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The dynamic predictive power of company comparative networks for stock sector performance

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ABSTRACT

As economic integration and business connections increase, companies actively interact with each other in the market in cooperative or competitive relationships. To understand the market network structure with company relationships and to investigate the impacts of market network structure on stock sector performance, we propose the construct of a company comparative network based on public media data and sector interaction metrics based on the company network. All the market network structure metrics are integrated into a vector autoregression model with stock sector return and risk. Several findings demonstrate the dynamic relationships that exist between sector interactions and sector performance. First, sector interaction metrics constructed based on company networks are significant leading indicators of sector performance. Interestingly, the interactions between sectors have greater predictive power than those within sectors. Second, compared with the company closeness network, the company comparative network, which labels the cooperative or competitive relationships between companies, is a better construct to understand and predict sector interactions and performance. Third, competitive company interactions between sectors impact sector performance in a slower manner than cooperative company interactions. The findings enrich financial studies regarding asset pricing by providing additional explanations of company/sector interactions and insights into company management using industry-level strategies.

1. Introduction

As economic integration and business connections increase, companies actively interact with each other in the market in cooperative or competitive relationships. Such relationships often exhibit industry-related features. For example, competitive relationships often exist within an industry because of limited resources and customers. These cooperative relationships usually arise between the supply and demand sides across different industries. Complex interactive business relationships depict the economic market with intra-sector and cross-sector links. These links are helpful for understanding information and shock transfers within and across sectors [1–3]. For example, the spillover effect between sectors was observed during the global financial crisis and the recent Chinese stock market crash. Consider the manufacturing sector and the utility sector in the Chinese stock market. Between June and July 2015, the manufacturing sector index[1] decreased by 29.96%, and the utility sector index decreased by 24.93%. The manufacturing sector suffered a much heavier loss than the utility sector. In market interactions, companies in the manufacturing sector have more business connections with other companies than companies in the utility sector. To understand market interactive structures and to explain the spillover effect between sectors, we designed this study.

Previous accounting and finance studies have begun to establish the connection between market network structure and stock sector performance [1–3]. They have used trading data to create sector relationship graphs, and they have proposed the theory that sectoral shocks are transmitted to other sectors using networks of input and output linkages. However, the trade flow graphs are rather coarse tools for describing company relationships. In the field of information systems (IS), some studies have

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[1] According to the Wind sector index.

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constructed company relationship networks based on textual information mining. They have identified the co-occurrences of two companies' names in documents [4–8]. This method helps to measure the closeness of two companies, but it cannot specify the types of comparative relationship, i.e., competitive relations or cooperative relations. In a real-world market, the relationship between Apple and Samsung is definitely different from that between Apple and FoxCom. These different relationships have different spillover effects on stock performance. Therefore, to further investigate the connections between market network structure and stock sector performance, we focus on the following research questions.

(1) Does the company comparative network provide a stronger market indicator than the company closeness network?
(2) What are the intra-sector and inter-sector network effects on stock sector performance?
(3) What are the dynamics of the relationship between company comparative network metrics and stock sector performance?

To answer these questions, we use public news[2] as a data source to build company networks because we believe that as an easily accessed Web-based data source, news describes richer business relationships between companies than simple trading data. Moreover, to identify network effects, we construct complex network metrics. First, we use comparative analysis, rather than co-occurrence analysis, to investigate the cooperative (positive) and competitive (negative) relationships identified by public information. Second, we construct inter-sector and intra-sector measurements to compare their different effects.

In contrast to previous studies that aimed to detect the static correlations between company network and stock performances, our study uses a vector autoregression with exogenous variables (VARX) model to consider all of the intricate dynamic relationships among network metrics and stock sector performance. The time-series model investigates continuous daily company network effects on stock sector performance, and it captures the dynamics of short- and long-term carryover effects over time.

This study has potential implications for theory and practice. Theoretically, our work confirms and extends financial theories by introducing rich market network structure metrics based on public information. We use a time-series model to investigate the dynamic relationships between company comparative networks and stock sector performance. Our research also provides practical suggestions for sector-level strategies such as industry associations and investments.

We first describe the theoretical background and hypotheses in Section 2. Section 3 introduces the data and the measurements. Section 4 describes the time-series model. The findings are presented in Section 5. The final section discusses the implications.

2. Theoretical background and hypotheses

2.1. Intra-sector and inter-sector network effects on stock sector performance

Stock sector performance has been demonstrated to be related to sector positions in market networks. In the finance domain, Aobdia, Caskey, and Ozel [3] constructed an industry network based on trade flows across different industries, and they found that firms in central industries are more exposed to systemic risks than other firms. Acemoglu et al. [1] argued that sectoral risks can be transmitted to other sectors through a network of input and output linkages in a system. Ahern and Harford [2] demonstrated that systematic risks constitute the aggregation of idiosyncratic shocks and that more central sectors in a network of intersectoral trade usually have higher returns because they experience greater exposure to systematic risks.

Because of the popularity of social media and Web 2.0, company interactions regarding sales, debts, and other financial or operating activities are reported in public news in real time. Company networks based on keyword co-occurrence have been widely used to explain and predict financial metrics such as company revenue; stock return; and risk. For example; Ma; Sheng; and Pant [6] predicted company revenue relationships based on a company network derived from company citations. Graph-theoretic measurements were used in the classification problem. Jin et al. [5] developed complex longitudinal features for company network evolution and proposed feature selection and prediction models to predict company profit and revenue growth. Focusing on stock market performance; Creamer; Ren; and Nickerson [9] tested the relationships among company positions in networks; company stock returns; and volatility.

We expect that constructing sector-related metrics based on company networks might also provide a useful indicator for predicting sector performance. Compared with trade flow, which has been used in previous financial studies [2,3], company networks encompass broader business relationships between companies.

H1a. Sector interaction metrics constructed based on company networks have significant predictive relationships with sector performance.

To further investigate the sector-interactive characteristics, we construct two metrics: an inter-sector metric and an intra-sector metric. These two metrics have primarily been used in economics to distinguish trades between different industries or within the same industry [10,11]. These sector metrics have also been used in financial studies that have investigated stock performances. Moskowitz and Grinblatt [12] and Aobdia, Caskey, and Ozel [3] demonstrated that inter-sector characteristics have predictive power for assessing firms' stock returns. Conversely, Asness, Porter, and Stevens [13] found that intra-sector momentum is superior to inter-sector momentum in explaining stock returns. Because this study aims to inspect how sector-interactive characteristics affect stock returns, we followed the two popular metrics and proposed two competing hypotheses:

H1b. The inter-sector metric has greater predictive power than the intra-sector metric.

H1b'. The intra-sector metric has greater predictive power than the inter-sector metric.

2.2. Company comparative networks provide a stronger market indicator than closeness networks

In the business world, company comparative analysis refers to evaluating a list of company metrics to compare them. The targets are usually similar companies in the same industry, such as Ford versus Toyota and eBay versus Amazon. In IS and marketing research, comparative analysis has been extended to the analysis of comparative opinions between two entities [14–16]. Taking products as an example, comparative analysis aims to identify the relationship of two products as "product A is better than product B" or "product B is better than product A." For example, Jindal and Liu [17,18] proposed using rules and naïve Bayes

[2] "News" in this article refers to a broad range of information from news wires, discussion boards, and blogs.

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