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Making the Most of Demographic Change in Southern Africa

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Abstract

The countries of the Southern African Customs Union have relatively diverse demographic and economic starting points. These economies have the potential to realize demographic dividends and experience an acceleration in their income per capita growth and poverty reduction progress through forthcoming shifts in their age structures. Between 35 and 75 percent of poverty reduction in 2015–50 in Southern African Customs Union economies could be attributed to demographic shifts in a business-as-usual scenario of economic development, if employment rates are at least maintained. The magnitude of the demographic dividends could be greater if countries are able to achieve policy outcomes in parallel in the areas of education, savings-investment, and employment. Scenario analyses of these different policy outcomes interacting with the shifting age structures in different ways suggest quantitatively different economic impacts despite qualitatively similar policies. Improving educational attainment is found to be most important in Lesotho and Swaziland; mobilizing savings for higher investment can be most useful for Botswana; and improving employment rates, especially by closing gender gaps, can be most useful for South Africa and Namibia.

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1. INTRODUCTION

Sub-Saharan Africa will be undergoing substantial demographic changes in the coming decades with the rising working age share of its population. Recent analyses suggest that demographic dividends in the region could account for 11 to 15 percent of GDP volume growth by 2030, while accounting for 40 million to 60 million fewer poor in 2030 (Ahmed et al. 2016). However, the realization and magnitude of demographic dividends for a given African country would depend on their current demographic profile and their trends in their demographic changes, as well as their ability to create an appropriate enabling environment (World Bank 2015a). An appropriate enabling environment would include improvements in educational attainment and quality, labor productivity, savings and investment, and job creation.

This paper examines how demographic dividends may play out in the economically linked but otherwise diverse Southern African Customs Union (SACU) economies, when presented with similar economic policy outcomes. SACU economies - Botswana, Lesotho, Namibia, South Africa, and Swaziland – have relatively diverse demographic and economic starting points. This diversity is present in terms of their demographic profile, as evidenced by South Africa being further along in the demographic transition process than the other countries. The diversity is also present in terms of their development indicators, as illustrated by the relatively lower educational attainment rates in Lesotho and Swaziland, or the extremely high unemployment rates in South Africa.

Three broad questions are addressed:

1) What is the potential contribution of demographic change to growth in the different SACU economies?
2) What is the potential effect of demographic change on poverty reduction for SACU economies?
3) What policy intervention might have the largest impact on the size of a SACU economy's demographic dividend?

Several different possible scenarios for demographic change and development in the SACU economies are considered following the approach of Ahmed et al. (2016) where a global dynamic simulation model is applied in tandem with a microsimulation model based on harmonized household and labor force survey data. Demographic changes in the different economies are considered against the backdrops of different policy outcomes in the areas of educational improvement, mobilizing savings, and improving employment rates. When considering the scenarios of individual interventions, Lesotho and Swaziland benefited the most from improvements in educational attainment rates by achieving higher economic growth and lower poverty rates. For other economies, interventions that had greater impacts were those that focused on improving employment ratios, through higher labor force participation, reducing unemployment, or eliminating gender gaps in the labor market. The paper thus provides a comparative analysis across several policies highlighted by the literature (e.g. as in Bloom,

Canning and Sevilla 2003; Eastwood and Lipton 2011; World Bank 2015a) as key interventions to realize demographic dividends. As such, this paper augments the substantial literature on demographic change and development by focusing on the policy outcomes necessary to realize (or maximize) the demographic dividend.

The remainder of this paper is organized as follows: Section 2 describes the channels through which demographic change may impact GDP growth in SACU countries. Section 3 provides the analytical framework, the underlying data set and the description of the scenarios. Section 4 presents and analyzes the mains results, following by the conclusion.

2. ECONOMIC POTENTIAL IN SACU ECONOMIES DUE TO DEMOGRAPHY

2.1 Demographic factors

The development impact of demographic change is closely linked to the country's demographic transition progress, with this transition generally paralleling economic development (Szreter 1993; World Bank 2015a). Demographic transition entails countries moving from high fertility and low life expectancy to low fertility and high life expectancy. At the same time, the demographics go from high proportions of children but low proportions of elderly, to low proportions of children and high proportions of elderly. Fertility and mortality rates are both high in this initial stage, where the population tends to be younger and population growth stable but low. If mortality rates fall but fertility rates remain high, as in the next phase, then population growth accelerates, with growing numbers of children and rising child dependency.[3] Once fertility rates begin to decline, population growth slows. During this time, the child dependency ratios also fall and the share of the working-age population rises, boosting per capita income growth through the first demographic dividend. After a long period of lower fertility, the growth rate of the working-age population slows and the aged dependency ratio begins to rise.

The age-structure shifts that come with progression through demographic transition can potentially boost development through so-called demographic dividends (Lee and Mason 2006; World Bank 2015a). Consider the case of when working-age population shares are rising and the shares of children are falling. First, if the working-age population share of a country is rising, it has the potential to increase the number of people employed as a share of the population. Even if output per worker remains constant, the per capita income in the economy will rise just due to the increased workers per capita – a phenomenon which Eastwood and Lipton (2011) refer to as an arithmetic dividend. Second, it has the potential to increase national savings and hence the investment rate, since income-earners would become a greater share of the population.[4] Saving

[3] The child dependency ratio is defined as the ratio of the number of people under the age of 15 to the number of people aged 15 to 64, the working-age population. The aged dependency ratio is the number of people over the age of 64 to the working-age population.

[4] Some studies, like Loayza, Schmitt-Hebel, and Servén (2000) suggest that declining dependency ratios tend to boost domestic savings and investment. Lee, Mason, and Miller (2003) and Kinugasa and Mason (2007) suggest that the impact of the dependency ratio on saving is most pronounced in countries experiencing rapid fertility decline, rapid economic growth, and shifts away from reliance on family transfers for old-age support.

and investment may also rise because rising working-age population shares are often associated with declining shares of children in total populations. Since there are fewer children to support, there can be greater consumption as well as investment. Third, it can lead to faster productivity growth since households might have more resources to invest in fewer children. Labor supply may also expand since mothers with lighter childrearing responsibilities may find it easier to enter the labor market.

These age-structure impacts on development are often classified as either a first or a second demographic dividend (Lee and Mason 2006; World Bank 2015a). The first demographic dividend is often associated with rising working-age population shares. As such, it could persist for decades but is ultimately transitory. Estimates suggest that the first demographic dividend explains between 9.2 to 15.5 percent of per capita economic growth over the 1960–2000 period for some countries (Mason and Kinugasa 2008). Indeed, an increase of 1 percentage point in the working-age population share is estimated to boost GDP per capita growth rates by 1.1 to 2.0 percentage points, on average (Cruz and Ahmed 2016; World Bank 2015a).[5]

The second demographic dividend arises if changes in age structure create space for higher savings and lead to increased investment in human and physical capital. These decisions subsequently influence the productivity of the workforce. An increase of 1 percentage point in the share of the working-age population is associated with an increase of 0.6 to 0.8 percentage point in savings (Cruz and Ahmed 2016; World Bank 2015a). National private-savings rates have been found to depend on the age composition of the population: individuals are typically net savers when they are working age, but they tend to be predominantly consumers when they are children. This outcome is associated with the second demographic dividend, where declining dependency ratios, led by a lower share of children in the population, tend to boost domestic savings and investment (e.g. Kelley and Schmidt 2005, Higgins 1998, Higgins and Williamson 1997, and Kinugasa and Mason 2007).

The causality underpinning the association between working-age population shifts and development can thus be seen to be complex and occurring through multiple pathways, including through an increase in the supply of workers relative to the total population; a rise in the capacity to save, which leads to a higher capital per worker ratio; and more investment in human capital. While these channels can work simultaneously, the differentiation between the first and second dividends is informed not only by the transmission mechanisms but also by the time horizon through which they are at work. It may very well be the case that a country is already successfully realizing the second dividend even before it has completely exhausted the first dividend.

With the mechanisms of the first and second demographic dividends in mind, the question now arises: what do the age-structure shifts in SACU economies mean for their development?

[5] The extensive literature on this includes but is not restricted to Bloom and Williamson (1998), Bloom et al. (2009), Bloom and Canning (2004), Higgins and Williamson (1997), Eastwood and Lipton (2011), Kelley and Schmidt (1995, 2005, 2007), and Rosenzweig (1990). These studies all suggest that growth in the working-age population share is associated with higher per capita income growth.

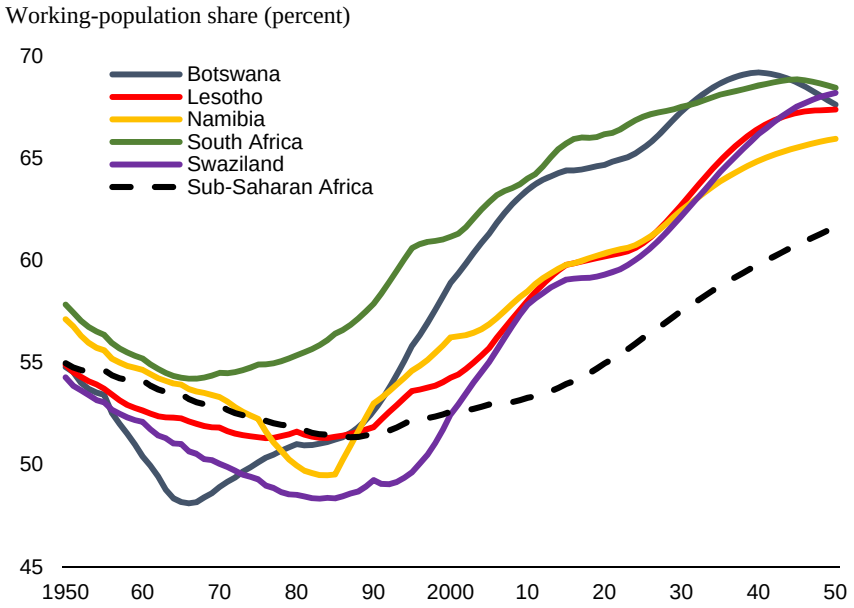
2.2 What do these demographic shifts means for economic development in SACU?

The first step to understanding the impact of age-structure shifts in SACU economies is to examine the demographic trends themselves. The working-age population shares in the SACU economies have generally been rising over the past few decades and are expected to continue to do so for several more decades, under the medium fertility scenario of the UN (2015) (Figure 1). At the same time, the total dependency ratios of these countries have been declining, driven by reductions in the shares of children in their populations (Figure 2).

Botswana and South Africa are further along in the demographic transition process than the other economies. This is reflected in three ways. First, the trough of their working-age population shares is much shallower than the trough of the working-age population shares of Lesotho, Namibia, and Swaziland. This is a reflection of the higher fertility rates and subsequently greater population shares of children in these countries. Second, the working-age population shares of Botswana and South Africa will peak sooner than the others, in 2040 and 2045, respectively. Third, the total dependency ratios in these two economies peaked in the 1960s, while they peaked in the 1980s in the other countries.

The potential demographic dividends for these economies can be substantial, but their realization is not automatic and magnitudes are uncertain. Intuitively, it can thus be expected that working-age population share growth in these economies can boost GDP per capita through the "arithmetic" dividend mechanism. Due to the declining child dependency driving the shrinking dependency ratios, there is an opportunity for savings as a share of GDP to rise in all these economies. However, these impacts will only occur if the burgeoning working-age population enters the labor force and is able to find employment. Also, there is no guarantee that households with fewer children will save more and lead to greater investment. Additionally, the magnitude of the dividend will also depend on the characteristics of the labor supply. Declining child dependency ratios can lead to greater investment in human capital, reflected in more skilled workers with higher productivity. The interaction of capital deepening and more skilled workers can lead to greater growth, *ceteris paribus*.

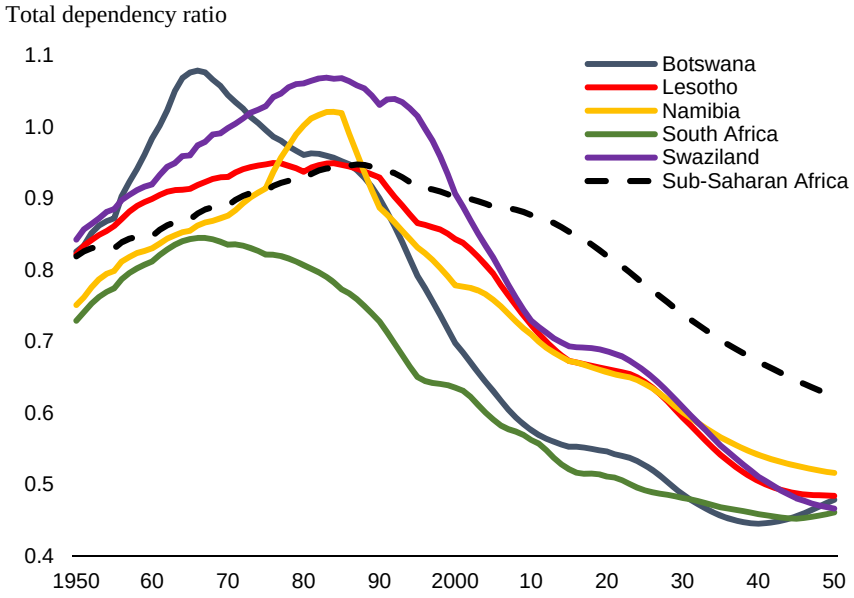
Figure 1: Southern Africa's rising working-age population share is expected to remain higher than that of Sub-Saharan Africa in coming decades, and will not peak for most countries before 2050



Source: Authors' estimates

Note: Data from UN (2015). The value for Sub-Saharan Africa is a weighted average. The working-age population is defined as people aged 15-64.

Figure 2: Total dependency ratios in Southern Africa have declined much faster than the rest of Sub-Saharan Africa since the 1980s and are now below the regional average



Source: Authors' estimates

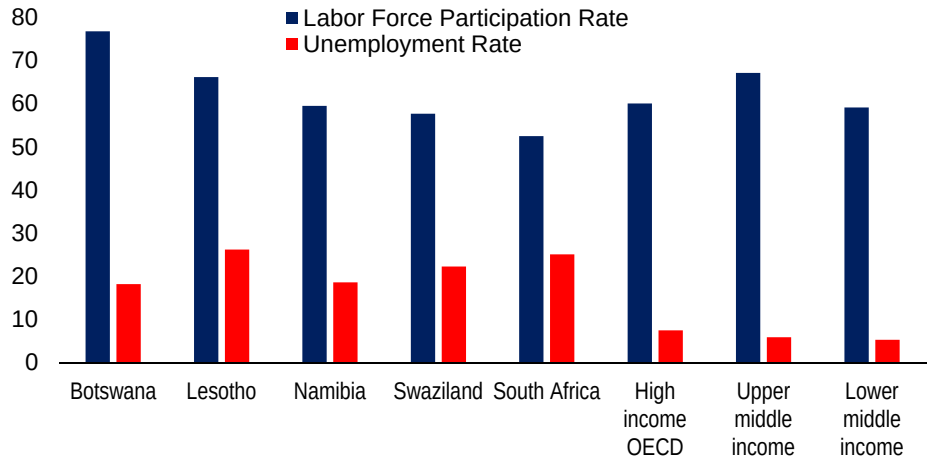
Note: Data from UN (2015). The value for Sub-Saharan Africa is a weighted average. The total dependency ratio is the ratio of the number of children (peopled aged less than 15 years) and aged (people aged over 64 years) to the number of people of working-age (15-64 years

Achieving these enabling conditions can require policy interventions. Improving the shares of skilled workers and productivity requires improvements in both the quantity and quality of education services. Absorbing the new labor market entrants requires policies that facilitate job creation, like maintenance of a stable macro-economy and a business environment that empowers the private sector to hire workers (World Bank 2013). Active labor market policies may also be necessary to remove market failures, like gender discrimination. Policies to mobilize savings, such as improving financial inclusion, may also be necessary.

For the different SACU economies, the "bang for the buck" for these policies may differ, given their different economic attributes. The labor market differences between these economies can illustrate. From a labor supply perspective, labor force participation rates vary tremendously across the region, but high unemployment rates are a significant challenge for all economies (Figure 3). However, these unemployment rates may be more urgent and of greater concern for countries that are closer to their peak working-age population share, like Botswana and South Africa. From a labor quality perspective, Botswana, South Africa and Namibia have some of the best educated populations in the region, with 61-67 percent of their populations having at least 9 years of schooling (Figure 4). Lesotho and Swaziland, on the other hand, lag far behind in terms of educational attainment, with only 20 to 37 percent of their populations having at least 9 years of education. If current educational attainment rates remain unchanged, the average skill shares in the least-educated economies will remain lagging far behind that of the region and more developed economies. So, improvements in educational attainment may lead to greater demographic dividends in an economy like Lesotho, while the growth contributions to improvements in employment ratios may be greatest for countries like South Africa.

Figure 3: Unemployment rates in SACU are more than triple that of middle-income countries on average

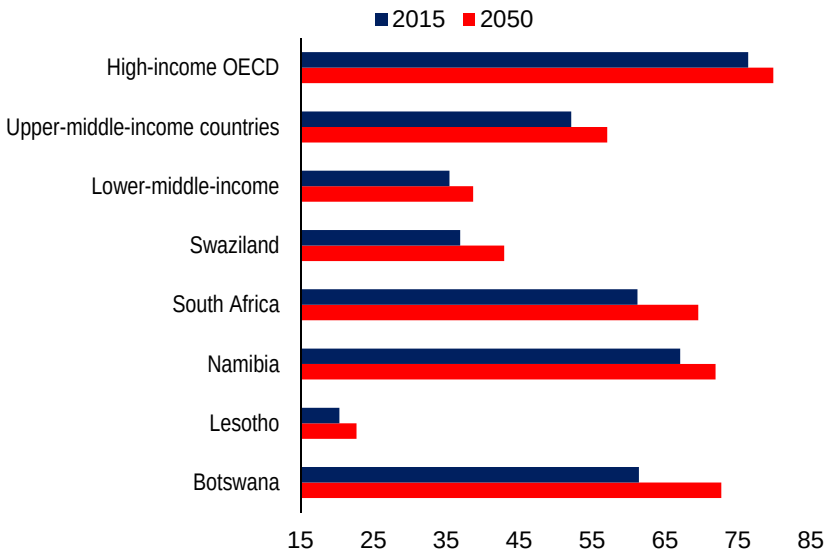
Labor force participation rate (share of population 15+, percent) and unemployment rate (share of labor force, percent)



Source: Authors' estimates
Note: Data are from World Bank (2016). High income OECD, upper-middle income, and lower-middle income country groupings are based on the World Bank Group's income based country classification.

Figure 4: The working-age population could become more skilled due to demographic change, if educational attainment rates are constant

Share of working-age population with at least 9 years of schooling if educational attainment rates constant (percent)



Source: Authors' estimates

Note: Data from UN (2015) and GMD household surveys. The data for upper-middle-income countries and high-income OECD are simple averages. Projections presented for SACU countries and two potential educational attainment convergence targets. High income OECD, upper-middle income, and lower-middle income country groupings are based on the World Bank Group's income based country classification.

While an understanding of the mechanisms and demographic trends can provide a sense of how policy impacts may differ across the region, a purely analytical approach may not provide any insight on their relative magnitudes, possibly confounding policy priority setting. These assessments are additionally complicated by the fact that the demographic changes can induce general equilibrium effects whose magnitude cannot be clearly identified in a multi-agent and multi-sector economy. However, widely cited work on the growth impact of changes in age-structure generally rely on empirical estimation of growth accounting relationships.[6] These provide some robust estimates of the importance of demographic changes on income per capita and savings, but do face some constraints. For example, since these empirical studies rely on historical variation in data to drive results, the studies may not necessarily find statistically significant impacts on economic indicators, even if the intuition would suggest otherwise. This may be why early empirical work for Africa, as in Bloom and Sachs (1998), found no significant impact of demographic change on growth. More recently, Canning, Raja, and Yazbeck (2015) finds that changes in age-structure have no discernable impact on savings as a share of GDP for African economies.

For this reason, simulation models have proven to be a useful approach to examine hypothetical impacts of future demographic shifts on economic outcomes. For example, Ashraf, Weil and Wilde (2013) presents a simulation model of economic growth and demography, where real GDP

[6] This vast literature includes Bloom and Williamson (1998), (Higgins and Williamson (1997), Eastwood and Lipton (2011), Kelly and Schmidt (1995, 2005, 2007), *inter alia*.

per capita growth is a function of several demographic effects on growth. These effects include the impact of the congestion of fixed factors, capital dilution, dependency ratios, experience, life-cycle labor, childcare, and child quality.[7] Demographic projections from different fertility scenarios are presented as exogenous shocks that determine economic outcomes through these seven channels. Another recent simulation model of demography and growth is the DemDiv model of Moreland et al. (2014), which links several statistically estimated reduced form economic relationships to demographic variables (such as total fertility rates).

While these models clearly delineate specific channels by which demographic variables can influence economic outcomes, they are unable to capture certain effects which may be important from a development policy perspective. Specifically, they do not account for general equilibrium effects (GE) in the economy which are bound to arise from the interaction of different demographic and economic factors, and from the interaction of different economic agents that may lead to structural shifts in the economy. For example, the interaction of labor force participation rates and labor demand from different sectors for different kinds of workers will interact with demographically influenced changes in the quantity and quality of the labor supply, as well as the rate of capital formation, to influence factor returns, and hence growth.

In contrast, computable general equilibrium (CGE) analyses are able to capture these effects, and provide insights on structural shifts in economies over time.[8] McKibbin (2006), Tyers and Shi (2007), and World Bank (2015a) use dynamic CGE analyses to examine the contribution of future demographic change to growth. McKibbin (2006) finds that demographic change leads to lower GDP for many high-income countries. For example, Japan's GDP in 2050 is expected to be 28 percent smaller than it was in 1985. Focusing on Sub-Saharan Africa, Tyers and Shi (2007) find that demographic change could lead to a 15 percent higher GDP over 1995 and 2030. Also focusing on Africa, Ahmed et al. (2016) goes further than these CGE analyses and integrate a household microsimulation model to global dynamic model to examine the contribution of demographic change to poverty reduction, as well as growth. In all these models, demographic changes are presented as exogenous changes in different scenarios, thus ignoring the endogeneity between economic growth and demographic variables, such as fertility rates.

This paper will build on Ahmed et al. (2016), by considering the interaction of policy outcomes under different economic scenarios rather than just decompose the possible contributions of demographics. Moreover, it will estimate and compare the effects on demographic change on poverty reduction across those different economic scenarios.

[7] Ashraf, Weil, and Wilde (2013) illustrate the model by examining the specific case of Nigeria and also provides a very useful review of the growth and demographics literature. In the paper, the congestion of fixed factors and capital dilution are also referred to as "Malthus" and "Solow" effects, respectively.

[8] Devarajan and Robinson (2013) provide a survey of how computable general equilibrium models built on microeconomic theory have been applied to other development issues. Recently, Devarajan et al. (2015) used the LINKAGE-GIDD modeling framework to stress-test the sensitivity of income per capita growth in African economies to different exogenous shocks, such as drought and conflict.

3. ANALYTICAL FRAMEWORK

3.1 Models and data

The magnitude of SACU's future demographic dividend depends on a range of economic variables that are not easily captured without consideration of the range of possible influencing factors in the global economy, their impact on the economies and households. LINKAGE, the recursive dynamic CGE model is well suited for this task.[9] It is supported by globally consistent data on production, consumption, investment, and trade from the GTAP Database V8.1 (Narayanan et al. 2012). LINKAGE is a multi-sectoral, multi-country and multi-agent dynamic recursive CGE model that assumes perfect competition, with equilibria in a given year being dependent on current year prices and quantities, and the previous year's equilibria. Household demand behavior is modeled using the Constant Difference of Elasticities function, while production is assumed to be based on a multi-nested CES function. At the top of the multi-nested structure, an aggregate of intermediate inputs is combined with an aggregate value added under Leontief technology. Unskilled labor is substitutable for a skilled labor and capital composite, while skilled labor and capital are themselves complementary.

Output is produced by different production streams—differentiated by capital vintage. Each production stream has an identical production structure based on a multi-nested Constant Elasticity of Substitution functional form, but with different technological parameters and substitution elasticities. At the top of the nest, a value-added bundle is combined with an intermediate inputs bundle under the Leontief technology assumption. The intermediate inputs bundle is combined with different inputs, with an Armington assumption applied to specific inputs. That is, for a given type of intermediate input, there is substitutability between domestic and imported inputs, and then again between imported inputs from different source countries. The value added bundle is made up of unskilled labor being slightly substitutable with a capital and skilled labor bundle. Skilled labor and capital are substitutable.

LINKAGE also considers segmented labor markets in developing countries, i.e. there are separate labor markets for unskilled labor in agriculture and non-agriculture. Endogenous migration of unskilled labor from one market to another within a country is modeled as a function of the wage of unskilled workers in agriculture relative to the wages received by unskilled workers in the non-agriculture market.

Since LINKAGE is a structural micro-foundations model that is consistent with neo-classical growth theory, aggregate growth depends on changes in the labor force, the capital stock, and total factor productivity. The economic impact of demographic change must therefore occur through one of these channels, and the key neo-classical growth drivers in LINKAGE that will be sensitive to demographics are the labor force and the capital stock. As a simulation is implemented over time, the skilled and unskilled labor forces for a given country are

[9] LINKAGE is able to support alternative assumptions about production and consumption behavior, factor market segmentation, *inter alia*. This section describes the assumptions considered in the application of LINKAGE specific to this paper. Details on LINKAGE can be found in van der Mensbrugghe (2011).

exogenously changed. At the same time, the model keeps track of children (less than 15 years of age), working age (15-64 years of age), and aged (over 64 years of age) populations, following the values of the medium fertility scenario of the UN (2015). These data are used to calculate the child and aged dependency ratios in each year of a given simulation, and are in turn used to help determine domestic savings behavior.

Domestic savings as a share of GDP is a linear function of four factors. The first factor is the savings share in the previous year, i.e. if savings were high in the previous year, they will only deviate from that value in the current year. The second factor is the growth rate of real GDP per capita. The third and fourth terms are the child and aged dependency ratios. The function is parameterized following the empirical estimates of Loayza, Schmitt-Hebel, and Servén (2000). These coefficients differ for countries based on their identification as either developing or developed, and are constant over the time horizon of the simulations. The coefficients for the savings and growth term are positive for all countries which imply that as countries grow they save more. The coefficients on the dependency ratio terms are negative for all countries.

As dependency ratios rise, the propensity for households to consume thus rises and savings as a share of GDP falls. The magnitudes of the aged dependency ratio coefficients are greater than that that of the young dependency ratio coefficients, and so an increase in the aged dependency ratio of a given magnitude will drag down savings to a greater extent than a decrease of similar magnitude in the child dependency ratio will increase the savings share. Since investment is modeled as being savings driven, total global investment is driven by total global savings, with the amount of investment in a given country being a function of both domestic savings as well as the current account balance, which is determined exogenously. The additional implication of the savings driven investment assumption is that that as dependency ratios fall in a given country, domestic savings will rise, which in turn will boost investment. The opposite would hold true for a country where dependency ratios are rising.

While LINKAGE provides the economy-wide effects of demographic change over time, the GIDD microsimulation framework (Bussolo et al., 2010; Bourguinon and Bussolo, 2013) will be used to generate income distributions under the various scenarios. GIDD draws on household level survey data benchmarked to 2010 to estimate income distributions by country that account for demographics, household characteristics (e.g. age, gender, and education of different members), sector of employment, skill premia on wages, and income.[10] Using the simulated income and employment under future scenarios from LINKAGE, and accounting for the demographic shifts characterized in the UN (2015), GIDD is able to generate income distributions by country that are consistent with both the more 'aggregated' changes under the CGE simulations and also what is known about households from survey data. In addition to incorporating the changes in key variables from the LINKAGE scenario results, the GIDD methodology updates the household survey data for the terminal year of the simulation. This is done by reweighting the population characterized by the base year household surveys using non-

[10] Table A1 in the annex provides information on the household surveys used in the micro-simulation.

parametric cross-entropy methods, but keeping it consistent with the United Nations' population projections and levels of education observed in the household surveys.[11]

To be consistent with the GIDD, LINKAGE is modified to adopt the former's skilled-unskilled labor definition, whereby a skilled worker is anybody with more than nine years of education, and an unskilled worker is anybody with nine years of education, or less. This redefinition necessitates an adjustment of the GTAP data on value added by labor type in production, such that the number of workers of a given skill type in a given sector is consistent in the 2007 benchmark year across the two modeling frameworks.

3.2 Scenarios

Using the simulation framework described above, seven alternative future scenarios are considered. The scenarios are designed so as to be able to identify the marginal impact of a given policy outcome as it interfaces with demographic change (Table 1). The policy outcomes are those related to the demographic dividend and include the maintenance and improvement of employment ratios, improvements in educational attainment and quality, and changes in savings behavior. To achieve this, first a "business-as-usual" scenario is considered to establish a baseline economic path till 2050 for the SACU economies. In the baseline, educational attainment rates are assumed to be constant, the total labor supply grows at the same rate as the working-age population (based on the same rate as the UN WPP's medium fertility scenario), and employment ratios remain constant at 2015 values. The current account balances and investment shares track the forecasts of World Bank (2015b) till 2017 before converging to long-run values. Labor productivity is assumed to grow in a fashion that real GDP grows till 2017 following the World Bank (2015b), and following growth projections under the Shared-Socio-Economic Pathway 2 scenario of Dellink et al. (2015) from 2018 to 2050.

The alternative scenarios then deviate from this baseline scenario in a specific, but different, way. The differences in economic outcomes – such as real GDP per capita growth - are then compared against the outcomes in the baseline to determine the marginal impact of the demographic dividend enhancing policy outcome.

The first alternative scenario can be characterized as a *no demographic effects* scenario. It differs from the baseline in the sense that the growing working-age population share, declining child dependency ratio, and rising aged dependency ratio do not lead to an acceleration of workers per capita or greater savings as shares of GDP.[12] Furthermore it assumes that the skill share of the labor supply is frozen at 2015 levels. So, the average skilling up of the labor force due to constant enrollment ratios and demographic change does not occur.

[11] The GIDD model also projects the share of skilled and unskilled workers by using initial information on education available in the household surveys, following a methodology that assumes constant enrollment rate across age cohorts.
[12] The total labor supply grows at the same rate as the total population.

Table 1: Baseline and scenarios with five dividend-enhancing interventions

Scenario	Key features	Purpose
Baseline	Population projections from UN (2015) medium fertility variant scenario; economic growth projections from World Bank (2015b) and Dellink et al. (2015); employment ratios held constant; constant education attainment rates	Establish business-as-usual for comparison with counterfactual scenarios; already incorporates impact of greater working-age population share on labor supply and relatively pessimistic savings behavior based on age-structure changes
No demographic effects	Same as baseline except labor supply grows at the same rate as the total population, the skill share remains fixed at 2015 values, and changes in child and aged dependency ratio have no effect on savings and investment.	This is used to identify the impact of changing age-structure on growth in the baseline through the labor supply and savings.
Faster productivity growth	Same as baseline, except labor productivity growth rates are 0.5 percentage points higher	Considers case where countries get more from their possible first demographic dividend by having more productive workers
Education convergence	Same as baseline, except educational attainment is higher; skill shares in Botswana, Namibia, and South Africa converges with that of high-income OECD economies by 2050; skill shares in Lesotho and Swaziland converges to that of upper-middle-income countries by 2050	Considers case where countries get more from their possible first and second demographic dividends by having better educated workers that can be absorbed into skill and capital-intensive higher value sectors.
Mobilized savings	Same as baseline, except the marginal propensity to save is higher and so investment is also higher	Considers case where countries try to get more from their possible second demographic dividend for longer by saving more, and with subsequently greater deepening capital.
OECD ER convergence	Same as baseline except the employment ratios of male and female converge to that of OECD male and female median employment ratios of 62.7 and 51.0 percent by 2050.	Considers the case of countries with employment ratios that are too high (due to low educational attainment) or too low (due to high unemployment or low labor force participation)
OECD ER convergence with gender parity	Same as baseline except the employment ratios of males and females converge to that of OECD male median employment ratios of 62.7 by 2050.	Considers the case of countries with employment ratios that are too high (due to low educational attainment) or too low (due to high unemployment or low labor force participation), while also considering the effect of gender disparities the labor market.
All interventions	Same as baseline, with mobilized savings, faster labor productivity growth, and improved education	Illustrates the synergies when countries implement all measures together.

The second and third alternative scenarios address the issue of educational improvements in attainment and quality. The faster productivity growth scenario considers the case of average annual labor productivity growth rates in SACU economies being higher by 0.5 percentage point. The idea is that improvements in the quality of education leads to workers being more productive, even with the same rates of educational attainment. In contrast, the education convergence scenario assumes that the educational attainment rates accelerate as much as necessary to allow the skill-share of SACU labor forces to converge to that of richer economies. Skill shares in Botswana, Namibia, and South Africa are assumed to converge to that of high-income OECD economies by 2050; while the skill shares in Lesotho and Swaziland converges to that of upper-middle-income countries. These scenarios can be interpreted as representing the cases where households invest more in the education of their children since they have fewer children on average in the future (as they undergo demographic transition), further reflecting the quality-quantity trade-off decision described by Becker (1960) and Becker and Lewis (1973).

The fourth scenario considers the issue of changes in child and aged dependency ratios affecting the savings behavior of SACU households. Specifically, the declining child dependencies should be accelerating savings shares while aged dependencies should be decelerating savings shares. In this scenario, an alternative set of coefficients from Loayza, Schmitt-Hebel, and Servén (2000), based on the full sample of countries, are applied to the model's savings function. The alternative coefficients allow for declining child dependency ratios to boost savings even more than the baseline, while rising aged dependency ratios have a smaller impact. This can be interpreted as representing the cases where households save the additional disposable income they have due to fewer dependents instead of consuming it, representing a change in behavior.

This scenario also serves the valuable purpose of providing a sensitivity analysis to the importance of demographic change on savings and investment behavior in the African context. High child-dependency or aged-dependency ratios are generally associated with lower savings shares of GDP from the empirical literature. However, evidence from Canning, Raja and Yazbeck (2015) suggests that in the African context, there does not appear to be clear evidence of rising working-age population shares (consistent with falling child-dependency ratios) leading to higher aggregate savings shares of GDP. The explanation provided is that household incomes in Africa may be too low for additional savings to play a role in capital accumulation.

The fifth and sixth alternative scenarios address the issue of improvements in employment ratios (ER), which lead to accelerations in the growth of the labor supply, to rates greater than that of the working-age population growth rate. The *OECD ER* scenario considers the case where male and female employment ratios in SACU economies converge to that of the OECD average male and female employment ratios. The average OECD employment ratio for males is 63 percent, while that of females is 51 percent. The *OECD ER with gender parity* scenario considers the case where the female employment ratio in SACU economies converges to 63 percent – the average ER for males in the OECD. These employment ratios are based on estimates from Oosthuizen (2015). The improvements in gender parity and greater female labor force participation and employment are critically intertwined with the demographic transition process, as described by Bloom et al. (2009), among others. As fertility rates decline, women are able to achieve greater

educational attainment and become employed more easily. Conversely, as women become more educated and enter the labor market, fertility rates tend to fall. This scenario thus considers this two-way relationship.

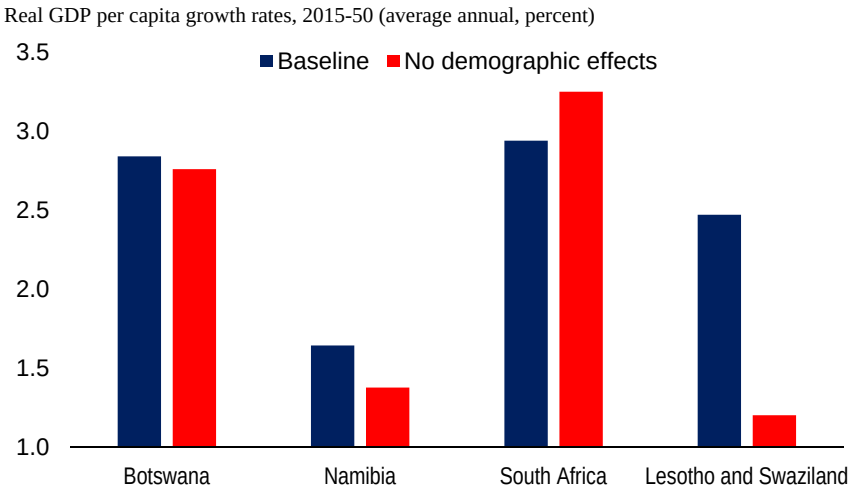
The final alternative scenario (*all interventions*) considers the case when there a country can achieve all the individual demographic dividend enhancing interventions together: educational convergence, accelerated productivity growth, greater mobilization of savings, improvements in employment rates, and closing the gender gap in the labor market.

For all scenarios, changes in the poverty headcount rate from the GIDD can be decomposed into three sources. The first source is the change in poverty due to the changes in employment, skill premia, and income that would have occurred had there been no additional income growth or distribution shifts – the poverty reduction effect without demographic effects. The second source of poverty reduction is the mechanical change in the distribution of households due to demographic change. This is based on the reweighting of the household surveys, and captures the impact of there being fewer (or more) households with certain demographic characteristics that in the benchmark survey data are found to be poorer (or richer). This can be referred to as the demographic composition effect. The third source of poverty reduction is the additional change in income and the income distribution that may occur when economies are able to realize their demographic dividends by absorbing the additional entrants into the working-age cohort and by increasing savings and investment due to declining child dependency ratios.

4. ANALYSIS

The rising working-age population shares in SACU economies can be beneficial for Botswana, Lesotho, Namibia, and Swaziland, although to varying degrees, considering the magnitude of the possible contribution of demographic change to future growth (Figure 5). The scenario analysis framework attributes half of the real GDP per capita growth for Lesotho and Swaziland to demographic change. The average annual growth rate is 1.2 percent (versus 2.6 in the baseline) if the labor supply only grows at the same rate as the total population – keeping workers per capita constant and implying that job creation is unable to keep up with the working-age population expansion – and if declining child dependencies do not translate into greater savings. Botswana's and Namibia's age-structures also contribute to their baseline income per capita growth rates – accounting for 2 to 13 percent of the growth.

Figure 5: Demographic change contributes positively to growth in all countries but South Africa where the working-age population is growing slowest and the aged share are growing fastest.



Source: Authors' simulation results

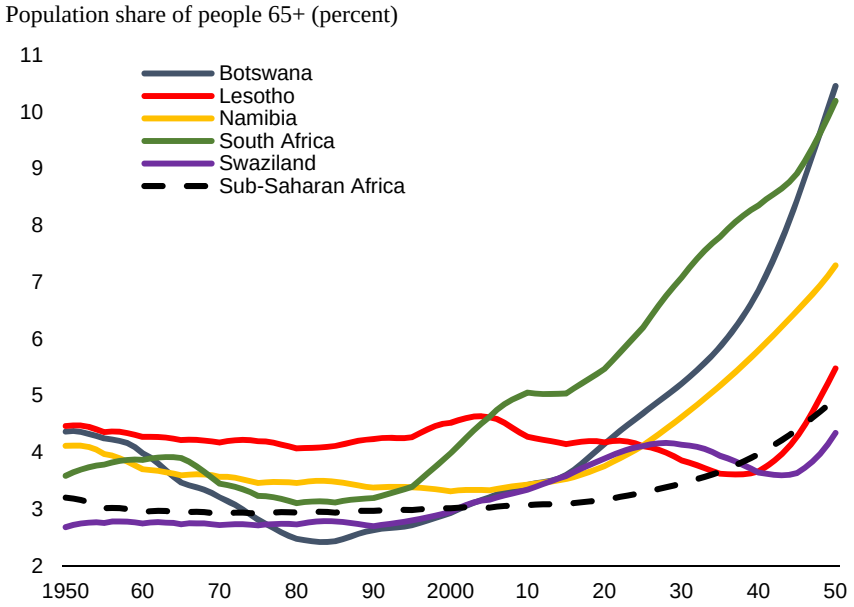
In contrast, demographic change can be found to be a drag on South Africa's growth over the next 35 years, consistent with other recent simulation analyses for the country.[13] In the case of South Africa, the working-age population is already relatively high, and so the labor supply is not growing as fast as in other countries. More importantly, the working-age population is growing more slowly relative to the total population. Under constant employment ratios, the labor supply would thus be growing more slowly in the baseline than in the *no demographic effects* scenario where labor supply grows at the rate of the total population. In the baseline, the population share of elderly is also growing faster than in any other African country, except for Mauritius (Figure 6). This has negative impact on savings as a share of GDP, and subsequently on investment. As the aged dependency ratio rises, there is a greater drag on savings and subsequently investment. However, in the *no demographic effects* scenario, changes in the aged dependency ratio have no impact on changes in savings behavior, and subsequently on investment.

Demographic change and realization of demographic dividends both have substantial impacts on poverty reduction success in SACU. Botswana, Namibia, and South Africa are able to almost eradicate extreme poverty, by reducing their poverty headcount rates by 11.6, 16.9 and 13.4 percentage points, from 2012 rates of 13.5, 19.7 and 16.2 percent, respectively, by 2050 (Figure 7). Lesotho and Swaziland are also able to reduce their poverty headcount rates by two-thirds over the same time period. When the sources of the poverty reduction are considered, demographic change shifting the distribution of households alone was responsible for almost 20 to 60 percent of poverty reduction, while realization of the demographic dividend was responsible for another 10 to 20 percent. In Swaziland, 75 percent poverty reduction was due to

[13] Ahmed et al. (2016) and World Bank (2015c).

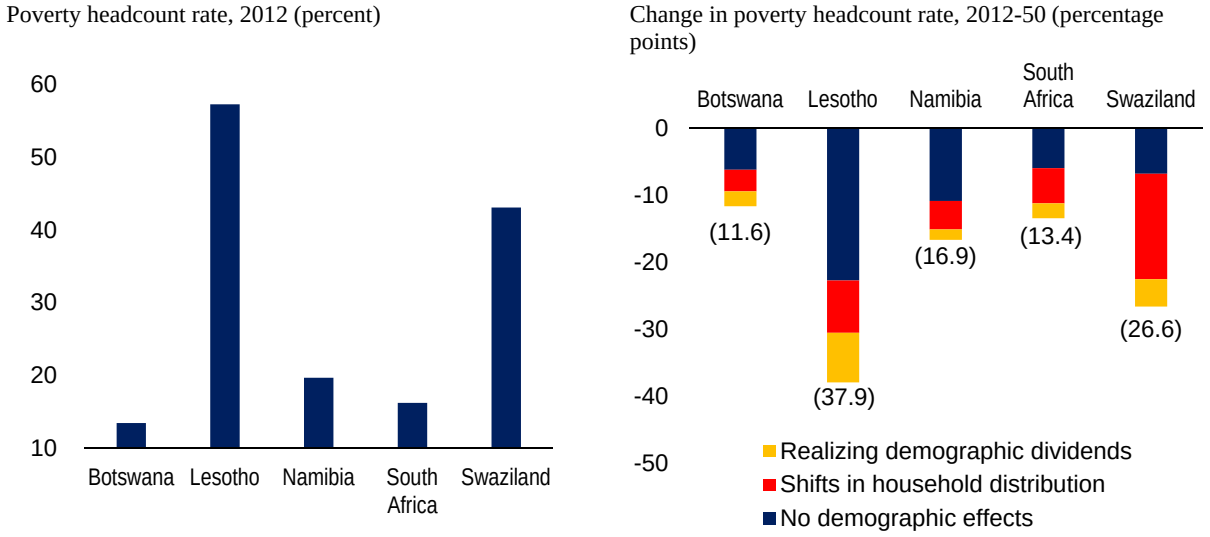
these two effects. In contrast, demographics contributed to only 35 percent of Namibia's poverty reduction.

Figure 6: South Africa will maintain the highest share of people 65+ in SACU till 2050



Source: Authors' estimates
Note: Data from UN (2015). The value for Sub-Saharan Africa is a weighted average.

Figure 7: Demographic change and realizing the demographic dividend can account for 35 to 75 percent of poverty reduction in SACU economies by 2050

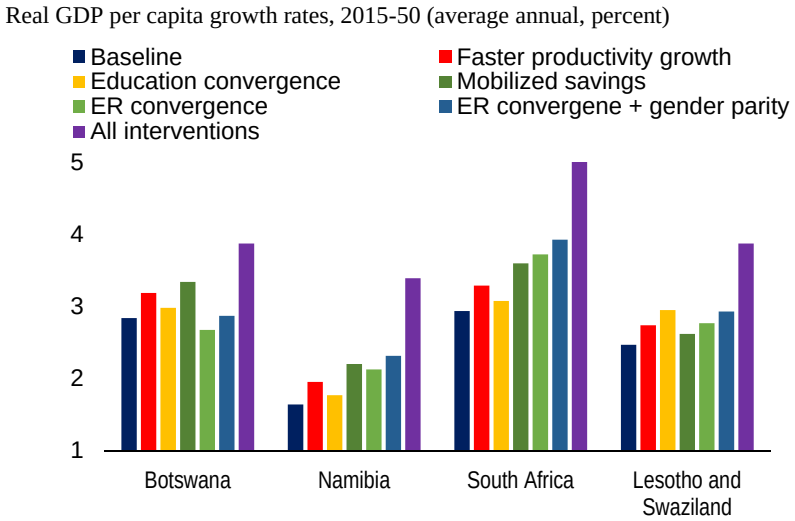


Source: Panel A is from PovcalNet (2016). Panel B is from authors' simulation results.
Note: The poverty headcount rate is based on $1.90 international poverty line determined with 2011 PPP.

Considering the policy outcomes that could enhance the magnitude of SACU's demographic dividends, almost all the interventions considered – on educational improvement, savings and investment, and improving the employment ratio – accelerate income per capita growth beyond

the baseline (Figure 8).[14] An exception to this is the case of Botswana, where the employment ratio convergence of males and females to the OECD average values (63 and 51 percent, respectively) leads to lower income per capita growth. This is because male and female employment ratios for Botswana are higher in the benchmark year, at 69 and 56 percent, respectively, and so a convergence to OECD ratios in the *ER convergence* scenario implies a slower growth of their labor supply relative to the baseline, and hence slower real GDP growth.

Figure 8: The key factor for acceleration of income per capita growth varies across countries



Source: Authors' simulation results.

While progressing in all policy areas leads to the greatest realization of demographic dividends, a few patterns emerge when comparing the magnitude of specific policy outcomes across countries. Improving educational quality – reflected through faster labor productivity growth – has greater impact in the countries with higher educational attainment rates than improving attainment. The labor forces of Lesotho and Swaziland have the lowest shares of skilled workers in the benchmark year, and skilling up the labor forces even to that of lower-middle income countries would lead to a greater boost to growth than accelerating the productivity of a less skilled labor force (*education convergence* versus *faster productivity growth* scenarios). Improving educational attainment in Lesotho and Swaziland has even greater impact on growth per capita than mobilizing savings. In other SACU economies, mobilizing savings for faster investment capital accumulation leads the *mobilize savings* scenario to have greater impact than education sector interventions.

Labor market interventions that enhance employment ratios are most important for South Africa, given that the country has the highest working-age population share for the longest period in 2015-50 and also has the lowest employment ratios of all SACU economies. As such, South Africa's labor market is potentially the most mature for a demographic dividend while also having the greatest room for improvement. South Africa's National Development Strategy recognizes the under-performance of the labor market relative to its potential, and its growth

[14] Figure A1 includes an alternative version of this figure, where the *all interventions* scenario does not consider an improvement in savings mobilization.

targets are based on substantial improvements in unemployment and labor force participation rates – unemployment rates falling to 6 percent and labor force participation rates rising to 65 percent by 2030.

The different policy outcomes have varying impacts on factor returns and can be explained by the interplay of the labor supply and savings-investment effects of the age-structure shifts. Considering first the returns on capital, it can be seen that rents are expected to fall in all scenarios in Botswana, Lesotho, and Swaziland (Figure 9). These economies experience the most rapid declines in child dependencies and increases in working-age populations among the SACU economies. When combined with policies that accelerate income per capita growth or mobilize savings even further, the rate of capital accumulation is faster than in the baseline. Due to the rapid expansion in investment, the returns on capital decline in these economies.

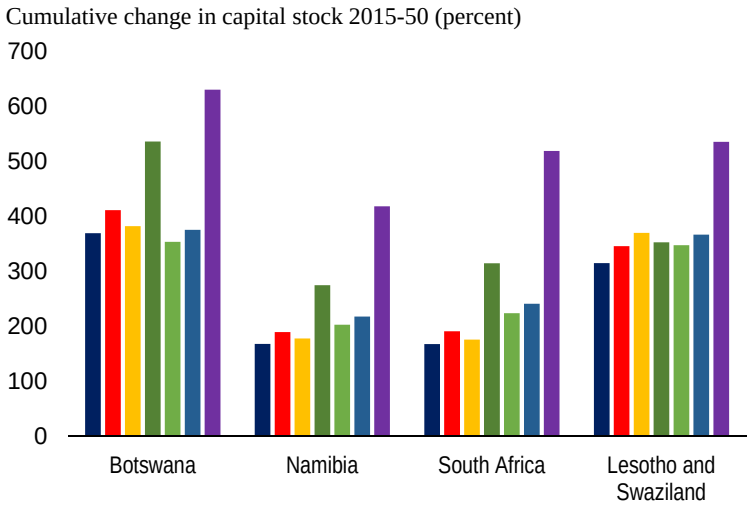
Since capital and skilled labor are complementary, the expansion of capital in these alternative policy scenarios increases the demand for skilled workers, increasing real wages (Figure 10). Indeed, Namibia's and South Africa's skilled wages increase the most above the baseline in the *mobilized savings* scenario, which is the only scenario for these countries where capital returns grow faster than in the baseline. The wages of unskilled workers also rise, especially in the education convergence scenario, where their supply grows much more slowly than in other scenarios, making them relatively scarcer and increasing their demand.

The differences in impacts across countries and scenarios are also reflected in the poverty reduction progress by 2050 (Figure 11).[15] As with the case of income per capita growth, the greatest poverty reduction progress is found to be when economies are able to achieve policy outcomes in education, savings, or greater employment. Similarly, when considering individual scenarios, some policy outcomes lead to greater poverty reduction progress. For example, educational attainment rate improvements lead to the fastest poverty reduction in Lesotho and Swaziland, while improvements in employment ratios in parallel with closing gender gaps are the most beneficial for other SACU economies. The reduction in moderate poverty follows a similar pattern with substantial reduction when all interventions are combined, enabling the realization of the demographic dividend.

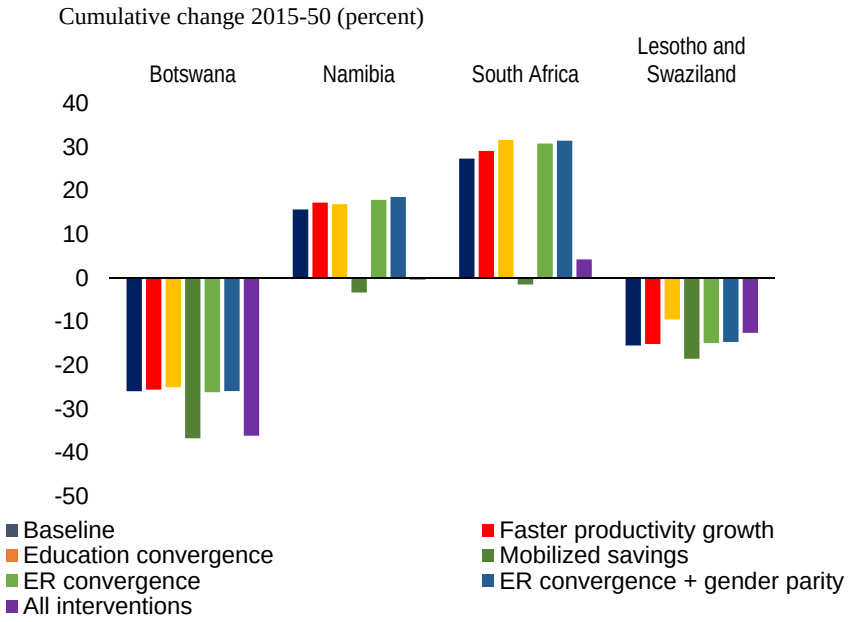
[15] Please see Figure A2 for poverty estimates where the *all interventions* scenario does not include mobilized savings.

Figure 9: SACU countries with slower aging have faster investment growth, which pushes down rents

A. Capital Stock

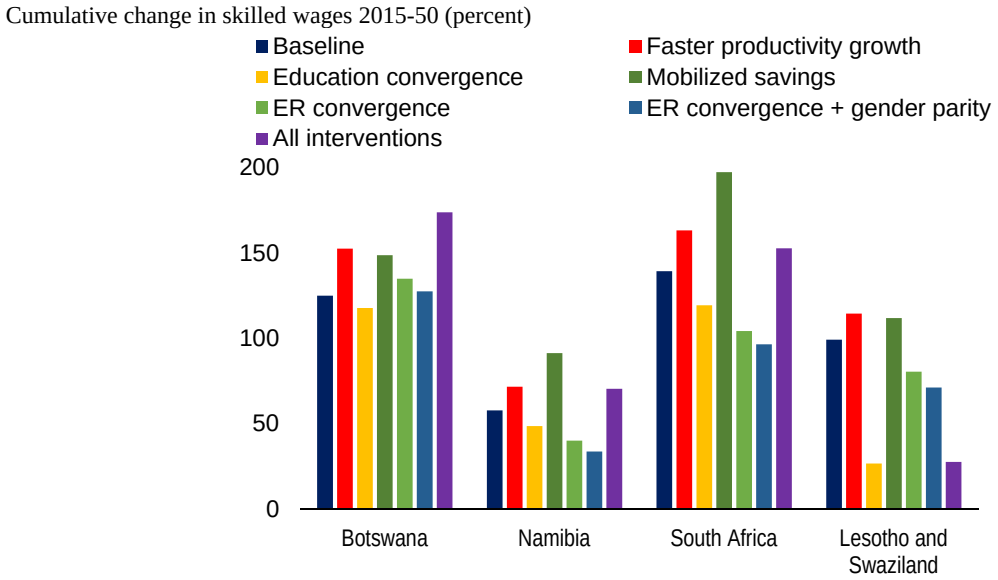


B. Capital rental rates



Source: Authors' simulation results

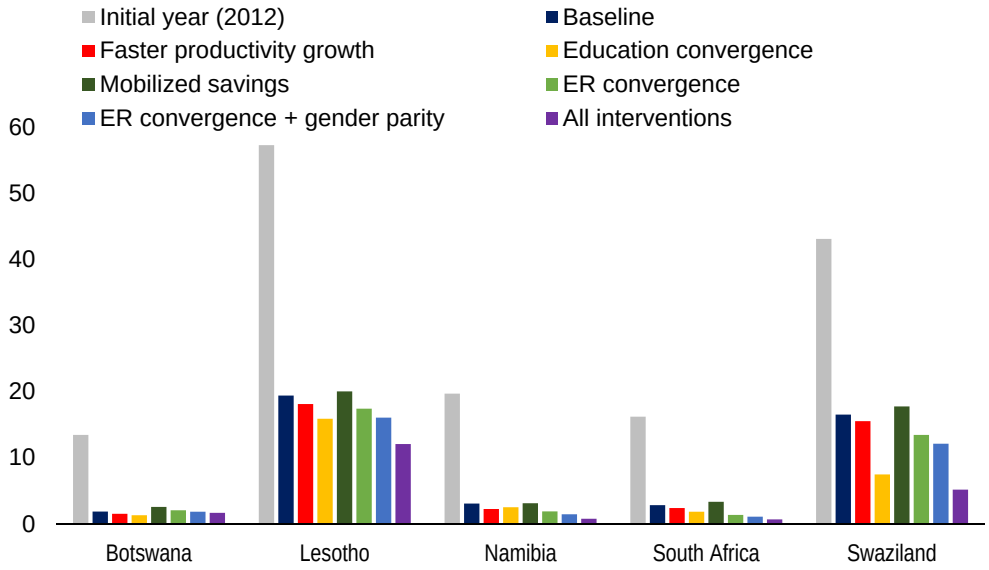
Figure 10: Due to the fast growth of cheap capital, skilled worker supply cannot keep up in many cases and their wages tends to rise.



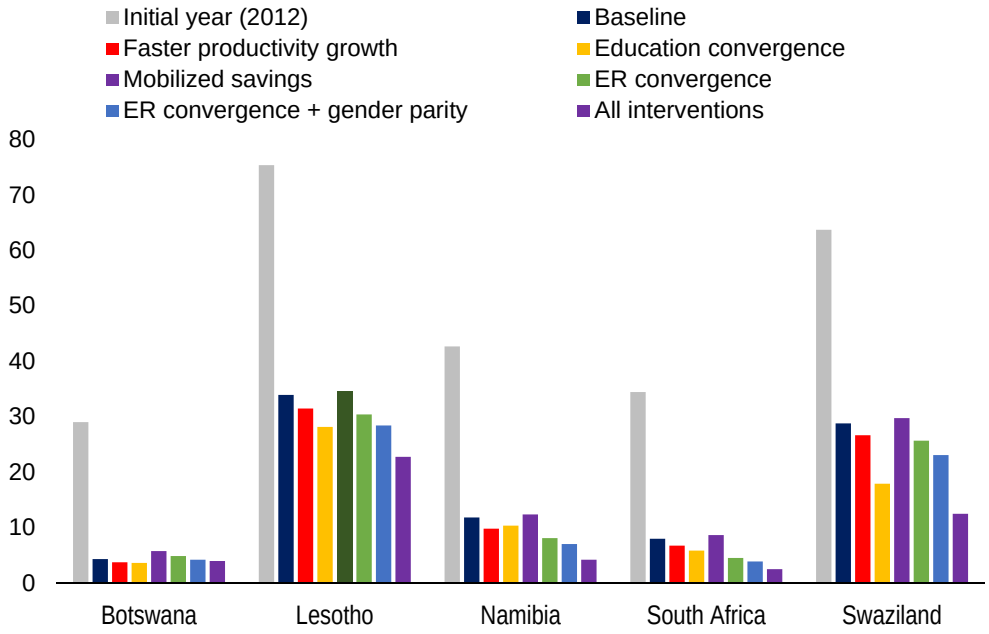
Source: Authors' simulation results

Figure 11: Poverty rates will fall substantially in all countries by 2050

A. Poverty headcount rate, $1.90 per day (percent)



B. Poverty headcount rate, $3.10 per day (percent)



Note: The extreme poverty headcount rate is based on $1.90 international poverty line determined with 2011 PPP while the moderate poverty headcount rate is based on $3.10 international poverty line determined with 2011 PPP.
Source: Authors' simulation results.

5. CONCLUSION

The SACU economies have relatively diverse demographic and economic starting points. This diversity is present in terms of their demographic profile. For example, South Africa and Botswana are furthest along in the demographic transition process with working-age population shares that will peak before 2050, when the rest of SACU will still have growing shares of

people in the working-age population. The diversity is also present in terms of their development indicators, as illustrated by the relatively lower educational attainment rates in Lesotho and Swaziland, or the high unemployment rates in South Africa.

As these economies continue to undergo demographic transition, they have the potential to realize demographic dividends. These demographic dividends are driven mostly by the potential growth in the working-age population share of the economies, and possible increase in savings and investment that may arise as households have fewer children. However, the magnitudes of these dividends are not the same for all countries, since they depend on their current demographic profile, the pace of their transition, and their ability to achieve certain development policy outcomes, specifically in the areas of education (both attainment and quality), mobilizing savings, and maintaining or improving employment rates. A scenario analysis approach is taken to examine the relative importance of these different policy outcomes in maximizing demographic dividends, by considering stylized alternative scenarios where different policy outcomes interact with demographic change.

Improving educational attainment rates are found to be the most important for growth acceleration and poverty reduction in Lesotho and Swaziland – the SACU economies with some of the lowest proportions of people with secondary education. In contrast, improvements in educational quality that boost average annual labor productivity growth rates by 0.5 percentage point are found to have a higher impact in other SACU economies. Accelerations in investment due to greater mobilization of savings is found to be most important in Botswana. However, in economies with low labor force participation and high unemployment rates, like South Africa, improving employment rates, including by closing the gender gap, can be the most important.

While these stylized scenarios provide a sense of the relative importance of different interventions in the various SACU economies as they interact with various demographic shifts, they should not be interpreted as arguing for the superiority of one policy focus or another. The growth and poverty impacts are sensitive to the assumptions made on the magnitude of the policy outcomes and the scenario design. Detailed sector analyses are necessary to validate the feasibility of the policy outcomes considered, and to place the policy areas in the context of national development strategies. Also, there are several channels by which demographic change can affect the economy which are not considered here, and which may affect the realization of demographic dividends in these economies. For example, economies like Botswana and South Africa are going to have the highest aged population shares in the region, and will be facing fiscal pressures to support them, as well as higher demand for services like long-term care and health services. These factors have not been considered in the model. Finally, the analysis presented in this paper considers the impact of policy outcomes, rather than specific policies to achieve those outcomes. Country-specific policies will need to be considered, as for the case of South Africa, where policies focused on youth and skill development have been identified as critical for boosting employment and realizing demographic dividends (World Bank 2015c).

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ANNEX

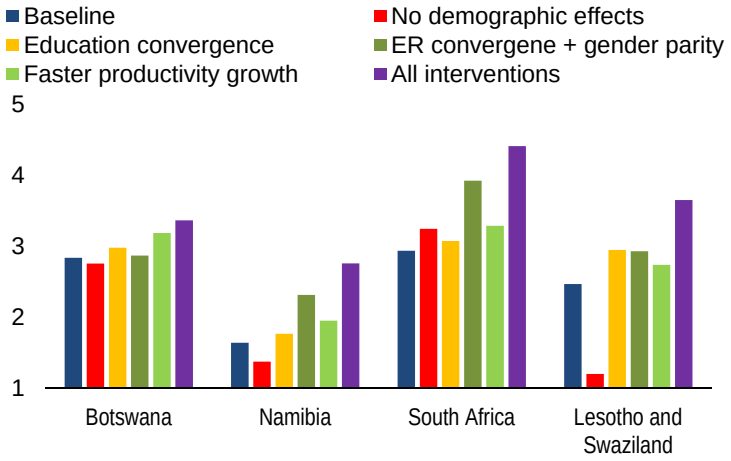
Table A1. Household surveys used in the micro-simulation exercise

Country	Survey - year
Botswana	Household Income and Expenditure Survey 2009/2010
Lesotho	Household Budget Survey 2010
Namibia	National Household Income and Expenditure Survey 2009/2010
South Africa	Income and Expenditure Survey 2010/2011
Swaziland	Household Income and Expenditure Survey

Source: GIDD database

Figure A1: The key factor for acceleration of income per capita growth varies across countries with all interventions having the greatest impact even when mobilized savings are not considered.

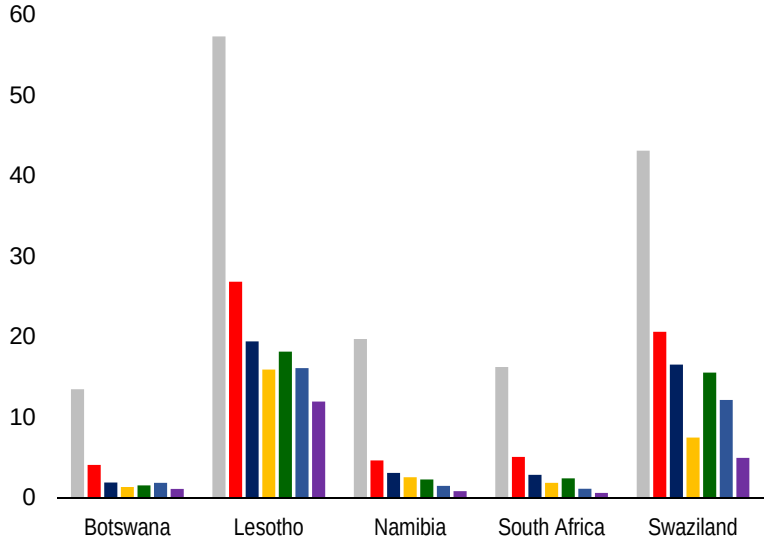
Real GDP per capita growth rates, 2015-50 (average annual, percent)



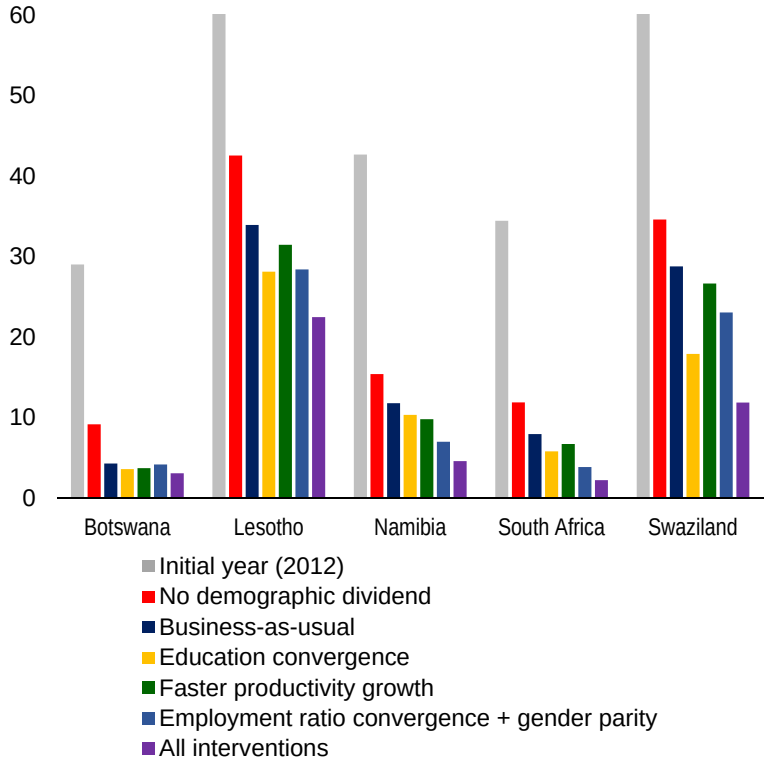
Source: Authors' simulation results.

Figure A2: Poverty headcount rate reductions are the greatest when demographic change is accompanied by achievement of policy outcomes, even if additional savings are not mobilized

A. Poverty headcount rate, $1.90 per day (percent)



B. Poverty headcount rate, $3.10 per day (percent)



Source: Authors' simulation results.

Note: The poverty headcount rates are based on the $1.90 and $3.10 international poverty lines determined with 2011 PPP. The $1.90 poverty line equivalent to the old $1.25 poverty line, while the $3.10 line is equivalent to the old $2.00 poverty line.