

Energy Transition and Migration in South Africa

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Energy poverty; electricity; fuel; panel data; rural-urban migration

Extended Abstract

Many large-scale societal transitions such as the one required to bring about an end to energy poverty in developing regions have historically been associated with urbanization (Bertinelli and Black, 2004; Bloom et al., 2008). The productivity gains associated with the density and connectivity of urban areas means that urban areas have the potential to transform poverty outcomes (and by extension - energy access) in African economies (Collier and Venables, 2016). The costs of energy-related infrastructure fall as the density of connections increases.

However, rapid urbanization also poses a significant challenge to often under-capacitated local authorities that struggle to provide services to new urban dwellers (Bos et al., 2018; Turok and Borel-Saladin, 2014). In the case of South Africa and other African countries this has resulted in a proliferation of under-serviced informal settlements on the urban periphery where a lack of energy access is compounded with a lack of access to other services and job-opportunities to result in sites of concentrated and multidimensional deprivation (de Swardt et al., 2005; Mushongera et al., 2017).

The South African government, as in the case of Kenya, has also embarked on an extensive rural electrification program in an attempt to prioritize the allocation of resources to areas where poverty is concentrated. Harris et al. (2017) suggest that the rollout of rural electrification programs coupled with role of new household formation as a result of rural-urban migration may have led to a situation where some rural-urban migrants move from serviced rural areas to un-serviced urban areas and that for this reason rural-urban migration can be associated with a decline in energy access.

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This paper presents the first analysis of the relationship between rural-urban migration and energy poverty in South Africa using panel data. We make use of a unique five wave nationally representative panel, the National Income Dynamics Study³ (NIDS), spanning a period of 10 years, and in which both migrants and non-migrants can be tracked in each wave to explore how the energy use-profiles of rural-urban migrants change with migration, compared to rural stayers.

The motivation for a focus on migration and the energy transition stems from various reasons. Firstly, the rate and scale of urbanization taking place in Southern Africa means that an accurate understanding of the energy-related implications of this process has implications for decision making regarding government electrification programs. Where, for example, should government efforts be concentrated? Secondly, individual migration – which is common in South Africa (Garlick et al., 2016) – is a process that results in a change in household composition for both the sending as well as the receiving households. As such research on migration and energy decisions tell us about household level responses to changes in household composition. Finally, an understanding of the implications of migration for the energy transition allow us to ask whether there are gains from migration, and if so, for whom (Garlick et al., 2016).

The South African case is interesting given the co-existence of both high levels of grid coverage (close to 90%) with high rates of poverty (50% poverty headcount using the government statistical agency Stats SA’s upper bound line) and high rates of traditional fuel use in rural areas. In addition, South Africa experienced a relatively early structural transformation in the African context and is also relatively urbanized by comparison (roughly two thirds of the population reside in urban areas). However, in large parts of rural South Africa, the development challenges resemble those of lower income African countries. The coexistence of these separate contexts presents potential lessons for the future of other African countries.

The NIDS data presents a hitherto unprecedented opportunity to study migration in South Africa where the post-apartheid period saw a decline in the coverage in internal migration-related questions in nationally representative surveys (Posel, 2004). In addition, the data contains valuable information related to cooking and lighting fuel use, electricity access and spending on electricity and other fuels, as well as stove type ownership. As the first national household panel study for South Africa, the NIDS data is a highly valuable source of information on the dynamics of socio-economic processes and outcomes in the country. The 2008 baseline sample of 28 000 individuals in 7300 households was designed to be nationally representative and selected using a two-stage sampling design with 400 primary sampling units (PSUs) and a target of 24 households per PSU (Brophy et al., 2018). Every two years following this, the same individuals were re-interviewed as Continuing Sample Members (CSMs).

As a general measure of energy poverty we use the Multidimensional Energy Poverty Index (MEPI), based on the Oxford Poverty and Human Development Initiative (OPHI) Multidimensional Poverty Index (MPI), proposed by Nussbaumer et al. (2012). This measure captures the different components of energy poverty, including grid access, fuel type, indoor air

³ <http://www.nids.uct.ac.za/>

pollution and the ability to make use of electrical appliances. We extend this by looking at which variables within the index drive the results.

Our empirical strategy is based on a difference in differences approach, following that of Beegle et al. (2010) and Cockx et al. (2018) (both in the case of Tanzania), but applied here to the case of energy. The use of panel data allows us to control for forms of unobserved fixed individual heterogeneity that may be associated both with both the decision to migrate and energy outcomes, such as risk aversion or fixed individual preferences. We adopt a range of approaches to control for the selection problem that is inherent to studies of migration (McKenzie et al., 2010). Firstly, we control for a range of observable variables correlated with migration to match migrants to observationally similar non-migrants in our preferred specification. In order to test the robustness of our results, we also use economic shocks in the form of remittance payments to instrument for the decision to migrate. Finally, we are able to exploit what we argue is random variation in the time of migration in the period of the panel and can thus compare the outcomes between early and later migrants, under the assumption that structural differences will become more evident over time.

We find firstly that household level energy outcomes are changing rapidly in South Africa. Using the Multidimensional Poverty Index headcount ratio, energy poverty decreases by close to 20 percentage points over the period of the panel, from close to 30% in 2008 to 10% in 2017. We find that rural-urban migration results in almost immediate reductions multidimensional energy poverty for migrants themselves, with especially dramatic reductions in the use of traditional cooking fuels. The size of these gains increases over time. We also explore how these changes vary depending on whether migrants move to informal or formal urban settings. Interestingly, the additional gains that result from migration are smaller than what might be expected, given the pace of change that is also taking place in rural areas, especially in the case of grid access and access to electrical appliances. However, while energy access in rural areas is improving rapidly, household level changes in energy use in are slower to change.

References

- Beegle, K., De Weerdt, J., Dercon, S., 2010. Migration and Economic Mobility in Tanzania: Evidence from a Tracking Survey. *The Review of Economics and Statistics* 93, 1010–1033. https://doi.org/10.1162/REST_a_00105
- Bertinelli, L., Black, D., 2004. Urbanization and growth. *Journal of Urban Economics* 56, 80–96. <https://doi.org/10.1016/j.jue.2004.03.003>
- Bloom, D.E., Canning, D., Fink, G., 2008. Urbanization and the Wealth of Nations. *Science* 319, 772–775. <https://doi.org/10.1126/science.1153057>
- Bos, K., Chaplin, D., Mamun, A., 2018. Benefits and challenges of expanding grid electricity in Africa: A review of rigorous evidence on household impacts in developing countries. *Energy for Sustainable Development* 44, 64–77. <https://doi.org/10.1016/j.esd.2018.02.007>
- Brophy, T., Branson, N., Daniels, R.C., Leibbrandt, M., Mlatsheni, C., Woolard, I., 2018. National Income Dynamics Study Panel User Manual.

- Cockx, L., Colen, L., De Weerd, J., 2018. From corn to popcorn? Urbanization and dietary change: Evidence from rural-urban migrants in Tanzania. *World Development* 110, 140–159. <https://doi.org/10.1016/j.worlddev.2018.04.018>
- Collier, P., Venables, A.J., 2016. Urban infrastructure for development. *Oxf Rev Econ Policy* 32, 391–409. <https://doi.org/10.1093/oxrep/grw016>
- de Swardt, C., Puoane, T., Chopra, M., du Toit, A., 2005. Urban poverty in Cape Town. *Environment and Urbanization* 17, 101–111. <https://doi.org/10.1177/095624780501700208>
- Garlick, J., Leibbrandt, M., Levinsohn, J., 2016. Individual Migration and Household Incomes (Working Paper No. 22326). National Bureau of Economic Research. <https://doi.org/10.3386/w22326>
- Harris, T., Collinson, M., Wittenberg, M., 2017. Aiming for a Moving Target: The Dynamics of Household Electricity Connections in a Developing Context. *World Development* 97, 14–26. <https://doi.org/10.1016/j.worlddev.2017.03.016>
- McKenzie, D., Stillman, S., Gibson, J., 2010. How Important is Selection? Experimental vs. Non-Experimental Measures of the Income Gains from Migration. *Journal of the European Economic Association* 8, 913–945. <https://doi.org/10.1111/j.1542-4774.2010.tb00544.x>
- Mushongera, D., Zikhali, P., Ngwenya, P., 2017. A Multidimensional Poverty Index for Gauteng Province, South Africa: Evidence from Quality of Life Survey Data. *Soc Indic Res* 130, 277–303. <https://doi.org/10.1007/s11205-015-1176-2>
- Nussbaumer, P., Bazilian, M., Modi, V., 2012. Measuring energy poverty: Focusing on what matters. *Renewable and Sustainable Energy Reviews* 16, 231–243. <https://doi.org/10.1016/j.rser.2011.07.150>
- Posel, D., 2004. Have Migration Patterns in Post-Apartheid South Africa Changed? *Journal of Interdisciplinary Economics* 15, 277–292. <https://doi.org/10.1177/02601079X04001500303>
- Turok, I., Borel-Saladin, J., 2014. Is urbanisation in South Africa on a sustainable trajectory? *Development Southern Africa* 31, 675–691. <https://doi.org/10.1080/0376835X.2014.937524>