) are all but a few years away from being in a position to start capturing the first demographic dividend, which is necessary but not sufficient for the capturing of the second.

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