Age-sex and education-specific urbanization projections up to 2100 for Kenya

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Short Abstract

The aim of this paper is to present a new methodology for producing urbanization projections disaggregated by age and sex. Using micro-data from the IPUMS international database (Minnesota Population Center, 2011), we computed historical education-specific age and sex distributions of individuals living in urban and rural areas and compared such distributions at different points in time. From this empirical analysis, we observed that age, sex and education-specific patterns of urbanization are remarkably regular and we consequently were able to identify “model” pathways of urbanization trajectories overtime. In order to derive the base year (2000-2005) net and education dependent age and sex specific proportion urbanized, we overlaid the empirical distributions to the IIASA estimates of educational attainment (Lutz *et al.*, 2007) and obtained the corresponding urban proportion by age and sex.

To project such urbanization rates up to 2100, we applied the education-dependent model schedules to the base year estimates, projected the population forward using the established IIASA multistate cohort component method (K.C. *et al.*, 2010) and obtained differential urbanization trajectories under three education scenarios (General Enrollment Trend (GET), Constant Education Numbers (CEN) and Fast Track (FT)). The GET scenario assumes enrollment increases of the sorts that we have observed in the past for similar countries. The CEN scenario assumes that enrollment numbers remain constant, even with growing populations, and the FT assumes that countries approach the highest observed enrollment rates quite quickly. To date this is the first effort in the specialized literature that aims at combining the human capital dimension with geographical location. Cognizant

of limitation of this approach, and acknowledging definitional and reclassification issues, we present a first set of results, urbanization rate forecasts for Kenya.

Introduction

To date, the United Nations Population Division has been publishing and revising its World Urbanization

Prospects since 1991 (the latest being the 2009 revision: United Nations 2009), i.e. it has been producing internationally recognized urbanization projections for all countries in the world up to 2030. The UN methodology is essentially an extrapolative method of the difference in the rural to urban growth rates. This method has the advantage of being simple and transparent, but it has been criticized (see for instance Bocquier, 2005, O'Neill *et al.*, 2006) on grounds that it assumes that countries will follow historical trends of urbanization, does not fit the trajectory of countries either at the beginning or the end of the urbanization transition, does not take into account age structure and rural to urban migration, and does not incorporate any measure of uncertainty.

Other recent efforts to produce urbanization projections include the Gridded Population of the World (GPW) database held at the Columbia University's Earth Institute's Center for International Earth Science Information Network (CIESIN). The latter exploits polygons based upon satellite images of night-time lights to identify urban agglomerations, although it is not available world-wide and it may reflect more availability of electricity rather than population density.

The importance of producing urbanization projections has been largely recognized, given their use as inputs in economic and environmental models.

To this end, scientists at IIASA have been working to improve the multi-state cohort component projections by sex, age and educational attainment in order to derive internally consistent education dependent urbanization projections up to 2100.

Data and Methods

This work involved several steps. Using micro-data from the IPUMS international database, the first step consisted of calculating empirical distributions of age and sex specific proportions of individuals living in urban and rural areas by level of educational attainment (those who attained primary, secondary and tertiary respectively). These age and sex specific distributions were compared at different points in time in order to identify empirical regularities. The data were smoothed in order to control for age heaping at older ages, using the Beers six terms modified formula. Interestingly enough, we found that age, sex and education-specific patterns of urbanization are remarkably regular and "model" pathways of urbanization trajectories were identified over time. In order to derive the base year (2000-2005) net and education-dependent age and sex specific proportion urbanized, we overlaid the empirical distributions to the IIASA estimates of educational attainment (Lutz *et al.*, 2007) and obtained the corresponding urban proportion by age and sex.

To project such urbanization rates up to 2100, we applied the education-dependent model schedules to the base year estimates, projected the population forward using the established IIASA multistate cohort component method (K.C. *et al.*, 2010) and obtained differential urbanization trajectories under three education scenarios (GET, CEN and FT).

The method explicitly takes into account and controls for issues of reclassification (i.e. an area previously defined as rural that is reclassified as urban) and annexation by including such "errors" in a residual component (unobserved heterogeneity) of the projection model. In addition reclassification cannot be discerned from rural to urban migration.

Elements of the methodology that we have used in the Kenya case are still tentative. In particular, for the final paper we will develop a general approach to producing model education-specific proportions urban and forecasting how they will change over time. Education is one major driver of urbanization. Another is economic growth. In the final paper, we will incorporate economic growth forecasts based on the same education scenarios into forecasting changes in the education-specific proportions urban.

The economic forecasts have already been produced. One major advantage of the approach proposed here is that it produces the joint age- sex- and education distribution of urban and rural populations.

Results

We present preliminary results for Kenya. Assumptions on the future age pattern of urbanization is based on the differentials that are observed between the two census data points (1989 and 1999, respectively) and for this exercise are kept constant. The future urbanization rate of the youngest cohorts (new born) is linked to the corresponding mothers (15-49). The residual of urbanization rates due to reclassification and annexation is kept constant, reaching a yearly value of 2.5% for those who attained primary or have no education, 1% for secondary and 0.5 % for tertiary, respectively.

We fixed an upper limit to the projection of urbanization rates which reaches 70% for those who attained primary, had no education and secondary, and 80% for tertiary at any point in time.

We first present the overall urbanization rate under the three scenarios, the global education scenario, the fast track and the constant enrollment scenario. Under the first two scenarios, Kenya will reach an urbanization rate of 60% and 70% in 2050 and 2100 respectively. The small differential between the FT and the GET scenario is due to the underlying assumption about setting the above mentioned upper limit in the urbanization projections.

Under the constant enrollment scenario, where education transitions are kept constant and only population momentum drives the cohort changes, Kenya will reach an urbanization rate of 42% and 46% in 2050 and 2100 respectively.

Figure 1: Urbanization projections for the total population, under the three scenarios (GET, FT and CEN).

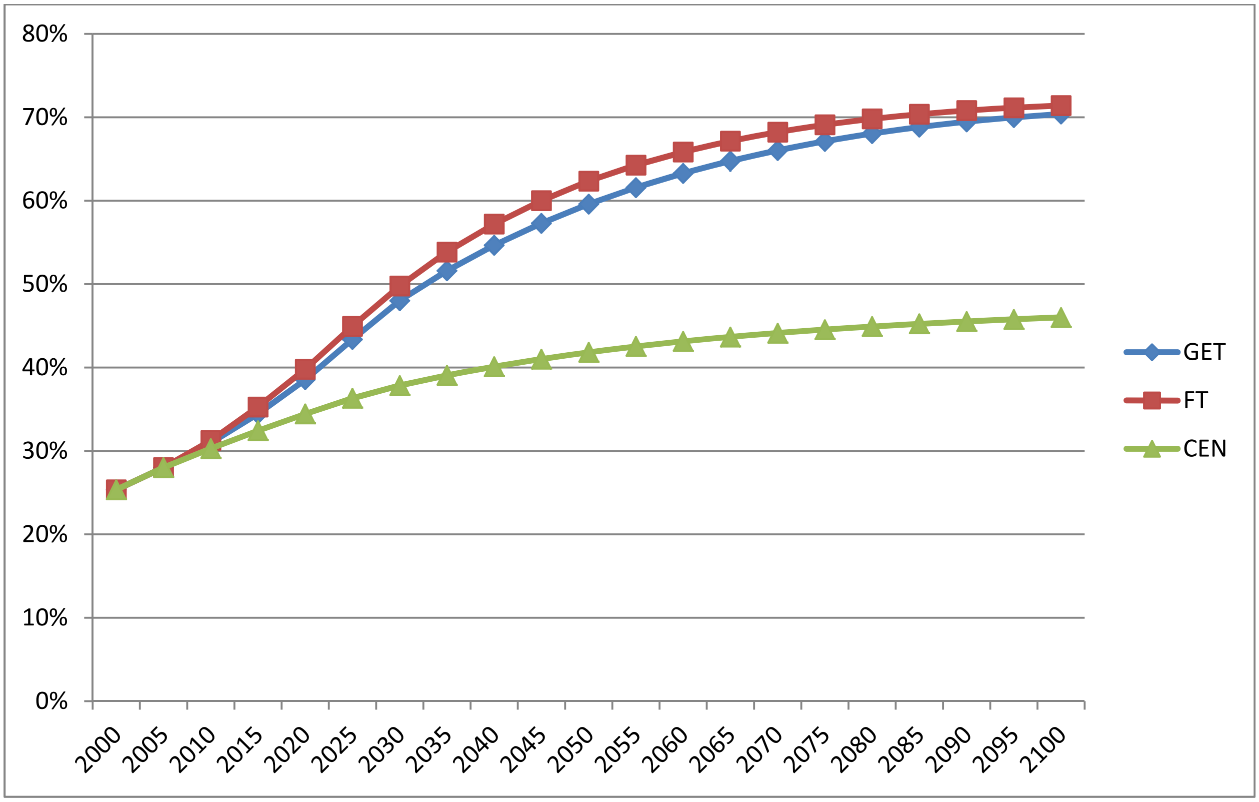

Figure 2 shows instead the differential urbanization rate by educational attainment (primary and no education vs. secondary and tertiary) and its average, under the GET scenario (Global Education Trend).

We can see how the overall changes are driven by the improvements in secondary education.

Figure 2: Urbanization projections for Kenya. Global education trend scenario (GET).

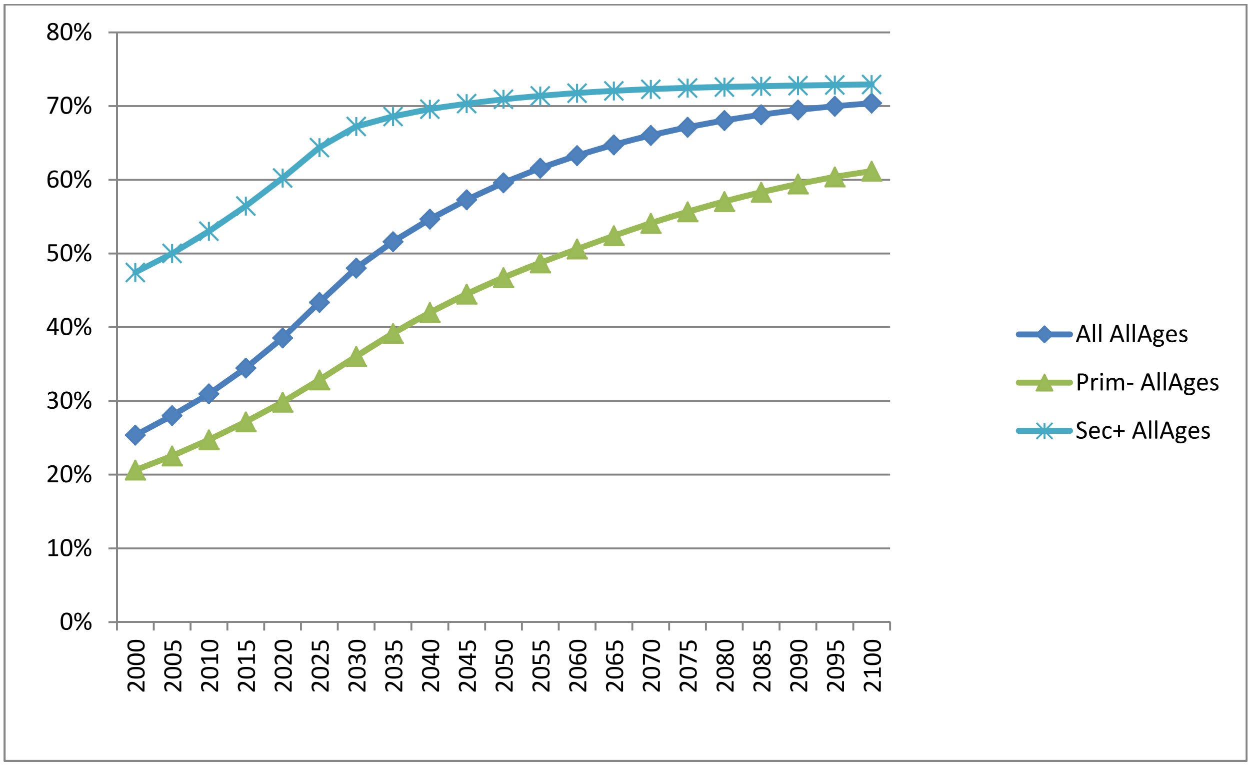

Figure 3: Urbanization projections for Kenya. Constant enrollment scenario (CEN).

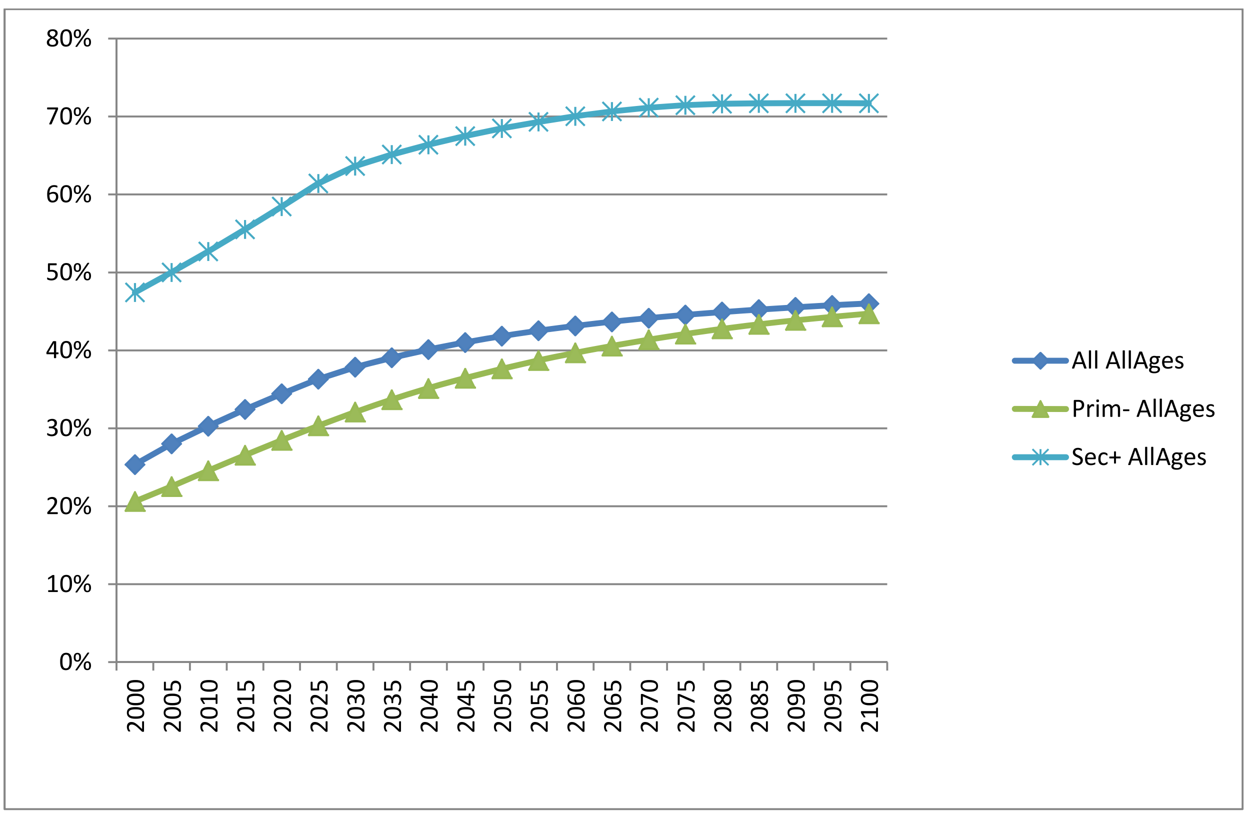

Figure 3 shows instead the differential urbanization rate by educational attainment (primary and no education vs. secondary and tertiary) and its average under the CEN scenario (Constant enrollment number scenario). Given the inherent assumptions which are made in the CEN scenario where education transitions are kept constant, the average rate of urbanization is very close to the one of those with primary and no education.

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