Chaos, Solitons & Fractals 69 (2014) 253–270

Contents lists available at ScienceDirect

Chaos, Solitons & Fractals

Nonlinear Science, and Nonequilibrium and Complex Phenomena

journal homepage: www.elsevier.com/locate/chaos

Local and global dynamics in a duopoly with price competition and market share delegation

Luciano Fanti [a], Luca Gori [b,*], Cristiana Mammana [c], Elisabetta Michetti [c]

[a] Department of Economics and Management, University of Pisa, Via Cosimo Ridolfi, 10, I-56124 Pisa, PI, Italy
[b] Department of Law, University of Genoa, Via Balbi, 30/19, I-16126 Genoa, GE, Italy
[c] Department of Economics and Law, University of Macerata, Via Crescimbeni, 20, I-62100 Macerata, MC, Italy

ARTICLE INFO

Article history:
Received 20 June 2014
Accepted 10 October 2014
Available online 9 November 2014

ABSTRACT

This paper aims at studying a nonlinear dynamic duopoly model with price competition and horizontal product differentiation augmented with managerial firms, where managers behave according to market share delegation contracts. Ownership and management are then separate and managers are paid through adequate incentives in order to achieve a competitive advantage in the market. In this context, we show that complexity arises, related both to the structure of the attractors of the system and the structure of their basins, as multistability occurs. The study is conducted by combining analytical and numerical techniques, and aims at showing that slight different initial conditions may cause very different long-term outcomes.

© 2014 Elsevier Ltd. All rights reserved.

1. Introduction

The issue of strategic delegation in oligopoly models has received in depth attention starting from the pioneering contributions of Baumol [2], Fama and Jensen [17], Vickers [40,41], Fershtman [20], Fershtman and Judd [21] and Sklivas [38]. This literature has investigated several types of contracts amongst firms' owners and managers. These contracts are observable, and the performance of managerial firms also depends on whether they behave as price setters or quantity setters. Specifically, when ownership and management are separate (this is the case of large companies, where governance is different from competitive firms) managers are likely to be driven by other motives than just maximizing profits, thus owners may try to motivate them through adequate incentives in order to achieve a competitive advantage in the market. To this purpose, managerial incentive schemes are essentially based on a weighted average of profits and output [40,41], profits and revenues [20,38], and relative performance evaluation [22,29,30,27]. The main interest of these studies lies in ranking outputs in oligopolies with managerial firms adopting these kind of contracts, and contrasting them with the case of profit maximization.

More recently, there has been a burgeoning interest in strategic incentive schemes where compensations of managers are based on profits and market shares [25,26,36,43,28], called market share delegation contracts. In particular, Jansen et al. [25] have studied a two-stage market share delegation game with two competing managerial firms, finding that a duopoly with market share delegation contracts performs better in terms of profits than a sales delegation game. Both cases of sales delegation and market share delegation lead to more aggressive managerial behaviors, causing lower profitability and higher social welfare than the standard Cournot and Bertrand duopolies. Market share delegation is found to be the dominant strategy in an asymmetric duopoly delegation game. Ritz [36] has tackled the issue of market share contracts showing that this kind of incentives for

* Corresponding author. Tel.: +39 010 209 95 03; fax: +39 010 209 55 36.
E-mail addresses: luca.gori@unige.it, dr.luca.gori@gmail.com (L. Gori).

http://dx.doi.org/10.1016/j.chaos.2014.10.006
0960-0779/© 2014 Elsevier Ltd. All rights reserved.

managers dominate delegation output-based contracts as well as standard profit maximization. They have also found that in an equilibrium with a market share contract, firms turn out to be less competitive than under sales delegation contracts and players are captured in a prisoner's dilemma. Later, Kopel and Lambertini [28] have revisited Jansen et al. [25] showing for Bertrand competition that they have used a misspecified demand system for horizontally differentiated products. By deriving correct demand functions (i.e., prices collapse to marginal costs when products are homogeneous), they have concluded that under market share delegation firms result in less competition (higher profits) than under sales delegation à la Fershtman and Judd [21]. In addition, some empirical studies have evidenced that market share rather than sales may provide an important objective for managerial firms, thus market share delegation contracts may become of importance in actual economies. For instance, Peck [34] has founded that increasing market shares are the second and third objectives for several Japanese and American top managers, while Gray [23] has substantially confirmed such a result finding that the market share objective is ranked second for a sample of managers of US firms with subsidiaries in Japan. Also in countries such as Canada, Germany and UK the market share objective seems to be relevant in the managerial performance evaluation [11].

The present paper revisits the nonlinear duopoly model with price competition and horizontal differentiation developed by Fanti et al. [19], thus obtaining a discrete time two dimensional dynamic system T which describes the price evolution in the economic setup. System T is then studied in order to explain how managerial incentive contracts based on market share affects local and global dynamics. To this purpose, we distinguish between the cases of: symmetric weight attached to the managers' bonus in their objective function (i.e., managers are of the same type and T is symmetric), and asymmetric weight (i.e., managers are of different types and the symmetry of system T is broken). We assume that products are substitutes and we show that there is an important relationship between the degree of horizontal product differentiation and the manager's bonus.

Specifically, we find different dynamic outcomes depending on whether the manager's bonus is equally weighted or weighted differently in the managers' objective function.

1.1. Symmetric case

In the case of symmetric delegation contracts, an interior Nash equilibrium[1] exists only if managers do not behave aggressively in the market. We find the existence of an upper bound of the weight of manager's bonus in the objective function such that the Nash equilibrium is locally and globally stable when it tends to such a threshold. With regard to stability outcomes, we find that when the bonus is close to its maximum threshold value ($\bar{b}$), the Nash equilibrium is locally (and globally) stable. The threshold $\bar{b}$ depends on the degree of product differentiation. In particular, when products tend to become homogeneous (substitutes), $\bar{b}$ decreases. This means that the higher product homogeneity is the less aggressive managers should be to guarantee the existence of a Nash equilibrium. In addition, when players start from the same initial condition coordination occurs in the long term. The attractor will become more complex if managers' behaviors are driven by contracts that assign an intermediate weight to the market share bonus in their objective function or the degree of substitutability between products is high or small. A chaotic attractor can be obtained if managers are driven less aggressively. In contrast, when players start from different initial conditions, if the attractor on the diagonal is transversely stable, the system synchronizes. In fact, given the manager's behavior, when products are substitutes (i.e., an increase in the market demand of product of variety 1 implies a decrease in the market demand of product of variety 2) managerial firms cannot coordinate themselves. We also find that the phenomenon of multistability of two or more attractors may occur depending on the relative weight of the manager's type and the attractors may be complex (the complexity in the structure of the attractor increases when the manager's bonus decreases sufficiently or products tend to be perfect substitutes). However, since products are imperfect substitutes not only the structure of the attractor but also the structure of the basin of attraction may be complex. This gives rise to problems of unpredictability (and then of policy rules) of the final outcome of the economy.

1.2. Asymmetric case

If delegation contracts are weighted differently, there exists a unique interior Nash equilibrium with different coordinates values. Specifically, the lower price is associated with the good produced by the firm where the manager behaves more aggressively. The local stability of the Nash equilibrium is obtained when managers behave not aggressively and similarly. By starting from the same kind of contract, we find that a slight perturbation on the size of the bonus (heterogeneity) causes the emergence of cycles. This because system T is no more symmetric and synchronized trajectories (coordination) are avoided. However, the multistability phenomenon continues to exist.

The present paper is connected with the work of Fanti et al. [18], that has developed a nonlinear Cournot duopoly with quantity setting firms and managerial incentive contracts based on relative profit delegation. Despite the assumption of homogeneous players (symmetric system), they have shown that an increase in the degree of competition between managers may be a source of on–off intermittency, blow-out phenomena and multistability. Similar events are found by Bischi et al. [10] under profit-maximizing quantity-setting firms but only when they are heterogeneous (asymmetric map). From a mathematical point of view, this holds because – unlike Bischi et al. [10] – the two-dimensional map that characterizes the Cournot duopoly with relative profit delegation of Fanti et al. [18] contains a parameter (i.e., the relative managers' attitude in their objective functions) that

[1] For the notion of Nash equilibrium see the seminal contributions of Nash [32,33].

Download English Version:

https://daneshyari.com/en/article/1889048

Download Persian Version:

https://daneshyari.com/article/1889048

Daneshyari.com