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Transport and Work Development and Impediments

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Abstract – Based on the recent World Bank urban transport strategy review "Cities on the move", the paper examines the critical differences between the urban transport problems facing cities in the developing and industrialized worlds. Premature congestion and deteriorating environmental safety and security conditions are seen as endemic in the developing country cities. Although the proportion of urban space devoted to movement is often relatively low in the developing world, rates of motorization are seen to be not untypical of those experienced in industrialized countries at similar average income levels. Hence rather than explaining the differences primarily in terms of natural endowments, the paper emphasizes the different and weaker policy and institutional contexts in which urban transport is typically performed in developing countries. It argues that the industrialized world, and particularly the multilateral banks and aid agencies, can make their most effective contribution to development by concentrating on assisting developing countries to overcome these institutional impediments to successful urban development.

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1. INTRODUCTION

In many developing countries, employment in the agriculture sector is very high relative to that in the developed countries. Globally, the poorest 5% of the countries have about 86% of their labor force in agriculture, whereas the richest 5% have less than 5%. In the process of development, economies experienced significant movements of labor from agriculture into modern sectors. The notion that economic growth and development has been associated with significant movements of labor out of agriculture and into manufacturing and services (structural transformation) has been put forward starting with Clark (1940), Kuznets (1966), Rostow (1959) and Chenery and Syrquin (1975). More recently economists have focused on structural transformation in the context of multi-sector models in order to present a more nuanced explanation of differences in productivity and growth rates across countries. This literature has emphasized, on the one hand, differences in productivity across agricultural and non-agricultural sectors1 and, on the other hand, barriers to structural transformation that include costs of transportation, of skill acquisition, and cultural factors. In this paper, we develop a general equilibrium model that incorporates both productivity differences and some empirically prominent barriers to the transformation of the economy from one where subsistence agriculture is dominant to one where modern sectors play a more significant role. In what follows, we construct a three-sector model with traditional subsistence agriculture, modern agriculture, and a non-agricultural sector (manufacturing and/or services). Agricultural goods are produced in the rural sector, whereas manufacturing and services are produced in the urban areas. Our setup differs from existing ones along a number of dimensions. Perhaps most importantly,

we bring together two stands of the recent literature. The first of these emphasizes the role playe by barriers to goods mobility, such as transportation costs for the movement of labor out of agriculture. Herrendorf et al. (2012) study the effect of the construction of railroads in the US during 1840-1860, and find that the associated reduction in transportation costs lead to settlement of the most fertile land in the Midwest, and a reduction in the agricultural labor force. Adamopoulos (2011) shows that transportation costs can lead to low aggregate output per worker, by reducing productivity within sectors and distorting allocation of resources across locations and between sectors. He analyzes the effect of cross country transportation cost disparities and finds that improvements in transportation productivity would have an asymmetric result on the poor and developed countries, with the former gaining more. Gollin and Rogerson (2014) allow for heterogeneity in agriculture through differences in the costs of transportation. They carry out some numerical exercises matching the parameters of their model to a typical sub-Saharan economy and find that transportation costs are quantitatively important in terms of both allocations and welfare.

2. TODAY'S TRANSPORT CHALLENGES CREATE AN URGENT NEED FOR ACTION DEMOGRAPHIC CHANGES AND MORE VEHICLES ARE PLACING NEW DEMANDS ON EXISTING NETWORKS

Many transportation systems are facing rising demand driven by increased urbanization of populations. Over the past decade, the biggest migration of Americans has been to cities with between 100,000 and 1 million residents.5 Many of these cities are less than prepared to deal with this influx of individuals and, as a result, are struggling to manage these busier transport networks. But not all cities are facing the same challenge. Chicago and Detroit, for example, are actually experiencing population declines, and cities with populations greater than 10 million suffered a 10 percent rate of outmigration over the last decade.6 This declining demand exacerbates existing revenue problems. Whether populations are increasing or declining creates a challenge for transportation providers in terms of maintaining an efficient and productive transport system in the face of population changes. In tandem, over the last 20 years, there has been substantial growth across all transport modes and, therefore, more vehicles and vessels using the transport network (see Figure 2). All these additional vehicles and vessels competing for limited capacity on the transport network create a challenge for transport providers trying to efficiently manage the network and balance demand and capacity.

3. THE MODEL

3.1 Firms

A typical assumption made in the literature on structural transformation is that agricultural sector is the traditional one and manufacturing and services are the modern ones without taking into consideration the heterogeneity of production technologies in the economy. In contrast, we assume that even though the non-agriculture good is produced only with modern technology, there are two available technologies for producing the agricultural good: a subsistence/traditional and a modern one.4 Thus modern technology could be used in either modern agriculture or non-agriculture sector, and in what follows, we suppose that education is a barrier to adopting modern technologies. Firms take the technology that they can use as given. Farms in the subsistence sector use unskilled labor as the only factor of production. Letting population be equal to a mass *n* and educated workers equal to a mass ne yields the unskilled workers to be equal to n − ne. Assuming a constant input-output coefficient of 1/Au, the output, Y A

u , of "food" by the subsistence agriculture sector is then given by:

Yu = Au (n − ne) (1)

Competitive firms produce food in themodern agriculture sector by combining intermediate inputs z and a fraction _ of skilled labor in a CRS Cobb-Douglas form:

Yn = An(_ne)_z1−_ (2)

Intermediate inputs are produced by competitive firms in the manufacturing sector which operate in the urban area and are subject to iceberg transportation costs _, such that farms in modern agriculture pay effectively p(1 + _), where *p* is the relative price ofmanufactured good in terms of food. Firms in modern agriculture choose the optimal amount of intermediate inputs and labor used in modern agriculture tomaximize profits Yn − wnnn − p(1 + _)z (where nn := _ne). The solution of this problemyields the following first-order conditions

p(1 + _) = (1 − _)Ank−_ (3)

wn = _Ank1−_, (4)

where we define the capital-labor ratio k as k := z/(_ne).

Note that the total amount of labor in agriculture is na = n − ne + _ne.

The only input of production in themanufactures sector is skilled labor: Ym = Amnm (5)

where subscripts m denote manufactures and nm = (1 − _)ne. Firms in manufacturing choose the optimal amount of skilled labor tomaximize profits pYm−wmnm. The solution of this problemyields the following first order condition: wm = pAm.

We also impose the condition that MPL in modern sector is always higher than in traditional agriculture, with the result that skilled workers will choose to work only in the modern sectors. We also note that wages in the modern sector do not have to be necessarily equal.

3.2 Households

All households consume food and manufactured goods according to the same non-homothetic utility function, and differ only in the budget constraint that they face. Their preferences are given by

u(cAj, cMj) = _ln(cAj− cA) + lncMj (6)

where cA > 0 denotes the subsistence level of food consumption and _ > 0 is the relative weight of food in preferences. Finally, cAj

denotes individual consumption of food and cMj denotes individual consumption of manufacturing good (j = m, u, n). This formulation yields an income elasticity of food demand that is below one. Let m, n, u represent households that live in urban areas and work in the manufacturing sector, that live in rural areas and work in the modern agriculture sector, and that live in rural areas and work in subsistence agriculture, respectively. Both type of workers supply their labor endowment inelastically.

Consumers in rural areas pay a price inclusive of transportation costs, _1, for the manufactured goods, and receive a wage equal to theirmarginal product of labor:

wi = cAi + p(1 + _1)cMi

where i = u, n.

3.3 Market clearing

Aggregating across sectors and assuming, byWalras' law, that excess demand for food, EDA, equals zero in equilibrium yields:

EDA := DA − SA = (n − ne)cAu+ _necAn+ (1 − _)necAm(1 + _2) − (Yu + Yn) = 0. (12)

Substituting equation (3) into (12) we can express the excess demand for food, EDA, as a function of k, _, and the parameters

EDA := (_, k;An,Am,Au, _, _1, _2, n, ne, ¯cA), (13) with i > 0 i ∈ {4, 8, 10, 11}, i < 0 i ∈ {1, 2, 5, 6, 9}, i ⋚ 0 i = 3, i = 0 i = 7, where DA and SA

denote the demand for and supply of food production and Y M = (1 + _1) _(n − ne)cMu + _necMn_ + (1 − _) necMm + z(1 + _) (14)

So that aggregate output of food, Y A(=SA) can be expressed as Y A = ncA + _2 (1 − _) necA + _p[Y M − z(1 + _)]. (15)

Since there are no impediments to the movement of labor across the two modern sectors, in utility terms skilled workers will receive the same pay-off in these two sectors:

Unm := Un − Um = (1 + _)_ln wn − ¯cA wm − (1 + _2)¯cA_ + _ ln(1 + _2) − ln(1 + _) = 0 (16)

where Ui (i = n,m) denotes the utility pay-off to skilled labor working in sector i and using (3) we

have Unm = '(_, k;An,Am,Au, _, _1, _2, n, ne, ¯cA). (17) with 'i > 0 i ∈ {2, 6, 8, 11} 'i < 0 i ∈ {3, 4, 7}, 'i = 0 i ∈ {1, 5, 9, 10}.All the partial derivatives, I and 'i are derived explicitly in the Appendix.

3.4 Equilibrium

An equilibriumfor this economy, given transportation costs (_, _1, _2), sectoral productivities (An,Am,Au), distribution of skill in the population (n, ne), and subsistence level of consumption for the agricultural good ¯cAis characterized by the relative price of manufactured good, capital-labor ratio, as well as the fraction of skilled labor employed in modern agriculture sector (p, k, _) together with wages (wn,wm), and allocations of consumption for each type of households that solve their respective constrained optimization problemand clear markets.

More precisely, the two equations (3) and (16) jointly solve for p and k. Given the solution for k, equation (12) can then be used to solve for _. Equation (4) and wm = pAm then solve for wages, while (11a)-(11c) do so for the consumption levels and (6) for utilities. It is helpful to use Figure 1 to visualize the solution of the model. The left-hand side panel in the figure displays the determination of k and p. The curve zz depicting the equation (3) slopes downward as an increase in the relative price of manufactures, p, reduces the demand for manufactures as an input and lowers k = z/(_ne). The curve labeled Unm = 0 slopes upward as a rise in p increases wm and, thus the utility pay-off to working in manufactures. Free mobility of labor would then lead to skilled workers moving to the manufacturing sector, reducing _ and, thus, increasing k. As (3) and (16) depend only on the two endogenous variables p and k, the left-hand panel of Figure 1 determines these two variables. On the right-hand panel, the curve EDA = 0 depicting equation (12) is drawn downward sloping as excess demand for food is decreasing in both k and _.

4. HIGH TRANSPORT COSTS PUSH DOWN PROFITS AND WAGES

The efficiency of transport services greatly determines the ability of firms to compete in foreign markets. For a small economy—for which world prices of traded goods are largely given—higher costs of transportation feed into import and export prices. To remain competitive, exporting firms that face higher shipping costs must pay lower wages to workers, accept lower returns on capital, or be more productive. The pressure on factor prices and productivity is even higher for industries with a high share of imported inputs. In these cases, small differences in transport costs can easily determine whether or not export ventures are at all profitable. In developing countries, for labor-intensive manufacturing industries such as textiles, high transport costs most likely translate into lower wages, directly affecting the standard of living of workers and their dependents. The cost structures of firms are equally affected by the quality of transport services. Efficiently handle small shipments, firms are likely to maintain higher inventory holdings at every stage of the production chain. The costs of financing large inventories can be significant, especially in countries with high real interest rates. Gausch and Kogan (2001)find that inventor - holdings in the manufacturing sector in developing countries are two to five times higher than in the United States, and estimate that cutting inventory levels in half could reduce unit costs of production by over 20 percent. At the wholesale and retail levels, firms depend greatly on high quality transport services in distributing products to geographically dispersed markets. For example, seamless transport services were critical to Kodak's decision to integrate once-separate national warehousing operations in the Mercosur countries into one trade bloc–wide operation located in Brazil, thus reaping economies of scale in distribution.1 Long journeys have a similar effect. They delay payments if goods are exported on a cost, insurance, and freight (c.i.f.) basis or importers may demand a time discount if goods are delivered free on board (f.o.b.). If products are perishable (such as food) or subject to frequent changes in consumer preferences (such as high-fashion textiles) , longer journeys lead to additional losses in terms of a product's shortened lifetime in the export market. Box

4.1 Kenyan Theory

Illustrates the complex logistical arrangements that ensure the timely delivery of Kenyan cut flowers to European consumers. One recent estimate, based on comparisons between air and ocean freight rates for U.S. imports, puts the per day cost for shipping delays at 0.8 percent of the value of trade for manufactured products. Only a small fraction of these costs can be attributed to the capital costs for the goods during the time they are on board the ship.2 Delivery time is found to have a more pronounced effect for imports of intermediate products (Hummels 2000), suggesting that the fast delivery of goods is crucial for the maintenance of multinational vertical product chains. Quality aspects of transportation are thus likely to be an important factor in the location decisions of multinational companies.

5. SOME COUNTRIES PAY MORE FOR TRANSPORT SERVICES:

Geography and income International transport costs vary dramatically

Transport costs vary widely across countries. According to the price quotes of one U.S. freight forwarder, it costs $1,000 to ship a 40-foot container from Baltimore to Dar es Salaam, the largest port city in Tanzania.Yet the price of shipping the same container to Durban South Africa) is $2,500 and goes up to $4,000 for Vienna (Austria), $6,500 for Asunción (Paraguay), $7,800 for Yerevan (Armenia), $10,000 for Bujumbura (Burundi), and $13,000 for Kathmandu (Nepal). The geographic distance from Baltimore alone cannot explain these dramatic price differences. Transport costs are determined by factors that can be changed in the short run by policy, and those that cannot. This section concentrates on the second set of determinants. Despite advances in transport *technology*, a large number of developing countries continue to be challenged by *geography* in terms of being landlocked or far away from the world's economic centers. In addition, poor physical *infrastructure* and thin *traffic densities*, typically associated with low-income economies, represent additional impediments to transport competitive ness (although policy can alter these constraints in the longer term). Thus, high shipping costs undeniably represent a constrain -ing factor in the trade and development prospects of many developing countries.

Advances in transport technology—

Innovations in transportation have been an important factor in the globalization of goods markets observed in the late twentieth century. An examination of ad valorem freight rates for U.S. imports, for which detailed data are available, suggests that the share of shipping costs in the value of trade in 1998 was smaller for all major commodity groups compared to 1938, and for all but two goods classes compared to 1974 (see table 4.1).15 However, declining ad valorem freight rates may also be due to changes in the composition of trade or in unit values of traded commodities, due, for example, to improvements in the quality of goods. Ocean, air, road, and railway shipping have each seen a different mix of technological and institutional innovations, with profound implications on how traded goods are shipped from one location to another.16 *Ocean shipping* is a relatively mature industry, yet there have been important advances in maritime transport technology over the past decades. Specialized ships have emerged for dry bulk commodities.

6. THE ROLE OF TRANSPORT IN DRIVING JOBS AND GROWTH IS MORE IMPORTANT THAN EVER

Transport contributes directly to economic activity and employment through bus, rail, road, air and maritime services. It also has a large indirect impact via all the other sectors and activities in the economy that depend on and use these various modes of transport to move people and goods around, nationally and internationally, in an efficient and safe manner.1 In the current economic environment, three interrelated factors are placing even greater weight on the role of transport in driving jobs and growth:

- The rate of urbanization globally has been rising and, in 2008, for the first time in human history, the proportion of the worlds' population based in urban areas was greater than 50 percent. In the United States, 82 percent of the total population is based in urban areas, and this is set to rise to 90 percent by 2050. Cities need to help ensure that their transportation networks can support this high and increasing level of human and economic activity based in cities.2

- The financial environment for cities and federal, state and local governments is challenging. Many states are amid their most severe fiscal crisis since the Great Depression. The largest collapse in state revenues on record combined with languid economic growth are constraining the use of traditional fiscal instruments to support job creation, as well as creating affordability and funding issues for large infrastructure investments.

CONCLUTION

Many transportation systems are facing rising demand driven by increased urbanization of populations. Over the past decade, the biggest migration of Americans has been to cities with between 100,000 and 1 million residents.5 Many of these cities are less than prepared to deal with this influx of individuals and, as a result, are struggling to manage these busier transport networks. But not all cities are facing the same challenge. Chicago and Detroit, for example, are actually experiencing population declines, and cities with populations greater than 10 million suffered a 10 percent rate of outmigration over the last decade.6 This declining demand exacerbates existing revenue problems. Whether populations are increasing or declining creates a challenge for transportation providers in terms of maintaining an efficient and productive transport system in the face of population changes. In tandem, over the last 20 years, there has been substantial growth across all transport modes and, therefore, more vehicles and vessels using the transport network (see Figure 2). All these additional vehicles and vessels competing for limited capacityon the transport network create a challenge for transport providers trying to efficiently manage the network and balance demand and capacity.

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For example, transport enables firms across all sectors of the economy to work better and so enhances the productivity of private capital. Wider market access facilitated by better transport links can help businesses realize economies of scale in production, distribution and consumption, as well as enable access to existing inputs at lower cost and a greater variety of inputs. For individuals, transport can provide better access to jobs so there is better matching in the labor market, benefiting both individual and businesses. See Steininger, Karl W. "Transport, Access and Economic Growth." World Economics. Volume 3, Number 2. 2002; Kotkin, Joel, Alex Iams and Pearl Kaplan. "Economic Development and Smart Growth: 8 Case Studies on the Connections Between Smart Growth Development and Jobs, Wealth, and Quality of Life in Communities." International Economic Development Council. August 2006, http://www.iedconline.org/downloads/smart_growth.pdf

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