

CONTROLLING CHAOS IN A DUOPOLY ADVERTISING MODEL

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Abstract. A Cournot duopoly with goodwill advertisement can be modeled as a discrete-time dynamical system, which exhibits complex bifurcation and chaotic behaviour. Based on some essential features of the model, we show how bifurcation and chaos can be controlled via the delayed feedback control method, whose application is very straightforward and one can easily switch from a chaotic trajectory to a regular periodic one. In addition, we give possible economic implications of chaos control strategies described in the paper and discuss some interesting phenomena when firms stay in several kinds of dynamical markets.

Keywords. Chaos, control, delayed feedback, Cournot duopoly, advertisement.

1 Introduction

Tremendous efforts have been devoted to investigating complex dynamical behaviour existing in various economic systems. Significant and transparent theoretical insights have been gained. Recently, it has also been shown that even oligopolistic markets may become chaotic under certain conditions [5, 7].

Oligopoly, with a few firms in the market, is an intermediate structure between the two opposite cases of monopoly and perfect competition. Even the duopoly situation in an oligopoly of two producers can be more complicated than one might imagine since the duopolists have to take into account their actions and reactions when decisions are made. Oligopoly theory is one of the oldest branches of mathematical economics dated back to 1838 when its basic model was proposed by Cournot [7]. Research reported in [8] gives one example to show that a Cournot adjustment process of output might be chaotic under some kind of economic circumstances. Since then, various modifications have been made by numerous economists. Rosser [10] has a good state-of-the-art review of the theoretical development of complex oligopoly dynamics.

Advertisement is a crucial process in economy. Advertising expenditure can be considered as a capital investment to create present and future demand