Sustainable Cities and Society 48 (2019) 101544

Contents lists available at ScienceDirect

Sustainable Cities and Society

journal homepage: www.elsevier.com/locate/scs

Urbanization and income inequality in Sub-Saharan Africa

Iddisah Sulemana[a,*], Edward Nketiah-Amponsah[a], Emmanuel A. Codjoe[a], Jennifer Akua Nyarko Andoh[b]

[a] Department of Economics, University of Ghana, P. O. Box LG 57, Legon, Accra, Ghana
[b] Business School, Ghana Institute of Management & Public Administration, P. O. Box AH 50, Achimota, Accra, Ghana

ARTICLE INFO

JEL classification:
O11
O15
O55

Keywords:
Gini index
Income inequality
Urbanization
Sub-Saharan Africa

ABSTRACT

According to the World Bank, a burgeoning proportion of Africans now live in urban areas. The United Nations notes that the fastest urbanizing regions in the world are Africa and Asia and projects that by the year 2050 these regions would become about 56% and 64% urban, respectively. At the same time, over the last several decades, many countries and regions have recorded rising income inequality. While some scholars have argued that urbanization worsens income inequality, others contend that the relationship is non-linear and dependent on the stage of development. In this regard, Sub-Saharan Africa remains largely understudied. This paper employed an unbalanced panel dataset for 48 Sub-Saharan African countries over the period 1996–2016 to examine whether urbanization is correlated with income inequality. We find evidence of a positive association between urbanization and income inequality in the region.

1. Introduction

Urbanization is a pertinent corollary of development because as countries develop, the proportion of their citizens who live in urban areas begins to rise as sections of their populations shift from rural areas into urban cities (Annez & Buckley, 2009; Castells-Quintana, 2018; Kuznets, 1955). One of the precursors of the post-2000 economic boom in Africa was the emergence of dynamic African cities with its concomitant rising urbanization (United Nations Development Programme, 2016). One reason for the burgeoning urbanization across the globe is the significant variation in wealth and resources across cities (Liddle, 2017). Consistent with this view, the World Bank has reported that, between 2010 and 2030, the proportion of Africans who live in urban areas could rise from 36% to 50% (World Bank, 2015).[1] Such increases in urbanization could have positive influences (e.g., economic growth, economic transformation) or deleterious consequences (e.g., increased inequality, urban poverty, and slums) on human well-being (Liddle & Messinis, 2015; World Bank, 2015). At the global level, a recent United Nations report indicated that, in 2014, about 54% of the world's population resided in urban areas and that by 2050 the global urbanization rate could increase to about 66%. This is interesting because less than 30% of the world's people lived in urban areas in 1950 (United Nations, 2014).

Among the world's regions, Africa and Asia have experienced the fastest urbanization rates. This may be due in part to the relative economic importance of their cities as countries that have lower incomes generally tend to have a disproportionate amount of their GDPs produced by their cities (Liddle, 2013). The United Nations Population Fund (2007) has suggested that no country in the modern age has achieved sustained economic growth without contemporaneous urbanization. Furthermore, Annez and Buckley (2009, p. 1) have argued that in the last century: "No country has ever reached middle income status without a significant population shift into cities." Similarly, Castells-Quintana and Royuela (2015) have observed that economic growth and development are strongly correlated with the pace of urbanization and income inequality across countries. Significantly, most urban centres in developing countries are struggling to address the challenges of inequalities related to adequate housing, schooling,

* Corresponding author.
E-mail addresses: idsulemana@ug.edu.gh (I. Sulemana), enamponsah@ug.edu.gh (E. Nketiah-Amponsah), ecodjoe@staff.ug.edu.gh (E.A. Codjoe), jandoh@gimpa.edu.gh (J.A.N. Andoh).

[1] We are cognizant of the debate surrounding the definitional issues about and state of urbanization in Africa (Champion & Hugo, 2004; Potts, 2012, 2013). For instance, what may be defined "urban" in one geographic location may be "rural" in another (Potts, 2012, 2013). Additionally, Potts (2012) has argued that urbanization has either slowed or even decreased in recent decades in Africa. Indeed, Potts (2013) contended that the urbanization rates in Sub-Saharan Africa in the 1900s had been exaggerated by UN-Habitat. However, based on the World Bank data used in this paper, we contribute to the strand of the literature that argues that African countries have been urbanizing rapidly (e.g., United Nations, 2014; United Nations Development Programme, 2016; World Bank, 2015).

https://doi.org/10.1016/j.scs.2019.101544
Received 20 January 2019; Received in revised form 7 April 2019; Accepted 7 April 2019
Available online 09 April 2019

transport and healthcare provision.

This paper contributes to the debate on the association between urbanization and income inequality in Sub-Saharan Africa by utilizing an unbalanced panel dataset for 48 countries from 1996 to 2016. This paper is motivated by the scant literature on the phenomenon in the Sub-Saharan African region. We note that our study is identical to Adams and Klobodu (2019) but differs from that study in several ways. First, Adams and Klobodu (2019) studied 21 African countries while our study covers 48 countries. Second, we employed a more recent dataset; while their study focused on the 1984–2014 period, our paper spans the period 1996–2016. Lastly, our estimation techniques differ from theirs because they employed the pooled mean group and common correlated effects techniques while we used fixed effects (FE), random effects (RE), feasible generalized least squares (FGLS) and generalized method of moments (GMM) approaches.

The rest of the paper proceeds as follows: Section 2 presents the background literature, including some theoretical explanations underlying the relationship between income inequality and urbanization. Section 3 discusses the data, data sources and our empirical strategy. In Section 4, we report and discuss the results. Finally, in Section 5, we provide a summary of the study and conclude by proffering some policy recommendations.

2. Background literature

A large extant literature has examined the relationship between urbanization on the one hand and economic growth and income inequality on the other hand (e.g., Annez & Buckley, 2009; Adams & Klobodu, 2019; Bertinelli & Black, 2004; Chen, Glasmeier, Zhang, & Shao, 2016; Fay & Opal, 2000; Gollin, Jedwab, & Vollrath, 2016; Henderson, 2003; Kuznets, 1955; Kanbur & Zhang, 1999; Liddle & Messinis, 2015; Wan & Zhou, 2005; Wu & Rao, 2017). In his seminal work, Kuznets (1955) observed an inverted U-shaped relationship between income inequality and economic growth. He further noted that the nature of income distribution in advanced economies was due to industrialization and urbanization as economies transitioned from agriculture to manufacturing. This also meant that, from the low-productivity agricultural sector of the economy, rural folks would move to high productivity non-agricultural sectors in urban centres. Because per capita productivity is higher for urban dwellers than for rural folks, Kuznets argued that urbanization would lead to higher income inequality as countries urbanize.

Inspired by prior studies (e.g., Adelman & Morris, 1973; Kuznets, 1955; Lewis, 1954), Robinson (1976) proposed a model for understanding the relationship between urbanization and income inequality. He assumed that the economy had subsistence and capitalist structures characterized by low-wage agricultural and high-wage non-agricultural sectors, respectively. He then argued that, in the absence of countervailing policies, and for a protracted period, a developing country should expect to have increasing or unchanged income inequality during its middle stage of economic development. In consonance with this hypothesis, Liddle and Messinis (2015) found that for developing countries, economic growth exerts a positive effect on urbanization but that urbanization diminishes economic growth. Some scholars have also argued that the relationship between urbanization and income inequality could either be positive or negative (e.g., Jones & Koné, 1996; Siddique, Wibowo, & Wu, 2014) or even non-linear (e.g., Kuznets, 1955; Robinson, 1976; Wu & Rao, 2017). For instance, if rural people move to urban areas with little or no education and skills that match the job demands of urban firms, then such individuals either may be unemployed or may have to engage in menial jobs that pay them significantly lower wages, thereby worsening the wage gap (Jones & Koné, 1996; Siddique et al., 2014). However, if rural migrants are able to secure employment in the formal sector in urban areas, then urbanization could decrease income inequality (Jones & Koné, 1996; Siddique et al., 2014).

In this regard, Kanbur and Zhuang (2013) uncovered that while urbanization had increased income inequality in the Philippines, Indonesia and India, it had rather reduced income inequality in China. Furthermore, Kanbur and Zhuang (2013) predicted that in the future, urbanization would continue to reduce income inequality in China, arguing that China may have already passed the "turning point." In their study of the effect of fiscal decentralization on income inequality in Indonesia, Siddique et al. (2014) controlled for urbanization and found a null effect of urbanization on income inequality. Yet, other studies have found evidence to support the inverted U-shaped relationship between urbanization and income inequality proposed by Kuznets (e.g., Liddle, 2017; Wu & Rao, 2017). Therefore, it is probable that the relationship between urbanization and income inequality is not a one-size-fits-all because different countries or regions are on disparate development trajectories and have different economic structures.

Most of the previous studies on income inequality in the development economics literature have focused on country-level income inequality (e.g., Barro, 2000; Castells-Quintana & Larrú, 2015; Gustafsson & Johansson, 1999; Roine, Vlachos, & Waldenstrom, 2009). However, a limited but growing strand of the literature emphasizes analysis at the regional-level (e.g., Castells-Quintana, Ramos, & Royuela, 2015; Rodríguez-Pose & Tselios, 2009; Royuela, Veneri, & Ramos, 2014). Additionally, while some previous studies have investigated how city size and income inequality are correlated at the city-level (e.g., Baum-Snow & Pavan, 2013; Chen, Liu, & Lu, 2017; Glaeser, Resseger, & Tobio, 2015; Sarkar, Phibbs, Simpson, & Wasnik, 2018), a few scholars have examined the association between city size and income inequality at the economy-wide scale (e.g., Castells-Quintana, 2018). For instance, inspired by the urban economics literature (e.g., Duranton & Puga, 2004; Nord, 1980; White, 1981), Castells-Quintana (2018) explored the association between city size and income inequality and found a U-shaped relationship in which as city size rises, income inequality initially declines, reaches a minimum and thereafter increases.

In a nutshell, the literature is inconclusive on the nature of the relationship between urbanization and income inequality. While some scholars have argued that the relationship is linear (e.g., Jones & Koné, 1996; Siddique et al., 2014), others contend that it is non-linear (e.g., Kuznets, 1955; Robinson, 1976; Wu & Rao, 2017). In particular, as a result of the lack of empirical evidence on the topic for Sub-Saharan Africa, we do not know the nature of the relationship for this region. The present paper contributes to the literature by providing evidence of a positive association between urbanization and income inequality in Sub-Saharan Africa.

3. Data and empirical strategy

We used an unbalanced panel dataset for 48 Sub-Saharan African countries for the period 1996 to 2016.[2] The dependent variable is income inequality and is measured by the Gini index (Gini, 1909). Data on the Gini index were drawn from the World Bank's World Development Indicators (WDI). We also used supplementary data on the Gini index from the United Nations University World Institute for Development Economics Research's (UNU-WIDER's) World Income Inequality Database. The main variable of interest is urbanization and is measured by the proportion of the total population residing in urban areas. We

[2] The countries include Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros Island, Democratic Republic of Congo, Republic of Congo, Côte d'Ivoire, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, São Tomé and Principe, Senegal, Seychelles, Sierra Leone, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia and Zimbabwe. The panel is unbalanced because of missing observations for some countries over some years.

control for other variables identified within the literature as correlates of income inequality. These include GDP per capita (measured in constant 2010 US$), net foreign direct investment (FDI) as a percentage of GDP, trade openness (as a percentage of GDP), corruption, inflation, and the contribution of manufacturing to GDP. The data on all these variables (except for corruption) were also drawn from the WDI. Data on corruption were taken from the Worldwide Governance Indicators (WGI) database. The corruption index ranges from −2.5, which represents highest corruption level/weak governance performance, to 2.5 denoting lowest corruption level/strong governance performance (see Kaufmann, Kraay, & Mastruzzi, 2011). However, for ease of interpretation, we transformed it by subtracting each observation from 2.5 so that higher values signify higher corruption levels.

We included GDP per capita and its squared term to control for the inverted U-shaped relationship between income inequality and economic growth discovered by Kuznets (1955). Prior studies have shown that FDI invariably increases income inequality in receiving developing countries (e.g., Adelman & Robinson, 1989; Chintrakarn, Herzer, & Nunnenkamp, 2012; Francois & Nelson, 2003; Herzer, Hühne, & Nunnenkamp, 2014; Pan-Long, 1995). For instance, the modernization hypothesis holds the view that income inequality must first rise before declining as countries receive FDI. The idea is that the injection of FDI into a developing economy increases marginal productivity, savings and consumption propensities. Because the proportion of the population engaged in the high-income non-agricultural sector is normally small in the initial stages of development, as countries grow and industrialize and as more FDI arrives and people transition from agriculture to nonagricultural sectors, income inequality would increase (Adelman & Robinson, 1989; Pan-Long, 1995). Similarly, some scholars have contended that trade liberalization improves income inequality the same way FDI does (Çelik & Basdas, 2010). Alesina and Angeletos (2005) argued that in corrupt developing countries, public funds earmarked for development projects may be misappropriated by corrupt public officials thereby increasing income inequality. Moreover, empirical evidence has shown that corruption increases income inequality through decreased economic growth (Gupta, Davoodi, & Alonso-Terme, 2002; Gyimah-Brempong, 2002; Sulemana & Kpienbaareh, 2018).

Studies have also shown that inflation influences income inequality (e.g., Bulíř, 2001; Blinder & Esaki, 1978; Scully & Slottje, 1991; Scully, 2002). Bulíř (2001) proposed an "outsider" versus "insider" model whereby outsiders are workers who accept nominal contracts while insiders' contracts are inflation-indexed. Because changes in inflation affect the real earnings of outsider workers, higher inflation would distract them and make them focus more on time-consuming activities in order to reduce income losses caused by inflation (Bulíř, 2001). Besides, inflation also reduces the value of nominal assets held by the outsiders. These could ultimately lead to a widening of the wage-gap between the two groups. Other scholars have argued that unanticipated inflation lowers income inequality because it redistributes income from the rich to the poor (e.g., Blinder & Esaki, 1978; Scully & Slottje, 1991; Scully, 2002).

The empirical literature shows mixed results for the effect of international remittances on income inequality (see e.g., Anyanwu, 2011; Rapoport & Docquier, 2006). While some studies have found a positive effect of remittances on income inequality (e.g., Acosta, Calderon, Fajnzylber, & Lopez, 2008; Lipton, 1980; Stahl, 1982), others have observed a negative effect (Barham & Boucher, 1998; Taylor & Wyatt, 1996). Yet, some studies did not find a significant effect of remittances on income inequality (Adams & Mahmood, 1992; Milanovic, 1987). Finally, because economic structure may be associated with income inequality (Benjamin, Brandt, & McCaig, 2017), we controlled for the manufacturing sector's contribution to GDP.

Therefore, the study's empirical strategy utilizes the following econometric approach. First, we modelled income inequality as follows:

$$G_{it} = \beta_0 + U_{it}\beta_1 + Z_{it}\gamma + \delta_i + \tau_t + \varepsilon_{it} \quad (1)$$

where G is the Gini index, U is the rate of urbanization, Z is a vector of other covariates of income inequality as discussed above, and i and t index country and time, respectively. β_0 is the intercept, β_1 is the slope parameter for urbanization, γ is a vector of coefficients for the other covariates, δ_i captures country fixed effects, τ_t denotes random effects while ε is the error term. Eq. (1) can be estimated using FE or RE models. FE models treat δ_i and τ_t as part of the regression parameters while RE models treat them as part of the error term (Stern & Common, 2001; Stern, 2008). If δ_i and τ_t are correlated, then the FE models generate consistent estimates while RE models yield inconsistent estimates. Hence, the FE models are preferred. A Hausman test can be conducted to determine whether the slope parameters from FE and RE models are significantly different (Hausman, 1978; Stern & Common, 2001).

We note that FE and RE models may not be very appropriate estimation techniques given the panel structure of the data because of country-specific heterogeneities, the presence of serial correlation, and potential endogeneity problem as urbanization and income inequality may be bi-causally related. For instance, a Wooldridge (2010) test for serial correlation with the null hypothesis of no first-order serial correlation yielded an F value of 76.181 that was statistically significant at the 0.1% level. Furthermore, a test for scale variation across the countries (Greene, 2012) yielded a statistically significant likelihood ratio Chi^2 statistic of 755.89, suggesting the presence of heteroscedasticity. With respect to endogeneity, urbanization may trigger rising income inequality. However, it may be that increasing income inequality is the reason people leave the rural areas to drift to the cities to start with.

To address these issues, we adopted two approaches. First, we transformed the variables by taking 5-year averages for each of them and then run FE and RE models. Additionally, to resolve the problem of heteroskedascity in the data, we run the model using FGLS regression. In the second approach, we employed the difference GMM (Arellano & Bond, 1991) and system GMM (Arellano & Bover, 1995; Blundell & Bond, 1998) estimators that use lagged values of the dependent variable as instruments and first differencing to overcome these problems. Re-writing Eq. (1), the model is as follows:

$$G_{it} = \beta_0 + G_{it-1}\alpha + U_{it}\beta_1 + Z_{it}\gamma + \delta_i + \varepsilon_{it} \quad (2)$$

where $\varepsilon_{it} = \tau_t + \varepsilon_{it}$. First differencing Eq. (2) yields:

$$\Delta G_{it} = \Delta G_{it-1}\alpha + \Delta U_{it}\beta_1 + \Delta Z_{it}\gamma + \Delta\varepsilon_{it} \quad (3)$$

where Δ is the difference operator. This eliminates the country fixed effects term. However, ΔG_{it-1} is correlated with $\Delta\varepsilon_{it}$ (Drukker, 2008). By including more lags of the dependent variable and first-differenced errors, the GMM estimators resolve the endogeneity as well as serial correlation problems (Arellano & Bond, 1991; Arellano & Bover, 1995; Blundell & Bond, 1998).

4. Results and discussion

Table A1 in the Appendix reports the summary statistics for the variables used in the study. For the period under consideration, the Gini index ranged from 29.80% in 2003 in Tanzania to 65.66% in Somalia in 2003. The average Gini index for the sample as a whole was 44.34%. The average rate of urbanization was 38.38% and ranged from 7.41% in Burundi in 1996 to about 87.37% in Gabon in 2016. GDP per capita averaged US$ 936.22, while FDI averaged US$ 567 million. The majority of the countries had trade constituting more than 50% of their GDP, and reported high corruption perceptions, averaging 3.13 on a 0–5 scale. Annual inflation rates varied significantly across the region within the period: some of the countries recorded deflation in some years while others experienced hyperinflation. However, the average rate of inflation was 48.28%. The mean amount of international remittances received was almost US$ 600 million. Finally, the data revealed that the mean contribution of manufacturing to GDP was about 5%.

Table 1 reports the partial correlations for the variables. The correlation coefficient between urbanization and income inequality was 0.117 and significant at the 5% level. Additionally, income inequality

Table 1
Correlation matrix.

Variable	1	2	3	4	5	6	7	8	9
1. Income inequality (Gini)	1.000								
2. Urbanization	0.117**	1.000							
3. GDP per capita	0.200***	0.541***	1.000						
4. Foreign direct investment	0.140**	0.043	0.188***	1.000					
5. Trade openness	0.042	0.316***	0.446***	0.112***	1.000				
6. Corruption	0.075	−0.154***	−0.357***	−0.035	−0.124***	1.000			
7. Inflation	0.029	−0.007	−0.013	0.008	0.013	0.059*	1.000		
8. Remittances	0.085	−0.129***	−0.131***	0.757	−0.097**	−0.153***	−0.020	1.000	
9. Manufacturing (% of GDP)	0.091	−0.029	−0.284***	−0.105	−0.242***	0.167***	−0.054	−0.060	1.000

Note: * $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

was correlated with GDP per capita and FDI at the 1% and 5% levels, respectively. Although the correlation coefficient between income inequality and each of the other control variables was positive, none was statistically significant.

We computed the average level of income inequality and the average rate of urbanization for each country.[3] Fig. 1 presents a scatterplot for the relationship between urbanization and income inequality for these average scores. The graph on the left (a) is a linear fit while the graph on the right (b) is a quadratic fit. Both reveal a linear, upward-sloping relationship between urbanization and income inequality. Thus, the data do not show a quadratic relationship. This suggests that urbanization and income inequality may have a positive relationship as opposed to a non-linear one for the sample.[4]

We now turn to the results of the econometric analysis. In Table 2, the FE, RE and FGLS regression results for the association between income inequality and urbanization are reported in Models 1, 2 and 3, respectively. The results reveal a positive association between urbanization and income inequality in all three models. However, while the association is statistically significant at the 5% level in Model 1, it is significant at the 10% level in Models 2 and 3. The Hausman test statistic is statistically insignificant suggesting that there are no systematic differences between the FE and RE slope parameters.

Table 3 reports the results of the GMM regressions. Models 4 and 5 report the difference GMM regression results while Models 6 and 7 report the system GMM regression results. Consistent with the results reported in Table 2, we found a positive and statistically significant coefficient of urbanization at the 1% level for Models 4 and 6, at the 5% level for Model 7, and at the 10% level for Model 5. The Hansen's J statistics for all the models in Table 3 were statistically insignificant suggesting no evidence of model misspecification (Hansen, 1982). Additionally, the results for the test for serial correlation were statistically insignificant, indicating that there was no serial correlation in the errors (Arellano & Bond, 1991). Thus, our results show a positive and significant association between urbanization and income inequality in Sub-Saharan Africa.

There are several plausible explanations for these results. First, Kuznets (1955) provided two reasons why income inequality may rise as the countries urbanize. The first is that economic growth would cause economies to move away from agriculture into industrialization and urbanization. He stated that: "Hence we may conclude that the major offset to the widening of income inequality associated with the shift from agriculture and the countryside to industry and the city must have been a rise in the income share of the lower groups within the nonagricultural sector of the population" (p. 17). Most African economies have rather deindustrialized as the share of industry in GDP in most African economies has rather declined compared to that in 1985 (Page, 2012; World Bank, 2019). However, the contribution of the services sector to GDP in the region has risen over the period studied (World Bank, 2019). Furthermore, the declining contribution of agriculture to GDP in the region confirms the notion of a population shift from the agricultural sector to the non-agricultural services sector.

Second, because rural people who are usually less educated and largely unskilled relative to their urban counterparts, they get trapped in persistent poverty due to limited economic opportunities as well as other barriers they encounter when they migrate to the urban cities (Chen, Gu, & Wu, 2006, 2016; Liu, Wu, & He, 2008). Perhaps, because of the prospects of higher formal sector wages, rural migrants risk underemployment in the informal sector when they migrate to the urban areas (Kim, 2008; Rauch, 1993). Since the formal sector pays more relative to the informal sector, such migration increases income inequality. Third, the region's rising dynamic cities may be creating more economic growth and development thereby widening the urban-rural income gap (United Nations Development Programme, 2016). Fourth, with increased technology and improved health care in the cities, it may be that urban workers have become increasingly more productive than their rural counterparts have and consequently tend to earn higher income than rural dwellers (Chen et al., 2016; Kamoche, 2011). Finally, the positive association between urbanization and income inequality may also be explained by urban-biased economic and social policies that provide urban residents with better economic opportunities than their rural counterparts, leading to widening urban-rural income gaps (Demont, 2013; Demont, Rutsaert, Ndour, & Verbeke, 2013; Lu & Chen, 2006).

In sum, these results may be indicative of the notion that urbanization leads to increasing income inequality by simply increasing income inequality within the cities (e.g., Baum-Snow & Pavan, 2013; Liddle, 2013, 2017). Because cities tend to produce a disproportionate amount of a country's GDP (Liddle, 2013), and because this relative importance is stronger for less wealthy nations, cities tend to attract rural migrants (Liddle, 2013, 2017). Thus, it may be that increased urbanization causes higher income inequality in the cities and consequently in the country. Therefore, rising income inequalities at the national levels are caused by rising income inequalities in Sub-Saharan African cities occasioned by rapid urbanization.

With respect to the control variables, after correcting for endogeneity, the results show an inverted U-shaped relationship between GDP per capita and income inequality thereby confirming the Kuznets (1955) hypothesis. Specifically, the coefficient of GDP per capita is positive while that of GDP per capita squared is negative and they are both statistically significant at the 10% level or better (Models 4, 5 and 6). Aside from Model 3 (Table 2) in which trade openness was negatively and significantly correlated with income inequality at the 10%, the results do not show any statistically significant relationship between any of other control variables and income inequality.

Finally, consistent with the scatterplots in Fig. 1, our results do not support a non-linear association between income inequality and urbanization. We tested for non-linearity between these variables by including a squared term for urbanization in some of the models reported on Tables 2 and 3. Additionally, we run a semi-log model by regressing the natural log of income inequality on the levels of the right hand side

[3] These were in natural logs.

[4] The regression results reported on Table A2 in the Appendix support this observation.

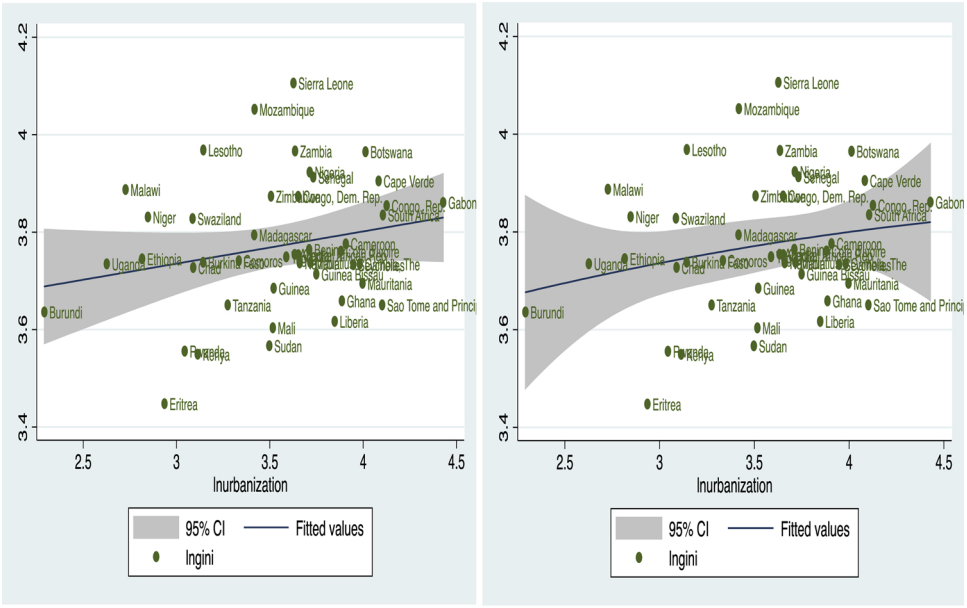

Fig. 1. Scatterplots for the relationship between urbanization and income inequality in Sub-Saharan Africa.

Table 2
FE, RE and FGLS regression results for the association between urbanization and income inequality in Sub-Saharan Africa.

	FE Model 1	RE Model 2	FGLS Model 3
Urbanization	0.6009**	0.1109*	0.0748*
	(0.2298)	(0.0661)	(0.0399)
GDP per capita	−0.7262	−0.0075	−0.1187
	(0.7375)	(0.3090)	(0.2036)
GDP per capita sq.	0.0433	0.0000	0.0084
	(0.0489)	(0.0207)	(0.0137)
Foreign direct investment	−0.0338	−0.0044	0.0030
	(0.0211)	(0.0096)	(0.0069)
Trade openness	−0.0007	−0.0005	−0.0007*
	(0.0012)	(0.0006)	(0.0004)
Corruption	−0.0870	−0.0618	−0.0323
	(0.0935)	(0.0417)	(0.0258)
Inflation	0.0025	−0.0001	−0.0015
	(0.0040)	(0.0028)	(0.0017)
Remittances	0.0045	0.0072	0.0004
	(0.0199)	(0.0106)	(0.0074)
Manufacturing	−0.0137	0.0216	0.0181
	(0.0883)	(0.0430)	(0.0314)
Intercept	5.4270**	3.5662***	3.9725***
	(2.5822)	(1.0680)	(0.6889)
Overall R-sq	0.0192	0.0610	
F-statistic/Wald Chi^2	1.31	7.70	10.90
Hausman test		8.77	
N	129	129	129

Note: Standard errors in parentheses. * p < 0.10. ** p < 0.05. *** p < 0. 01. Gini, urbanization, GDP per capita, FDI, and remittances are in logs.

variables. The results are reported in Table A2 in the Appendix. The inclusion of a quadratic term in each of the models causes urbanization to lose its statistical significance. Hence, we conclude that the association between income inequality and urbanization in Sub-Saharan Africa is positive and not non-linear.

5. Summary and conclusion

The primary objective of this study was to examine whether urbanization is correlated with income inequality in Sub-Saharan Africa using an unbalanced panel dataset for 48 countries for the 1996–2016 period.

Table 3
Difference and system GMM regression results for the association between urbanization and income inequality in Sub-Saharan Africa.

	DIFF-GMM		SYS-GMM	
	One-step Model 4 Model 4	Two-step Model 5 Model 5	One-step Model 6 Model 6	Two-step Model 7 Model 7
$Gini_{t-1}$	0.8471***	−0.0121	0.8903***	−0.4038
	(0.1527)	(0.4869)	(0.1179)	(0.6861)
$Gini_{t-2}$	0.0322	−0.8845	−0.1018	−1.0968
	(0.1402)	(0.6309)	(0.1212)	(0.9828)
Urbanization	0.6741***	0.5162*	0.1926***	0.2464**
	(0.1983)	(0.2908)	(0.0663)	(0.2520)
GDP per capita	1.1851*	2.4172**	0.6316***	2.7131
	(0.6386)	(1.1057)	(0.4653)	(3.6132)
GDP per capita sq.	−0.0684*	−0.1485**	−0.0409**	−0.1691
	(0.0398)	(0.0724)	(0.0316)	(0.2271)
Foreign direct investment	0.0045	−0.0052	−0.0007	−0.0074
	(0.0076)	(0.0087)	(0.0059)	(0.0096)
Trade openness	0.0006	−0.0008	0.0001	−0.0016
	(0.0006)	(0.0011)	(0.0006)	(0.0015)
Corruption	−0.0132	−0.0408	−0.0483	−0.1758
	(0.0497)	(0.0815)	(0.0428)	(0.1517)
Inflation	−0.0007	−0.0012	0.0000	−0.0009
	(0.0009)	(0.0009)	(0.0009)	(0.0010)
Remittances	0.0092	−0.0115	−0.0051	−0.0278
	(0.0119)	(0.0155)	(0.0065)	(0.0189)
Manufacturing	−0.0662	−0.0336	0.0019	−0.0005
	(0.0470)	(0.1036)	(0.0364)	(0.1438)
Wald Chi^2	56.01***	32.19***	122.10***	129.50***
Hansen's J test	0.0752	2.4604	0.7751	3.8830
AR(1)		0.6804		0.9376
AR(2)		0.7681		1.1423

Note: Standard errors in parentheses. * p < 0.10. ** p < 0.05. *** p < 0. 01. Gini, urbanization, GDP per capita, FDI, and remittances are in logs.

Empirical results from various models revealed a positive and statistically significant association between urbanization and income inequality in sub-Saharan Africa. These findings hold even after correcting for potential endogeneity. Our results are consistent with results of prior studies that have shown a positive relationship between urbanization and income inequality (e.g., Chen et al., 2016; Kuznets, 1955; Kanbur & Zhuang, 2013) but contrast sharply with previous studies that have documented a

negative (e.g., Jones & Koné, 1996; Kanbur & Zhuang, 2013) or non-linear association (Liddle, 2017; Robinson, 1976; Wu & Rao, 2017). Therefore, it could be argued that the relationship between urbanization and income inequality is not a universal or a one-size-fits-all one because different countries and regions are on disparate development trajectories.

Perhaps, Sub-Saharan African governments need to look into the social dimensions of urbanization and implement public policies that meet the needs of their citizens as their economies transition into modernization (Chen et al., 2016). In particular, it is imperative for them to embark on and pursue rigorous industrialization in order to absorb low-skilled workers when they migrate to urban towns (e.g., Wu & Rao, 2017). Furthermore, because the majority of rural migrants to urban areas end up in the informal sector, public policy could target the provision of educational opportunities and access to health care and other social amenities in the rural areas. Such policies could reduce the incentive for rural people who may want to internally migrate to the urban areas (African Development Bank, 2012; Harris & Todaro, 1970). Nevertheless, these results should be interpreted with caution as we have only documented conditional correlations and not causations.

Acknowledgments

We are very grateful to the Editor-in-Chief of this journal, Professor Fariborz Haghighat, and two anonymous reviewers whose comments and criticisms have immensely helped us to refocus and strengthen the paper. All remaining errors are ours.

Appendix A

Table A1
Summary statistics.

Variable	N	Mean	S. D.	Range
Income inequality (Gini)	324	44.342	6.647	29.800–65.658
Urbanization	859	38.375	16.165	7.412–87.366
GDP per capita	838	2110.984	3123.828	122.856–20,333.940
Foreign direct investment	774	5.66e+08	1.32e+09	−7.12e+09–9.89e+09
Trade openness	780	78.656	45.596	19.101–531.737
Corruption	864	3.127	0.626	1.283–4.369
Inflation	797	48.284	877.957	−35.836–24,411.030
Remittances	679	5.98e+08	2.55e+09	0.8926961–2.12e+10
Manufacturing (% of GDP)	728	4.968	10.716	−72.231– 72.298

Table A2
Regression results showing tests for a non-linear relationship between income inequality and urbanization.

	FE Model 1a	RE Model 2a	FGLS Model 3a	DIFF-GMM Model 4a	SYS-GMM Model 6a	Semi-log Model 7
$Gini_{t-1}$				0.8052***	0.8618***	
				(0.1543)	(0.1180)	
$Gini_{t-2}$				0.0259	−0.0934	
				(0.1393)	(0.1233)	
Urbanization	−0.1412	−0.1820	0.1718	−0.7642	0.0404	−0.0006
	(1.2250)	(0.6432)	(0.4870)	(1.6040)	(0.5718)	(0.0045)
Urbanization sq.	0.1107	0.0435	−0.0146	0.0181	−0.0363	0.0000
	(0.1794)	(0.0947)	(0.0717)	(0.2174)	(0.0892)	(0.0001)
GDP per capita	−0.5853	0.0530	−0.0885	1.0447	0.6360	0.0000
	(0.7760)	(0.3386)	(0.2457)	(0.8307)	(0.4631)	(0.0000)
GDP per capita sq.	0.0339	−0.0043	0.0062	−0.0595	−0.0410	−0.0000
	(0.0514)	(0.0229)	(0.0167)	(0.0498)	(0.0313)	(0.0000)
Foreign direct investment	−0.0337	−0.0048	0.0036	0.0049	0.0006	−0.0000
	(0.0212)	(0.0097)	(0.0077)	(0.0076)	(0.0063)	(0.0000)
Trade openness	−0.0007	−0.0005	−0.0005	0.0005	0.0000	−0.0002
	(0.0012)	(0.0006)	(0.0005)	(0.0006)	(0.0006)	(0.0005)
Corruption	−0.0808	−0.0654	−0.0385	−0.0139	−0.0492	−0.0206
	(0.0945)	(0.0428)	(0.0305)	(0.0519)	(0.0426)	(0.0345)
Inflation	0.0030	0.0002	−0.0014	−0.0006	0.0001	−0.0016
	(0.0041)	(0.0029)	(0.0026)	(0.0009)	(0.0009)	(0.0027)
Remittances	0.0032	0.0081	0.0001	0.0072	−0.0067	0.0000
	(0.0201)	(0.0108)	(0.0085)	(0.0116)	(0.0069)	(0.0000)
Manufacturing	−0.0138	0.0235	0.0189	−0.0602	0.0054	−0.0012
	(0.0888)	(0.0435)	(0.0368)	(0.0469)	(0.0364)	(0.0036)
Intercept	6.1259**	3.8354***	3.7211***	−1.3081	−0.9771	3.8249***
	(2.8332)	(1.2296)	(0.9227)	(2.0699)	(1.8929)	(0.1519)
Overall R-sq/Adj-R-sq	0.0182	0.0583				0.0113
F-statistic/Wald Chi2	1.21	7.85	8.16	60.94***	127.25***	1.11
Hausman test		8.77				
N	101	101	101	84	100	101

Note: Standard errors in parentheses. * $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

References

Acosta, P., Calderon, C., Fajnzylber, P., & Lopez, H. (2008). What is the impact of international remittances on poverty and inequality in Latin America? *World Development, 36*(1), 89–114.

Adams, S., & Klobodu, E. K. M. (2019). Urbanization, economic structure, political regime, and income inequality. *Social Indicators Research, 142*(3), 971–995. https://doi.org/10.1007/s11205-018-1959-3.

Adams, R. H., & Mahmood, Z. (1992). The effects of migration and remittances on inequality in rural Pakistan [with comments]. *The Pakistan Development Review, 31*(4), 1189–1206.

Adelman, I., & Morris, C. T. (1973). *Economic growth and social equity in developing countries.* Stanford University Press.

Adelman, I., & Robinson, S. (1989). Income distribution and development. In H. Chenery, & T. N. Srinivasan (Eds.). *Handbook of development economics* (pp. 949–1003). New York: North Holland.

African Development Bank (2012). *Championing inclusive growth in Africa.* URL: . (Accessed 24 January 2018) https://www.afdb.org/en/blogs/afdb-championing-inclusive-growth-across-africa/post/urbanization-in-africa-10143/.

Alesina, A., & Angeletos, G. M. (2005). Corruption, inequality and fairness. *Journal of Monetary Economics, 52*(7), 1227–1244.

Annez, P. C., & Buckley, R. M. (2009). Urbanization and growth: Setting the context. In M. Spence, P. C. Annez, & R. M. Buckley (Eds.). *Urban and growth* (pp. 1–45). Washington, DC: World Bank.

Anyanwu, J. C. (2011). *International remittances and income inequality in Africa. Working Paper Series N° 135.* Tunis, Tunisia: African Development Bank.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies, 58*(2), 277–297.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics, 68*(1), 29–51.

Barham, B., & Boucher, S. (1998). Migration, remittances, and inequality: Estimating the net effects of migration on income distribution. *Journal of Development Economics, 55*(2), 307–331.

Barro, R. J. (2000). Inequality and growth in a panel of countries. *Journal of Economic Growth, 5*, 5–32.

Baum-Snow, N., & Pavan, R. (2013). Inequality and city size. *Review of Economics and Statistics, 95*(5), 1535–1548.

Benjamin, D., Brandt, L., & McCaig, B. (2017). Growth with equity: Income inequality in Vietnam, 2002–14. *The Journal of Economic Inequality, 15*(1), 25–46.

Bertinelli, L., & Black, D. (2004). Urbanization and growth. *Journal of Urban Economics, 56*(1), 80–96.

Blinder, A., & Esaki, H. (1978). Macroeconomic activity and income distribution in the postwar U.S. *Review of Economics and Statistics, 60*, 604–609.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics, 87*(1), 115–143.

Bulíř, A. (2001). Income inequality: Does inflation matter? *IMF Staff papers, 48*(1), 139–159.

Castells-Quintana, D., & Larrú, J. M. (2015). Does aid reduce inequality? Evidence for Latin America. *European Journal of Development Research, 27*, 826–849.

Castells-Quintana, D., & Royuela, V. (2015). Are increasing urbanisation and inequalities symptoms of growth? *Applied Spatial Analysis and Policy, 8*(3), 291–308.

Castells-Quintana, D., Ramos, R., & Royuela, V. (2015). Inequality in European regions: Recent trends and determinants. *Review of Regional Research, 35*, 123–146.

Castells-Quintana, D. (2018). Beyond Kuznets: Inequality and the size and distribution of cities. *Journal of Regional Science, 58*(3), 564–580.

Çelik, S., & Basdas, U. (2010). How does globalization affect income inequality? A panel data analysis. *International Advances in Economic Research, 16*(4), 358–370.

Champion, A., & Hugo, G. (Eds.). (2004). *New forms of urbanization: Beyond the urban-rural dichotomy*. Aldershot: Ashgate.

Chen, G., Gu, C., & Wu, F. (2006). Urban poverty in the transitional economy: a case of Nanjing, China. *Habitat International, 30*(1), 1–26.

Chen, G., Glasmeier, A. K., Zhang, M., & Shao, Y. (2016). Urbanization and income inequality in post-reform China: A causal analysis based on time series data. *PLoS One, 11*(7), e0158826.

Chen, B., Liu, D., & Lu, M. (2017). *City size, migration, and urban inequality in the People's Republic of China (No. 723). ADBI Working Paper Series*.

Chintrakarn, P., Herzer, D., & Nunnenkamp, P. (2012). FDI and income inequality: Evidence from a panel of US states. *Economic Inquiry, 50*(3), 788–801.

Demont, M. (2013). Reversing urban bias in African rice markets: A review of 19 National Rice Development Strategies. *Global Food Security, 2*(3), 172–181.

Demont, M., Rutsaert, P., Ndour, M., & Verbeke, W. (2013). Reversing urban bias in African rice markets: Evidence from Senegal. *World Development, 45*, 63–74.

Drukker, D. M. (2008). *Econometric analysis of dynamic panel-data models using Stata.* College Station: TX: StatCorp.

Duranton, G., & Puga, D. (2004). Micro-foundations of urban agglomeration economies. In V. Henderson, & J. Thisse (Vol. Eds.), *Handbook of regional and urban economics: Vol. 4*, (pp. 2063–2117). Amsterdam: North-Holland.

Fay, M., & Opal, C. (2000). *Urbanization without growth: A not-so-uncommon phenomenon. The World Bank Policy Research Working Paper Series 2412*.

Francois, J., & Nelson, D. (2003). *Globalization and relative wages: Some theory and evidence. GEP Research Paper 03/15.* Retrieved from: University of Nottingham. . (Accessed 30 July 2018) http://www.gep.org.uk/shared/shared_levpublications/Research_Papers/2003/03_15.pdf.

Gini, C. (1909). Concentration and dependency ratios (in Italian). English translation in *Rivista di Politica Economica, 87*(1997), 769–789.

Glaeser, E., Resseger, M., & Tobio, K. (2015). Inequality in cities. *Journal of Regional Science, 49*(4), 617–646.

Gollin, D., Jedwab, R., & Vollrath, D. (2016). Urbanization with and without Industrialization. *Journal of Economic Growth, 21*(1), 35–70.

Greene, W. H. (2012). *Econometric analysis* (7th ed.). Upper Saddle River, NJ: Prentice Hall.

Gupta, S., Davoodi, H., & Alonso-Terme, R. (2002). Does corruption affect income inequality and poverty? *Economics of Governance, 3*(1), 23–45.

Gustafsson, B., & Johansson, M. (1999). In search of smoking guns: What makes income inequality vary over time in different countries? *American Sociological Review, 64*(4), 585–605.

Gyimah-Brempong, K. (2002). Corruption, economic growth, and income inequality in Africa. *Economics of Governance, 3*(3), 183–209.

Hansen, L. P. (1982). Large sample properties of generalized method of moments estimators. *Econometrica, 50*, 1029–1054.

Harris, J. R., & Todaro, M. P. (1970). Migration, unemployment and development: A two-sector analysis. *The American Economic Review, 60*(1), 126–142.

Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica, 46*(6), 1251–1271.

Henderson, V. (2003). The urbanization process and economic growth: The so-what question. *Journal of Economic Growth, 8*(1), 47–71.

Herzer, D., Hühne, P., & Nunnenkamp, P. (2014). FDI and Income Inequality—Evidence from Latin American Economies. *Review of Development Economics, 18*(4), 778–793.

Jones, B. G., & Koné, S. (1996). An exploration of relationships between urbanization and per capita income: United States and countries of the world. *Papers in Regional Science, 75*(2), 135–153.

Kamoche, K. (2011). Contemporary developments in the management of human resources in Africa. *Journal of World Business, 46*(1), 1–4.

Kanbur, R., & Zhang, X. (1999). Which regional inequality? The evolution of rural–urban and inland–coastal inequality in China from 1983 to 1995. *Journal of Comparative Economics, 27*(4), 686–701.

Kanbur, R., & Zhuang, J. (2013). Urbanization and inequality in Asia. *Asian Development Review, 30*(1), 131–147.

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2011). The worldwide governance indicators: Methodology and analytical issues. *Hague Journal on the Rule of Law, 3*(2), 220–246.

Kim, S. (2008). *Spatial inequality and economic development: Theories, facts and policies. Working Paper no. 16.* Commission on Growth and Development.

Kuznets, S. (1955). Economic growth and income inequality. *The American Economic Review, 45*(1), 1–28.

Lewis, W. A. (1954). Economic development with unlimited supplies of labour. *The Manchester School, 22*, 139–191.

Liddle, B. (2013). Urban density and climate change: A STIRPAT analysis using city-level data. *Journal of Transport Geography, 28*, 22–29.

Liddle, B. (2017). Urbanization and inequality/poverty. *Urban Science, 1*(35), 1–7.

Liddle, B., & Messinis, G. (2015). Which comes first–urbanization or economic growth? Evidence from heterogeneous panel causality tests. *Applied Economics Letters, 22*(5), 349–355.

Lipton, M. (1980). Migration from rural areas of poor countries: The impact on rural productivity and income distribution. *World Development, 8*(1), 1–24.

Liu, Y., Wu, F., & He, S. (2008). The making of the new urban poor in transitional China: Market versus institutionally based exclusion. *Urban Geography, 29*(8), 811–834.

Lu, M., & Chen, Z. (2006). Urbanization, urban-biased policies, and urban-rural inequality in China, 1987–2001. *Chinese Economy, 39*(3), 42–63.

Milanovic, B. (1987). Remittances and income distribution. *Journal of Economic Studies, 14*(5), 24–37.

Nord, S. (1980). An empirical analysis of income inequality and city size. *Southern Economic Journal, 46*(3), 863–872.

Page, J. (2012). Can Africa industrialise? *Journal of African Economies, 21*, 86–124. https://doi.org/10.1093/jae/ejr045.

Pan-Long, T. (1995). Foreign direct investment and income inequality: Further evidence. *World Development, 23*(3), 469–483.

Potts, D. (2012). What do we know about urbanisation in sub-Saharan Africa and does it matter? *International Development Planning Review, 34*(1) v–xxii.

Potts, D. (2013). *Urban livelihoods and urbanization trends in Africa: Winners and losers. Environment, Politics and Development Working Paper Series.* Department of Geography, King's College London.

Rapoport, H., & Docquier, F. (2006). *The economics of migrants' remittances. Handbook of the economics of giving, altruism and reciprocity, vol. 2*, 1135–1198.

Rauch, J. E. (1993). Economic development, urban underemployment, and income inequality. *Canadian Journal of Economics, 26*, 901–918.

Robinson, S. (1976). A note on the U hypothesis relating income inequality and economic development. *The American Economic Review, 66*(3), 437–440.

Rodríguez-Pose, A., & Tselios, V. (2009). Education and income inequality in the regions of the European Union. *Journal of Regional Science, 49*(3), 411–437.

Roine, J., Vlachos, J., & Waldenstrom, D. (2009). The long-run determinants of inequality: What can we learn from top income data? *Journal of Public Economics, 93*, 974–988.

Royuela, V., Veneri, P., & Ramos, R. (2014). *Income inequality, urban size and economic growth in OECD regions. OECD Regional Development Working Papers*.

Sarkar, S., Phibbs, P., Simpson, R., & Wasnik, S. (2018). The scaling of income distribution in Australia: Possible relationships between urban allometry, city size, and economic inequality. *Environment and Planning B: Urban Analytics and City Science, 45*(4), 603–622.

Scully, G. W. (2002). Economic freedom, government policy and the trade-off between equity and economic growth. *Public Choice, 113*(1–2), 77–96.
Scully, G. W., & Slottje, D. J. (1991). Ranking economic liberty across countries. *Public Choice, 69*, 121–152.
Siddique, M. A. B., Wibowo, H., & Wu, Y. (2014). *Fiscal decentralisation and inequality in Indonesia: 1999–2008. University of Western Australia, Business School Discussion Paper 14.22*.
Stahl, C. W. (1982). Labor emigration and economic development. *International Migration Review, 16*(4), 869–899.
Stern, N. (2008). The economics of climate change. *The American Economic Review, 98*(2), 1–37.
Stern, D. I., & Common, M. S. (2001). Is there an environmental Kuznets curve for sulfur? *Journal of Environmental Economics and Management, 41*(2), 162–178.
Sulemana, I., & Kpienbaareh, D. (2018). An empirical examination of the relationship between income inequality and corruption in Africa. *Economic Analysis and Policy, 60*, 27–42.
Taylor, J. E., & Wyatt, T. J. (1996). The shadow value of migrant remittances, income and inequality in a household-farm economy. *The Journal of Development Studies, 32*(6), 899–912.
United Nations (2014). *World urbanization prospects. The 2014 revision.* New York: United Nations.
United Nations Development Programme (2016). *Africa inequality study, UNDP Regional Bureau for Africa Working Paper Series Volume 1, Numbers 1-4*.
United Nations Population Fund (2007). *State of world population 2007: Unleashing the potential of urban growth.* Washington, DC: United Nations.
Wan, G., & Zhou, Z. (2005). Income inequality in rural China: Regression-based decomposition using household data. *Review of Development Economics, 9*(1), 107–120.
White, M. (1981). Optimal inequality in a system of cities or regions. *Journal of Regional Science, 21*(3), 375–387.
Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data* (2nd ed.). Cambridge, MA: MIT Press.
World Bank (2015). *Urbanization in Africa: Trends, promises, and challenges.* URL: . . (Accessed 7 October 2017) http://www.worldbank.org/en/events/2015/06/01/urbanization-in-africa-trends-promises-and-challenges.
World Bank (2019). *World development indicators.* URL: . (Accessed 27 February 2019) https://databank.worldbank.org/data/source/world-development-indicators#.
Wu, D., & Rao, P. (2017). Urbanization and income inequality in China: An empirical investigation at provincial level. *Social Indicators Research, 131*(1), 189–214.