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Network structure and industrial dynamics. The long-term evolution of the aircraft-engine industry

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Abstract

This paper proposes a new approach to explain the long-term evolution of a supplier industry. The network of vertical relations between suppliers and buyers is identified as a determinant of the concentration of the supplier industry and of the dynamics of market shares. The vertical structure of the industry is captured by collecting information on *all vertical relations between dyads of firms* and by building matrices of interaction for the aircraft-engine industry from 1953 to 1997. An econometric exercise is used to test some hypotheses about the relation between selected network measures and industrial dynamics.

JEL classification: L13; L19; L22; L62

Keywords: Industrial dynamics; Vertically-related industries; Network; Industrial concentration; Market shares

1. Introduction

Industries come to be organised, in the long run, according to dynamics that shape their horizontal structure and vertical configuration. The identification of the properties of these dynamics is the object of much research and explains the recent convergence of interests between structural theories of economic change, evolutionary theories of the firm, and industrial dynamics.

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Within this context, the problem of identifying the specific mechanisms that relate the horizontal dynamics of an industry (entry, exit, survival and growth of firms, stability of market shares, firm size distribution) to the vertical dynamics (vertical integration/disintegration or change in the division of labour, industrial dynamics in upstream/downstream sectors) is of much interest. While a certain amount of empirical evidence has been collected on this problem, and some general models have been developed, much work remains to be done.

We propose that the notion of network of relations between suppliers and users captures the vertical organisation of an industry. The originality of this paper lies in the use of economic network time series for the explanation of the long-term dynamics of a supplier industry. We study the relations between engine and aircraft manufacturers in the jet and turboprop markets. The vertical structure of the industries is captured by collecting information on all vertical relations between dyads of firms, by building matrices of interaction for the entire industries during the period 1953–1997, and by computing selected network measures at the industry and at the firm level.

We develop the hypothesis that the structural dynamics of the supplier industry, as represented by the evolution of the level of concentration and the dynamics of market shares, depend on the way vertical relations are created and distributed among actors. We take into account specific factors underlying the creation of linkages between the firms in the two industries and formulate different hypotheses about the sign of the relation between network and industry measures. The question we try to answer is the following: can the distribution of vertical relations in two vertically-related industry affect the level of concentration and the dynamics of firms' market shares of the supplier industry?

An econometric analysis is carried out to test the hypothesis that, depending on the characteristics of the distribution of relations in the networks, relational density has a different impact on the level of concentration of the supplier industry. More precisely, in oligopolistic regimes characterised by asymmetries among actors in relational behaviour, relational density has a positive effect on concentration, while in oligopolistic regimes in which actors follow symmetric relational behaviours, the sign of the relation is negative. As for the firm level, we propose that actor centrality explains market share, but the intensity of the relation depends on characteristics of vertical linkages and on the size distribution of firms in the downstream industry.

The paper is organised as follows. Section 2 offers a brief review of existing contributions on the dynamics of vertically-related industries. It introduces the notion of network and discusses the potential of network concepts and techniques in industrial economics. Section 3 introduces data, methodology and descriptive statistics of the variables used in the empirical analysis, while Section 4 develops the hypotheses of the model. Section 5 presents an econometric analysis and Section 6 concludes.