Title: Dynamics of development: Infrastructure, migration and crowding
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I. Motivation for Research

Governments in developing countries must routinely make decisions about spending on infrastructure such as roads, water facilities, and electrification. To make good decisions, it is important to know how to value the benefits of infrastructure projects. A key feature of infrastructure is that it is tied to a place — and so improving roads or providing sewers or electricity to houses in some areas might induce people to move into these areas. When migration in response to a particular local infrastructure project is large, other public goods such as schools may become congested. Estimates of spatial projects' welfare benefits must take account of this congestion, too.

II. Policy Impact

Our research provides better methods for estimating the value of infrastructure projects. These methods will help policymakers better allocate scarce funds to the most valuable projects.

III. Audience

Economists and policymakers involved in designing and allocating resources for infrastructure projects.

IV. Policy Implications

- Estimates of the welfare benefits of infrastructure must explicitly account for migration responses to infrastructure projects, because more people imply more congestion in other public goods.

Suppose that a government improves the quality of some areas by providing electricity to households there. If people migrate into these areas, the local schools may become more crowded unless the government builds more schools and provides more teachers at the same time. We show empirically that exactly this outcome occurred after a household electrification project in rural KwaZulu-Natal, South Africa: Employment rose as electrification freed up time previously devoted to household production, but there was massive in-migration, and household density, household size and student-teacher ratios all rose. To accurately value the electrification program, we cannot look only at the rise in employment but must also take account of crowding in public goods. On net, we find that in the South African case, migration wiped out 96% of the benefits of rural household electrification.

[1] The views expressed herein are those of the authors and not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.

- The structure of the land market affects the extent of migration: with no land markets, more people move to take advantage of the infrastructure, reducing the project's benefits.

We use a simple location-choice model to show that the property rights regime of the area that receives the infrastructure affects the size of the migration response. When land is communally owned and not traded, migration in response to a project is higher, creating additional congestion costs in inelastically supplied public goods. However, in-migrants do not fully internalize these congestion costs — since there is no market for land, rising land prices cannot signal that in-migration causes crowding.

The role of land markets in preventing inefficient in-migration is an important and under-recognized point and suggests that planners may want to consider the form of land rights in an area before committing to infrastructure projects. Interestingly, when we examine an electrification project in Brazil, where land is much more likely to be priced than South Africa, we find a much smaller migration response — although other factors may, of course, also be responsible for the difference between South Africa and Brazil.

- Although developing countries often have poor-quality land price data or missing land markets, it is still possible to place bounds on the welfare impact of a local infrastructure program using estimates of the income and population responses to the program.

Our research provides a new framework for evaluating the welfare impacts of local infrastructure programs in rural settings that takes into account the migration response and that can be used either when there are complete markets but poor-quality land price data or when there are no markets for land. We show that the welfare effect of an infrastructure program depends on the program's effect on incomes and population and on the strength of preferences for consumption goods relative to local amenities. Researchers can easily measure each of these components using standard econometric methods and data on incomes and migration. No data on land rents are required to implement our formulae. This is an important feature because methods to estimate the welfare impacts of local programs that come from the urban economics literature rely on having high-quality data on wages, population and land rents. The need to measure rents is challenging for policy-makers in poorer countries to implement because land price data are often of poor quality, and land prices may not even exist (e.g., when land is communally owned).

- If governments anticipate large migration responses to infrastructure programs, they may want to invest in several forms of infrastructure at once.

By bundling investments in multiple forms of infrastructure — for example, by building roads, schools, clinics and electric lines at the same time — policymakers may be able to mitigate some of the congestion that a stand-alone infrastructure project would otherwise cause.

V. Implementation

The main message of our research is that it is possible to learn about the welfare impacts of rural infrastructure projects with the right sort of data, and a flexible modelling framework. We do not think it is possible to generalize from the South African or Brazilian case to other country contexts; rather, we would urge policy makers to collect the data necessary to implement our empirical framework with existing infrastructure projects, and before they decide how to allocate infrastructure funds going forward.

We believe that the important barriers to actually implementing our framework relate mainly to data accessibility. The specific action points we would recommend in order to estimate the welfare impacts of a program include:

- Collate accurate and timely administrative data on the location (GIS coordinates) and timing of specific infrastructure rollouts (energy, or water, or schools, or clinics etc). If possible, construct a comprehensive databases of past projects (timing and location) in order to learn about the impact of historical projects
- Combine these project level data with other data sources (household surveys, or Census data) that will allow you to measure (1) population changes in areas getting access to infrastructure and in areas not getting new access; (2) income changes in the same types of areas
- Work with a local researcher to use these data along with our estimating equations (for population and income effects of a program) to estimate welfare effects of specific infrastructure projects. This local researcher may need to tweak our model in order to reflect the exact way that a particular infrastructure affects a rural location (e.g. through a productivity shock, or purely through a consumption channel)
- Provide these estimated welfare effects to local planning agencies so that they can incorporate these estimates into future plans about how to prioritize funds for various infrastructure projects

VI. Dissemination

- South African National Planning Commission (and similar planning commissions in countries like Kenya, Ghana, and Nigeria)
- South African National Treasury
- Development Bank of Southern Africa
- World Bank researchers and project coordinators associated with Rural and Urban Development

VII. Further Readings

Dinkelman, Taryn and Sam Schulhofer-Wohl. 2012. "Welfare effects of location-based development programs in the presence of migration," Working Paper.

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Lipscomb, Molly, Ahmed Mushfiq Mobarak, and Tania Barham. 2011. "Development effects of electrification: Evidence from the geologic placement of hydropower plants in Brazil." Mimeo, Yale University.

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