THE IMPLICATIONS OF HIV/AIDS FOR DEMOGRAPHICS, GROWTH, AND POVERTY IN SOUTHERN AFRICA

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1. Introduction

Southern Africa's dependency ratios have generally been falling, consistent with the trends of the rest of the continent. However, they remain high in Mozambique. This has the potential for the region to accelerate growth, and reduce poverty and inequality through greater savings and investment as well as a direct boost to labor supply. These gains can be higher if educational attainment can be accelerated, leading to improvement in the human capital of the labor supply (Ahmed et al., 2014).

This sustained economic growth is predicated on the maintenance of good economic policies, the absence of stresses like natural disasters, with the demographic dividend depending further on the maintenance of favorable demographic trends. However, the region does face threats to these enabling conditions. One major threat to the maintenance of favorable demographic trends, is the impact of HIV/AIDS. As of 2011, about 70 percent of the people living with HIV/AIDS reside in Africa, with the region having an incidence of 4.9 percent.

In the case of Southern Africa – Botswana, Lesotho, Namibia, South Africa, and Swaziland – the incidence is more than 20 percent. HIV/AIDS in the region has detrimentally affected economic growth and poverty reduction efforts. In regard to demographics, analyses from the early 1990s projected HIV/AIDS to lead to contractions in affected populations, with differential impacts across age-cohorts and gender. However, due to the substantial scaling up of antiretroviral treatment availability, the impacts of HIV/AIDS on mortality (especially child mortality) and productivity have been mitigated over the last decade. Due to the relatively recent nature public health success and the inertia of the current state of HIV/AIDS incidence, the full economic impacts through the demographics channel are not fully known.

The paper thus addresses two broad questions:

1) What are the implications of different HIV/AIDS epidemiological scenarios for demographic and skilled labor supply projections in Southern Africa?
2) What are the implications of these demographic and skilled labor supply projections for growth and poverty reduction in Southern Africa and Mozambique?

2. Recent Evidence on Demography and Growth

The HIV/AIDS pandemic has impacted the demographic profile and trends of Southern Africa. Southern Africa is the region that has seen the highest prevalence of HIV-AIDS in the world. The spread of the disease has severely impacted the current cohorts of working age, and especially women between the ages of 20 and 40 years and men between 30 and 44 years at present. The impact of the HIV/AIDS epidemic can be best seen through the dramatic drops in life expectancy at birth in the early 2000s. In Lesotho, life expectancy at birth dropped from around 60 years in the early nineties, to 45 years in 2005. Swaziland and Botswana followed similar trends. And while the drop in South Africa and Namibia has been smaller in relative terms, it remains dramatic: as of 2012, and in spite of being much wealthier, life expectancy in South Africa is close to the average of Sub-Saharan Africa.

The HIV/AIDS epidemic resulted in a reduction in the size of the working age population (adults aged 20 to 49 years accounted for 50 percent of all deaths in Southern Africa during the 2005-2010

period, compared with 21 percent in 1985-19903) – and thus a stall in the dependency ratio between 2000 and 2020. At the same time, population growth slowed with downward pressure on the number of women of childbearing age within the population, as well as increased infant and child mortality related to mother-to-child transmission of HIV. Thus, the overall effect of the pandemic has then been to first stall the decline in the dependency ratio by reducing the size of the working-age population (2000-2020), but then to decrease it by slowing the growth of the elderly population as the cohorts most affected by the pandemic reach old age.

The literature on the relationship between population change and economic growth is varied and includes work that argues that the former can have a range of effects on the latter: enhancing growth, restricting growth, or having no relationship.[2] However, Bloom and Williamson (1998) and Bloom et al. (2000) have found strong evidence that the rapid growth that East Asia experienced over 1965-1990 was due to the effects of the working age population growing faster than populations as a whole.

Eastwood and Lipton (2011) summarize some of the key channels by which demographic change may affect economic growth, specifically output per capita. These channels include the dilution of natural capital (i.e. the number of workers grow and the stock of natural capital falls over time), rising returns to the population via productivity improvements and scale economies due to higher population density, the dilution of reproducible capital (i.e. investment does not keep pace with labor force growth), and age structure effects. This last channel has been the focus of much of the demographic dividend literature.

While a full theoretical exposition of this channel can be found in Eastwood and Lipton (2011), it can be summarized as follows. Consider the economic output of an economy as Y, the population as N, and the working age population as WA. The growth rate of a given variable, *x*, is denoted as *g(x)*. Then, by definition:

$$g\left(\frac{Y}{N}\right) = g\left(\frac{Y}{WA}\right) + g\left(\frac{WA}{N}\right) \qquad \text{EQ. 1}$$

So, if the working age share of the population rises by one percentage point, then the per capita output growth rate would also rise by one percentage point. This relationship is referred to as the *arithmetic age-structure dividend*. Moving beyond this is the strong form of the age-structure hypothesis which states than any change in demographic structure comes through the working age share, with the magnitude of this effect possibly being greater (or smaller) than the arithmetic dividend.

However, Bloom et al. (2003) suggest that a demographic dividend is not automatic and requires an enabling policy framework that addresses public health, family planning, labor market flexibility, and

[2] See Bloom et al (2003) for discussion of some of these alternate effects of population on growth. Brückner & Schwandt (2013) argue that economic growth can conversely also have an impact on population growth.

openness to trade, savings, and human capital accumulation. The question arises as to what scope there actually is for Sub-Saharan Africa for obtaining a demographic dividend.

2. Methodology

2.1 Models and Data

The magnitude of the impact of HIV/AIDS on Southern African growth and poverty depends depends on a range of economic variables that are not easily understood through analysis of only *ex post* data or without consideration of the range of possible influencing factors in the global economy. This paper examines the impacts on demographic changes in particular, a dynamic simulation model that can capture these diverse global behaviors in general equilibrium. LINKAGE, the recursive dynamic computable general equilibrium (CGE) model is ideally suited for this task.[3] 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. The model takes a vintage approach to capital in production, so production can occur with either 'old capital' or 'new capital'. The key difference being that 'new capital' is slightly more substitutable (or slightly less complementary) with skilled labor than 'old capital'.

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 exogenously changed. At the same time, the model keeps track of the young (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 United

[3] It must be noted that 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).

Nations (2013). These data are used to calculate the youth and elderly dependency ratios in each year of a given simulation, and are in turn used to help determine domestic savings behavior.

While LINKAGE provides the economy-wide effects of demographic change over time, the GIDD microsimulation framework of Bussolo et al. (2010) will be used to generate income distributions under the various scenarios. GIDD draws on household level survey data benchmarked to 2007 for over 128 countries 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. Using the simulated income and employment under future scenarios from LINKAGE, and accounting for the demographic shifts characterized in the United Nations (2013), 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-parametric cross-entropy methods, but keeping it consistent with the United Nations' population projections.

To be consistent with the GIDD, the 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 less than nine years of education. 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. Results and Analysis

4. Conclusion

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