Urban Infrastructure and Industrialization[1]

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Public infrastructure in Third World cities is generally in a fairly poor condition. The quality of infrastructure services is further eroded by the rapid population growth in most of these cities. Poor infrastructure reduces the profitability of modern sector manufacturing and may therefore inhibit industrialization. The present analysis demonstrates that there may arise situations with stable, multiple equilibria: a high-income equilibrium involving modern manufacturing and a low-income equilibrium involving traditional manufacturing. © 2000 Academic Press

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1. INTRODUCTION

Public infrastructure in LDC cities is typically in a fairly poor condition. Road systems are neglected, public transport and telecommunication systems are unreliable, power supply frequently breaks down, etc.[2] Tight government budgets and economic mismanagement are partly to blame for this state of affairs. But one should also recognize the fact that city populations in developing countries grow extremely fast, resulting in large increases in the demand for public infrastructure services. The fastest growth in urban population today takes place in Africa: From 1970 to 1995 the average rate of urban population growth on this continent was 4.7%, according to The World Bank [14]. The United Nations [13] predicts that the urban population of Africa will reach 857 million by the year 2025, implying an average yearly growth rate of 3.8% in the period 1995–2025. In 1950, Africa's urban population numbered only 32 million.

Urbanization is normally associated with economic development. But in Africa, per capita income dropped by a yearly average of 0.7% from 1970

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[1] I thank Hans Jarle Kind, two anonymous referees, and the editor of this journal for useful comments. Remaining errors are mine.

[2] For a description of the poor state of public infrastructure in Africa, see Becker *et al.* [1], in particular Chap. 2, The Southern African Economist [11], and World Bank [14], in particular Chaps. 6–8.

to 1995; see The World Bank [14]. The performance of the manufacturing sector, typically the "engine of growth" in the early stages of development, has been disappointing, with negative growth rates in many countries. The persistence of the economic stagnation in many African countries suggests that these countries may be locked in a poverty trap.

Several mechanisms may sustain such a trap, the pecuniary externalities in the classical paper by Rosenstein-Rodan [10] on industrialization in Eastern Europe, formalized by Murphy *et al.* [9], being one example. The present paper suggests another mechanism, namely a "congestion externality" caused by rural to urban migration: A large and growing city population creates pressure on the urban infrastructure which reduces formal sector manufacturing productivity. If the infrastructure is sufficiently poor and the congestion effect of city growth therefore sufficiently great, a growing city population can reduce manufacturing output, increase the relative price of the manufactured good, and thereby stimulate further migration to the city (where manufacturing takes place). In this way, urban congestion may in fact constitute an urban "pull" factor, sustaining a low income trap characterized by a large city population and a weak manufacturing sector.

The basic assumptions of the present analysis are the following: (i) manufacturing takes place exclusively in the urban region, agriculture in the rural region; (ii) workers move to the region which offers the higher wage; (iii) there exist dual technologies for producing the manufactured good, one being more advanced than the other, and access to the advanced technology is limited; (iv) city growth (caused by rural to urban migration) causes congestion, which reduces the quality of infrastructure services (such as regular electricity supply) and hence increases the costs of modern manufacturing; (v) traditional manufacturing is less sensitive to congestion costs, since in practice this type of production is less capital intensive and decentralized within the city.

I have elsewhere used the dual-technology framework, made popular by Murphy *et al.* [9] and also discussed in Krugman [6], to study the consequences of regional integration in the Third World; see Bjorvatn [2]. In that paper, the focus is on the effects of regional integration, i.e., a reduction in the costs of shipping goods across regional borders. The present model differs from my earlier contribution in two important respects: First, the focus is on the traditional issue in studies of migration and industrialization, namely the interaction between the rural and urban sectors. Second, growth in the urban population gives rise to congestion effects.

Congestion effects have not received much attention in the new economic geography literature, initiated by Krugman [5]. One exception is Krugman and Elizondo [7], a model with commuting costs, motivated by the possible impacts of NAFTA on Mexico and Mexico City. Another exception is Tabuchi [12], who introduces commuting costs in the core-periphery