"Farther on down the road: transport costs, trade and urban growth in sub-Saharan Africa" (extended abstract)

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Abstract

In this paper, I seek to determine the effect of changing transport costs on growth in a sample of over a thousand hinterland cities with and without manufacturing in 36 sub-Saharan African countries. Specifically, I consider whether periphery cities with lower transport costs to their country's primate city grew faster than those further away or with poorer road connections, in the context of dramatically rising oil prices between 2003 and 2008. This is an empirical implementation of a new economic geography (NEG) model in a geographic context where they have been rarely used, using newly available data on transport networks and proxies for city economic activity.

This paper investigates the growth of periphery cities in the context of intercity and international trade in sub-Saharan Africa. Despite a great deal of attention paid to the largest cities like Lagos, Kinshasa and Nairobi, 61% of African urban residents lived in cities of less than 500,000 as of 2000, and this percentage is expected to remain high over the next couple of decades (NRC 2003). There were only 5 sub-Saharan countries (Liberia, South Africa, Togo, and both Congos), in which the majority of 2005 urban residents were in urban agglomerations with a 2007 population of more than 750,000. In most countries, smaller cities are also growing faster (United Nations 2008).

In many countries, though, a large city or core region, often a port, plays a very important role in the national economy, as the largest domestic market, the main manufacturing center, and the primary trading connection with the rest of the world. Other cities in the periphery have relationships with their country's core that are potentially critical to their success. And countries spend to improve those links. Almost $7 billion is invested per year on roads in sub-Saharan Africa, with a significant portion funded by donors (World Bank 2010).

In this paper, I seek to determine the effect of changing transport costs on economic output in hinterland African cities with and without manufacturing. Specifically, I consider

whether periphery cities with lower transport costs to their country's primate city grew faster than those further away or with poorer road connections, in the context of dramatically rising oil prices between 2003 and 2008. This is an empirical implementation of a new economic geography (NEG) model in a geographic context where they have been rarely used. In general, I hope to gain some insight into what has driven urban growth on the continent over the past two decades, and where some 800 million new city-dwellers over the course of the next 40 years might live.

New economic geography (NEG) theory, following Krugman (1991), provides a relevant starting point two-city framework for studying this development. Krugman's original model implies that when transport costs are sufficiently low, manufacturing will agglomerate in one city. In this literature, the site of agglomeration is often known as the core, while the other city is the periphery. An extension in Fujita, Krugman and Venables (2001) adds agricultural transport costs to this model. When these are fixed as proportional to manufacturing transport costs, the results are similar to what is found in the original model. Behrens, Gaigné, Ottaviano and Thisse (2006) add a foreign sector, accessible only through one of the two domestic cities (the core), but the resulting comparative statics on domestic transport costs are similar.

In each of these models, however, the periphery city gains or loses based on its manufacturing sector - the residual agricultural sector is fixed in place. If the periphery city has minimal manufacturing, but is more of a market center for exchanging manufactured goods imported from the core with agricultural products from nearby rural areas, then decreased transport costs will not bring increased competition with core manufacturing. Instead, they will increase exports of rural agricultural goods that are otherwise not sold (or even grown) by credit-

constrained farmers in the absence of an export market, and increase imports of manufactured goods, including agricultural inputs, in exchange.

I build a variant of the Behrens, Gaigné, Ottaviano and Thisse (2006) model to investigate the relative importance of these different channels. I then test it using annual satellite data on lights at night as a proxy for economic activity in over a thousand individual cities and towns in 39 countries, following a methodology similar to Henderson, Storeygard and Weil (2009), and transport costs between each city and its country's core. As oil prices increased over the course of the last decade, I expect that transport costs increased more for cities further away from their country's core, and for cities connected by worse roads. Thus, static network distance and road quality measures interacted with the exogenous oil price increase identify the differential change in transport costs faced by near and far cities. I expect that among most periphery cities without significant manufacturing, the less-connected will experience a relative loss in economic activity. This effect may be mitigated or even reversed in cities that do have manufacturing, if they have enough of a home market.

Base transport costs are measured using both road length and road-quality measures. Rudimentary national statistics like road density and percentage of roads paved, which are typically used in cross-national studies, fail to capture the role of roads in connecting cities. A recent World Bank project on infrastructure in Africa has dramatically improved the state of roads data for the continent (World Bank 2010). The most comprehensive previous database, the Digital Chart of the World, is a declassified US military product combining data of unknown quality from four decades. The World Bank dataset combines information on road location, surface material and quality assigned to a specific (and recent) year from each country's transport ministry or equivalent. For each city, I generate the shortest path to the national primate city. I

then calculate the distance travelled on the path in each of 20 categories (5 quality levels X 4 surface classes), which will be combined nonparametrically in regressions.

In order to decompose growth effects into population increases and growth in income per capita, I have also gathered city population data. However, because these are generally only available from censuses carried out every 10 to 15 years, they cannot directly address the period of rising oil prices – they can only provide a longer-term baseline in some countries.

I use the World Bank enterprise surveys to characterize a minimum set of cities with substantial manufacturing. These surveys also have some evidence on where firms' customers are located.

The theory described above applies most obviously to a country with one primate city that is also its main port. In my empirical work, I will have to consider how to treat countries like South Africa that have multiple cores. Major oil producers and landlocked countries may also require special treatment. I will also account for the role that tariff changes, especially those related to the African Growth and Opportunities Act (AGOA) and Everything But Arms (EBA) arrangements introduced by the United States and the European Union, respectively, may have played during this time period (Collier and Venables 2007).

Of course, there is another channel through which oil prices might affect lights directly. Power plants in some countries are fueled by oil (and gas, which also faced a significant price increase). So I will consider whether any relationship I find is stronger for places where fossil fuels are used instead of hydropower, using a database of power plants in Africa, by type (hydroelectric or fossil fuel), size and location (World Bank 2010).

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