Urbanization, Fertility and Child Education in Sub-Saharan Africa

Flückiger, M., & Ludwig, M. (2017). Urbanization, Fertility and Child Education in Sub-Saharan Africa. *Economics Letters*, *157*, 97-102. https://doi.org/10.1016/j.econlet.2017.05.024

Published in:
Economics Letters

Document Version:
Peer reviewed version

Urbanization, Fertility and Child Education in Sub-Saharan Africa*

Matthias Flückiger† Markus Ludwig‡

May 15, 2017

Abstract

Using individual-level survey data, we show that the urbanization process in today's Sub-Saharan Africa is associated with the fertility transition and increased investment in child education. This is consistent with the experience of the Western economies during their transition from a (post-)Malthusian towards a modern growth regime. The use of individual-level data allows us to analyze structural rural-urban differences, holding constant age and regional characteristics which are potentially confounding factors in regional- and country-level regressions.

JEL classification: O11, O18, R11
Keywords:

*We are grateful to Alan Fernihough and Erik Hornung for helpful comments.
†Queen's University Belfast. Email: matthias.flueckiger@qub.ac.uk
‡University of Bayreuth. Email: markus.ludwig@uni-bayreuth.de

1 Introduction

Urbanization, i.e., the realization of structural change away from subsistence farming to modern service and industry sectors, was central in the transition of Western economies from a (post-)Malthusian towards a regime of sustained economic growth (e.g., Galor (2005)). Closely interconnected with urbanization were the processes of fertility transition and increased investment in child education, both of which were first observed in cities (Guinnane, 2011). Together, the three characteristics are seen as necessary conditions that enabled the transition to long-run growth (Galor, 2005).[1]

Recent literature on the urbanization process in Sub-Saharan Africa (SSA)—a region in which this process has started relatively recently—highlights the existence of (short-run) negative externalities, such as congestion and crime, associated with urbanization (e.g., Glaeser (2014); Castells-Quintana (2017); Jedwab and Vollrath (2017)). However, whether urbanization in today's SSA is, akin to the experience of the Western economies during their transition towards sustained economic growth, associated with a decline in fertility as well as increased investment in human capital of children is an important, but largely open, question. This paper constitutes a first step towards addressing this shortcoming. Depending on the answer, the implications with respect to the effects of policies targeted at reducing rural to urban migration on long-run growth, currently implemented in 84% of African countries (p.90 UN, 2013), can be quite different.

For our empirical analysis, we draw on nationally and subnationally representative individual-level survey data on women aged 15–49 and their children from the Demographic and Health Surveys (DHS) Program. Our cross-sectional dataset encompasses 427,234 observations, covers 72% of countries in SSA, and more than 80% of its total population. Relying on individual-level data allows us to control for country and region fixed effects as well as age of respondents. This implies that we will only compare urban residents with rural dwellers that are of same age and live in the same region. Thereby, we abstract from macro factors, such as the level of development or institutional characteristics, which potentially confound studies conducted at aggregate levels. For example, cross-country analyses of the relationship between urbanization and fertility rates are based on fertility data that are averaged across rural and urban populations. This masks existing structural urban-rural differences.

[1] Even though urbanization, fertility transition and increased investment in child education are seen as necessary for the transition towards sustained economic growth, the precise mechanisms, such as direction of causality, interlinking the processes are not well understood (Guinnane, 2011)

Our results document that women of reproductive age that reside in urban areas have fewer children (both, alive and ever born) relative to women living in rural areas. Furthermore, investment in human capital of their children, measured by years of schooling, is higher. Together, these findings imply a shift from quantity to quality of children in urban areas, which constitutes an essential step in the transition towards sustained economic growth (Galor and Weil, 2000). Exploiting the representativeness of our data, we show that these results carry over to the subnational as well the country level. Furthermore, we show that mother's eduction and income are two important factors underlying our findings. Overall, our findings document that the urbanization process in today's SSA is not at odds with a transition towards a modern growth regime. It is important to note, however, that our results do not suggest that polices designed to alleviate congestion-related costs—undoubtedly existing today—are not needed in order to promote economic growth in the short run.

Our paper relates to various branches of literature. Closely related is the literature on economic growth, particularly on unified growth theory (Galor and Weil, 2000; Galor, 2005) as well as the literature on fertility decisions, initiated by the seminal work of Becker (1960). Equally relevant are studies that analyze determinants and consequences of urbanization in developing countries, and in SSA in particular (e.g., Henderson (2005); Jedwab et al. (2017); Henderson et al. (Forthcoming)). Within this field, a number of studies find that the costs associated with urbanization, such as congestion-related externalities or increased crime rates, can outweigh potential benefits (e.g., Glaeser (2014); Castells-Quintana (2017); Jedwab and Vollrath (2017)). These results are not incompatible with ours. While the aforementioned papers focus on current effects of urbanization, our paper addresses its compatibility with a transition to long-run growth. Finally, our paper relates to the demographic literature on urbanization in SSA that correlates the level of urbanization with fertility rates in cross- or single-country regressions (e.g., Shapiro and Tambashe (2002); White et al. (2008)). Our study adds to the existing literature by providing empirical evidence for the compatibility of SSA's urbanization process with a transition towards a modern growth regime. The use of individual-level data avoids issues related to aggregate analyses.

The remainder of the paper is organized as follows: Section 2 outlines our empirical strategy, Section 3 describes the data, while Section 4 presents the results and Section 5 concludes.

2 Empirical Strategy

We assess the strength of the relationship between population growth, child education and urbanization at the individual level using the following cross-sectional OLS regression setup:

$$y_{i,r,c} = \psi \, \text{urban}_{i,r,c} + \boldsymbol{\gamma}' \, \mathbf{C}_{i,r,c} + \tau_r + \varepsilon_{i,r,c}. \tag{1}$$

The dependent variable $y_{i,r,c}$ is the outcome variable for individual i, living in region r and country c. Whether a person resides in an urban area is captured by the indicator $\text{urban}_{i,r,c}$. The vector $\mathbf{C}_{i,r,c}$ includes individual-level controls such as age fixed effects and sex of the children. Regional differences, and with that country-specific differences, are accounted for by region fixed effects (τ_r). The idiosyncratic error term is symbolized by $\varepsilon_{i,r,c}$ and the standard errors are clustered at the DHS cluster level.[2] All regressions are weighted using sample weights provided by the DHS. For the empirical analysis at the subnational and country level, we employ regression setups analogous to Eq.(1).

3 Data and Descriptive Analysis

Data

We employ individual-level survey data on women aged 15–49 from the Demographic and Health Surveys (DHS) Program. The surveys are representative at both country level and subnational reporting areas. The latter typically correspond to first-level administrative country subdivisions or groups thereof.

For each respondent, we extract the number of children ever born, the number of children that died as well as the number of children alive.[3] The surveys further report the respondents' age, years of schooling, wealth (captured by an index ranging from 1–5) as well as location of residence, categorized as either rural or urban. We link the surveyed women to their children, for whom information on sex, age and educational attainment is provided.[4]

The DHS surveys are conducted at irregular intervals and the number of waves available per country vary. When multiple survey waves exist, we use the most recent, subnationally

[2]The level of significance remains unchanged if we cluster the standard errors at the regional level (Tab A.3–A.4).

[3]"Number of children alive" captures the difference between the number of children ever born and the number of children that died, i.e., the "net" number of children.

[4]Information on child education, sex and age is reported in the DHS household surveys.

representative, survey.[5] Overall, the individual-level dataset of women aged 15–49 encompasses 427,234 observations gathered from 31 SSA countries that encompass 304 regions. These women are mothers to a total of 403,711 children aged 6–17.[6] Representative subnational and country-level datasets are constructed by computing weighted averages of the variables.

Figure 1 depicts the geographical scope of our dataset along with the subnational reporting areas. Shaded gray are the countries included. They are home to 83 percent of SSA's total population.

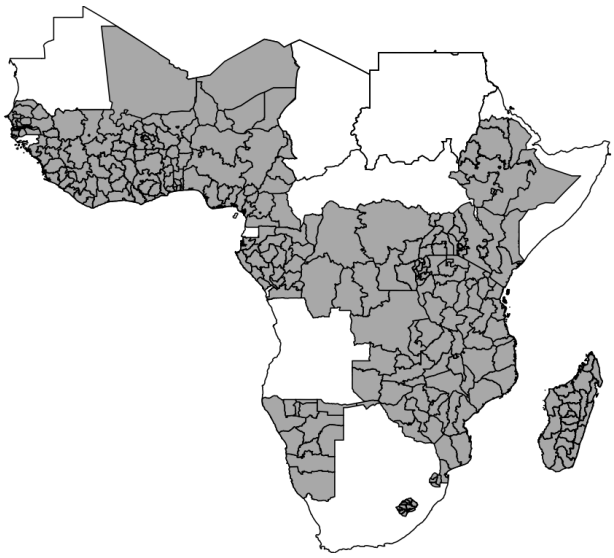

Figure 1: Sample coverage. Regions shaded gray are included in our dataset.

Summary Statistics

Table 1 reports summary statistics for our key variables stratified according to type of residence. Thirty-eight percent of respondents live in urban areas. The comparison of unconditional means foreshadows formal results presented in the next section: Women aged 15–49 residing in cities give birth to fewer children than females living rural areas. This difference persists after accounting for lower urban child mortality. Furthermore, urban residents are more educated and wealthier than rural dwellers. We also find preliminary evidence that urbanization is associated with greater investment in education of children.

[5]Table A.1 reports details on countries and survey waves included in our analysis.

[6]Primary school starting age in SSA is typically age six (World Development Indicators). When investigating investment in child education, we therefore restrict our attention to children aged 6 and older. The pattern of results remains unchanged if we include children of all ages.

Table 1: Descriptive Statistics Key Variables

Variable	Mean	Std. Dev.	Min	Max	Mean Rural	Mean Urban	Obs.
				Women Aged 15–49			
Urban residence	0.383	0.486	0	1	0	1	427,234
Number of Children ever born	2.801	2.729	0	18	3.230	2.110	427,234
Number of Children dead	0.377	0.884	0	15	0.480	0.216	427,234
Number of Children alive	2.424	2.316	0	16	2.753	1.894	427,234
Years of schooling	5.199	4.605	0	22	3.782	7.480	427,234
Wealth index	3.160	1.424	1	5	2.491	4.238	427,234
				Children Aged 6–17			
Years of Schooling	2.493	2.657	0	13	2.102	3.455	403,711
In school	0.746	0.436	0	1	0.691	0.880	403,711
Primary completed	0.127	0.333	0	1	0.087	0.226	403,711

Summary statistics are computed using sample weights provided by the DHS.

4 Results

Urbanization, Demography and Investment in Education

Column (1) of Table 2 documents that the number of births per woman of a given age and subnational region is 0.675 lower in urban than in rural areas. Child deaths, on the other hand, are less frequent (column (2)). The magnitude of the rural-urban mortality differential, however, is much lower than the fertility gap. Altogether, the number of children alive per women is 0.525 lower in urban compared to rural areas. Evaluated at the sample mean of 2.4, this amounts to a 22% reduction. We further find that the comparatively low fertility in urban areas is accompanied by an increased investment in the education of children (columns (4)–(6)). Conditional on child's age and sex, mother's age as well as region fixed effects, children in urban areas attend school for almost a year longer than children in rural areas (column (1)). This is also reflected in a lower probability of currently attending school as well as completing primary education.[7]

Taken together, the results presented in Table 2 document that the urbanization process in SSA is associated with the quantity-quality trade-off and implies a continued increase in human capital which, ultimately, may results in sustained economic growth (Galor and Weil, 2000).

[7]We obtain qualitatively equivalent results when investigating the probability of completing secondary education. However, because our child data is capped at the age of 17—when secondary school has typically not been completed—the size of the point estimate is somewhat smaller.

Table 2: Urbanization, Demography and Investment in Education

	Number of Children Ever Born	Number of Children Dead	Number of Children Alive	Child Years of Schooling	Child in School	Child Completed Primary Education
	(1)	(2)	(3)	(4)	(5)	(6)
Urban residence	-0.675***	-0.150***	-0.525***	0.914***	0.147***	0.084***
	(0.014)	(0.006)	(0.012)	(0.021)	(0.005)	(0.002)
Observations	427,234	427,234	427,234	403,711	403,711	403,711
R-squared	0.609	0.215	0.576	0.604	0.249	0.374

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the DHS cluster level. All regressions control for region fixed effects and age of the respondent. Regressions in columns (4)–(6) additionally control for sex and age of the child. "Number of Children Alive" is defined as the difference between the number of children ever born and the number of children that died.

The results of Table 3 show that our results carry over to the subnational (panel A) and the country level (panel B).[8] Within as well as across countries we find that the average number of children—ever born, surviving and dead—is lower the higher the proportion of total population that lives in urban areas (columns (1)–(3)). At the same time, a higher degree of urbanization is associated with an increased investment in child education (columns (4)–(6)).

Table 3: Aggregate Level: Urbanization, Population Growth and Investment in Education

	Number of Children Ever Born	Number of Children Dead	Number of Children Alive	Child Years of Schooling	Child in School	Child Completed Primary Education
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Subnational Level					
Urbanization rate	-1.528***	-0.337***	-1.191***	1.756***	0.220***	0.177***
	(0.096)	(0.037)	(0.065)	(0.151)	(0.038)	(0.014)
Observations	304	304	304	304	304	304
R-squared	0.791	0.637	0.794	0.747	0.711	0.759
	Panel B: Country Level					
Urbanization rate	-1.216***	-0.431***	-0.785**	1.434**	0.293**	0.224***
	(0.430)	(0.135)	(0.317)	(0.639)	(0.123)	(0.048)
Observations	31	31	31	31	31	31
R-squared	0.190	0.222	0.149	0.127	0.112	0.385

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. "Number of Children Alive" is defined as the difference between the number of children ever born and the number of children that died.

Panel A: Standard errors clustered at the country level. All regressions control for country fixed effects.

Panel B: White-Huber standard errors are reported.

[8]These results remain unaltered if we account for differences in the population composition of regions (countries), such as difference in the age structure.

Mechanisms

Theory predicts that an increase in women's human capital raises the opportunity costs of childbearing. This reduces the number of children and raises investment in children's education (e.g., Becker (1960); Galor (2005)). An increase in household income is expected to have the same effect (Galor and Weil, 2000). Because both education and income are higher in urban areas due to the concentration of skill-intensive, modern, sectors (see e.g., Young (2013) and Table 1), we expect that these two factors are important in explaining the interrelation between urbanization, fertility and investment in child education documented above. We test the validity of these predictions by re-rerunning the regressions presented in Table 2, but now additionally include women's years of schooling as well as their income (proxied by wealth) as explanatory variables. Table 4 presents the outcome of the horse race.

Table 4: Urbanization, Demography and Investment in Education: Mechanisms

	Number of Children Alive			Child Years of Schooling		
	(1)	(2)	(3)	(4)	(5)	(6)
Urban residence	-0.525***	-0.268***	-0.164***	0.914***	0.637***	0.258***
	(0.012)	(0.010)	(0.011)	(0.021)	(0.017)	(0.017)
Years of schooling		-0.097***	-0.089***		0.125***	0.096***
		(0.001)	(0.001)		(0.002)	(0.002)
Wealth index			-0.077***			0.287***
			(0.003)			(0.005)
Observations	427,234	427,234	427,234	403,711	403,711	403,711
R-squared	0.576	0.597	0.598	0.604	0.626	0.638

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the DHS cluster level. All regressions control for region fixed effects and age of the respondent. Regressions in columns (4)–(6) additionally control for sex and age of the child. "Number of Children Alive" is defined as the difference between the number of children ever born and the number of children that died.

Women's education and wealth account for a substantial share of the urban effect.[9] Compared to the baseline estimate (reported in column (1)), the coefficient of urban residence on the number of children alive is reduced by 49% when women's education is taken into account (column (2)). The coefficient size is reduced by a further 20% when we include household wealth in the regression setup. As predicted by theory, the sign of the point coefficient is negative for women's education as well as wealth. That is, better educated and

[9]To save space, Table 4 only depicts regressions in which we use the number of children alive and child's years of schooling as dependent variables. As documented in Table A.2, the pattern of results is the same for any of the LHS variables employed in Table 2.

wealthier women have fewer children. Looking at the relationship between urban residence and child education, we find that the inclusion of the two additional covariates reduces the size of the urban coefficient by similar magnitudes (columns (5)–(6)). The coefficients again exhibit the expected signs, i.e., positive in both cases.

5 Conclusion

This paper documents that the interrelationship between urbanization, fertility and investment in human capital of children in SSA is consistent with a transition from a (post)-Malthusian towards a modern growth regime.

References

Becker, Gary (1960) 'An economic analysis of fertility.' In 'Demographic and Economic Change in Developed Countries' (National Bureau of Economic Research, Inc) pp. 209–240

Castells-Quintana, David (2017) 'Malthus living in a slum: Urban concentration, infrastructure and economic growth.' *Journal of Urban Economics* 98, 158 – 173. Urbanization in Developing Countries: Past and Present

Galor, Oded (2005) 'From Stagnation to Growth: Unified Growth Theory.' In *Handbook of Economic Growth,* ed. Philippe Aghion and Steven Durlauf, vol. 1 of *Handbook of Economic Growth* (Elsevier) chapter 4, pp. 171–293

Galor, Oded, and David N. Weil (2000) 'Population, technology, and growth: From malthusian stagnation to the demographic transition and beyond.' *The American Economic Review* 90(4), 806–828

Glaeser, Edward L. (2014) 'A world of cities: The causes and consequences of urbanization in poorer countries.' *Journal of the European Economic Association* 12(5), 1154–1199

Guinnane, Timothy W. (2011) 'The historical fertility transition: A guide for economists.' *Journal of Economic Literature* 49(3), 589–614

Henderson, J. Vernon (2005) 'Urbanization and Growth.' In *Handbook of Economic Growth,* ed. Philippe Aghion and Steven Durlauf, vol. 1 of *Handbook of Economic Growth* (Elsevier) chapter 24, pp. 1543–1591

Henderson, J. Vernon, Mark Roberts, and Adam Storeygard (Forthcoming) 'Is urbanization in Sub-Saharan Africa different?' *Journal of Development Economics*

Jedwab, Remi, and Dietrich Vollrath (2017) 'The urban mortality transition and the rise of poor mega-cities.' Technical Report

Jedwab, Remi, Luc Christiaensen, and Marina Gindelsky (2017) 'Demography, urbanization and development: Rural push, urban pull and ... urban push?' *Journal of Urban Economics* 98, 6 – 16. Urbanization in Developing Countries: Past and Present

Nations, United (2013) *World Population Policies 2011* (New York: United Nations Publications)

Shapiro, David, and B. Oleke Tambashe (2002) 'Fertility transition in urban and rural Sub-Saharan Africa: Preliminary evidence of a three-stage process.' *Journal of Africa Policy Studies* 8(2), 103–127

White, Michael J, Salut Muhidin, Catherine Andrzejewski, Eva Tagoe, Rodney Knight, and Holly Reed (2008) 'Urbanization and fertility: An event-history analysis of coastal Ghana.' *Demography* 45(4), 803–816

Young, Alwyn (2013) 'Inequality, the urban-rural gap, and migration.' *The Quarterly Journal of Economics* 128(4), 1727–1785

A Web Appendix

Table A.1: DHS data used to construct dataset

Country	Phase	Year	Country	Phase	Year
Benin	2011-12	DHS-VI	Mali	2012-13	DHS-VI
BurkinaFaso	2010	DHS-VI	Mozambique	2011	DHS-VI
Burundi	2010	DHS-VI	Namibia	2013	DHS-VI
Cameroon	2011	DHS-VI	Niger	2012	DHS-VI
Congo	2011-12	DHS-VI	Nigeria	2013	DHS-VI
CongoDemocraticRepublic	2013-14	DHS-VI	Rwanda	2014-15	DHS-VII
Cote d'Ivoire	2011-12	DHS-VI	Senegal	2010-11	DHS-VI
Ethiopia	2011	DHS-VI	SierraLeone	2013	DHS-VI
Gabon	2012	DHS-VI	Swaziland	2006-07	DHS-V
Ghana	2014	DHS-VII	Tanzania	2010	DHS-VI
Guinea	2012	DHS-VI	Gambia	2013	DHS-VI
Kenya	2014	DHS-VII	Togo	2013-14	DHS-VI
Lesotho	2014	DHS-VII	Uganda	2011	DHS-VI
Liberia	2013	DHS-VI	Zambia	2013-14	DHS-VI
Madagascar	2008-09	DHS-V	Zimbabwe	2010-11	DHS-VI
Malawi	2010	DHS-VI			

Table A.2: Urbanization, Demography and Investment in Education: Mechanisms

	Number of Children Ever Born			Number of Children Dead			Child in School			Child Completed Primary Education		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Urban residence	-0.675***	-0.353***	-0.195***	-0.150***	-0.085***	-0.031***	0.147***	0.107***	0.037***	0.084***	0.058***	0.028***
	(0.014)	(0.011)	(0.012)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.002)	(0.002)	(0.002)
Years of schooling		-0.121***	-0.110***		-0.025***	-0.021***		0.018***	0.013***		0.012***	0.010***
		(0.001)	(0.001)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)
Wealth index			-0.117***			-0.040***			0.053***			0.023***
			(0.004)			(0.002)			(0.001)			(0.001)
Observations	427,234	427,234	427,234	427,234	427,234	427,234	403,711	403,711	403,711	403,711	403,711	403,711
R-squared	0.609	0.633	0.635	0.215	0.224	0.226	0.249	0.266	0.281	0.374	0.387	0.391

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the DHS cluster level. All regressions control for region fixed effects and age of the respondent. Regressions in columns (7)–(12) additionally control for sex and age of the child.

Table A.3: Robustness Standard Errors: Urbanization, Demography and Investment in Education

	Number of Children Ever Born	Number of Children Dead	Number of Children Alive	Child Years of Schooling	Child in School	Child Completed Primary Education
	(1)	(2)	(3)	(4)	(5)	(6)
Urban residence	-0.675***	-0.150***	-0.525***	0.914***	0.147***	0.084***
	(0.027)	(0.017)	(0.027)	(0.050)	(0.017)	(0.004)
Observations	427,234	427,234	427,234	403,711	403,711	403,711
R-squared	0.609	0.215	0.576	0.604	0.249	0.374

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors reported in parentheses clustered at the regional level. All regressions control for region fixed effects and age of the respondent. Regressions in columns (4)–(6) additionally control for sex and age of the child. "Number of Children Alive" is defined as the difference between the number of children ever born and the number of children that died.

Table A.4: Robustness: Urbanization, Demography and Investment in Education: Mechanisms

	Number of Children Alive			Child Years of Schooling		
	(1)	(2)	(3)	(4)	(5)	(6)
Urban residence	-0.525***	-0.268***	-0.164***	0.914***	0.637***	0.258***
	(0.027)	(0.025)	(0.021)	(0.050)	(0.039)	(0.026)
Years of schooling		-0.097***	-0.089***		0.125***	0.096***
		(0.003)	(0.003)		(0.004)	(0.003)
Wealth index			-0.077***			0.287***
			(0.009)			(0.012)
Observations	427,234	427,234	427,234	403,711	403,711	403,711
R-squared	0.576	0.597	0.598	0.604	0.626	0.638

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors reported in parentheses clustered at the regional level.All regressions control for region fixed effects and age of the respondent. Regressions in columns (4)–(6) additionally control for sex and age of the child. "Number of Children Alive" is defined as the difference between the number of children ever born and the number of children that died.