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Historical trends of agglomeration to the capital region and new economic geography☆

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ABSTRACT

This paper shows that a family of the Dixit–Stiglitz type of new economic geography models is capable of simulating the real-world tendency for agglomeration to the primate city. It is often observed that while regional populations were dispersed in early times, they have been increasingly concentrated into one capital region over recent years. The present paper thus characterizes the stable equilibrium distribution for any number of regions, any set of interregional distances, and any distribution of immobile demand for sufficiently small or large transport costs. It also demonstrates that multi-region new economic geography models are able to simulate the real-world population distribution trends witnessed over the past few centuries.

1. Introduction

Since the pioneering work of Krugman (1991), new economic geography (NEG) has been developed and sophisticated in several directions in order to show how the spatial distribution of economic activities is evolving in the real world. Specifically, the alternative modeling strategies proposed by Ottaviano et al. (2002), Forslid and Ottaviano (2003), and Pflüger (2004), among others, have improved analytical tractability, which has enabled researchers to gain further insights into the space economy and its transition. Furthermore, NEG has been enriched by introducing important ingredients such as intermediate goods, commuting costs, land for housing, agricultural transport costs, firm heterogeneity, and economic growth.

The scopes of most of the theoretical studies published thus far have been limited to two regions in order for researchers to reach meaningful analytical results. The two-region NEG models tend to demonstrate that spatial distribution is dispersed in the early period (high trade costs or low manufacturing share) and agglomerated in one of the two regions in the late period (low trade costs or high manufacturing share).

However, it is no doubt that the two-region NEG models are too simple to describe the spatial distribution of economic activities in real-world economies. Since there are only two regions, their geographical locations are necessarily symmetric, and thus diverse spatial distributions cannot occur. Moreover, it is unlikely that, say, Eastern regions have been growing at the expense of Western regions in a country. Many regions interact both in trade and in migration in the real world, where geographical locations of regions are asymmetric suggesting that their respective transport costs are different. In order to describe such geography, it is indispensable to assume many regions and unequal transport costs between them.

Some scholars have already attempted to extend two-region to multi-region NEG models. Multi-region NEG models are somewhat analytically tractable in a racetrack economy, where regions are symmetrically located on the circumference of a circle (Krugman, 1993; Picard and Tabuchi, 2010), as well as in a linear economy, where regions are located on a line (Venables and Limão, 2002; Ago et al., 2006). In order to depict the long-run evolutionary process of multi-regional development, we start from a position of autarky with the dispersed distribution of economic activities. The decrease in transport costs would enable firms to trade between regions, which alters equilibrium prices, wages and profits and fosters the migration of firms and thereby workers. This would enable some

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regions to gain manufacturing share and may allow one region to attract all the manufacturing activities. This scenario is analytically confirmed in Section 3 of this paper.

Although there have been attempts to simulate the spatial distribution of economic activities in the real world (notably Bosker et al., 2010), previous studies have not yet succeeded in obtaining practical analytical results for the long-term transition of the spatial distribution of economic activities in a multi-region economy. The present paper thus bridges this gap in the current body of knowledge on this topic by describing the transition of the spatial distribution of economic activities over the past few centuries. To do so, consider NEG models using an arbitrary number of regions in order to maintain analytical tractability.

The spatial distribution of economic activities has certain characteristics. The first is Zipf's law or the rank-size rule of city size distribution. The microfoundations of this law have been explained by Rossi-Hansberg and Wright (2007), among others. However, this is beyond the scope of the present paper, which focuses on explaining long-term changes in the size distribution of regions rather than of cities. In this paper, each region consists of (manufacturing) cities and (agricultural) rural areas, which is to be analyzed by NEG models.

The second characteristic is the robustness of long-run regional population distribution trends to large temporary shocks, such as the bombing of Japan during World War II (Davis and Weinstein, 2002). However, although regional population distribution is robust and stable during an intermediate period of time, it has been shown to be gradually changing over very long periods of time, as described in the next section. In particular, it is often observed that the capital region has experienced distinct growth patterns over centuries especially after the Industrial Revolution.

Therefore, this paper simply plots the long-term regional population distributions for several countries in order to assess how the aftermath of the Industrial Revolution and the recent IT revolution have influenced decreases in shipping and communication costs and thereby affected urbanization and agglomeration to core regions (Bairoch, 1988). It then presents NEG models with asymmetric transport costs and immobile demand that are capable of explaining the described changes in the spatial distributions of economic activities.

The remainder of this paper is organized as follows. The regional population distribution trends for the postwar period and for a few centuries in several countries are investigated in the next section. In order to explain these trends, a multi-region extension of Krugman's (1991) model is presented and the existence and stability of the spatial equilibrium are examined and interpreted in relation to an actual multi-region economy for symmetric and asymmetric regions in Section 3 Section 4 concludes the paper.

2. Long-term trends in population distribution

2.1. Postwar trends

I first considered the rates of population growth and decline of the largest city in each sample country. Since the largest cities in these countries often spread beyond municipal boundaries, I chose metropolitan areas rather than municipal city areas as the unit of analysis. Although the definitions of metropolitan areas differ by country, the United Nations database of urban agglomerations includes both central cities and suburbs, and provides a universal definition of metropolitan areas.[1] The data sources are listed in Appendix 1.

From the UN database, I chose the top 30 countries according to GDP in 2010 and then selected the largest metropolitan area (= agglomeration) in each country. I collected these data on every fifth year between 1950 and 2010, resulting in a dataset of 13 observations per country. Even though the national populations in each sample country increased during the study period, the population shares of the largest metropolitan areas also increased owing to interregional migration. In order to confirm this trend, I calculated the correlation coefficients between the population share of the largest metropolitan area and sample years of 1950, 1955,..., 2010. It was found that these correlation coefficients were significantly positive in 24 countries, significantly negative in 4 countries, and insignificant in 2 countries out of the 30 countries at the 5% level. This finding implied that *the population shares in most of the largest cities in the top 30 countries by GDP have grown since World War II*.

Fig. 1a displays the 25 countries in which the population share of the largest metropolitan area is increasing over time, while Fig. 1b shows the five countries in which these population shares are decreasing

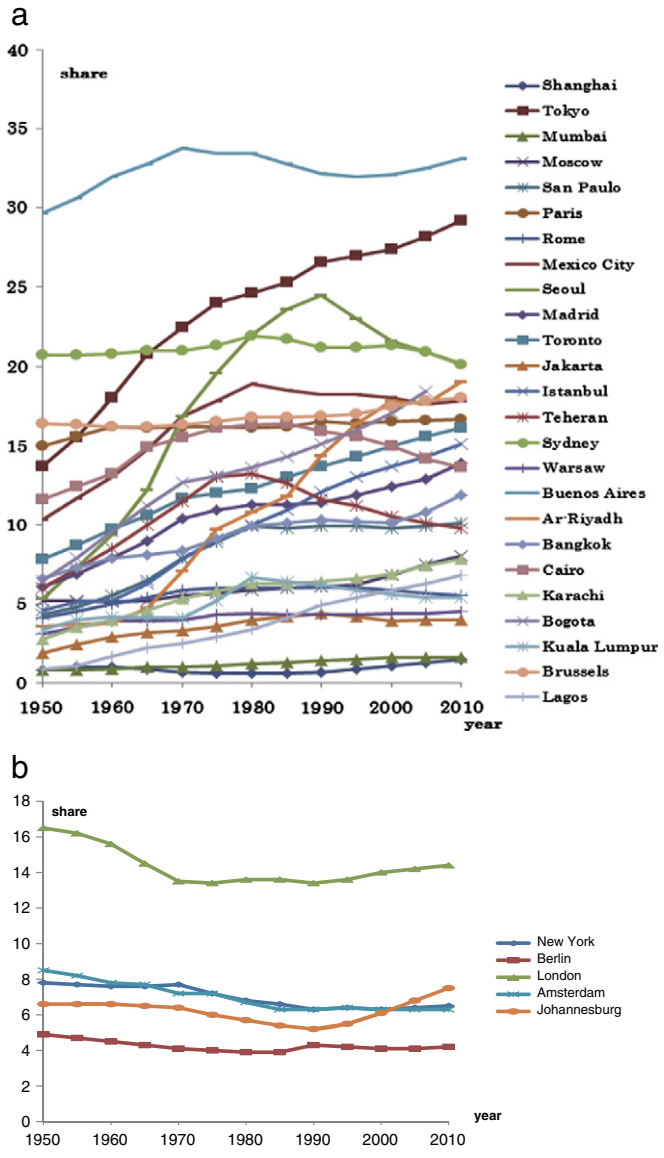

Fig. 1. a. Increasing population share of the largest metropolitan area. b. Decreasing population share of the largest metropolitan area.

[1] According to World Urbanization Prospects (http://esa.un.org/unup/index.asp?panel=6), the term "urban agglomeration" refers to the de facto population contained within the contours of a contiguous territory inhabited at urban density levels without regard to administrative boundaries. It usually incorporates the population in a city or town plus that in the suburban areas lying outside of but adjacent to the city boundaries.