

# Research Digest



PHOTOGRAPH BY STEVE NIEDORF

Sam Schulhofer-Wohl

## Tragedy of the commons

*Measuring the unintended consequences of infrastructure projects in developing countries*

The benefits of government infrastructure projects in developing countries are obvious: Irrigation systems increase crop yields; schools produce educated, productive citizens; health clinics and sewage treatment plants enhance wellbeing. What isn't so evident—in large part because it's difficult to measure—is what happens when people flock to an area to take advantage

of these benefits. New infrastructure may raise incomes and improve quality of life, but it may also put pressure on other community resources such as housing or transportation.

To measure the “congestion” effects from migration, economists typically use land prices as a proxy; new arrivals invariably drive up rents. But reliable price data simply aren't available in many parts of the world. Recent research by Taryn Dinkelman, an economist at Dartmouth College, and Sam Schulhofer-Wohl, a senior research economist with the Minneapolis Fed, demonstrates an alternative method for gauging often overlooked migration effects in less-developed countries.

In “Migration, Congestion Externalities, and the Evaluation of Spatial Investments”

## Research Digest

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(Minneapolis Fed Working Paper 700, online at [minneapolisfed.org](http://minneapolisfed.org)), the economists use population growth as a yardstick for congestion and find that the impact of migration can be considerable, especially in areas where land is not priced. Rural South Africa is a case in point; in studying the consequences of an electrification project in that country, Dinkelman and Schulhofer-Wohl estimate that congestion effects, including crowded settlements and schools, cut the project's per capita benefits in half.

### If you build it ...

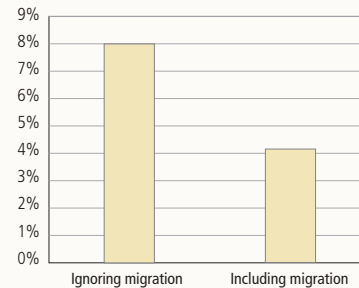
The notion that congestion can diminish the benefits of location-specific infrastructure programs is well established, although migration effects have received less attention than direct, positive outcomes of those programs, such as higher incomes and improved health. A new public amenity like a hospital or a water treatment plant will continue to draw people until crowding of other shared public resources becomes so severe

that in-migration ceases. "That intuition is pretty well understood in economics," Schulhofer-Wohl said in an interview. "The challenge is how to measure that effect."

To investigate the welfare impact of migration, the economists develop a model in which infrastructure upgrades in a rural area induce people to move there from the city. The government-funded facility raises local incomes (by allowing women to work outside the home, for example), but also increases the population—and demand for other public goods such as subsidized housing, schools and bus service.

Unlike standard analytical methods, the model doesn't rely on land prices to estimate the impact of migration on welfare. Instead, the model looks at income and population data to determine the net effect of infrastructure improvements. "The existing methods work if there is a land market and you can observe the prices," Schulhofer-Wohl said. "What we contribute is how to analyze these programs if either

Welfare effect, per capita, of rural electrification program\*



\*As a percentage of income after program is in place, for people who lived in the program area before it was implemented

there's a land market but you can't observe the prices, or there isn't a land market"

That is the case in many rural areas of developing countries, including Dinkelman's native country of South Africa. Large expanses of that country are state owned or communally held and are allocated based on tribal or family ties.

To put their model to the test—and illustrate the importance of migration in assessing the worth of infrastructure projects—the researchers analyze a government electrification project in KwaZulu-Natal (KZN), a South African province with high unemployment and no land market. The project extended electrical service to about 200,000 households in the late 1990s, and the primary impacts on labor market outcomes were documented by Dinkelman in a 2011 paper.<sup>1</sup>

# Research Digest

## Welfare drain

Electrification in KZN increased employment, raising average incomes; but it also led to dramatic population increases in comparison with communities that didn't receive electrical hookups. One outcome of population gain was crowded schools; student-teacher ratios rose by two-thirds relative to villages that remained off the grid.

To calculate the net per capita welfare impact—the degree to which congestion effects offset income gains—the economists feed into their model summary income and Census data gleaned from over 1,800 rural KZN communities. The output of the model is the monetary value of the project to residents, measured as a fraction of monthly income. It turns out that when congestion effects are accounted for, roughly half of that value—the per capita welfare gain from the electrification project—disappears (see chart). Thus, the study “provides the first empirical evidence from a developing-country context that congestion effects exist and can be quantitatively large,” the researchers write.

The model also shows that migration undercuts the benefits of infrastructure projects the most in places like rural South Africa that lack a functioning land market. Without rising land prices to signal increasing congestion, people

*Dinkelman and Schulhofer-Wohl see “broad relevance” for their model in gauging the costs and benefits of infrastructure projects in developing countries, where people are becoming increasingly mobile.*

keep moving into the rural area, consuming more communal land and other public goods and reducing welfare gains for all—an outcome that the researchers view as a version of a tragedy of the commons. Migration exacts a lower toll in areas with land markets because congestion is less severe, and landowners benefit from higher rents.

## Accounting for mobility

Dinkelman and Schulhofer-Wohl see “broad relevance” for their model in gauging the costs and benefits of infrastructure projects in developing countries, where people are becoming increasingly mobile. In some cases, the net benefits of such programs may be less than supposed, because of resulting strains on public resources that are slow to respond to population inflows.

In areas without land markets or reliable price data, a means of quantifying congestion effects could help planners mitigate welfare losses—by spreading out projects,

for example, or simultaneously expanding other public services such as schools or health clinics.

“Our hope is that people will use our work as a building block to be able to account for migration in evaluating these programs,” Schulhofer-Wohl said.

—Phil Davies

<sup>1</sup> Dinkelman, Taryn. 2011. “The effects of rural electrification on employment: New evidence from South Africa.” *American Economic Review* 101 (7): 3078-3108.