Cattle, Steaks and Restaurants: Development Accounting when Space Matters

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Abstract

Productivity is much lower in poor countries than in rich ones (REFS). To understand the fundamental causes of productivity differences, it is important to identify the sectors in which these differences are greatest (REF). Several recent papers have studied the sectoral composition of productivity differences by using data on sector-level prices (REF). The main result is XXX. Intuitively, prices are XXX

We revisit the measurement of sectoral prices and sectoral productivity in a macro model where land and location play a role. A high price in one sector may simply reflect high rents accruing to a non-reproducible input, land. For example, the fact that restaurants are expensive in New York City has more to with high rents, and may not imply that NYC restaurants are inefficient. Rents are, in turn, determined in general equilibrium, and may respond to demand for land in other activities, such as finance, culture and housing in the NYC example.

We build a multi-sector general equilibrium model. Each sector uses labor (or a composite of other spatially mobile inputs) and land. The location of sectors is determined in the canonical von Thünen city model. XXX DESCRIBE MODEL

Our model yields a simple spatial equilibrium in which agriculture ("cattle") locates farthest away from the center, manufacturing ("steaks") occupies a ring outside the center, and services ("restaurants") are in a central circle.

There are two reasons why development accounting in our model is different from models without land. First, as some sectors are more land intensive, their prices may be more sensitive to rents. Because of this, conditional on productivity, agricultural prices will be relatively higher in rich countries. Second, because sectors endogenously choose locations, their price is also affected by the rent gradient: the speed with which rents decline in distance from the city center. Urban sectors will be relatively more expensive in countries where the rent gradient is higher.

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To quantify the importance of these two mechanisms, we calibrate our model to match the spatial distribution of economic activities in the U.S., and the share of sectors in each country.

1 A model of industry location

1.1 Technology

Output in sector i at location z depends on capital, employment and land used at that location,

$$Q_i(z) = A_i K_i(z)^{\alpha_i} N_i(z)^{\beta_i} L_i(z)^{1-\alpha_i-\beta_i}.$$

Sectors differ in their capital and labor shares α_i and β_i and Hicks neutral productivity shifter A_i.

All products are sold and consumed at a single location, the central business district. This is location $z = 0$, so that z indexes distance to the center.

1.2 Shipping

To ship a product to the center, one has to incur shipping costs. If a unit of product i leaves location z, only

$$e^{-\tau_i z}$$

units arrive at the center. This is akin to the iceberg assumption of fixed costs. Sectors also differ in the intensity of shipping costs τ_i.

1.3 Worker–consumers

Workers can choose their location freely. Workers have only labor income (landlords are absentee). They consume goods and services in the center and housing services locally, combining them in a Cobb–Douglas fashion. The utility-based price index of a consumer at location z is

$$P(z) = R(z)^{\gamma_0} \prod_i P_i(0)^{\gamma_i},$$

where $R(z)$ is rent at location z and $P_i(0)$ is the price of good i in the center.

Free mobility ensures that real wages are equalized across locations,

$$\frac{W(z)}{P(z)} = W_0.$$

2 Data and calibration

2.1 Sector gradients

We use the 2010 ZIP Business Patters of the U.S. Census to determine the location of sectors in the United States. We use this to calibrate transportation costs and XX.

The ZIP Business Patterns contains the number of establishments in employment size categories in each ZIP code for each 6-digit NAICS code. We merge NAICS codes into agriculture, manufacturing and services as follows. XX TO DO.

To map the model into the data, we need to specifiy how far each ZIP code is from the city center. We take Metropolitan Statistical Areas (MSAs) as independent monocentric cities, and we assign the central point to the business center of the first-mentioned city in the MSA. For example, the center of "New York–Northern New Jersey–Long Island, NY–NJ–PA MSA" is the corner of Broadway and Chamber St in downtown Manhattan, whereas the center of "Boston–Cambridge–Quincy, MA–NH MSA" is 1 Boston Pl.

We calulcate the distance of each ZIP code to business center of the nearest MSA.