Corporate board network and information flows in the Italian Stock Exchange

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Abstract: *In this work we investigate the governance models of listed companies in the Italian Stock Exchange. We use a network approach in order to investigate the interlinks among board of directors. A graph theoretical approach and the vertex centrality measures quantify the role of network and the intensity of the relationships, according to the assumption that the information conveyed by such interconnections could exert some impact on market prices. A weighted graph represent the listed companies (vertices) and their relationships (weighted edges) by using as centrality measure the flow-betweenness. It is expected that this centrality measure may give a representation of the intensity of the relationship between companies, capturing the volume of information flowing from a vertex to another one.*

keywords: corproate board network, centrality measures, information:

1. Introduction

The aim of this work is to examine the governance models of listed companies in the Italian Stock Exchange.

The idea is based on the role of information in the Italian Stock Exchange channelled through networks represented by ownership chains and presences in the boards of directors structure of the Italian market. We argue that the last channel is a specific one which might influence the stock prices; in other words it could weaken the efficiency of market prices and the quality of trading in the market.

2. The methodological approach: the network topology

As several studies have recently suggested (see Battiston and Catanzaro, 2004, Bertoni and Randone, 2006), the structure of the board of directors in corporations may be easily represented by a graph-theoretic approach. Starting from a simple structural representation, we are interested in analyzing how the network may effectively describe the information flows moving from a vertex to another one. We may obtain a positive solution to this problem by using the vertex-centrality measures.

Graph centrality measures were initially introduced in the analysis of social networks (see for example Bonacich, 1987 Borgatti, 2005, Wassermann and Faust, 1994). The application has been extended to different fields, such as physics, and, more recently, economics and finance (D'Errico et al., 2008).

In the scientific literature many different measures have been proposed (Bonacich, 1987, Borgatti, 2005, and Freeman, 1979) aimed to capture different profiles of a vertex's importance in a graph;

the choice of an appropriate measure depends on the specific framework.

For example, the degree-centrality is simply defined as the degree of a vertex and it measures the direct connections of a vertex to many others. Differently, the eigenvector-centrality is positively proportional to the sum of adjacent centralities, consequently a vertex shows a high centrality when it is adjacent to high-centrality vertices.
The betweenness centrality of a vertex v is the fraction of shortest paths between pairs that pass through v, and it is a measure of the influence a vertex has in spreading information through the network.
In our work a weighted graph represents the listed companies (vertices) and their relationships (weighted edges). That's why we focus on the flow-betweenness centrality (see Freeman et al., 1991 for a reference on this measure). It may give a picture of the intensity of the relationship between companies, and is assumed to capture the volume of information flowing from a vertex to another through an intermediary vertex.

3 The corporate board network

According to the scientific literature we use the approach proposed in Battiston and Catanzaro (2004) in order to obtain a weighted graph where vertices are listed companies and weighted edges represent interlinks between companies based on the co-existence of the same directors in the related boards. The graph is generated from an adjacency matrix of all listed companies in the Italian Stock Exchange.

Isolated vertices have been excluded and the connected components have been evidenced.

We studied the information flow inside the giant component by the flow-betweenness centrality tool; furthermore, we analyzed the topology of the mentioned component by selecting suitable structural parameters.

As an intermediate step, we try to identify possible dominant structures embedded in a giant component by purely studying the interlinks among listed banking institutions and the remainder of non-financial companies. Looking at the results from an institutional perspective, the approach may provide interesting suggestions about the role of banks in the Italian economic system. The evidence of interlinks between banks and non-financial companies, through the presence in the boards of the latter, should signal a specific influence of banking system on the governance of domestic industrial firms and an attitude of banks in controlling in some way part of the domestic economy. As a consequence, the analysis might suggest an "Italian style" in the bank-firm relationships starting from the model of universal banking adopted in the UE banking industry.

4 Data set

Information on companies includes companies listed at may 2008 in all segments and markets in the Italian Stock Exchange and ruled by Borsa Italiana S.p.A. The composition of the boards of directors has been extracted by the official website of Consob (Commissione Nazionale per le Società e la Borsa) which update the information in a dedicated section on a continous basis.

Bibliography

Battiston S., Catanzaro M. (2004), Statistical properties of Corporate Board and Director Networks, European Physica J. B 38: 345-352.

Bertoni F., Randone P.,(2006), The Small-World of Italian Finance: Ownership Interconnections and Board Interlocks amongst Italian Listed Companies, Technical Report. Politecnico di Milano, Italy.

Bonacich P. (1987): Power and Centrality: A Family of Measures, American Journal of Sociology 92,1170-1182.
Borgatti S. (2005), Centrality and Network Flow, Social Networks 27(1): 55-71
Freeman L.C., Borgatti S., White, D. R. (1991), Centrality in Valued Graphs: a Measure of Betweenness Based on Network Flow, Social Networks 13, 141-154.
Freeman L. C. (1979), Centrality in Social Networks. Conceptual Clarification, Social Networks 1, 215-239.
D'Errico M., Grassi R. Stefani S. Torriero A., (2008), Shareholding networks and centrality: an application to the italian financial market, Networks, Topology and Dynamics: Theory and Applications to Economic and Social Systems, Lecture Notes in Economics and Mathematical Systems, Springer-Verlag, Heidelberg (in press)
Wasserman S., Faust, K.(1994), Social Network Analysis: Methods and applications. Cambridge University Press, Cambridge.