Journal of African Population Studies (JAPS)

UAPS UEPA

Original Article

Urbanization and net fertility in Zambia, 1951-2022

Michel Garenne [1-4], Nancy Stiegler [1]

Citation: Garenne, M.; Stiegler, N.; Urbanization and net fertility in Zambia, 1951-2022. *Journal of African Population Studies* **2025**, *38(1)*, 5302. https://doi.org/10.59147/k4cbx684

Academic Editor: Ngianga-Bakwin Kandala
Received: 31 October 2024
Accepted: 27 November 2025
Published: 2 December 2025

Publisher's Note: JAPS stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

[1] Department of Statistics and Population Studies, University of the Western Cape, Bellville, South Africa; Michel.Garenne@ird.fr
[2] MRC/Wits Rural Public Health and Health Transitions Research Unit, School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa;
[3] Institut de Recherche pour le Développement (IRD), UMI Résiliences, Bondy, France ;
[4] Senior Fellow, FERDI, Université d'Auvergne, Clermont-Ferrand, France;
* Correspondence: mgarenne@hotmail.com; Tel.: +33344212697

Abstract: The study estimates net migration flows between rural and urban areas in Zambia between 1951 and 2022. An innovative method is proposed, based on an estimation of differences in net fertility between urban and rural areas. Data comes from two sources: population censuses, which provide proportions urban and population growth rates at regular intervals, and demographic and health surveys (DHS), which provide trends in fertility, child survival, and net fertility. Results show huge net migration flows between rural and urban areas, at times positive (1951-1980) and (2000-2022), but negative at other times (1980-2000). Net migration contributed positively to 57% of urban growth in the first period, and 40% in the third period, but negatively in the second period (−25%). These fluctuations were correlated with changes in economic growth, positive between 1950 and 1975 and between 1995 and 2020, but negative between 1975 and 1995, mainly because of increasing or decreasing prices of copper ore on international markets. Counter-urbanization was concentrated in the mining cities of Copperbelt. Zambia appears as an outstanding case of the impact of economic fluctuations due to an external shock on urbanization. However, over a long period (1951-2022), urbanization in Zambia was similar to the average in sub-Saharan Africa.

Keywords: Urbanization; Net fertility; Copper Price; Income per Capita; Zambia.

1. Introduction

Urbanization, defined as an increasing proportion of the population living in urban areas, was a major feature of population dynamics in the 19th century in Europe and in the 20th century all over the world. Urbanization is usually associated with economic development and industrialization, although not always. Sub-Saharan Africa is no exception, and even though urbanization occurred later than in other parts of the world, it has been very rapid since 1950. According to estimates made by the United Nations Population Division, World Urbanization Prospects (WPP-2018), the proportion of the sub-Saharan population living in urban areas increased from 11.1% in 1950 to 40.4% in 2018 [1].

Urbanization is the result of several processes: net migration from rural to urban areas, differential natural increase between urban and rural areas, often due to lower mortality in urban areas, reclassification of rural areas into urban areas, and differential international migration, positive or negative [2]. When natural increase is the same in urban and rural areas, urbanization is mainly determined by migration from rural to urban. When net-migration flows are small, most of urbanization is determined by differential natural increase (natality − mortality), that is, differential net fertility. Reclassification can also play an important role, especially in cases of rapid population growth: because growing villages can reach the threshold to qualify for urban areas (such as > 5000 or > 10000 people), or because growing towns change administrative status, or because growing cities absorb nearby rural areas by geographical expansion. Numerous academic debates have focused on the role of these factors in African countries [3-10]. Of course, the role of each factor depends on the local situation, which can differ markedly from country to country and from period to period because of a variety of factors (fertility, mortality, migration, and administrative reforms).

Migration between rural and urban areas may be due to changes in economic activity, or to other reasons (changes in marital status, family reasons, health, security, etc.). Economic reasons are usually considered in two categories: push and pull factors. Among pull factors, migration from rural to urban areas is usually associated with capital accumulation and money circulation in cities (search for higher income), or with urban commodities (electricity, water, schools, health facilities, etc.), or with quality of life (various opportunities, more independence from traditional families, prestige of urban life, etc.). Numerous push factors can also explain rural to urban migration: difficult life in rural areas because of land scarcity (population pressure), climate change (drought, flood), insecurity (civil war, terrorism), or other factors. In brief, rural dwellers search for a better life in cities. Reverse flows from urban to rural respond to the same factors, but in the opposite direction: loss of jobs in cities, job scarcity, job competition, decline in income, lack of housing, difficult life (in slums), insecurity, etc. In this case, urban dwellers search for a better life in villages.

Zambia is an interesting case in Africa, because urban–rural migration flows were huge since 1950, and because they reversed in the 1970s and 1980s and were associated with a major economic downturn. Zambia escaped most other push and pull factors mentioned above (land scarcity, insecurity, war, climate change, etc.), so it is usually presented as a typical case of the impact of fluctuations in income on urban–rural migration flows. Several studies have tackled the Zambian case, sometimes with conflicting results [11-19]. The main reason is the difficulty in quantifying net urban–rural migration flows, unless there is a full-scale population register. Even basic vital registration (registration of births and deaths) is deficient in Zambia, as in most African countries. So, one has to rely on estimates from censuses and surveys in order to assess the role of urban–rural migration on urbanization. This study aimed to present a simple method for estimating net migration flows in Zambia over the 1951-2022 period using census data on the proportion urban and demographic survey data on net fertility. The study also attempted to relate these flows to fluctuations in economic growth. In the first step, migration flows were estimated independently of reclassification, and in the second step, reclassification was introduced to make final estimates.

2. Materials and Methods

Methods

The method developed for this study uses properties of stable populations. In a stable population, the growth rate (r) is given by:

$$r = dP(t) / P(t) \times dt = d(\mathrm{Ln}(P(t)) /dt$$

Where P(t) is the population size at time t

And the rate of natural increase (s) by:

$$s = \mathrm{Ln}(NRR) / A$$

Where NRR is the net reproduction rate, and A is the mean age at childbearing.

When the population is divided into two strata (1 = urban and 2 = rural) with migration for rural to urban, the net migration rate is given by:

$$m = ((r1 - r2) - (s1 - s2)) \times k \times (1 - k)$$

where m = net migration rate from rural to urban; ri = population growth rate in strata (i); si= rate of natural increase in strata (i), k = proportion urban, with

$$(s1 - s2) = (\mathrm{Ln}(NRR1/NRR2)) / A$$

Derivations can be found in Appendix A. Note that with this method, there is no need to estimate birth rates and death rates in each stratum, or the need to directly estimate the net reproduction rates: only the ratio of net fertility (NRR1/NRR2) matters for calculating (s1–s2).

Data

The method developed for this study required data on population growth rates in urban and rural areas and differential rates in natural increase. These data were taken from censuses and demographic surveys.

Population censuses

Population censuses provided the population size in urban and rural areas needed to calculate the intercensal growth rates (ri) and the proportion urban (k). In Zambia, seven censuses were available, conducted at about 10-year intervals in 1963, 1969, 1980, 1990, 2000, 2010, and 2022. To these were added an estimate of population size in 1951, based on sample surveys and population counts. All data were provided by the Zambian Central Statistical Office (ZamStats).

Demographic surveys

Demographic and health surveys (DHS) provided data on the mean number of children surviving as well as data on the mean age at childbearing by area of residence (urban and rural). Estimates of NRR were obtained from the mean number of children surviving among women ages 20-49. Since only the ratio of urban to rural NRR is necessary for the calculations, the ratio of the mean number of surviving children in both areas was used. It was calculated for each DHS survey and interpolated at the mid-intercensal period. Six Demographic and Health Surveys (DHS) were utilized, conducted at about 5-year intervals in 1992, 1997, 2002, 2007, 2013, and 2018. For periods before 1992, trends in the log-ratio NRR1/NRR2 were extrapolated backwards, and the extrapolation was justified by a trend analysis of fertility rates and child mortality rates over the 1960-1991 period [see 20-21 for the details of these calculations].

DHS surveys also provide information on the place of previous residence (urban and rural), and on the time since moving to the current place of residence. This information was used to corroborate the magnitude of internal movements over 5-year periods (between DHS surveys).

DHS surveys also provide information on work status and employment. Only the information on work status (currently working or not), consistent from survey to survey, was used in this study. This information was used to correlate job availability with migration from rural to urban.

Other data

Data on income per capita were used to document the rationale for rural–urban migration. Data on per capita Gross-Domestic Product in Purchasing Power Parity (GDP-PPP) were derived from the Maddison project database for the 1950-1999 period [22], and from the World Bank / World Development Indicators (WDI) database for the 2000-2022 period [23]. Both data sets were standardized in 2017 International US Dollars (USD).

3. Results

3.1. Background on Zambia

The Zambian territory had earlier a small and scattered population, because of a difficult physical environment (soil, rainfall) and a difficult epidemiological environment (malaria, trypanosomiasis) in the heart of the African continent. The situation changed at the end of the 19th century, with the arrival of Europeans, British colonization, and the discovery of huge mineral deposits in the northern part of the country, now called the Copperbelt because of the copper mines. The modern country was structured along the line of rail going from South to North, and around two major urban areas: the capital city (Lusaka) and the Copperbelt cities (Kitwe, Ndola, Mufulira, Luanshya, Chingola, Kalulushi, and Chililabombwe). The first population count in 1911 gives a population of 820,000 inhabitants, with hardly any cities. At independence (1964), the country already counted 3.5 million inhabitants, and at the last census (2022) it counted 19.7 million, that is a fast average annual population growth of 27 per 1000. From the first count to the last census, the population was multiplied by 24, and there was no evidence of a decline in population growth in the past 12 years. This fast population growth is conducive to urbanization [5, 7, 10].

Urbanization was rapid, but irregular. Urbanization was very rapid from 1951 (11.5%) to 1980 (39.9%) but then halted and even reversed to reach 34.7% in 2000, before resuming its course (44.7% urban in 2022). This was mainly the consequence of the price of copper on the international markets, because copper exports are the main source of state income. The 1975-1992 crisis was documented elsewhere because it had an impact not only on urbanization but also on fertility and mortality trends [24-27]. This crisis was due in part to the consequences of the Vietnam War, which inflated copper prices during the war (high demand for copper used in weapons), and deflated copper prices after the war (release of huge quantities of copper ore no longer needed by the US military). The crisis was also made more acute because of poor economic policies, economic mismanagement, political fights, other crises occurring at the same time (oil price increases in 1973 and 1979), and structural adjustment policies [24-25]. The political and economic situation improved after 1992 because a new political regime was put in place, better economic management, and better opportunities in international markets, in particular, higher prices and higher demand for copper.

3.2) Demographic dynamics: 1951-2022

Zambia has undergone a rapid population growth since 1951, because of high fertility and moderate mortality. The country counted about 2.7 million inhabitants in 1951 and 19.7 million in 2022. The population grew 7.4-fold in a 71-year period, which is considerable.

Fertility rates were very high in the 1950s and 1960s and underwent an irregular decline thereafter. The Total fertility rate (TFR) was estimated at 8.1 children ever born in 1977-1979, and 4.9 in 2015-2018. Fertility changes were not regular and different in urban and rural areas. In urban areas, fertility declined from 1977-1979 (8.1 children) to 2015-2018 (3.7 children), despite stagnation (fertility stall) from 1985 to 1994 (TFR = 6.6 children). In rural areas, fertility declined slowly from 1977-79 (8.1 children) to 1995-1999 (6.9 children), then it rose somewhat until 2000-2004 (7.6 children), before resuming its decline until 2015-2018 (6.1 children). As a result, the ratio of urban to rural fertility declined from 1.0 in 1977-1979 to 0.61 in 2015-2018, a major change with large consequences for fertility differentials (see Annex Table B1).

Trends in child survival (1-q (5)) were also complex and different in urban and rural areas. Improvements in child survival were impressive, from 0.645 in 1958-1959 to 0.940 in 2015-2018. Mortality trends were irregular, and in fact, child mortality increased from 1975 and 1992 because of the economic crisis [25]. At baseline, in 1958-1959, child survival was lower in urban areas (U/R ratio = 0.89), and still lower than 1.0 in 1960-1964 (U/R ratio = 0.96). This changed rapidly over the years, and urban child survival improved more rapidly than rural child survival from independence (1964) until 1975-1976 (U/R ratio = 1.10). After this date, the gap between urban and rural areas was reduced again and was close to 1.0 (U/R = 0.99) in the most recent period (2015-2018) (see Annex Table B2).

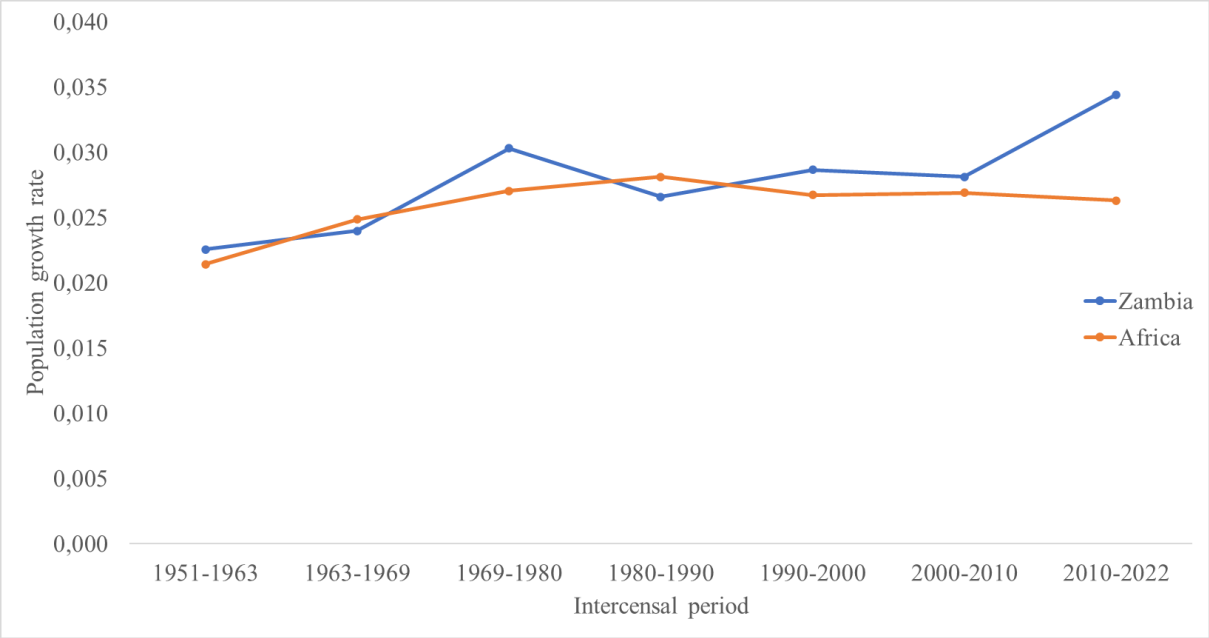
With respect to net fertility, the gap between child survival in urban and rural areas played a smaller role (range 0.89 to 1.10 over the years, that is, a 1.23 to 1.0 ratio) than the gap in total fertility (range 1.0 to 0.59 over the years, that is, a 1.70 to 1.0 ratio). And because of mortality decline, when child survival gets close to 1.0, the gap in net fertility becomes dominated by fertility trends in recent years.

Data on internal migration are scarce in Zambia. According to DHS surveys conducted between 1992 and 2018, some 40% of women aged 15-49 and 30% of men aged 15-59 moved at least once in the 5 years before the survey, of which about a fourth were migrations between urban and rural areas. Similarly, high values of internal moves were documented in successive censuses. These are high values, indicating large flows of internal migration. Flows of internal migration could work both ways, with positive or negative net migration. Very large internal migration flows were also described in another mining country, South Africa [28-29].

3.3) Intercensal growth rates

Intercensal growth rates were very high over the whole period, and tended to increase over the years, with some fluctuations following the complex trends in fertility and mortality. Population growth rates were 22.6 per 1000 in 1951-1963, 23.0 per 1000 in 1963-1969, reached a high value of 30.3 per 1000 in 1969-1980 because of high fertility and declining mortality, then declined to 26.6 per 1000 during the difficult years in 1980-1990, rose again somewhat (28.7 per 1000 in 1990-2000, 28.8 per 1000 in 2000-2010), before reaching a peak in 2010-2022 (34.4 per 1000). Note that at this rate, the population is doubling every 20 years. Compared with the average for sub-Saharan Africa, growth rates were similar in Zambia from 1950 to 1990, but higher and increasing from 1990 to 2022, whereas they declined slowly in sub-Saharan Africa (Figure 1).

Figure 1: Intercensal population growth rates, Zambia



3.4) Urbanization

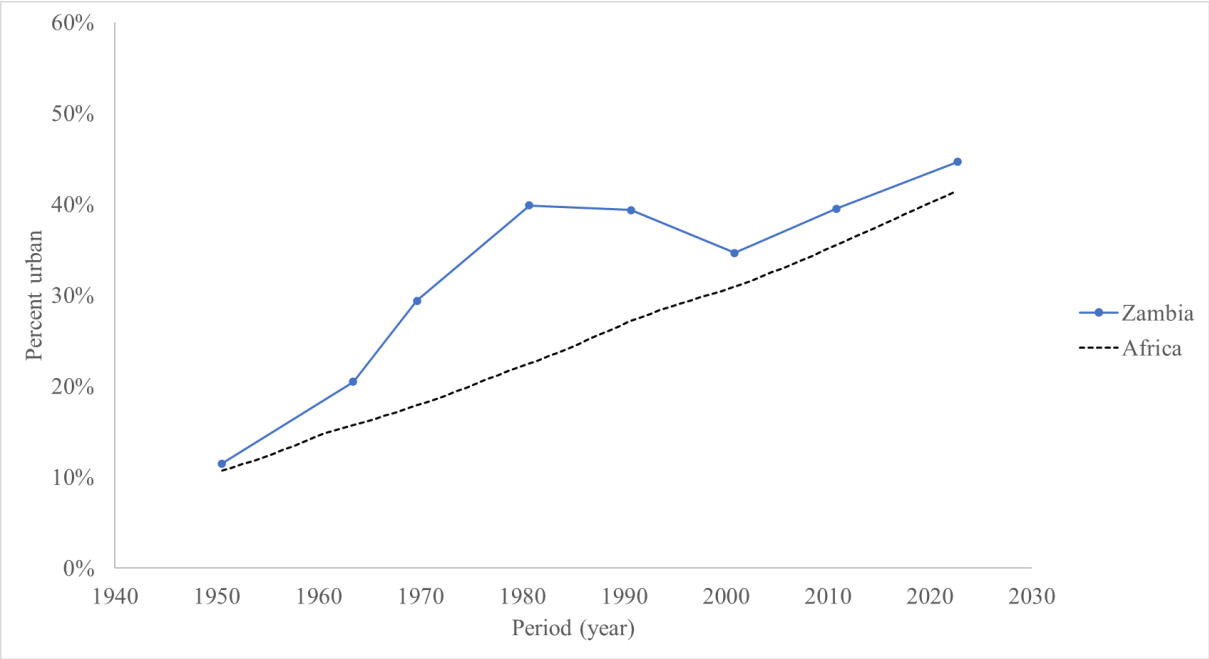
Urbanization, measured by the increasing proportion living in urban areas, was rapid in Zambia from 1951 (11.5% urban) to 1980 (39.9% urban), then halted and even reversed from 1990 to 2000 (34.7% urban), before resuming its fast speed (44.7% urban in 2022). Compared with the average for sub-Saharan Africa, urbanization was faster in the favorable period (1951-1980), negative during the difficult years (1980-2000), and close to the African average from 2000 to 2022. Urbanization trends appeared, therefore, atypical in Zambia, and were correlated with the serious economic difficulties following the copper crisis (1975-1992). (Table 1; Figure 2).

Table 1: Population by urban residence, Zambia

Census year	Reference date (dd/mm/yyyy)	Urban population	Rural population	Percent urban
1951	01/07/1951	307 050	2 362 950	11.5%
1963	15/05/1963	715 256	2 774 914	20.5%
1969	25/08/1969	1 192 116	2 864 579	29.4%
1980	25/08/1980	2 258 569	3 403 232	39.9%
1990	20/08/1990	2 905 283	4 477 814	39.4%
2000	25/10/2000	3 426 862	6 458 729	34.7%
2010	23/10/2010	5 173 450	7 919 216	39.5%
2022	31/08/2022	8 793 369	10 900 054	44.7%

Source: Zambian Central Statistical Office (ZamStats)

Figure 2: Proportion of urban population, Zambian censuses and comparison with Africa



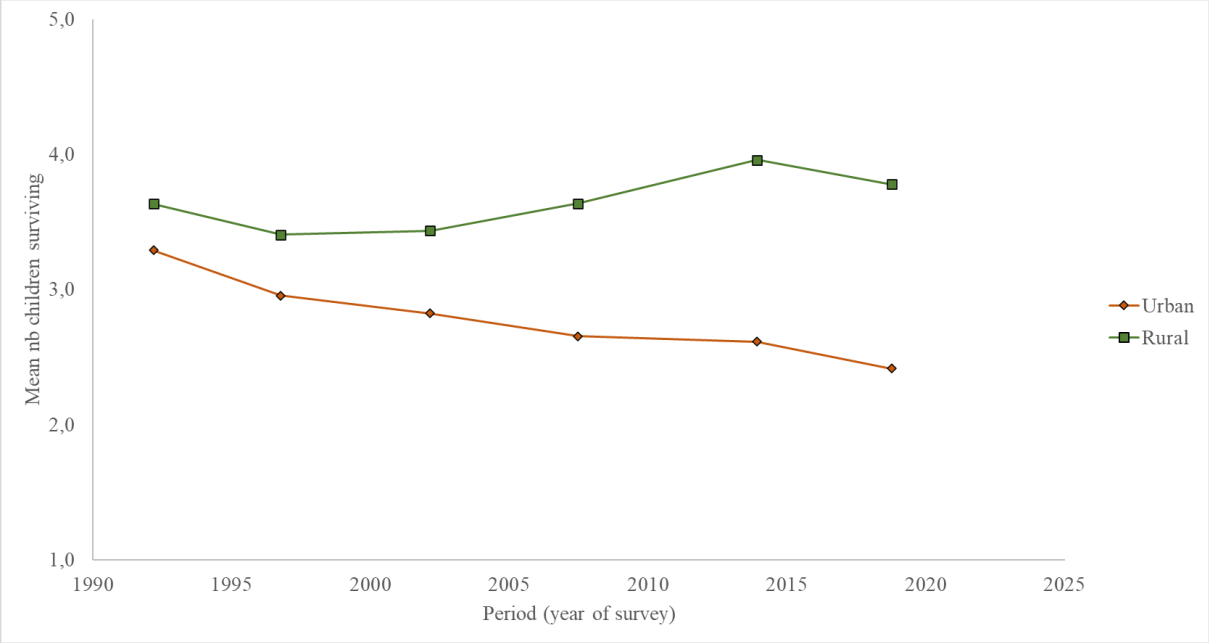
3.5) Differential net fertility

Net fertility (defined as the mean number of surviving children among women ages 20-49) underwent major changes over the years. In urban areas, it underwent a steady decline from 3.29 in the 1992 survey to 2.41 in the 2018 survey. In contrast, in rural areas it first declined, then increased from 2002 to 2013 (because of mortality decline), before resuming its decline. But by 2018, it was still slightly higher than in 1992. As a result, the ratio of urban/rural net fertility declined regularly from 0.906 to 0.639. After extrapolation, corresponding values of the difference between natural increase in urban and rural areas (s1-s2) first increased from −3.4 per 1000 from the first intercensal period (1951-1963) to +2.6 per 1000 in 1969-1980, then decreased to −19.3 per 1000 in the last intercensal period (2010-2022). These values had an impact on the dynamics of urban and rural populations. (Table 2; Figure 3).

Table 2: Net fertility (mean number of surviving children, women age 20-49), Zambia, DHS surveys

Ref. date	Survey	Urban	Rural	Ratio urban/rural
1992.2	1992 DHS	3.290	3.633	0.906
1996.8	1996 DHS	2.953	3.405	0.867
2002.1	2001-02 DHS	2.824	3.435	0.822
2007.5	2007 DHS	2.653	3.636	0.730
2013.9	2013-14 DHS	2.613	3.959	0.660
2018.8	2018 DHS	2.414	3.780	0.639

Figure 3: Differential net fertility in Zambia



3.6) Estimating rural to urban migration

Results from calculations to estimate net migration are displayed in Table 3 and Figure 4. They show major changes in rural to urban migration rates: first increasing from +8.2 per 1000 in 1951-1963 to +14.3 per 1000 in 1963-1969, then declining in 1969-1980 (+9.0 per 1000), becoming nil in 1980-1990 (0.2 per 1000) and negative in 1990-2000 (−2.7 per 1000), before resuming to average values (+8.0 and +9.0 per 1000 in 2000-2010 and 2010-2022 respectively (Figure 4, Table 3).

Figure 4: Net rural to urban migration rates, Zambia

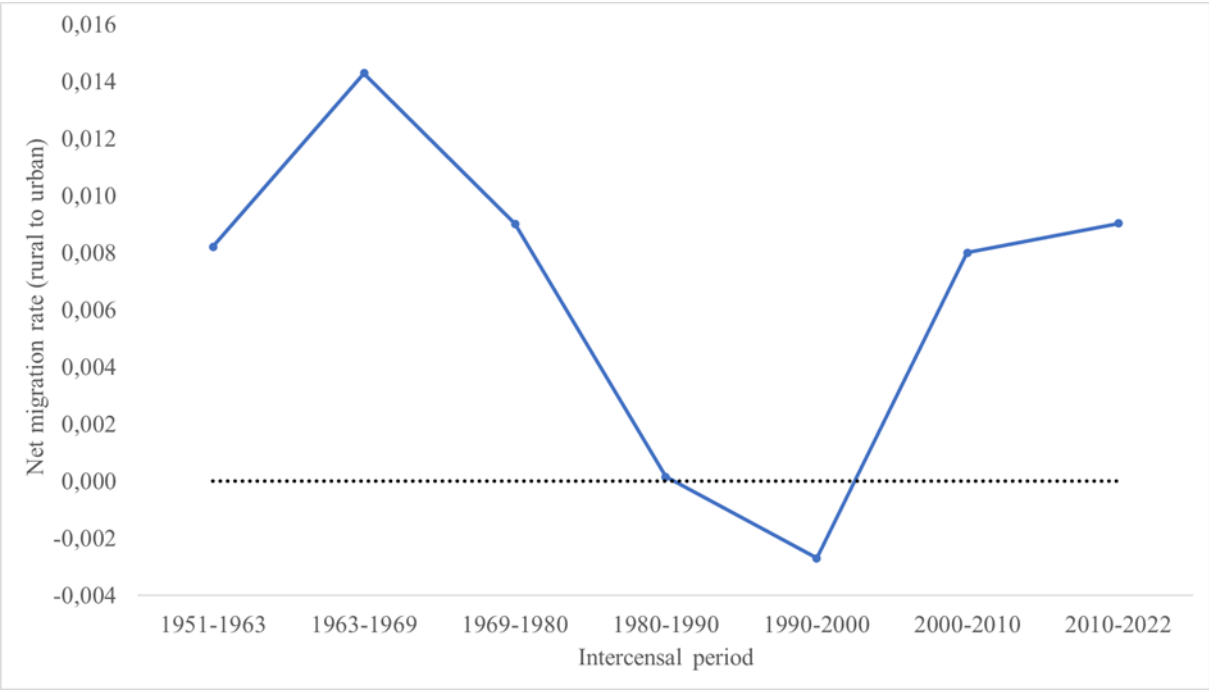


Table 3: Estimation of rural to urban net migration rates, Zambia

Intercensal period	Percent urban	Growth rate		Difference in growth	Diff in net fertility	Composition	Net-Migration rural to urban
		Urban	Rural				
	k	r1	r2	r1−r2	s1−s2	k×(1−k)	
1951-1963	16.0%	0.0712	0.0135	+0.0577	−0,0034	0.1344	+0,0082
1963-1969	24.9%	0.0814	0.0051	+0.0763	+0,0000	0.1872	+0,0143
1969-1980	34.6%	0.0581	0.0157	+0.0424	+0,0026	0.2264	+0,0090
1980-1990	39.6%	0.0252	0.0275	−0.0023	−0,0029	0.2392	+0,0002
1990-2000	37.0%	0.0162	0.0360	−0.0198	−0,0082	0.2331	−0,0027
2000-2010	37.1%	0.0412	0.0204	+0.0208	−0,0135	0.2333	+0,0080
2010-2022	42.1%	0.0447	0.0269	+0.0178	−0,0193	0.2437	+0,0090

NB: Rates are average annual growth rates over the intercensal period

3.7) Estimating net migration flows

Estimations of net migration rates allowed the calculation of the magnitude of net migration flows in Zambia. Results showed huge variations from one intercensal period to the next (Table 4). If flows were largely positive and roughly as expected in the first three periods (+300 000, +339 000 and +482 000 persons), they became almost nil in 1980-1990 (almost as many migrations from rural to urban as from urban to rural), then largely negative (−237 000 persons in 1990-2000), before becoming huge and positive (+920 000 persons in 2000-2010, and +1 755 000 in 2010-2022).

In terms of net contribution, rural to urban migration contributed to a large share of urban growth in the first three intercensal periods (+73.5%, +71.0% and +45.2% respectively), had a negative impact (reduced urban growth) in the next two periods, before contributing again largely to urban growth in the last two periods (+52.7% and +48.5% respectively. Conversely, rural to urban migration tended to reduce rural population growth in the first three periods (−42.2%, −79.1% and −47.2%), then contributed positively (return migration from urban to rural), to reduce rural population growth in the last three periods (−38.6% and −37.1% respectively). These large variations indicate major changes in economic growth, income, and job opportunities in urban areas.

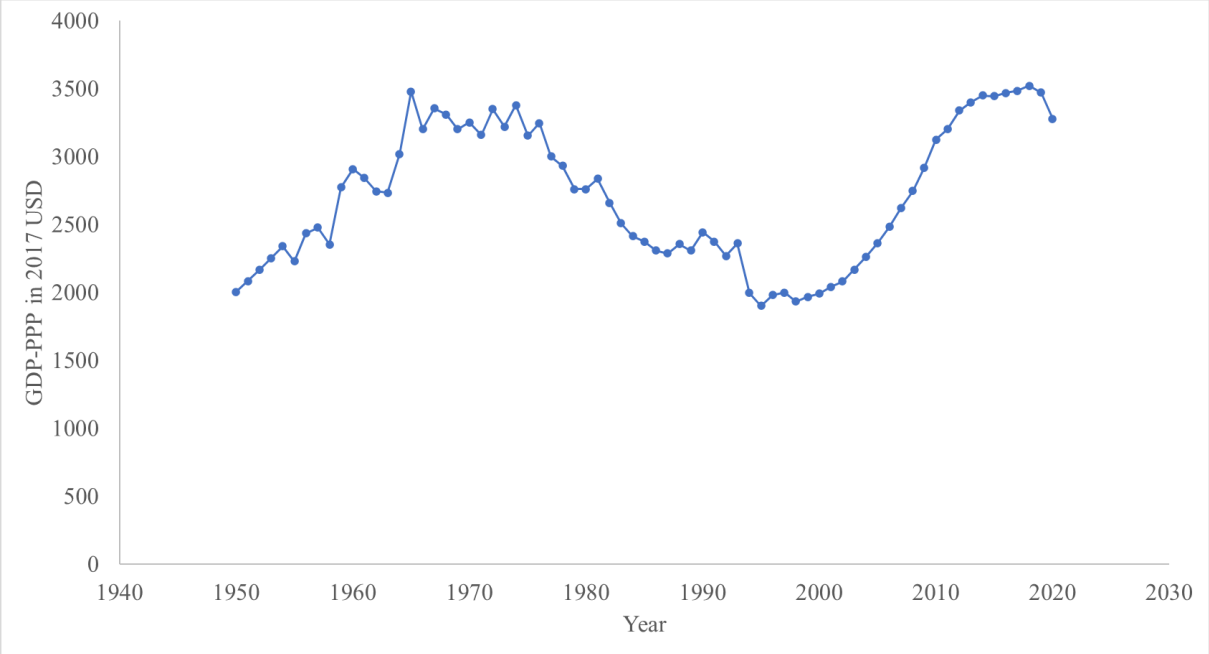
Table 4: Estimates of net migration flows, and their contribution to population growth, Zambia 1951-2022

Intercensal period	Net migration from rural to urban	Urban areas		Rural areas	
		Population growth	Contribution of net migration	Population growth	Contribution of net migration
1951-1963	+300 193	408 206	+73,5%	411 964	−42,2%
1963-1969	+338 592	476 860	+71,0%	89 665	−79,1%
1969-1980	+482 029	1 066 453	+45,2%	538 653	−47,2%
1980-1990	+10 146	646 714	+1,6%	1 074 582	−0,9%
1990-2000	−236 668	521 579	−45,4%	1 980 915	+13,6%
2000-2010	+919 695	1 746 588	+52,7%	1 460 487	−38,6%
2010-2022	+1 755 123	3 619 919	+48,5%	2 980 838	−37,1%

3.8) Relationship of net migration with economic growth

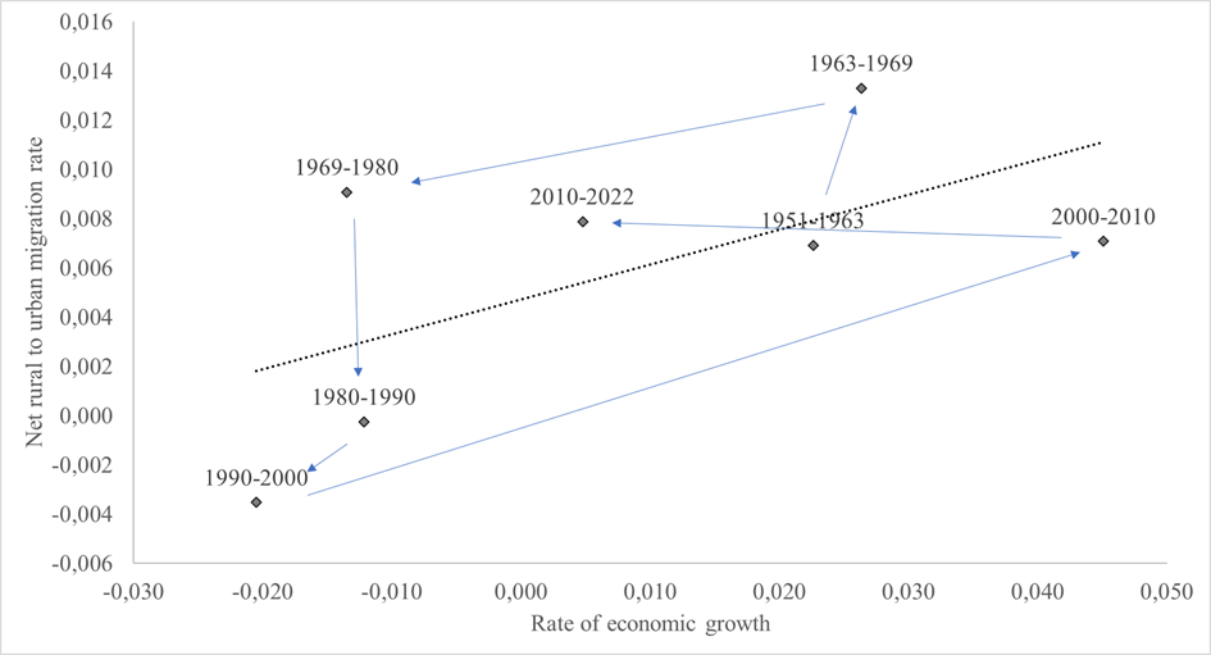
Zambia underwent major fluctuations in income per capita (GDP-PP) and large changes in economic growth. After a first period of increase in income per capita (1950-1967), GDP-PPP stagnated for 9 years (1967-1976), after which it underwent a major recession from 1976 to 1995, then stabilized for about 5 years (1995-2000), before resuming to a positive growth from 2000 to 2020, the last two years being perturbated by the Covid-19 epidemic (2020-2022). (Figure 5).

Figure 5: Trends in income per capita, Zambia



Intercensal periods do not cover the same years as those defined by periods of economic growth and recession. However, the correlation between net-migration rates and rates of economic growth in intercensal periods was positive and high (ϱ= +0.605). Due to the large perturbations, the path followed by the country was complex. The first period (1951-1963) was close to the average defined by the regression line between the two rates (economic growth and net migration). The next period (1963-1969) was rather favorable, with net migration exceeding the average given the increase in income per capita, as well as the following period (1969-1980). The next two periods (1980-1990 and 1990-2000) were the most difficult years, with declining income and inverse flows from urban to rural areas. The last two periods saw positive economic growth and positive migration from rural to urban areas, lower than expected in 2000-2010 and higher than expected in 2010-2022 (Figure 6).

Figure 6: Correlation between economic growth and rural to urban migration in intercensal periods, Zambia



3.9) Correlation with work status

Correlations between migration and work status are difficult to interpret. If the availability of jobs in cities determines many rural to urban migrations, it also regulates the reverse flows: when people lose their jobs in cities, they tend to return to rural areas. So, the proportion employed in urban areas could remain roughly constant, while people move back and forth, hindering many migrations for adjusting the job market.

DHS surveys ask about current work status (currently working for pay at the time of survey) for both men ages 15-59 and women ages 15-49. In urban areas, the proportion of men working at the time of the survey increased steadily from 57.8% in 1996 to 73.3% in 2018. This clearly indicates improvements in job availability, which correlates well with the large migration flows from rural to urban areas between 2000 and 2022. However, it seems that work status also improved in rural areas during the same period, although less so. For women, there was no trend in work status in urban areas, and fluctuations in rural areas. In brief, correlations between work status and rural to urban migration are difficult to interpret and probably reflect more the flexibility of the workforce and the interactions between push and pull factors.

Table 5: Proportions of adults currently working, Zambia, DHS survey

Survey	Women 15-49		Men 15-59	
	Urban	Rural	Urban	Rural
1992 DHS	46.6%	50.4%		
1996 DHS	44.3%	46.7%	57.8%	66.5%
2001-02 DHS	45.9%	60.4%	61.4%	72.2%
2007 DHS	45.3%	48.7%	70.1%	82.2%
2013-14 DHS	43.5%	53.8%	71.6%	76.3%
2018 DHS	45.7%	44.5%	73.3%	77.2%

NB: Proportion of adults currently working for cash at time of survey; no information on men in 1992.

3.10) Copperbelt cities

Another piece of evidence of the importance of employment in the mines in the counter-urbanization process is the population dynamics of the seven cities in Copperbelt. Copperbelt cities grew less rapidly (13.6 per 1000 a year), and less than natural increase between 1980 and 2000, whereas other cities grew at a rate above natural increase (+35.8 per 1000). Some Copperbelt cities even lost population between 1980 and 1990 (Chililabombwe, Kalulushi, Mufulira), when Lusaka, Kabwe, and Livingstone continued to grow at a higher rate. Copperbelt cities accounted for 68% of total urban areas in 1963, 45% in 1980, and 25% in 2022. They had different dynamics than other urban areas and were very sensitive to copper prices and employment in the mines, whereas other urban areas had dynamics more independent from economic fluctuations due to copper exports. This process was well documented elsewhere [17].

3.11) Moving back to rural areas

The correlation of counter-urbanization is the move of urban dwellers to rural areas. These moves are motivated both by push factors out of the city (loss of jobs in particular) but also by the possibility of a better life in rural areas (pull factors). Many of these moves were described throughout Africa, with their rationale, as well as the issue of the integration of urban migrants coming from more modern societies into more traditional societies [29-30]. In Zambia, these moves were probably facilitated by rural development policies and by the ties that urban dwellers had kept with their extended families due to recent urbanization [16, 32-33].

3.12) Correcting for reclassification 1980-2022

In the previous sections, the effect of reclassification was neglected. An estimation of the role of reclassification was done from 1980 to 2022 (no data was available for 1969), by comparing the lists of urban areas from census to census. In 2022, some 89 urban centers were identified, among those, 15 were not urban in 2010, 13 more in 2000, 12 more in 1990, and 3 more in 1980 (46 urban centers). For each intercensal period, the population reclassified was compared with urban growth (Table 6). Results show that reclassification contributed to less than 10% of urban growth over the whole period (3.5% in 1980-1990; 9.2% in 1990-2000; 13.5% in 2000-2010; 8.3% in 2010-2022), which is small compared with other developing countries. In contrast, reclassification had a higher impact on estimates of rural to urban migration: increasing the negative estimates (by a ratio of -1.20 in 1980-1990 and 1.20 in 1990-2000), while decreasing the positive estimates (by -26% in 2000-2010 and by -17% in 2010-2022). However, this correction did not change the main picture of negative flows from 1980 to 2000 and of large positive flows from 2000 to 2022.

Table 6: Estimates of the impact of reclassification of rural areas into urban areas during intercensal periods, Zambia 1980-2022.

Intercensal period	Population		Percent due to reclassification	Migration rural to urban	
	Urban growth	Reclassification		Raw estimate	After reclassification
1980-1990	646 714	22 354	3.5%	+10 146	−12 208
1990-2000	521 579	47 795	9.2%	−236 668	−284 463
2000-2010	1 746 588	235 637	13.5%	919 695	684 058
2010-2022	3 619 919	298 987	8.3%	1 755 123	1 456 136
Total	6 534 800	604 773	9.3%	2 448 296	1 843 523

4. Discussion

Zambia presents a peculiar case of very rapid urbanization, followed by a reversal in trends (counter-urbanization), then again, a rapid urbanization. These changes were due to the deep trauma caused by economic reversals, due mainly to an external shock (the price of copper on international markets). The Zambian case of changing trends in urbanization is not unique in Africa, although it seems to be the most acute. For instance, nearby Zimbabwe underwent a major political and economic crisis, due to internal political factors, leading also to counter-urbanization from 2002 (34.6% urban) to 2012 (32.8% urban), but of smaller magnitude and shorter duration, and with full recovery by 2022 (38.6% urban). Senegal underwent a stagnation in urbanization and low rural to urban migration from 1988 to 2002, also associated with economic downturn (decline in GDP-PPP). In Niger, urbanization stagnated between 2001 and 2012, following a long economic recession [data from the World Urbanization Prospects, 2018]. In countries severely affected by civil war, counter-urbanization also occurred because of insecurity (Liberia, Somalia, South Sudan). Large flows of return migration from urban to rural areas were also documented in other countries, such as Cameroon, during economic recession due to declining oil prices, but without an impact on urbanization rates at the national level [31].
Zambia had an atypical urbanization, concentrated around the mines between 1950 and 1975. In fact, Copperbelt cities were one of the largest urban concentrations in Africa in the 1950s and 1960s. Copperbelt cities played a large role in the de-urbanization of the 1980-2000 period. Deborah Potts investigated in great detail the case of Copperbelt cities, with an in-depth analysis of their historical, sociological, political, economic, and demographic context [17].

Overall, on a long period of time, Zambia continued to urbanize at a high rate, with values similar to the African average on a long period of time. This rapid urbanization was fueled by the fast population growth due to high fertility, producing a large supply of people in rural areas for the labor force in urban areas. This phenomenon was described by other authors [5, 10]. Migration from rural to urban areas was also fueled by modern education (schooling), which facilitated adaptation to city life for those born in rural areas, and the level of education is particularly high in Zambia compared with other African countries [see the DHS website for details]. Return migration (from urban to rural) may be facilitated by rural development policies and programs, which were active in Zambia, and by improving health and living conditions in rural areas. In Zambia, under-five mortality in rural areas in recent years was equivalent to that in urban areas, which was not the case in the 1980s. In many African countries, the gap between urban and rural areas was strongly reduced in recent years [34-36].

In the Zambian case, intercensal periods were used to document trends in urbanization, the only reliable information. However, in correlation with economic changes, it would have been more appropriate to use periods of economic growth or recession, such as 1950-1975 / 1975-1995 / 1995-2019. Unfortunately, precise population data are lacking for these periods.

A number of assumptions were made for the calculations of net migration. Firstly, international migrations were ignored and were probably of small magnitude compared with other moves, except in the 1950s when migration to the mines for nearby countries (e.g., Malawi, Congo, and Angola) occurred on a large scale, facilitated by the Central African Federation (grouping Northern Rhodesia, Southern Rhodesia, and Nyasaland) in place between 1953 and 1963. For the calculations of net fertility, the age and sex composition of the urban and rural populations were ignored to estimate the differential net fertility (in theory, one would prefer to have precise values of birth rates and death rates). The mean age at childbearing was assumed to be the same in urban and rural areas (28.9 years), and in fact it varied little between the two areas (+/− 0.3 years). Given the magnitude of the flows, these limitations are unlikely to have much effect on the final estimates of net migration. Calculations were provided with great detail, but, of course, they hide imprecision due to inaccuracy in all parameters. Lastly, calculations were based on formulae derived from stable population theory. This was justified by the fact that population growth was rather stable in the long run, and by the fact that these formulae apply at the margin in intercensal periods.

The relationships between urbanization and economic growth are complex, and some African countries continue to urbanize even in periods with no economic growth [18, 37-38]. The relationships work both ways. When more income is available, more migrants come to cities; therefore, more workforce is available, which could induce lower salaries, more investments, more profits, and in turn more jobs. Overall, in Zambia, income per capita did not increase much between 1965-1969 (3300 $) and 2015-2019 (3500 $), whereas urbanization grew from 29% to 45% over the period.

Therefore, the level of income does not explain everything, and the dynamics of each factor appear more important than absolute values to explain the changes.

Reclassification of rural areas into urban areas did not appear to have a major impact on urbanization in Zambia, contrary to other low-income countries [39-40]. It was also very different from the case of high-income countries. For instance, in the USA, during the 2000-2010 intercensal period, reclassification accounted for 43% of urban growth, and ignoring reclassification would have led to a −3.6% decline in the proportion urban instead of a real +1.8% increase [41]. However, in Zambia, reclassification had an effect on the estimation of net urban-rural migration. Neglecting reclassification led to underestimating negative flows and overestimating positive flows. In this case, people who appeared as migrants from rural to urban were in fact rural people who did not move and were simply re-assigned to an urban area.

This study did not address the thorny issue of the definition of urban areas: only the official census definition was used (mostly demographic and administrative). Other authors have attempted to use a geographical definition, based on population density of small 1 km² areas, and found quite different estimates of the proportion of urban growth due to natural increase, to rural-urban migration, to reclassification, and to international migration [41-42]. Such exercise was beyond the scope of this paper.

This study focused on urbanization, defined as the changing proportions living in urban areas, and not on urban growth, the focus of many other studies. In urban growth studies, natural increase appears as a major component of urban population growth. In the case of Zambia, as in most African studies, natural increase in urban areas is now lower than natural increase in rural areas (mostly because of lower fertility and despite somewhat lower mortality), so that natural increase cannot contribute to urbanization. This was not always the case, and for instance, in Zambia, in the 1960s, fertility appeared equivalent in urban and rural areas while child mortality was lower, so that urban areas had a higher natural increase, contributing positively to urbanization.

This study relied on urban/rural differentials in fertility and mortality to estimate net migration. Other methods are available, such as using vital registration data, but in Zambia, registration of births and deaths is incomplete. One could also use direct estimation of urban-rural migration, for instance, when a place of residence at the previous census is available in the next census, but this type of information was not available in Zambia. Other indirect estimations were tried, using place of birth or place of last residence, or the residual / survival method, but gave results difficult to interpret. For instance, the statistical office found −44,000 net-migrants in the intercensal period 1990-2000 [43], when estimates from net fertility gave six times more, and about twice those found by the residual method [17].

5. Conclusions

Zambia remains a classic case of the interactions between income per capita and rural to urban migration in Africa. It shows in particular the reactivity of the labor force to economic opportunities, positive or negative, the impact of brutal retrenchment in the mines, and the necessity of keeping the solidarity of extended families who remain in rural areas, which could permit absorbing the shocks with minor effects on key parameters such as under-five mortality trends.

Supplementary Materials: None

Author Contributions: Conceptualization, M.G.; methodology, M.G.; software, M.G.; validation, M.G., N.S.; formal analysis, M.G.; writing—original draft preparation, M.G.; writing—review and editing, M.G., N.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Acknowledgments: The author thanks the Zambian Central Statistical Office (ZamStats), the IPUMS-International program, and the DHS program for providing open access to individual (micro) census data.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

The derivations linking net migration with population growth and net fertility are based on properties of stable populations (constant fertility, constant mortality, no international migration over time).

In a stable population, the growth rate of a population (POP) is constant:

$$POP(t) = POP(0) \times \exp(r \times t)$$

$$r = d(POP(t))/POP(t) \times dt = d(Ln(POP(t)))/dt$$

The net reproduction rate (NRR) is also constant:

$$NRR = \exp(s \times A)$$

$$s = Ln(NRR) / A$$

Where s = growth rate due to natural increase, and A = mean age at childbearing. In a stable population: r = s. This is different in subgroups.

Let the population be divided into two groups (1 = urban, 2 = rural) and let migration occur from rural to urban (positive or negative)

The proportion of the urban population is:

$$k = POP1 / (POP1+POP2)$$

The two groups grow at different speeds because of rural to urban migration (MIG) and different natural increase.

Let NATi be the natural increase in stratum (i), and MIG the migration from rural to urban

$$d(POP1) = NAT1 + MIG$$

$$d(POP2) = NAT2 - MIG$$

$$d(POP1)/POP1 = (NAT1/POP1) + (MIG/POP1) = r1$$

$$d(POP2)/POP2 = (NAT2/POP2) - (MIG/POP2) = r2$$

$$MIG / (k \times POP) = (r1 - s1)$$

$$MIG / ((1-k) \times POP) = (r2 - s2)$$

Then, the net migration rate is:

$$MIG/POP = m = ((r1 - r2) - (s1 - s2)) \times (k \times (1 - k))$$

Estimation of the net migration rate depends only on the difference in population growth between the two groups (r1–r2), the difference in net fertility (s1–s2), and the proportion urban (k).

The difference in net fertility is given by:

$$(s1 - s2) = (1/A) \times Ln(NRR1/NRR2)$$

If SURVi is the mean number of surviving children, and assuming the same sex-ratio and the same mean age at childbearing in the two groups, the difference can be estimated by

$$(s1 - s2) = (1/A) \times Ln(SURV1/SURV2)$$

In practice, SURV1/SURV2 can be estimated by the ratio of the mean number of surviving children among women ages 20-49 (urban/rural). It may also be estimated directly from fertility and mortality rates when available.

Appendix B

Table B1: Trends in period fertility (TFR), Zambia

Period	Mid-Point	Total fertility rate (number of children)		Ratio urban/rural
		Urban	Rural	
1977-79	1978.5	8.15	8.11	1.00
1980-84	1982.5	6.90	7.94	0.87
1985-89	1987.5	5.99	7.20	0.83
1990-94	1992.5	6.14	7.09	0.87
1995-99	1997.5	5.17	6.92	0.75
2000-04	2002.5	4.81	7.57	0.64
2005-09	2007.5	4.80	7.48	0.64
2010-14	2012.5	4.03	6.82	0.59
2015-18	2017.0	3.68	6.07	0.61

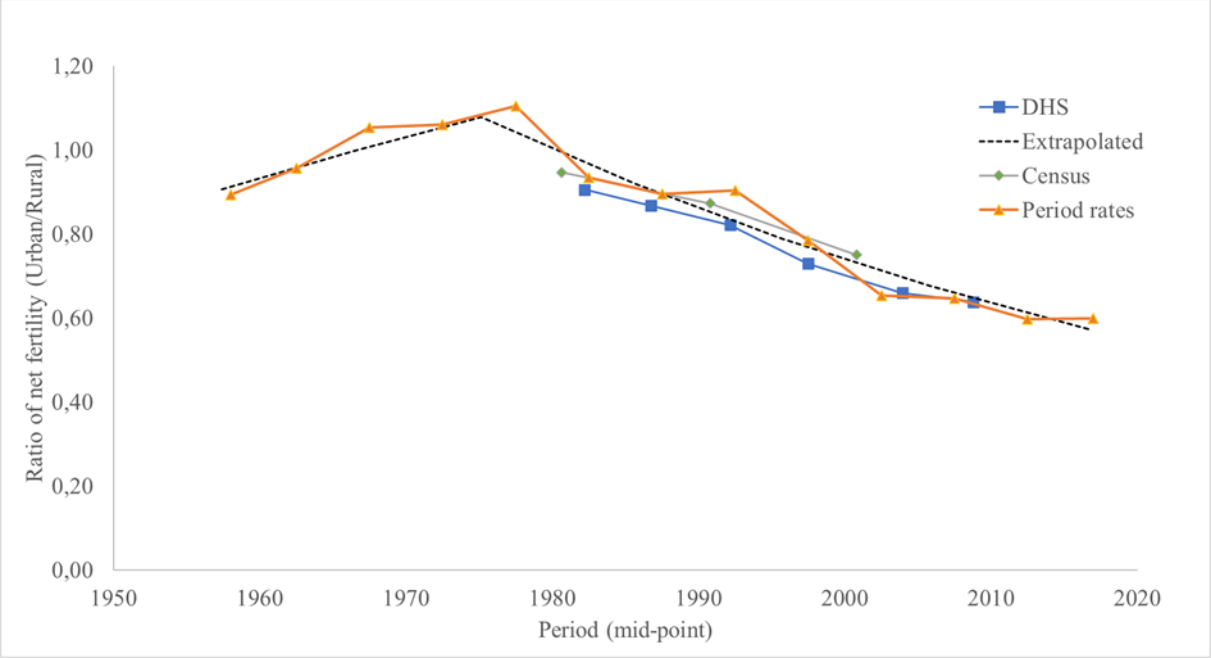
NB: Author's calculations from DHS surveys

Table B2: Trends in period child survival (1-q(5)), Zambia

Period	Mid-Point	Survival ratio (age 0 to 5)		Ratio urban/rural
		Urban	Rural	
1958-59	1958.0	0.611	0.684	0.89
1960-64	1962.5	0.722	0.755	0.96
1965-69	1967.5	0.796	0.756	1.05
1970-74	1972.5	0.851	0.803	1.06
1975-79	1977.5	0.883	0.804	1.10
1980-84	1982.5	0.869	0.809	1.07
1985-89	1987.5	0.854	0.794	1.08
1990-94	1992.5	0.837	0.803	1.04
1995-99	1997.5	0.868	0.826	1.05
2000-04	2002.5	0.887	0.862	1.03
2005-09	2007.5	0.914	0.906	1.01
2010-14	2012.5	0.919	0.908	1.01
2015-18	2017.0	0.934	0.944	0.99

NB: Author's calculations from DHS surveys

Figure 7: Trends in the ratio of net fertility (urban/rural), Zambia



References

1. United Nations. *World Urbanization Prospects: The 2018 Revision*. New York: United Nations, Department of Economic and Social Affairs, Population Division, 2018.

2. Davis, K. The Urbanization of the Human Population. *Scientific American*, 1965, 213(3), 40-53.

3. Cohen, B. Urban growth in developing countries: a review of current trends and a caution regarding existing forecasts. *World Development*, 2004, 32(1), 23-51

4. De Haas, M.; Frankema, E. (eds). *Migration in Africa, Shifting Patterns of Mobility from the 19th to the 21st Century.* London, Routledge, 2022.

5. Dyson, T. The role of the demographic transition in the process of urbanization. *Population and Development Review*, 2011, *37*, 34-54.

6. Fox, S. Urbanization as a global historical process: Theory and evidence from sub-Saharan Africa. *Population and Development Review*, 2012, *38*(2), 285-310.

7. Fox, S. Mortality, migration, and rural transformation in sub-Saharan Africa's urban transition. *Journal of Demographic Economics*, 2017, *83*(1), 13-30.

8. Hanse, W.A. *Population, migration and urbanization in Africa*. New York, Columbia University Press, 1970.

9. Jedwab, R.; Christiaensen, L.; Gindelsky, M. Demography, urbanization and development: Rural push, urban pull and… urban push? *Journal of Urban Economics*, 2017, *98*, 6-16.

10. Preston, S. H. Urban growth in developing countries: A demographic reappraisal. *Population and Development Review*, 1979, 5(2),195-215.

11. Crankshaw, O.; Borel-Saladin, J. Causes of urbanisation and counter-urbanisation in Zambia: Natural population increase or migration?. *Urban Studies*, 2019, *56*(10), 2005-2020.

12. Kay, G. *A social geography of Zambia*. London, University of London Press, 1967.

13. Ohadike, P. O. The Nature and Extent of Urbanisation in Zambia. *Journal of Asian and African Studies*, 1969, *4*(2), 107.

14. Ohadike, P. O. Migrants in the Copper Mines of Zambia, 1940-66. In: S.H. Ominde and C.N. Ejiogu (eds.), *Population Growth and Economic Development in Africa, Heinemann, London, 1972.*
15. Ohadike, P.O.; Tesfaghiorghis, H. *The population of Zambia*. CICRED monograph, Paris, 1975.
16 Potts, D. Shall we go home? Increasing urban poverty in African cities and migration processes. *Geographical Journal*, 1995, 245-264.
17. Potts, D. Counter-urbanisation on the Zambian Copperbelt? Interpretations and implications. *Urban Studies*, 2005, *42*(4), 583-609.
18. Potts, D. Debates about African urbanisation, migration and economic growth: what can we learn from Zimbabwe and Zambia?. *The Geographical Journal*, 2016, *182*(3), 251-264.
19. Van Dong, J. K. Rural–Urban Migration and the Rural Alternative in Mwase Lundazi, Eastern Province, Zambia. *African Studies Review*, 1984, 27(1), 83-96.
20. Garenne, M.; Gakusi, A.E. Reconstructing under-five mortality trends in Africa from demographic sample surveys. *DHS Working Papers No* 26. IRD-Macro, Calverton, Maryland, USA, 2004.
21. Garenne, M. Fertility changes in sub-Saharan Africa. *DHS Comparative Report, No. 18*. Calverton, Maryland, USA: Macro International Inc., 2008, 128 p.
22. Maddison, A. *L'économie mondiale, une perspective millénaire*. Paris, OECD Publications, 2001.
23. World Bank. *World Development Indicators* (WDI). Washington, DC, The World Bank Group, 2022.
24. Fraser, A.; Larmer, M. (eds.). *Zambia, mining, and neoliberalism: boom and bust on the globalized Copperbelt*. New York: Palgrave Macmillan, 2010.
25. Garenne, M.; & Gakusi, A. E. Vulnerability and resilience: determinants of under-five mortality changes in Zambia. *World Development*, 2006, *34*(10), 1765-1787.
26. Shapiro, D.; Gebreselassie, T. Fertility transition in sub-Saharan Africa: falling and stalling. *African Population Studies*, 2008, *23*(1), 3-23.
27. Chisumpa, V. H.; De Wet, N. Estimating regional variations in adult mortality in Zambia. *African Population Studies*, 2017, *31*(1), 3144.
28. Collinson, M.; Tollman, S.M.; Kahn, K.; Clark, S.; Garenne, M. Highly prevalent circular migration: households, mobility and economic status in rural South Africa. In: Tienda M, Findley SE, Tollman S, Preston-Whyte E (eds). *Africa on the Move: African Migration and Urbanisation in Comparative Perspective*. Johannesburg: Wits University Press, 2006, p 194-216
29. Kanayo, O.; Anjofui, P.; Stiegler, N. Push and pull factors of international migration: evidence from migrants in South Africa. *Journal of African Union Studies*, 2019, 8(2).
30. Beauchemin, C.; Bocquier, P. Migration and urbanization in Francophone West Africa: a review of the recent empirical evidence. *Urban Studies*, 2004, 41 (11):2245-72.
31. Gubry, P.; Lamlenn, S. B.; Ngwé, E.; Tchégho, J. M.; Timnou, J. P.; Véron, J. *Le retour au village: une solution à la crise économique au Cameroun?* Paris: L' L'Harmattan, 1996.
32. Chamberlin, J.; Jayne, T. S.; Sitko, N. J. Rural in-migration and agricultural development: Evidence from Zambia. *Agricultural Economics*, 2020, *51*(4), 491-504.
33. Ogura, M. Rural-urban migration in Zambia and migrant ties to home villages. *Developing Economies*, 1991, *29*(2), 145-165.
34. Garenne, M. Migration, urbanisation and child health: an African perspective. In: Tienda, M., Findley, S.E., Tollman, S., Preston-Whyte, E. (eds), *Africa on the Move: African Migration in Comparative Perspective.* Wits University Press, Johannesburg, South Africa, 2006, pp. 252-279.

35. Garenne, M. Urbanisation and child health in resource poor settings with special reference to under-five mortality in Africa. *Archives of Disease in Childhood*, 2010, *95*(6), 464-468.
36. Garenne, M. Will urban and rural mortality converge in Africa? In: D. Ramiro Fariñas & M. Oris (eds), *New approaches to death in cities during the health transition*. Springer International Publishing Switzerland; International Studies in Population, Vol. 12: 2016. DOI 10.1007/978-3-319-43002-7_10
37. Fay, M.; Opal, C. *Urbanization without growth: A not so uncommon phenomenon* (Vol. 2412). World Bank Publications, Washington DC, 2000.
38. Gollin, D.; Jedwab, R.; Vollrath, D. Urbanization with and without industrialization. *Journal of Economic Growth*, 2016, *21*, 35-70.
39. Farrell, K. The rapid urban growth triad: a new conceptual framework for examining the urban transition in developing countries. *Sustainability*, 2017, 9(8), 1407.
40. Menashe-Oren, A.; Bocquier, P. Urbanization is no longer driven by migration in low- and middle-income countries (1985–2015). *Population and Development Review*, 2021, 47(3), 639-663.
41. Jiang, L.; Jones, B.; Balk, D.; O'Neill, B.C. The importance of reclassification to understanding urban growth: A demographic decomposition of the United States, 1990–2010. *Population, Space and Place*, 2022, 28(6), e2562.
42. Alessandrini, A.; Deuster, C.; Dijkstra, L.; Ghio, D.; Natale, F. Rethinking City Population Growth: How Reclassification Matters. *Population and Development Review*, 2024, 50(4): 997–1015.
43. Zamstats. *Migration and urbanization. 2000 census report*. Zambia, Central Statistical Office, Lusaka, 2003.

Websites

DHS program (Demographic and Health Surveys). https://dhsprogram.com/
United Nations, Population Division. World Urbanization Prospects (WUP). https://population.un.org/wup/
Zambia, Central Statistical Office (ZamStats). www.zamstats.gov.zm