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A new statistical dynamic analysis of ecological niches for China's financial centres

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HIGHLIGHTS

- A definition of the ecological niche of a financial centre (FC-niche) is proposed.
- Dynamic equations of FC-niches are set up by MGEP.
- A self-organised feature map algorithm is designed.
- FC-niches of China's 29 major cities are simulated.

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ABSTRACT

This study, undertaken from the perspective of statistical dynamics, proposes the treatment of financial centres as an ecosystem, creates a multidimensional financial centre niche (FC-niche) under given generalised entropy and constraints, and interprets the evolutionary process of an FC-niche with dynamic equations obtained from the maximum generalised entropy principle (MGEP). To solve these dynamic equations, a self-organised feature map (SOM) is designed. Finally, the values and evolutionary rules of FC-niches in China's 29 major cities are simulated as a case study.

1. Introduction

With the rapid economic growth observed in recent years, global financial flows have been considered in the current reorganisation of financial sectors. These growing flows of capital, people, and information are not without direction, given their concentration within financial centres [1]. A financial centre is defined as "a place in which there is a high concentration of banks and other financial institutions, and in which a comprehensive set of financial markets is allowed to exist and develop, so that financial activities and transactions can be effectuated more efficiently than at any other locality". In recent years, an increasing number of studies have focused on three interrelated questions: Why is there a spatial agglomeration of financial activities? What types of specific factors are required to drive a place to become a financial centre? How do we identify and evaluate a financial centre?

In general, there are three main theories that discuss the agglomeration of financial activities: the financial aggregation theory, the information theory, and the production-oriented theory. The financial aggregation theory, directed by geographical concentration, claims that there is momentum behind agglomeration and that both economies of scale and external

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economies can reduce the cost of the information and transactions involved in financial activities. However, the rapid development of information and communication technologies has led capital services, corporate services and even the markets in which these services exist to disperse their operations around the world. The common expressions of "death of distance" and "end of geography" indicate that the traditional anchoring devices of financial centres have weakened, and as a result, banks and other financial institutions no longer need to be located in financial centres. Rather than observing aggregation as a simple fading phase, the information theory and the production-oriented theory indicate that aggregation is continuous. Focusing on different types of financial activities, the information theory argues that the ongoing communication revolution has simplified access to standardised information. However, complex information poses problems with the interpretation of its value. These problems are mainly due to data compression, which creates the need for the further geographic agglomeration of financial activities [2]. Based on the information theory, the production-oriented theory argues that the distribution of financial products is not random but tends to flow to the locations that reproduce themselves (through impositions on historical and the institutional dimensions) in an attractive manner, thus leading to the agglomeration of financial products [3].

It is clear that financial activities always tend to concentrate. What are the factors that make one specific region a favourable location to host and maintain financial activities? A region's financial time zone is an important location-specific factor and must support 24 h capital transactions around the world. Consequently, the world can be divided into three financial time zones: New York, London, and Asia (the Asia–Pacific Basin). Each time zone has a world financial centre surrounded by second-tier financial centres and national sub-centres [4]. The types of financial products and services that a location can provide are important, as well. Clark and O'Connor (1997) divided financial products into three categories, i.e., transparent, translucent and opaque, primarily by analysing the type and specificity of information that are required to trade these products. The more localised (tacit) knowledge needed to handle the product, the less concentrated financial activities will be [5]. The opaque products tend to be traded in sub-national centres, translucent products are primarily in national centres, and transparent products are mostly in global financial centres [6]. The contact made with other locations through making deposits and lending will influence the prominence of a financial centre [7]. In addition, international trade has paved the way for the explosive development of international financial operations, and the volume of trade directly influences the activity of banks as they undertake such activities as facilitating payments and providing letters of credit.

The degree of government regulation significantly affects the concentration of finance because financial institutions, in attempting to offer depositors higher interest rates and charge borrowers lower interest rates, prefer to settle in locations with fewer regulations. Adequate infrastructures, such as telecommunications and transportation facilities, can improve a city's communication with the rest of the world and thus ensure the physical and electronic accessibility of the financial centre [8,9]. Well-educated and sophisticated human resources may also play an important role in the financial sector because the sector relies on "people's business" and possesses a high demand for specialised expertise [4,8]. Because financial firms use specialised services, the concentration of firms from the areas of law, accountancy, consultancy, and computation is particularly important. Being located near the source of these intermediate services can ensure better service and a lower price. Considerable size and sufficient market liquidity are necessary in order for investors to trade. In addition, there appears to be a certain liquidity threshold below which a financial centre loses diversity and therefore its reputation [10,11].

A ranking of financial centres has been conducted according to the driving factors that impact the development of a financial centre. Reed [12] proposed an initial ranking of international financial centres based on a hierarchical cluster analysis that measures the level of banking activities. This researcher started by dividing 80 centres into five categories and then extended the original nine indicators to 16 indicators by covering a greater range of financial institutions and financial markets. Choi and Tschoegl [13–15] published three articles ranking the world's major financial centres in the 1970s, 1980s, and 1990s, respectively. These researchers constructed TO/FROM matrices by examining the location of the offices of the world's top 300 commercial banks to obtain their attractiveness and office establishment potentials. Next, the authors applied the ordinary least square method (OLS) and nonlinear weighted least-squares to analyse the determinants of interpenetration. Abraham [16] employed factor analysis to measure the importance and magnitude of the activities in various European financial centres. Liu [17] used 12 variables to cluster 12 financial centres from the Asia–Pacific region into four clusters. Poon [18] analysed the hierarchy of capital markets in financial centres (based on 45 cities with major stock exchanges) by the rank size model, which is widely used in urban hierarchical analysis. Sagaram and Wickram [19] empirically examined the status and sustainability of Australia, Hong Kong, Japan and Singapore as financial centres in the Asia–Pacific region by applying the error correction model and panel regression model. The following indicators were adopted: the number of foreign banks, gross domestic product in real terms, tax rates of corporations, values of external assets, external liabilities, and foreign assets of banks in real terms. Peter [20] ranked international banks according to their network centrality scores. The global financial centres index (GFCI) in 2007–2010, as published by the City of London, produced an indicative rating of major financial centres based on 75 factors from five different aspects: people, business environment, market access, infrastructure and general competitiveness.

These previous studies have been devoted to the evaluation of financial centres or the creation of an index with indicators that reflect the performance of the financial sector. However, a new complex topic arises, i.e., whether existing financial centres will sustain their status or other cities will become new financial centres. Considering the continuous interaction between driving factors, a complex system is constituted by cities and these driving factors. Thus, the research on financial centres should benefit from a systematic perspective with a comprehensive consideration of driving factors. This study attempts to provide a new analytical framework and evaluation method for financial centres. From a novel perspective, a