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Rural–Urban Linkages, Public Investment and Transport Costs: The Case of Tanzania

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Summary. — The economy of Tanzania, like those of many other sub-Saharan African countries, displays strong geographic and locational disparities. We develop a three-location spatial applied general equilibrium model calibrated to the 2001 Tanzanian Social Accounting Matrix to examine the impact of various public investment programs on household welfare across this diverse geography in which production and consumption are locationally specific and transport costs support equilibrium price differences across locations. We examine how different public investment packages combined with reforms in the transport sector alter the equilibrium structure and location of economic activity. The choice of financing arrangement matters for welfare, since tax incidence, relative price, and real exchange rate movements are non-neutral. We show that the distributional consequences of alternative investment programs may matter more in terms of household welfare than the direct consequences of targeting investment to particular sectors or locations. For instance, under some financing scenarios, interventions that aid agriculture may lead to decreases in the welfare of the rural unskilled labor force, because the financing mechanisms create distortions that effectively skew the terms of trade sufficiently powerfully against the rural unskilled as to outweigh the direct welfare-enhancing effects of the public investment. We also note that welfare gains are generated by the movement of rural workers out of quasi-subsistence agriculture into higher productivity jobs in other sectors and locations.

Key words — structural transformation, Africa, Tanzania, applied general equilibrium, public investment, public finance

1. INTRODUCTION

Tanzania's economy, like those of many other sub-Saharan African countries, displays strong geographic and locational disparities. In a stylized sense, it can be thought of as consisting of several distinct components, spatially separate and imperfectly connected. The capital, Dar es Salaam, is a vibrant urban economy with a strong government presence; given its location as a port on the Indian Ocean, it is reasonably well integrated into the global economy. At the opposite extreme, many interior rural regions are heavily agricultural and are poorly linked to national or global markets. Households in these rural areas consume much of what they produce, and they produce much of what they consume; they sell modest fractions of their agricultural output and purchase manufactured goods and services. In between the urban economy of Dar es Salaam and these quasi-subsistence rural regions lies a mixture of secondary cities, market towns, and well-connected commercially oriented rural areas. They have better access to markets in Dar es Salaam and the rest of the world than do the more remote rural areas, although they still face consequential transport and transaction costs with respect to those markets.

These spatial patterns are associated with corresponding differences in the patterns of production and consumption. They also are associated with substantial differences in prices, wages, and living standards. The spatial disparities create a variety of seeming paradoxes: an economy that is simultaneously open (in Dar) and closed (in rural areas), with respect to world trade; an economy that is subsistence oriented coexisting with one that is highly commercial; and an economy in which people are free to migrate but in which there are substantial differences in standards of living across locations.

Within an economy like this, public investments targeted to different sectors or locations can have different effects on national income and on welfare. This paper uses an applied general equilibrium model to explore the impact of a set of government policies on household welfare, taking seriously the spatial and sectoral differentiation of the Tanzanian economy. In particular, we focus on public infrastructure investments that may differentially affect the agricultural sector and on reforms that directly reduce transport costs. The model, which is calibrated to Tanzania's 2001 Social Accounting Matrix, pays particular attention to inter-regional transaction costs and rural–urban linkages. We view the resulting model as occupying a middle ground between a highly stylized but equally transparent model (as in Gollin & Rogerson, 2014) and the highly detailed CGE models sometimes used for policy analysis, such as the 58-sector model deployed in Pauw and Karl (2010). The former are perhaps too stylized to be useful for realistic policy analysis, whereas the latter by necessity build in a high degree of structure that limit their usefulness in thinking about policies that might alter the underlying organization of the economy.

Our model generates a set of stylized but important insights. We show how different programs of investment generate substantially different impacts on the economy and also have different effects on the well-being of unskilled workers. In general, we find that the benefits of public investment are often felt in sectors other than those that are the primary target of the interventions. For example, although a large fraction of the unskilled labor force resides in rural areas and works in agriculture, we find that increasing public investment in the agricultural sector generally does not improve the well-being of those unskilled workers who remain in agriculture. It does, however, result in an outflow of workers from agriculture to

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other sectors. Similarly, we show that increased public investment in urban areas, particularly in secondary cities, may lead to welfare benefits for rural households.

The second key message from the paper is that the poverty impacts of different interventions are highly sensitive to the ways in which these are financed. As in Adam and Bevan (2006) and Adam and Bevan (2014), outcomes are sensitive to government choices with respect to financing mechanisms. In our analysis, interventions can be financed through taxes or other forms of domestic revenue collection (e.g., tariffs). Alternatively, they can be financed through aid inflows—essentially gifts from abroad—or "deficit financed" which entails the direct crowding-out of private investment. All of these sources of finance create impacts on the economy and on the distribution of well-being. Taxes create obvious effects on the absolute and relative well-being of different households and locations through differential incidence; the same is true for tariffs. Foreign assistance appears at first glance to be relatively neutral as a source of financing, but the capital inflows associated with foreign aid lead to exchange rate effects and relative price effects that can impact the poor. We argue that the choice of financing arrangement, no less than the location or sector in which the public sector invests, will affect income distribution, and by extension the poverty impacts of public policies.

A third finding of the paper is that we estimate the potential welfare gains associated with interventions that *directly* reduce the transport costs that sustain the disintermediation of the economy. While it is impossible to accurately cost these interventions in the context of our stylized model, we show that reduction in the transport cost wedge directly accelerates processes of structural transformation. This process may be complicated, however, if transport costs represent rents to monopoly providers. In this case, policy reforms have potentially large effects on the pattern of domestic demand; the "pure" gains from transport cost reductions are mediated by the loss in rents to the transport sector.

Finally, we note that an important channel for these effects is through the sectoral and regional reallocation of labor. This finding is consistent with numerous recent papers suggesting that structural transformation and migration are important channels for welfare improvement—as opposed to increases in income for workers within sectors; e.g., Beegle, de Weerdt, and Dercon (2011) and Christiaensen, de Weerdt, and Todo (2013). Different interventions may lead low-skill workers to move across sectors or regions. Where there are important sectoral differences in income or productivity (e.g., Gollin, Lagakos, & Waugh, 2014; Young, 2013), sectoral movements have the potential to increase output and income considerably. Such welfare gains can easily be overlooked in household surveys that maintain constant sampling frames and do not track individuals or households that migrate.

2. BACKGROUND

Tanzania is a country with strong spatial patterns of economic activity. Almost 80% of the population lives in rural areas and approximately the same proportion of the labor force works primarily in agriculture. Most households depend for their livelihoods on farming small plots of land, where they primarily produce food for home consumption. Small amounts of food (and non-food agricultural goods) are sold to market. Productivity in the agricultural sector is generally very low. Agriculture's share of GDP is estimated at 45%, which implies—if the numbers are taken at face value—that output per worker in agriculture is only about one fourth as high as in the rest of the economy. [1] This translates into large differences in urban–rural levels of poverty and deprivation. For instance, the poverty incidence in Dar es Salaam is one third of that in Singida (one of the more remote regions) while under-5 child mortality varies from a low of 58 per 1,000 in Arusha to more than four times that in Mbeya. [2] Confronted with large differences between urban and rural areas in poverty and well-being, standard economic models predict that there should be rapid movement of people across locations. While rural–urban migration has been an important feature of the economy, the pace has not until now been sufficient to equalize social or economic outcomes across regions. In this paper, we focus on the role of transport costs in sustaining these large differences in outcomes.

(a) *Evidence on transport costs*

Tanzania's roads and transport system are arguably better than those found in some other parts of sub-Saharan Africa, but nonetheless large fractions of the country's area and population are poorly served by the road network. Aggregate data show that the density of paved roads was well below the norm for low-income countries, with 47 km of paved roads per 1,000 km^2 of arable land, compared to the average for low-income countries, which was 87 km/1,000 km^2, and for middle-income countries, which was 507 km/1,000 km^2. [3] In spite of the low density and low quality of roads, almost all goods move by road. Although major trunk roads are adequate, minor roads and rural roads can be poorly maintained and impassable at certain times of the year. As a result, many of the country's rural areas are substantially remote from markets. This affects the opportunities that farmers have to sell their products, and it also influences the prices that rural households pay for goods purchased from other parts of the country. Even Tanzania's secondary cities can face substantial transport costs, creating large price wedges with respect to markets in Dar es Salaam.

Although the economy is nominally open to food imports, relatively small fractions of staple foods are imported. For example, Tanzania imports less than two percent of its maize and is almost entirely self-sufficient in virtually all agricultural commodities. Prices throughout the country co-move across locations, suggesting a reasonably high degree of cross-market integration; but there are nevertheless large price wedges across markets.

Derksen-Schrock, Anderson, and Gugerty (2011) cite data showing that nearly two-thirds of Tanzanian farmers sell their produce from the farm gate rather than carrying it to a nearby market, largely because of the high transaction and transportation costs. Since many farmers have very small marketable quantities, the returns from carrying these quantities to market are limited, and the travel time and expense are effectively fixed costs. Moreover, historically, large numbers of farmers have found themselves with "stranded" crops that they were unable to market because of transportation failures at key moments. Anecdotally, this problem remains today; during the rainy season, farmers in some parts of the country may be effectively cut off from markets. This affects crop choices (reducing the attractiveness of perishable fruits and vegetables, for example) and input use, as well as the profitability of harvested commodities.

There are no straightforward ways of measuring transport and transaction costs. Traders and those involved in the physical movement of goods may have strong incentives to underreport the prices and margins that they charge. Cross-location

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