Price–quantity competition with varying toughness [☆]

Claude d'Aspremont [a,*], Rodolphe Dos Santos Ferreira [b,c]

[a] *CORE, Université Catholique de Louvain, Louvain-la-Neuve, Belgium* [1]
[b] *BETA-Theme, Université Louis Pasteur, Strasbourg, France*
[c] *Institut Universitaire de France, France*

Abstract

For an industry producing a single homogeneous good, we define and characterize the concept of oligopolistic equilibrium, allowing for a parameterized continuum of regimes with varying competitive toughness. This parameterization will appear to be equivalent to the one used in the empirical literature. The Cournot and the competitive outcomes coincide, respectively, with the softest and the toughest oligopolistic equilibrium outcome. The concept offers an alternative to the conjectural variations approach with better foundations. It can be viewed as a canonical description of oligopolistic behavior which can receive different theoretical justifications and provide a convenient tool for modeling purposes. Two illustrative cases (linear and isoelastic demands) are developed and the possibility of endogenizing (strategically) the choice of competitive toughness by the firms is examined.
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[*] Corresponding author.
E-mail address: daspremont@core.ucl.ac.be (C. d'Aspremont).
[1] CORE is affiliated to ECORE.

1. Introduction

A fundamental problem of oligopoly theory is equilibrium indeterminacy. This indeterminacy is not only of the kind associated with a given equilibrium concept and the possibility of multiple solutions. It is mainly related to the choice of the equilibrium concept itself. This is most simply demonstrated in static models by the choice between quantity competition (usually assimilated to the approach of Cournot, 1838) and price competition (linked to Bertrand's 1883 critique of Cournot). However, this second kind of indeterminacy only reflects the variety of observed competition regimes varying in their degree of toughness and implying different firm conducts.

In order to formalize this variety of oligopoly regimes, we shall adopt an approach that was pioneered by Shubik (1959), where firms do not privilege one strategic variable but behave strategically in price–quantity pairs. This approach will lead us to a comprehensive and canonical concept of oligopolistic equilibrium providing a unified formulation of the whole spectrum of enforceable non-cooperative equilibria. The proposed concept remains Cournotian and considers oligopolistic competition as a generalization of monopoly. Two types of competition are at stake: the struggle of the whole industry for market size, and the struggle of each individual firm for its market share. With each type of competition will be associated a constraint. The set of solutions (corresponding to different competition regimes) can be parameterized according to the relative values of the Lagrange multipliers associated with these two constraints. This parameterization can be interpreted in terms of competitive toughness. At one extreme, one finds the Cournot solution as the softest oligopolistic equilibrium, and, at the other extreme, one finds the competitive equilibrium when competitive toughness is maximal. As mentioned by Shubik (1959), the price equilibrium (corresponding to Bertrand competition) is a particular price–quantity equilibrium, which coincides with the competitive equilibrium when all firms are producing at equilibrium. All other enforceable outcomes are intermediate to these two extremes.

This parameterization will appear to be equivalent to the one used in the empirical literature, building econometric models that incorporate general equations where each firm conduct in setting price or quantity is represented by a parameter, itself viewed as an index of competitiveness. This so-called "conduct parameter method" has been at the basis of the *new empirical industrial organization* and has generated a large number of empirical studies (for a synthesis see Bresnahan, 1989 and, for more recent references, Corts, 1999). It is related to the conjectural variations approach since both methods encompass the same theories of oligopoly. But, as stressed by Bresnahan, "the phrase 'conjectural variations' has to be understood in two ways: it means something different in the theoretical literature than the object which has been estimated in the empirical papers" (Bresnahan 1989, p. 1019). Moreover, in the theoretical literature, conjectural variations have been criticized for their lack of theoretical foundations, at least in static models.[2]

The goal of the canonical representation of oligopolistic competition that we propose here is to provide a convenient tool to the theorist (it amounts to use a generalization of Cournot equilibrium), which is more game-theoretically founded than the conjectural variations theory, and which, in parallel to the conduct parameter method used by the econometrician, still nests a continuum of theories of oligopolies. This theoretical tool will be derived and justified from different approaches, such as the "supply-function," the "facilitating practices" or the "min-pricing scheme" approaches.[3] Each of these approaches may be more relevant for specific industries. For

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[2] For references and a discussion, see Martin (2002, pp. 50–51).
[3] See, respectively, Grossman (1981), Salop (1986), and d'Aspremont et al. (1991).