A new economic geography model of central places

Takatoshi Tabuchi, Jacques-François Thisse

Faculty of Economics, University of Tokyo, Japan
CORE, Université catholique de Louvain, Belgium
PSE, France
CEPR, United Kingdom

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A B S T R A C T

One of the most striking features of the space-economy is that cities form a hierarchical system exhibiting some regularity in terms of their size and the array of goods they supply. In order to show how such a hierarchical system may emerge, we consider a model with monopolistically competitive markets for the industrial sectors. As transport costs steadily decrease from large values, the urban system formed by several small cities entails structural changes in that some cities expand at the expense of the others by attracting a growing number of industries. Beyond some threshold, some cities disappear from the space-economy. Such an evolution of the urban system describes fairly well what has been observed in various historical periods that have experienced major changes in transportation technologies and/or political unification.

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1. Introduction

The main thrust of new economic geography is that steadily decreasing transport costs foster the agglomeration of economic activities in a small number of urban regions. Tackling the formation of the urban system from this angle is especially relevant because, ever since the beginning of the Industrial Revolution, the transport sector has undergone the most stunning changes. According to Bairoch (1997) “On the whole, between 1800 and 1910, it can be estimated that the lowering of the real average prices of transportation was on the order of 10 to 1.” [our translation]. Transport costs have continued to decrease after World War I. For example, in the United States, Glaeser and Kohlhase (2004) observe that over the twentieth century, the costs of moving manufactured goods have declined by over 90% in real terms. The World Bank (1995) reports comparable drops from 10 to 3 and from 10 to 1.5 in maritime and air freights, respectively.

To a large degree, however, by focussing primarily on the two-location framework of international trade theory, the existing literature has failed to address its main objective. Using the dataset of World Urbanization Prospects 2009, we want to figure out whether the above prediction is supported by casual empirical evidence.

Specifically, we have computed the ratio of the population in the top five urban agglomerations to the total population in each OECD country having at least five agglomerations with more than 750,000 inhabitants over the period 1950–2005. This leaves us with 10 countries. By focussing on the share, instead of the level, of urban population we control for the urban population growth, while retaining OECD countries allows us to avoid comparing countries having very different transport infrastructure. In order to determine the evolution of the population share in each country’s five largest metros, we have computed the correlation between the share and the corresponding year. Note that testing the significance of the correlation between the share and the year is equivalent to testing the significance of coefficients when regressing the share on the year. The correlation is positive and significant in 8 out of 10 countries (Australia, Canada, France, China, Germany, Japan, Spain, Sweden, UK) according to World Urbanization Prospects (United Nations, Department of Economic and Social Affairs, http://esa.un.org/wup2009/wup/source/country.aspx), the term “urban agglomeration” refers to the population contained within the contours of a contiguous territory inhabited at urban density levels without regard to administrative boundaries. It incorporates the population in a city plus that in the suburban areas lying outside of, but being adjacent to, the city boundaries. However, some countries do not produce data according to the concept of urban agglomeration but use instead that of metropolitan area or city proper. Whenever possible, these data are adjusted to match the concept urban agglomeration. When sufficient information is not available to permit such an adjustment, data based on the concept of city proper or metropolitan area are used.
Italy, Japan, Mexico, Republic of Korea, and Turkey), whereas the correlation is almost zero in the US and negative and significant only for the UK.\footnote{Using the data gathered by Eaton and Eckstein (1997), the correlation is positive for France and Japan for much longer time spans, that is, 1876–1990 in France and 1925–1985 in Japan.} Thus, we find it fair to say that those results do not reject the main prediction of new economic geography.

Building on this, we want to study whether and how a system of central places may emerge in a multi-location space when transport costs keep decreasing. To achieve our goal, we consider a spatial economy endowed with different industrial sectors operating under monopolistic competition and increasing returns, in which the number, size, and location of cities are determined endogenously. More precisely, we focus on the size and location of cities (the urban aspect) as well as on the spatial distribution of each industry across cities (the industrial aspect) when workers are free to choose where to live and for which industry to work. The novelty of our analysis is that the hierarchical principle of central place theory (i.e. the number of goods supplied in a city rises with its size and the spacing of cities having the same size is equal) stems from a symmetry-breaking process, which is itself triggered by falling transport costs.

That said, we may summarize our main findings as follows. First of all, when transport costs are high, we show that there exist a large number of small and equidistant cities. That each city has the same size and industrial structure makes all goods accessible to its workers and to the farmers living in its hinterland. This takes the concrete form of consuming a limited range of varieties of each good as importing varieties from other cities is very expensive. Such a pattern agrees with the fact that, in pre-industrial economy endowed with different industrial sectors operating under monopolistic competition and positive transport costs; the array of varieties supplied by an industry varies with the mass of workers in this particular industry. Note, however, that the above interpretation of productivity effects, we have chosen to work with a setting in which farmers’ wages are equalized across space; this is guaranteed by the assumption of zero transport cost for the agricultural good. We acknowledge the fact that this assumption is restrictive since decreasing transport costs for manufactured goods below some threshold, while preserving those of agricultural goods, stops the concentration process and leads to the redispersion of manufacturing firms and population (Fujita and Mori, 2005). One should keep in mind, however, that both types of transport costs have actually decreasing transport costs for manufactured goods below some threshold, while preserving those of agricultural goods, stops the concentration process and leads to the redispersion of manufacturing firms and population (Fujita and Mori, 2005). One should keep in mind, however, that both types of transport costs have actually

2 The spatial economy is described by a circumference $[0,1]$ of length 1. There are two production factors, one being immobile and the other mobile across space. It is convenient to think of them as being farmers and workers. In the agricultural sector, a homogenous good (e.g., rice) is produced under constant returns, perfect competition and zero transport cost; this good is taken as the numéraire. The economy involves a given number of farmers’ wages is equalized across space; this is guaranteed by the assumption of zero transport cost for the agricultural good. We acknowledge the fact that this assumption is restrictive since decreasing transport costs for manufactured goods below some threshold, while preserving those of agricultural goods, stops the concentration process and leads to the redispersion of manufacturing firms and population (Fujita and Mori, 2005). One should keep in mind, however, that both types of transport costs have actually
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