Chapter 2

Forecasting economic and social trends for long-term social protection planning

Identifying how Africa's population boom will interact with key socio-economic trends is crucial to understanding the evolving needs for social protection and the context within which it will operate. This chapter forecasts economic and social trends of key interest to social protection planners in the sample countries. It estimates the rate at which these economies and their per capita incomes will grow, as well as the impact this growth will have on poverty. It also projects the structure of the economy and the labour force in order to show how workers are likely to be employed over the next 50 years.

The prospects for growth are strong in East Africa

Economic growth rates across the six countries have improved markedly since the 2000s after stagnating during the 1980s and 1990s (Figure 2.1). East Africa outperformed sub-Saharan Africa as a whole between 2000 and 2015 and is expected to do so over the next five years. The strong economic growth witnessed since the early 2000s has increased per capita incomes (Figure 2.2).[1] However, population growth has diluted this impact such that only Zambia and Kenya have graduated to middle income status (as determined by World Bank thresholds). This in turn has slowed the rate of poverty reduction, an effect exacerbated by the level of inequality across the six countries. Despite their strong economic performance in recent years, all the sample countries with the exception of Kenya are still classified by the United Nations as Least Developed Countries.

Figure 2.1. **Average GDP growth rates, historic and projected, 1980-2020**
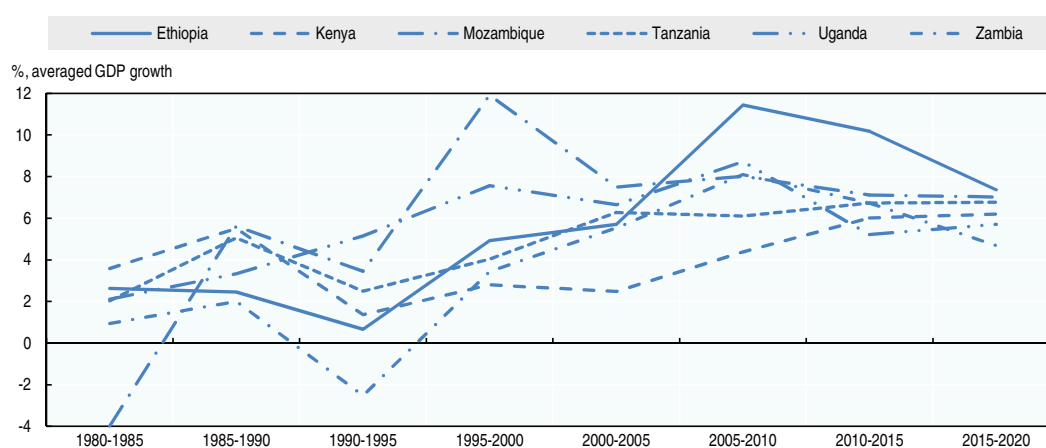
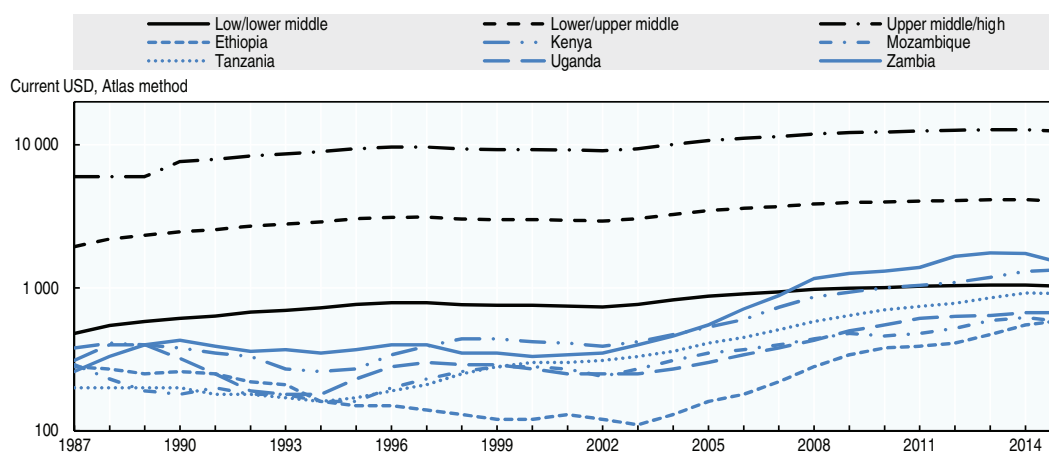*Source*: IMF (2016), *World Economic Outlook* (database), April.

Beyond 2020, much will depend on the countries' capacity to improve infrastructure. Investment in infrastructure has been a major contributor to the African growth story in recent years (Foster and Briceño-Garmendia, 2010) but has not been nearly sufficient to meet the region's deficit in this regard relative to the rest of the world. Sustained and high levels of investment will rely on the countries' capacity to mobilise savings and attract foreign investment.

Domestic savings across the sample vary, both in terms of level and trend. Ethiopia's gross domestic savings rate has grown strongly since 2010, reaching 31.8% of GDP in 2015. Kenya's gross domestic savings rate, on the other hand, has declined from 17.3% of GDP in 2007 to 12.7% in 2015. The trend since 2010 has been flat in Tanzania and Uganda at just above 20% of GDP. The average gross domestic savings rate for sub-Saharan Africa as a whole was 15.4% of GDP in 2015, versus 17.3% of GDP in Latin America and the Caribbean and 29.6% of GDP in Emerging Asia. Investment rates across the six countries have been higher than the savings rate (dramatically so, in Mozambique's case), meaning that the countries have been able to attract foreign investment to fill this financing gap (IMF, 2016).

It is not advisable to extrapolate current economic trends far into the future; past performance is no guarantee of future outcomes. Easterly et al. (1993), for example, demonstrated that growth rates are unstable over time, with correlations across decades of 0.1 to 0.3, even though country characteristics are much more stable. This cautions against projecting forward the growth rates achieved in the last 15 years. In terms of the future, the long-term economic prospects not only of sub-Saharan Africa but also of the

world as a whole are laden with uncertainty. The projections used in this report should not be regarded as predictions but as a means of understanding the interactions between different components of the economy.

Figure 2.2. **GNI per capita, 2015 USD (Atlas method, log scale)**

Source: World Bank (2016), *World Development Indicators*, http://data.worldbank.org/products/wdi.

The OECD long-term forecast of global GDP implies an annual growth rate of 2.53% from 2020 to 2065 (OECD, 2016). The United Nations' projections of the global population aged 15-64 implies an annual growth rate of 0.54% per annum. Assuming a constant employment rate, the OECD forecast implies that labour productivity will increase by 1.98% per year, which is slightly faster than the annual productivity growth rate of 1.8% found for the period 1965-2015 by the McKinsey Global Institute (2015). As the basis for the calculations in this chapter, a rate of productivity growth of three-quarters of the mean of the OECD projection and the McKinsey historical estimate is assumed for the six countries. This results in a projected increase in labour productivity of 1.4% per annum across the survey period. This is lower than the 2.2% found by McMillan and Harttgen (2014) for the 2000-10 period in 19 countries in sub-Saharan Africa.

Structural change – the process by which economic activity and employment typically move from agriculture (the primary sector) to industry and services (secondary and tertiary sectors) – has not been a major driver of development in sub-Saharan Africa. The region's secondary sector is dominated by extractive industries: manufacturing's share of GDP has declined from around 17% in the early 1990s to around 11% currently (versus 20% for extractive industries), raising the possibility that the region is already deindustrialising – a phenomenon typically associated with advanced economies (Page, 2013; Rodrik, 2015). Manufacturing is more labour-intensive than extractive industry and has proven much better at absorbing low-skilled labour. However, automation could jeopardise the employment gains associated with manufacturing growth in the future and is also likely to negatively impact employment generation in the services sector (Rodrik, 2015).

Even where structural transformation has taken place in Africa, the shift has been more from agriculture to services, where productivity growth has been low (de Vries et al., 2013). McMillan, Rodrik and Verduzco-Gallo (2014) find that since 1990, structural change has had a negative impact on growth in sub-Saharan Africa, though the picture has improved since 2000. Of course, the experience varies by country and will continue to do so: as noted by the AEO (AfDB, OECD and UNDP, 2015): "Countries are achieving growth

with different degrees of sectoral transformation. In Ethiopia, structural changes are most pronounced with the share of agriculture in GDP shrinking (although remaining higher than in the other countries) and services expanding more than in the other countries."

Structural change is not just about economic output. Urbanisation and changes to the age structure of the population can transform societies and have been shown to promote productivity gains. Sub-Saharan Africa is in a position to capitalise from all three, in which case the projections in this Chapter will prove pessimistic. However, in none of these cases is the response automatic: rather, appropriate policies are required to exploit this potential.

Table 2.1. **Projected GNP growth, GNP per capita growth, and GNP per capita levels, 2015-2065**

	Ethiopia	Kenya	Mozambique	Tanzania	Uganda	Zambia
Average annual growth in:						
GDP	3.6%	3.5%	4.8%	4.3%	4.6%	4.6%
GDP per capita	2.0%	1.6%	2.5%	1.8%	2.0%	1.8%
GNP per capita (2015 US dollars):						
2015	634	1 371	607	864	639	1 509
2065	1 722	3 046	2 083	2 077	1 735	3 787

Source: Authors' calculations based on IMF (2015), IMF World Economic Outlook (database), October, and UN DESA (2015), World Population Prospects: The 2015 Revision.

Table 2.1 shows the growth in GDP, per capita GDP and GNP between 2015 and 2065 based on the assumed growth in productivity. The median GDP growth rate across the six countries over the projection period is 4.4% and 1.9% in per capita terms, which is close to the 2% projected by Rodrik (2014). Figure 2.3 shows the variation in average GDP growth rates across the six countries, which is a consequence of the differing growth rates of the working-age population relative to the total population across the sample countries. It also shows how population growth dilutes economy-wide gains on a per capita basis.

Figure 2.3. **Average annual GDP growth rates between 2015 and 2065**
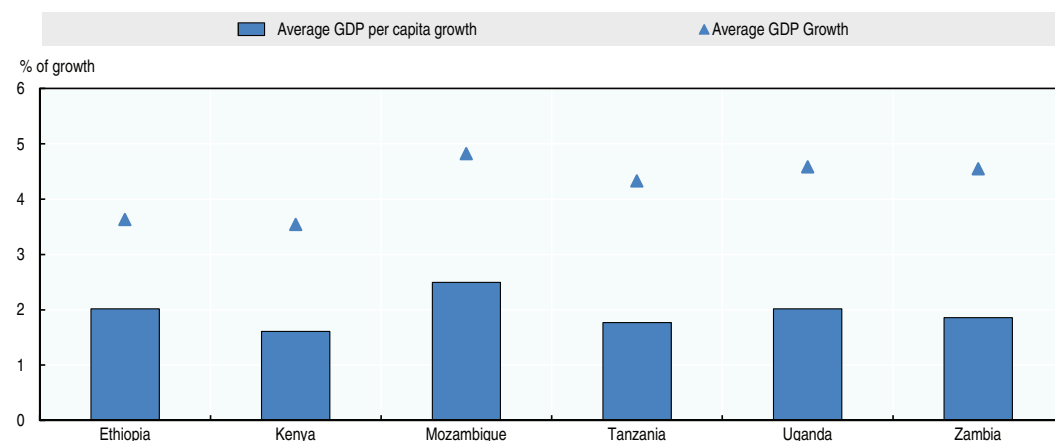
Source: Authors' calculations based on IMF (2016), *World Economic Outlook* (database), April.

A demographic dividend is represented by the excess of GDP per capita growth over the 1.4% assumed labour productivity growth. Ethiopia's annual average GDP growth rate is projected to be the second-slowest of the sample after Kenya but, because of its relatively slow population growth, its GDP per capita will grow by 2.0% per year on average, the second-fastest rate after Mozambique.

Slow structural change and the implications for employment

The next step is to show how the different sectors of the economy are likely to develop given the overall growth rates identified above. Figure 2.4 shows how the structure of output changed in the six countries between 2000 and 2010 and projects the composition of output by sector for 2065 based on the current trajectory as per the methodology applied by Fox et al. (2013). In all countries, the contribution of agriculture is projected to decline while that of services and industry increases. However, the contribution of agriculture is not projected to fall below half of its 2010 level in any of the six countries.

Figure 2.4. **Structure of output, 2000, 2010 and 2065**
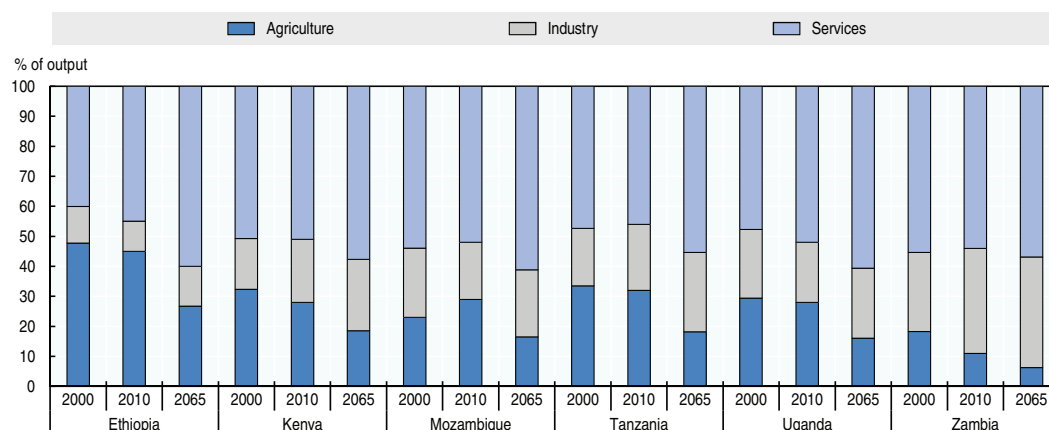
Source: Authors' calculations based on World Bank (2015), World Development Indicators (database), http://data.worldbank.org/products/wdi.

Having projected the structure of output, it is then possible to project the structure of employment up to 2065 across the three sectors, distinguishing between wage and non-wage employment in industry and services as per Fox's methodology. Figure 2.5 shows the results of this projection for each of the sample countries, which is based on three key assumptions: that labour force participation will remain at its present level, that the agricultural sector will absorb all employed people not absorbed by industry and services, and that the elasticity of employment for different sectors remains the same into the future. Partly because the agriculture sector is used to clear the market, it is projected to remain the majority form of employment in all countries in 2065, despite its declining contribution to output. Only in Tanzania and Zambia will agriculture account for less than 60% of employment at that point.

While wage employment in industry and services will increase as a proportion of total employment, it is projected to remain as a minority form of employment across this timeframe. Wage employment will be lower than employment in agriculture in all six countries and also lower than employment in household enterprises in Ethiopia, Tanzania and Uganda. A sensitivity analysis for these calculations (Annex 2.A1) indicates that agricultural and other informal work will remain predominant even under a more favourable development trajectory.

Figure 2.6 shows how new entrants to the labour market will be allocated across the labour market given the current absorption rates of different sectors. It indicates that 46% of the employment increase between 2015 and 2065 in the six countries together is projected to take place in agriculture, 28% in household enterprises, 20% in wage services and 6% in wage industry. If the labour force participation rate is to stay the same in each of the countries, additions to employment will need to total just over 7 million on average each year across the sample over the whole period. The projected demand for employment per year will vary over time in accordance with the trends in population growth, meaning it will rise relatively fast over the first 20 years of the timeframe before plateauing and then declining.

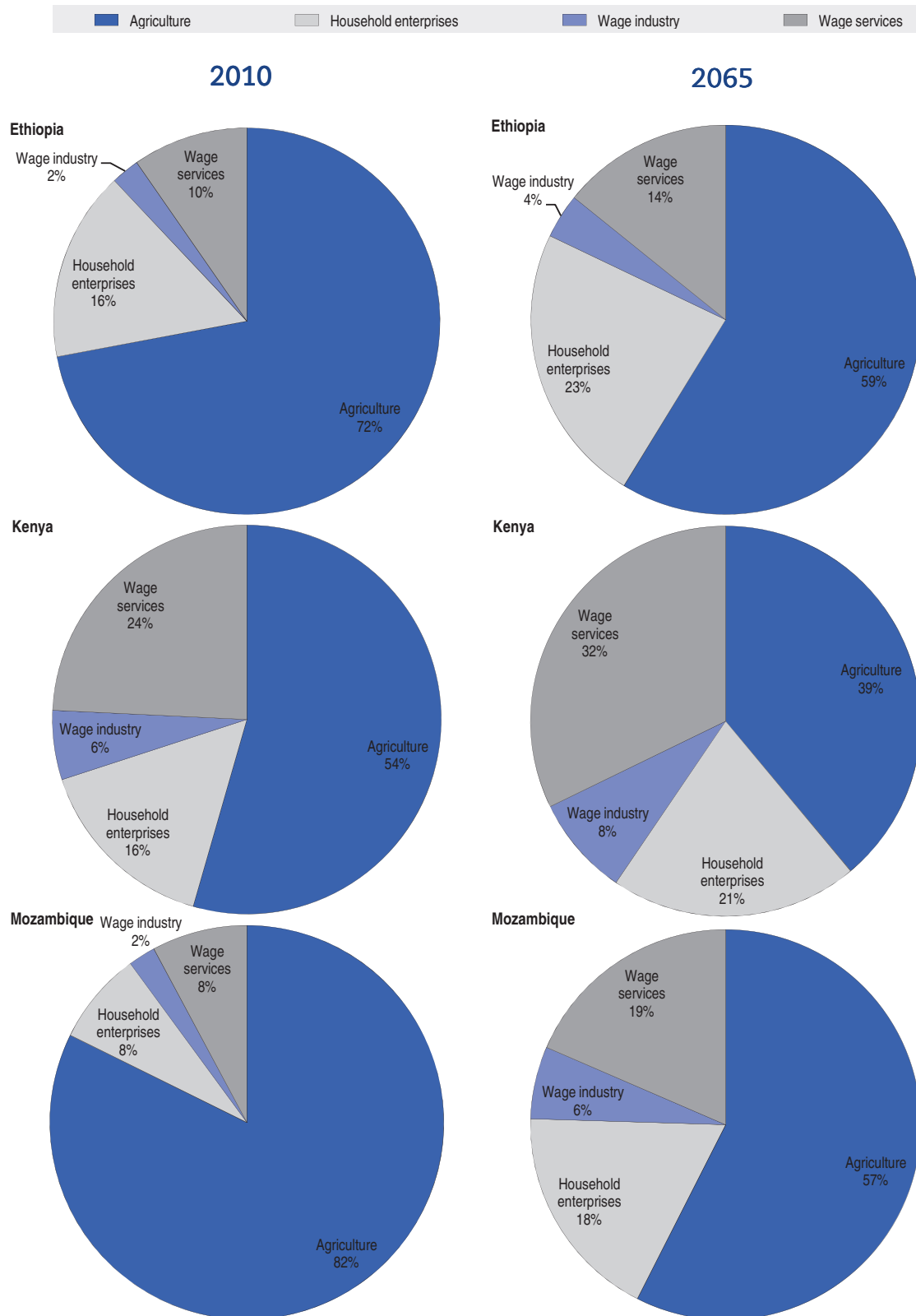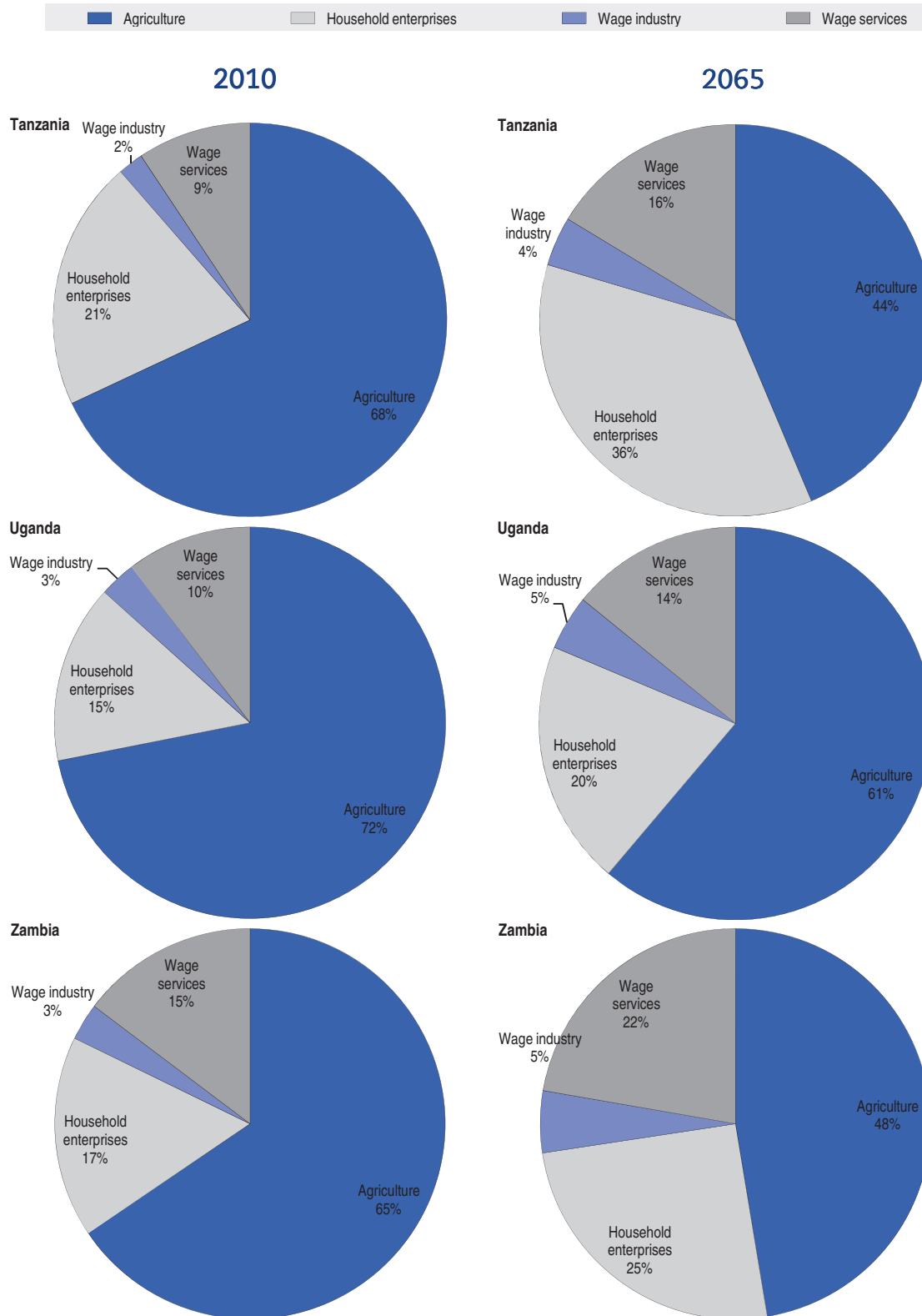Figure 2.5. **Employment shares by sector, 2010 and 2065**

Figure 2.5 **Employment shares by sector, 2010 and 2065** *(cont.)*

Legend: Agriculture | Household enterprises | Wage industry | Wage services

2010

Tanzania
- Agriculture 68%
- Household enterprises 21%
- Wage industry 2%
- Wage services 9%

Uganda
- Agriculture 72%
- Household enterprises 15%
- Wage industry 3%
- Wage services 10%

Zambia
- Agriculture 65%
- Household enterprises 17%
- Wage industry 3%
- Wage services 15%

2065

Tanzania
- Agriculture 44%
- Household enterprises 36%
- Wage industry 4%
- Wage services 16%

Uganda
- Agriculture 61%
- Household enterprises 20%
- Wage industry 5%
- Wage services 14%

Zambia
- Agriculture 48%
- Household enterprises 25%
- Wage industry 5%
- Wage services 22%

Source: Authors' calculations.

Figure 2.6. **Employment creation forecasts by sector 2015-2065, agriculture as residual**

Source: Authors' calculations.

Ensuring the youth are not left behind

The youth cohorts of today and tomorrow are likely to suffer most from the combined effects of rapid population growth and slow structural change. Among each of the six countries, the rate of unemployment is higher than among the working age population as a whole: ILO (2015a) estimates and projections (Figure 2.7) indicate particularly high youth unemployment rates for Mozambique, Zambia and Kenya. If rates of population growth relative to job creation persist in Kenya, the number of unemployed youth has been projected to double by 2035 (UNDP, 2013). Table 2.2 (also based on ILO figures) shows a high proportion of youth not in employment, education or training in Tanzania and Zambia. For now, high youth unemployment rates appear to be compatible with low adult unemployment rates across the sample except in Mozambique, where the ILO also finds relatively high adult unemployment. However, exclusion from the labour market at a young age is likely to have an adverse impact on this cohort's labour-market outcomes further along the lifecycle: youth unemployment is associated with lower earnings and inferior employment prospects later in life (ILO, 2010; ILO, 2015b; OECD, 2010).

Figure 2.7. **Unemployment rates, youth and adult, 2010-2020**
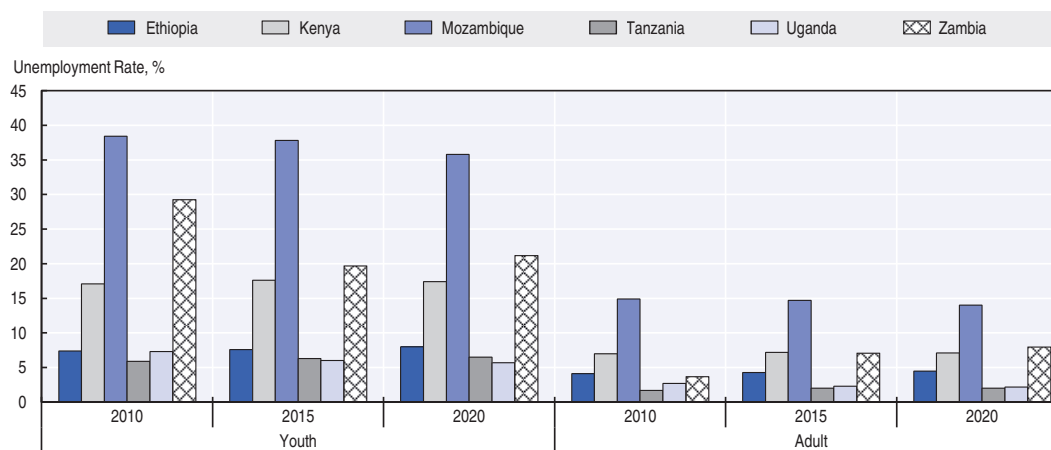
Source: ILO (2015a), Key Indicators of the Labour Market, 9th Edition (database), http://ilo.org/ilostat.

Prolonging the length of time the youth spend in education will be of critical importance. Not only will this ease pressure on the labour market but it will also allow young people to develop the skills needed to find work and be productive. While net enrolment in primary school averaged 86% across the six sample countries across 2008 and 2012, net enrolment in secondary school averages just 30% (UNESCO, 2016).

Although higher educational attainment is often associated with improved employment prospects, the relationship does not always hold: in Ethiopia, Rwanda, Uganda and Tanzania, the unemployment rate is higher for those with secondary education or above than for those with basic or no education (UNESCO, 2013; UNECA, 2016), implying a mismatch between the skills young people acquire at school and the demands of the labour market (Kew, 2015). This is a worrying phenomenon: if continuing education past primary school fails to generate clear returns then many households will be unwilling to bear the costs of sending a child to school rather than putting them to work.

Table 2.2. **Youth not in employment, education or training (NEETs)[2]**

	Year	Age range	Per cent
Mozambique	2012	15-24	10.1
Tanzania	2012	15-24	31.8
Uganda	2013	15-24	5.9
Zambia	2012	15-29	28.3

Source: ILO (2015a), Key Indicators of the Labour Market, 9th Edition (database), http://ilo.org/ilostat.

Governments need to unlock the potential of youth entrepreneurship rather than rely on the formal sector to create jobs. In a context where the formal sector absorbs only a small proportion of new labour market entrants, many young people already find themselves in own-account work in the informal sector. This phenomenon is likely to increase as more young people enter the labour market. Making self-employment more profitable is likely to be the most important route out of poverty for millions of young people; doing so requires a co-ordinated response that tackles a number of the challenges to youth entrepreneurship, including how to foster the appropriate skills and improve access to capital.

Sexual and reproductive health (SRH) services can generate a number of very important benefits for the youth: they can address the unmet need for contraception (discussed in Chapter 1), reduce teenage pregnancy and prevent the spread of HIV/AIDS and other infections. Across Africa, however, provision of SRH services is failing to meet the needs of young people (Prata, Weidert and Sreenivas, 2013). SRH needs not only to be scaled up dramatically but should also be specifically tailored to young people (for example, by emphasising privacy and confidentiality) and particularly to adolescent women, who are often at greater risk of stigmatisation than adolescent men (Tylee et al., 2007).

Given the higher prevalence of HIV/AIDS in urban areas, expanding SRH services in cities – and particularly in informal settlements – will be very important (Renzaho et al., 2017). The cost of meeting demand for SRH services for the youth will rise as this cohort continues to grow but this investment would not only improve human capital among young people but also help to reduce the total fertility rate.

Population growth and inequality make poverty eradication a long-term challenge

Projecting the rate of economic growth across the six economies provides a framework for analysing future poverty dynamics. The first step is to identify how aggregate income gains will be distributed on the basis of the Gini coefficient. Figure 2.8, which sets out observations of the Gini coefficients by country between 1989 and 2012, shows significant variation between the six countries. Inequality has been consistently highest in Zambia and lowest in Ethiopia over this period, with a difference of more than 20% between these two according to the most recent data. The relatively rapid economic growth experienced over this period has not been associated with significant changes to the distribution of income in the majority of countries though there was a notable increase in Ethiopia. The poverty projections presented in this section assume that inequality will stay at its current level between 2015 and 2065, in accordance with a recent IMF finding that inequality appears to have remained broadly unchanged overall in sub-Saharan Africa, although there is variation across countries (IMF, 2015).

Figure 2.8. **Gini coefficients, 1989 to 2012**
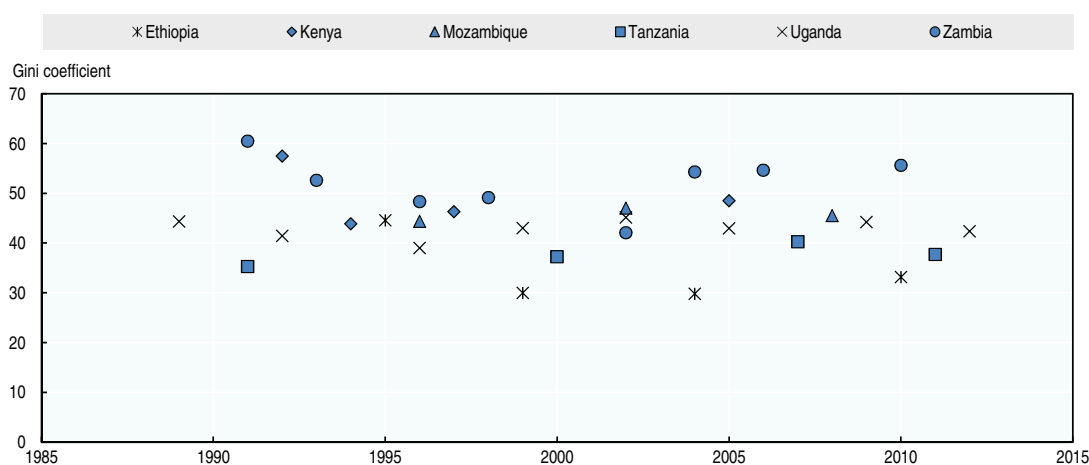
Source: World Bank (2015), *PovCalNet* (database), povertydata.worldbank.org/poverty/home.

The current level of poverty, the size of the poverty gap and the level of inequality across the sample countries in 2015 are shown in Table 2.3. These are extrapolations of historic trends.[3] As with the rates of inequality, the headcount poverty ratio and the poverty gap vary across the sample. Mozambique's poverty rate and poverty gap are highest among the sample, indicating that it will have the furthest to go in terms of eliminating poverty, while the headcount ratio and poverty gap are lowest in Kenya. However, Kenya also has the second-highest level of inequality, which will dampen the poverty-reducing effect of its per capita income gains over the sample period. Zambia has the second-highest headcount poverty ratio, the second-largest income gap and (by some distance) the highest level of inequality.

None of the six countries are likely to achieve the first Sustainable Development Goal – to eradicate poverty – by 2030 or for many years after. Figure 2.9 shows projected poverty headcounts against the World Bank's two updated poverty thresholds: USD 1.90 per day (extreme poverty) and USD 3.10 per day.[4] On a 20-year view, poverty headcount ratios

against the USD 1.90 benchmark (left-hand panel) will range from 9% to 35% in 2035. On a 50-year view, only three countries will have poverty headcount ratios of less than 5% against the USD 1.90 benchmark: Ethiopia, Tanzania and Uganda. Against the USD 3.10 benchmark, only Ethiopia is projected to reduce poverty to below 10% by 2065.

Table 2.3. **Gini coefficients, poverty headcounts and poverty gaps, 2015**

Consumption based poverty line, USD 1.90 per person per day, 2011 PPP

	Gini coefficient	Headcount ratio	Poverty gap
Ethiopia	33.2	25.5	8.3
Kenya	48.5	24.4	7.8
Mozambique	45.6	55.2	22.1
Tanzania	37.8	26.7	8.8
Uganda	42.4	31.3	10.7
Zambia	55.6	47.7	18.3

Source: Authors' calculations based on World Bank (2015), World Development Indicators (database), http://data.worldbank.org/products/wdi.

Figure 2.9. **Headcount poverty ratios, USD 1.90 and 3.10 per day (2015-2065)**

Source: World Bank (2015), *World Development Indicators* (database), http://data.worldbank.org/products/wdi.
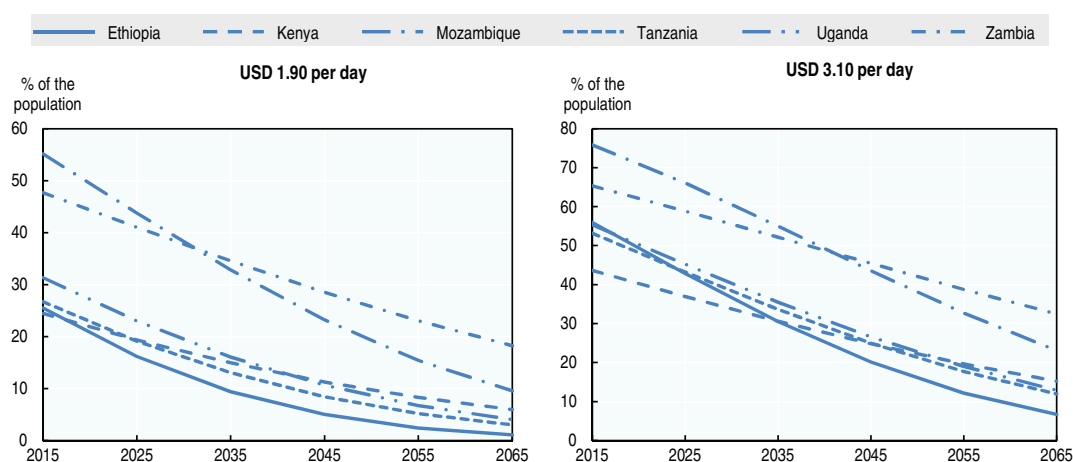
At the current rate of progress, the number of extremely poor individuals across the six countries will decline only slightly between 2015 and 2035, from 86.3 million to 74 million, then drop to 39.4 million in 2065 (Figure 2.10). The decline in poverty in Ethiopia is responsible for much of this reduction: it is the only country where the absolute number of poor is projected to decline throughout the timeframe according to both poverty lines. In Kenya, Tanzania and Uganda, the number of extremely poor individuals will decline only slowly over the 50 years, while the number of poor as defined by the USD 3.10 threshold will increase between 2015 and 2035 before returning to its initial level. In Mozambique, poverty as defined by both lines initially increases before declining towards the end of the timeframe, while in Zambia the absolute number of poor individuals is projected to grow throughout the survey period against both measures.

Figure 2.10. **Number of poor, USD 1.90 and 3.10 per day (2015-2065)**

Source: World Bank (2015), *World Development Indicators*, http://data.worldbank.org/products/wdi.
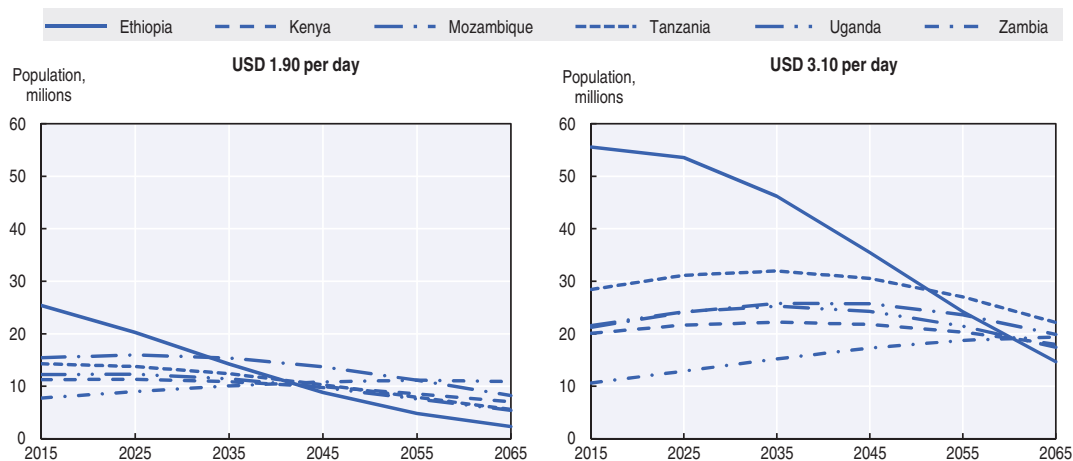
Notes

1. National accounts data require a certain degree of caution. Analysing the performance of 44 countries against 71 indicators, the African Development Bank came to the conclusion that five of the six countries in this study performed adequately on 60%-70% of the indicators (Ethiopia the best, followed by Mozambique, Kenya, Zambia and Tanzania), with Uganda lagging at just under 50% (African Development Bank, Statistics Department, *Situational Analysis of the Reliability of Economic Statistics in Africa: Special Focus on GDP measurement,* June 2013).

2. The ILO does not provide an estimate for youth not in employment, education and training in Kenya. The Ethiopian estimate includes children between the ages of 10 and 14.

3. The methodology for updating the data is described in Annex 2.A2.

4. These figures are derived by updating the latest survey data for each country according to a methodology described in Annex 2.A2.

References

African Development Bank (2013), *Situational Analysis of the Reliability of Economic Statistics in Africa: Special Focus on GDP measurement*, AfDB Statistics Department, Abidjan.

AfDB, OECD and UNDP (2015), *African Economic Outlook 2015: Regional Development and Spatial Inclusion*, OECD Publishing, Paris, http://dx.doi.org/10.1787/aeo-2015-en.

de Vries, G., K. de Vries and M. Timmer (2013), "Structural Transformation in Africa: Static Gains, Dynamic Losses", *Journal of Development Studies*, Vol. 51, Issue 6, pp. 674-688.

Easterly, W. et al. (1993), "Good policy or good luck? Country growth performance and temporary shocks", *Journal of Monetary Economics*, 32(3): 459–483.

Foster, V. and Briceño-Garmendia, C. (2010), *Africa's infrastructure: a time for transformation*, World Bank, Washington, DC, https://openknowledge.worldbank.org/handle/10986/2692.

Fox, L. et al. (2013), "Africa's got work to do: Employment prospects in the new century", *IMF Working Paper* WP/13/201, International Monetary Fund, Washington, DC.

ILO (2015a), *Key Indicators of the Labour Market, 9th edition* (database), http://ilo.org/ilostat, (accessed June 2016).

ILO (2015b), *Global Employment Trends for Youth 2015: Scaling up investments in decent jobs for youth*, International Labour Organisation, Geneva.

ILO (2010), *Global Employment Trends for Youth, August 2010: Special issue on the impact of the global economic crisis on youth*, International Labour Organization, Geneva.

IMF (2016), *World Economic Outlook* (database), April, imf.org/en/data (accessed June 2016).

IMF (2015), *World Economic Outlook* (database), October, imf.org/en/data (accessed January 2016).

IMF (2015), *Regional Economic Outlook, Sub-Saharan Africa: Dealing with the Gathering Clouds*, World Economic and Financial Surveys, International Monetary Fund, Washington, DC.

Kew, J. (2015), "Africa's Young Entrepreneurs Unlocking the potential for a brighter future", International Development Research Centre [IDRC], Cape Town.

McKinsey Global Institute (2015), *Global growth: Can Productivity Save the Day in an Aging World?*, McKinsey & Company, McKinsey Global Institute.

McMillan, M., D. Rodrik and Í. Verduzco-Gallo (2014), "Globalization, Structural Change, and Productivity Growth, with an Update on Africa," *World Development* 63, pp. 11-32.

McMillan, M. and K. Harttgen (2014), "What is driving the 'African growth miracle?", *African Development Bank Group Working Paper* No. 209, African Development Bank, Tunis.

OECD (2016), *GDP long-term forecast* (indicator), accessed January 2016, http://dx.doi.org/10.1787/d927bc18-en.

OECD (2010), *Education at a Glance 2010 – OECD Indicators*, OECD Publishing, Paris. http://dx.doi.org/10.1787/eag-2010-en.

Page, J. (2013), "Should Africa Industrialize?", in A. Szirmai, W. Naude and L. Alcorta (eds.), *Pathways to Industrialization in the Twenty-First Century: New Challenges and Emerging Paradigms*, Oxford University Press, Oxford.

Prata, N., K. Weidert and A. Sreenivas (2013), "Meeting the need: youth and family planning in sub-Saharan Africa", *Contraception* 88(1), pp. 83-90.

Renzaho, A.M.N. et al. (2017), "Sexual, Reproductive Health Needs, and Rights of Young People in Slum Areas of Kampala, Uganda: A Cross Sectional Study", *PLoS ONE* 12(1), pp. 1-21, http://dx.doi.org/10.1371/journal.pone.0169721.

Rodrik, D. (2015), "Premature Deindustrialization", *NBER Working Paper Series*, No. 20935, National Bureau for Economic Research, http://dx.doi.org/10.3386/w20935.

Rodrik, D. (2014), "An African growth miracle?", *NBER Working Paper Series*, No. 20188, National Bureau for Economic Research, http://dx.doi.org/10.3386/w20188.

Tylee, A. et al. (2007), "Youth-friendly primary-care services: how are we doing and what more needs to be done?", *The Lancet* 369(9572), pp. 1565-73, http://dx.doi.org/0.1016/S0140-6736(07)60371-7.

UN DESA (2015), *World Population Prospects: The 2015 Revision*, United Nations Department of Economic and Social Affairs, New York.

UNECA (2016), *Social cohesion in Eastern Africa*, United Nations Economic Commission for Africa, Subregional Office for East Africa, Addis Ababa, http://hdl.handle.net/10855/22957.

UNDP (2013), "Kenya's youth employment challenge", discussion paper, United Nations Development Programme, New York.

UNESCO (2016), *UIS.Stat* (database), data.uis.unesco.org, accessed October 2016.

UNESCO (2013), "Educational Attainment and employment outcomes", Background paper prepared for the Education for All Global Monitoring Report 2013/4, United Nations Economic Scientific and Cultural Organization, Paris.

World Bank (2016), *World Development Indicators* (database), accessed October 2016, http://data.worldbank.org/products/wdi.

World Bank (2015), *World Development Indicators* (database), accessed June 2015, http://data.worldbank.org/products/wdi.

World Bank (2015), *PovCalNet* (database), World Bank, Washington, DC, accessed December 2015, povertydata.worldbank.org/poverty/home.

UN DESA (2014), *World Urbanization Prospects: The 2014 Revision*, United Nations Department of Economic and Social Affairs, United Nations, New York.

Annex 2.A1. Sensitivity analysis for employment projections

There are a number of factors that could enhance the level of formal employment over the projected timeframe, including:

- A more rapid demographic transition, leading to slower population growth;
- Higher long-term growth in per capita income;
- A greater shift towards industrial and services output;
- Higher elasticity of wage employment in industry and services with respect to the growth of output.

To carry out a sensitivity analysis, four scenarios are successively built up as follows:

1. Population develops in accordance with the "Lower 80" rather than the "Median" United Nations probabilistic projection, under which East Africa's TFR has fallen to replacement rate by 2065 (as shown in Figure 2.A1.1).
2. Scenario A plus a 20% increase in the long-term growth rate, which is driven by a higher productivity assumption.
3. Scenario B plus a 5% increase in the share of industry and services by 2065.
4. Scenario C plus a 10% increase in the employment growth to sectoral output growth elasticities for wage industry and wage service employment.

Figure 2.A1.1. **Median versus lower 80 population projections for East Africa: Population size and total fertility rate (right-hand side)**
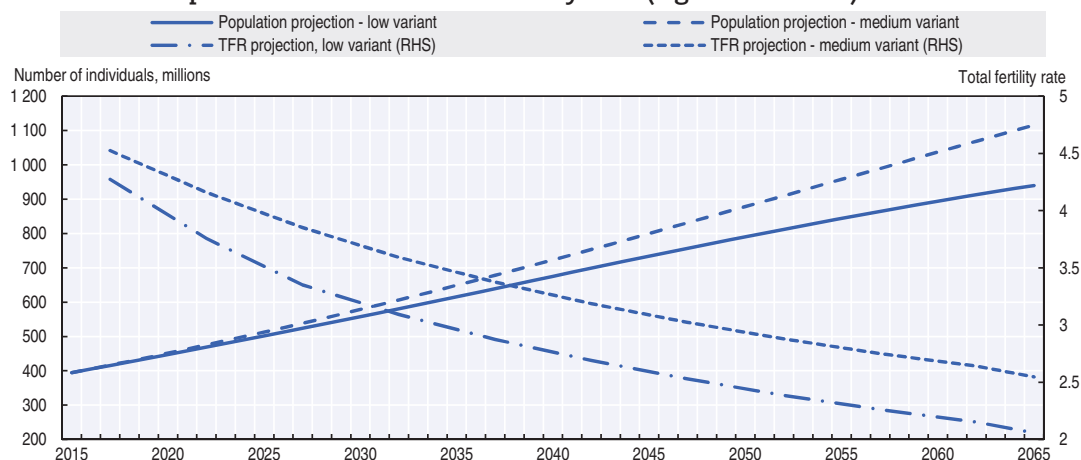
Source: UN DESA (2015), *World Population Prospects, 2015 Revision,* United Nations Department of Economic and Social Affairs, United Nations, New York.

The table below sets out the proportion of wage employment in total employment in 2065 in the base case and in the four alternative scenarios. Even with the successive changes in factors favouring the growth of wage employment, the conclusion reached from the baseline projection continues to hold, except in Kenya under Scenarios B, C and D. It should be borne in mind that the probability of each scenario materialising drops progressively. No corresponding downside set of scenarios has been created, since they would all strengthen the conclusion drawn from the baseline projection.

Table 2.A1.1. **Share of wage employment in total employment in 2065**

	Ethiopia (%)	Kenya (%)	Mozambique (%)	Tanzania (%)	Uganda (%)	Zambia (%)
Base case	17.4	38.5	24.0	19.5	18.6	25.1
Scenario A	21.4	46.1	29.1	23.8	22.5	31.2
Scenario B	26.0	56.0	35.3	29.0	27.4	37.9
Scenario C	27.3	58.8	37.1	30.4	28.7	39.8
Scenario D	30.7	66.5	45.2	36.4	33.5	47.2

Source: UN DESA (2015), *World Population Prospects: The 2015 Revision*, United Nations Department of Economic and Social Affairs, United Nations, New York.

Annex 2.A2. Basis for adjusting the headcount and poverty gap measures and updating them to 2015

The mathematical framework for adjusting headcount and poverty gap measures is the log-normal distribution. Income and consumption distributions are approximated by this distribution, which depends on two parameters, μ and σ. Once these are known, the entire distribution is specified. Two relationships are important. The Gini coefficient is given by:

$$Gini = 2\Phi(\sigma/\sqrt{2}) - 1, \tag{Equation 1}$$

where $\Phi(.)$ is the cumulative normal distribution function, and the mean of the distribution is

$$m = exp(\mu + \sigma^2/2), \tag{Equation 2}$$

The Gini coefficient is assumed constant throughout. This enables one to calculate for each country, using Equation 1. Then the mean of the distribution (monthly per capita income in 2011 purchasing power parity US dollars) can be used in Equation 2 to find μ.

Denote any level of monthly income per capita in 2011 PPP US dollars by y. If y is log-normally distributed, then $ln(y)$ is normally distributed, and a z-value can be calculated in order to refer to the standard normal distribution, with a mean of zero and a standard deviation of 1. Thus

$$z = (ln(y) - \mu)/\sigma, \tag{Equation 3}$$

and, in particular, when y is the poverty line p (USD 57.8 per month)

$$z_p = (ln(p) - \mu)/\sigma, \tag{Equation 4}$$

The headcount measure of poverty then becomes

$$H = \Phi(z_p) \tag{Equation 5}$$

The poverty gap measure can be calculated from the conditional expectation of y up to the threshold p, $E[y|y < p]$. This conditional expectation yields the mean income of people below the poverty line, from which the poverty gap can be readily calculated.

The method also allows one to update the headcount and poverty measures. If σ is constant and mean income per capita is growing at rate g per annum, and we update at intervals of t (say ten years), then the median grows at the same rate as the mean. Now the median of the log normal distribution is $exp(\mu)$, so $\mu = ln(y^*)$, so, where y^* is the median income. Denote the median income in a base year as $y^*(0)$, and the median income after t years as $y^*(t)$. Then

$$y^*(t) = y^*(0) \cdot (1+g)^t, \text{ so taking logarithms}$$

$$\mu(t) = \mu(0) + t \cdot ln(1+g) \tag{Equation 6}$$

so that Equation (4) becomes

$$z_p(t) = (ln(p) - \mu(t))/\sigma,$$

and the calculation of the headcount and poverty gap proceed as before.

Equation 6 holds only when the Gini coefficient, and hence σ, remains constant over time. In this case, the median income and the mean income grow at the same rate.

To generalise it to the case where inequality varies over time, the mean income $m(t)$ reflects the growth rate g so that

$ln(m(t)) = ln(m(0)) + t \cdot ln(1+g)m$ so that, from Equation 2,

$\mu(t) + \sigma^2(t)/2 = \mu(0) + \sigma^2(0)/2 = t \cdot ln(1+g)$, or

$$\mu(t) = \mu(0) + t \cdot ln(1+g) - (\sigma^2(t) - \sigma^2(0))/2 \qquad \text{(Equation 7)}$$

Compared with Equation (6), Equation (7) has an additional term on the right hand side, which accounts for changes in inequality.

It remains to adjust the headcount and poverty gap for the three countries in which the survey estimate of consumption per head is significantly different from the national accounts estimate of consumption per head, and to update all estimates to 2015. For the three countries, the headcount ratio was taken as the mean of the survey-based estimate and the national accounts based estimate in 2011 PPP US dollars. Then the method of updating the estimates to 2015 outlined above was applied.