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CENTRAL PLACE ANALYSIS

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Abstract

Central place analysis is a collection of theoretical and empirical attempts, originated from the *Central Place Theory* by Christaller (1933) and Lösch (1940), aiming to explain the spatial coordination of the provision of goods and services. The goods and services whose production is subject to scale economies are called *central goods*, and they are supplied from *central places*, typically towns and cities. The degree of scale economies associated with each central good determines the hinterland size of each central place. The central places supplying the goods associated with larger scale economies are called *higher-order* central places. The theory predicts the spatial coordination of central places leading to the *hierarchy principle* which asserts that each central place supplies all goods provided in lower-order central places, and the *spacing-out property* that central places of a given order are equally spaced.

Keywords: Central place theory, Cities, Market area, Hierarchy principle, Spacing-out property, Economic geography, Agglomeration, Increasing returns, Transport costs

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Origins Central Place Theory dates back to Christaller (1933) who describes how a city hierarchy is formed on a featureless plain over which consumers are uniformly distributed. *Central places* are the locations (typically towns and cities) from which central goods are supplied. *Central goods* are goods and services whose production is subject to scale economies. The central goods that are subject to larger scale economies and/or lower transport costs are called *higher-order* goods. Christaller identified three principles in the spatial patterns of central places based on the observation of urban hierarchies in Southern Germany: (i) *Exhaustive principle*: All consumers can purchase all goods from one of the central places; (ii) *Maximum spacing of centers*: Central places are positioned so that the number of central places in each order is minimum; (iii) *Hierarchy principle*: Each central place supplies all goods provided in lower-order central places. These imply that the market areas of central places are represented by the nested hexagonal partitions of the plane.

While Christaller's theory was largely descriptive, Lösch (1940) derived the hexagonal partitions as an equilibrium outcome of spatial competition among firms. The resulting central place systems are somewhat different between the Christaller model and Lösch model. In particular, the market area of each central place is at the maximum in the former, while the free entry of firms in the latter made it the minimum; there is a hierarchical nesting of market areas in the former, but not in the latter.

Evidence While there are only sparse evidence for the hexagonal market areas and the spacing of central places (e.g., Christaller, 1933; Marshall, 1989), some systematic evidences have been reported for the hierarchy principle among the cities. Namely, Mori et al. (2008) and Mori and Smith (2011) developed the test for hierarchy principle, and have shown evidence for the case of manufacturing industries in Japan. By applying this method, Schiff (2014) has shown evidence for the restaurant location patterns in the US cities. These studies suggest that despite the fact that the political economy and industrial background behind the Christaller and Lösch in the 1930s are very different from those in the current time, the basic elements of the theory still remain to be true for industrial activities today.

Theories The original theory by Christaller (1933) was largely descriptive, and positive and normative aspects were mixed in the three "principles" above. The theory by Lösch (1940) had similar defects. But, by introducing the notions of spatial demand, spatial competition and spatial equilibrium, Lösch (1940) built the theoretical foundation for the literature to follow. The first formal model of spatial competition leading to the spacing-out property of central places in equilibrium was Eaton and Lipsey (1976). The conditions for the hierarchy principle were formally examined for the first time by Eaton and Lipsey (1982), while Quinzii and Thisse (1990) showed the case in which the hierarchy principle is consistent with social optimum.

Hsu (2012) proposed a spatial competition model with a continuum of goods, and established both the hierarchy principle and the spacing-out property as an equilibrium outcome. In his model, consumers demand all types of goods, while the goods differ in terms of the size of fixed cost of production. It contrasts with the above models

in that the equilibrium configuration exhibits *central place property*: there is only one next-order central place between the neighboring central place of a given order, which is consistent with the “marketing principle” outcome in the original Central Place Theory by Christaller (1933). Hsu (2012) further derived conditions under which the central place equilibrium is consistent with the power law for the city size distribution known as the rank-size rule. The connection between the Central Place Theory and the rank-size rule has been pointed out by Beckmann (1958). But, Hsu (2012) was the first to provide a microeconomic foundation for this linkage. Hsu et al. (2014) established the condition for social optimality for the equilibrium configuration in Hsu (2012).

In the context of the new economic geography, Fujita et al. (1999) and Tabuchi and Thisse (2011) have shown that the central place configuration can be attained as a stable equilibrium in a general equilibrium framework by utilizing monopolistically competitive markets and plant-level increasing returns. In both models, there are multiple groups of differentiated consumption goods, where each group consists of a continuum of products which are differentiated under a constant elasticity of substitution. The elasticity of substitution (and/or transport costs) differs across groups of products, so that more differentiated products correspond to higher-order central goods. In these models, the single-city equilibrium is a unique equilibrium when the population size of the economy is sufficiently small, and multiple cities are formed for a sufficiently large population size. The former paper indicates that among a continuum of equilibria the ones consistent with the hierarchy principle and spacing-out property tend to be selected as a result of self-organization following the exogenous increase in the population size of the economy.

All these theoretical results should be taken with caution, however, since they are subject to specific functional forms, and since the stability of central place equilibria are at best local. The robustness of the results are subject to further scrutiny (Berliant, 2006).

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Suggested Reading :

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