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Technological forecasting at the Korean stock market: A dynamic competition analysis using Lotka–Volterra model

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Abstract

The purpose of this paper is to attempt to analyze the dynamic relationship between the Korean Stock Exchange (KSE) and Korean Securities Dealers Automated Quotation (KOSDAQ), two competing markets at the Korean stock market, in the viewpoint of technological forecasting of competition. The Lotka–Volterra system of equations, one well-known competitive diffusion models, is adopted to represent the competitive situations of the Korean stock market and it is estimated using daily empirical index data of KSE and KOSDAQ during 1997–2001. The results show that there existed a predator–prey relationships between two markets in which KSE acted as a prey for the time being after the emergence of KOSDAQ. This interaction was altered to symbiotic relationship and finally to pure competition relationship. We also perform an equilibrium analysis of the estimated Lotka–Volterra equations. As a result, we find that there is an equilibrium point in a dynamic sense. However, the equilibrium point could be unstable in the latest pure competition relationship.
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1. Introduction

Korean stock market has expanded enormously since Korean Securities Dealers Automated Quotation (KOSDAQ), an over-the-counter market modeled after the US NASDAQ, emerged in 1997. Since the conditions of listing on KOSDAQ are much easier than the traditional Korean stock market, the Korean Stock Exchange (KSE), many small and medium companies including venture firms can succeed in IPO and their securities are traded at KOSDAQ market. Now, some excellent high-technology-based companies in KOSDAQ market even have a greater market value than the large firms listed in KSE.

After the Korean economic crisis in 1997, owing to the government's venture company support policies to overcome the economic hardship, the activities of ventures companies were markedly increasing and investors were paying attention to this emerging potential market. This was contemporary with hot interests for information technology (IT)-related companies all over the world. Thereafter, KOSDAQ market has rapidly expanded, while the traditional manufacturing firms listed on KSE attracted little attention from investors. Few years later, the heat of KOSDAQ market dissipated with the excessive appearances of nonprofitable ventures and the recession of international economy. This phenomenon caused investors to be conservative on the venture industry and they were likely to pay attention to fundamental factors and more stable companies. Consequently, KOSDAQ market experienced a crash and the money from the stock investors flew into KSE again.

Looking at the above trend of Korean stock market, it can be thought that the Korean investors seem to regard each market, KSE or KOSDAQ, as a distinct niche on a single stock market. Of course, most inventors make diversification strategies by portfolio of both markets. However, in this case, they should determine how to allocate their restricted capital budget to certain amount of stocks from each market according to their expected investment value of each market.

For this reason, we cannot affirm that two markets move toward the same direction by common shocks. An economic event may be good news to one market, while bad to the other, and investors regard each market as an independent alternative to make portfolios. This fact suggests that KSE and KOSDAQ market would rather interact as individual markets than belong to a single stock market. This means that, in order to understand Korean stock market in detail, it is necessary to clarify the exact relationship of both markets.

Toward this end, this paper is based on the rationale that the relationships of two markets could be best understood by viewing them as species competing for investor's resources. That is, we regard the two markets as competitors or as competing goods in a single market. This situation could be described by diffusion models, which explain the growth of cells or species in ecology [1]. Particularly, Lotka–Volterra equation includes a competition mechanism in the diffusion process. This model incorporates the dynamics of competition between species in ecology system. It classifies the relationship of competing species into natural selection, survival of the fittest and predator–prey interaction under restricted space and resources. In marketing researches, Lotka–Volterra equation has been adopted to describe the diffusion process of durables with the entry of new competitor in existing monopoly market [2–5].

Research that applied diffusion models to explain the growth of stock market is sparse. Modis [6] analyzed the behavior of common stocks by Lotka–Volterra model as if they were