Dynamic Price and Quantity Postponement Strategies

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ABSTRACT

This paper studies duopolistic competition under dynamic price and production quantity postponement for two differentiable products, which share common components from one supplier at a certain degree of substitution. Both price and quantity postponement is benchmarked according to the Bertrand and Cournot Stackelberg game. In addition, system dynamic is applied to show the long term effect of both strategic decisions (price and production quantity) on profit and against demand uncertainty. The results show that price postponement is appropriate for high modular products (make-to-stock) and production quantity postponement for special orders (make-to-order). The final part of the paper concludes with results and outlines future research directions.

Keywords: Game Theory, Managerial Flexibility, Market Share, Strategic Planning, Supply Chain Management

INTRODUCTION

Price and production capacity are two strategic decisions which product managers face over time. Kreps and Scheinkman (1983) showed that if firms choose capacities before engaging in Bertrand-like price competition, then the Cournot outcome is the result if the given capacities are at Cournot levels, or they should be rationed when the capacity cannot meet market demand. Davidson and Doneckere (1986), however, argued against this investigation and showed that the alternative rationing rule can eliminate idle capacity because the players agree to compete at higher equilibrium capacity.

Because the products undertaken by order-based firms are characterized by uniqueness, uncertainty and complexity, however, the Kreps and Scheinkman or Davidson and Doneckere rationing rules are difficult to apply to this type of firm. One reason is that order-based firms are different from mass production-based firms in many respects. These differences extend to their requirements with respect to product substitutability because consumer preferences are diversified among the available brands (Perloff & Salop, 1985). Since a homogenous product gives no options to consumers, most discussions of price or production postponement focus on their appropriateness, depending on the single firm demand uncertainty (Fine & Freund, 1986; Miegham, 1998; Miegham & Dada, 1999), while the product substitutability effect is often considered exogenous, so that such models may underestimate the benefit of production and price postponement to mass customized products (Kristianto & Helo, 2010).

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The effectiveness of product substitutability degrees has been extensively studied in a large number of contributions (Spence, 1976; Singh & Vives, 1984; Katz & Shapiro, 1985; Perloff & Salop, 1985; Martin, 1995; Colombo, 2002; Lambertini et al., 2004; Panchal et al., 2007). Some of them, for example Singh and Vives (1984) analyse the dominant strategy between price and quantity predetermined contract in a differentiated duopoly. On the other hand, Cellini and Lambertini (2002) and Lambertini and Mantovani (2004) investigated a long term join venture in Research and Development (R&D) to optimize the product differentiation degree (hereafter called product substitutability degree) of cooperating and non-cooperating firms according to the competition, according to Cournot (Kristianto & Helo, 2009).

With respect to previous efforts in product substitutability degree investigation, so far, few serious attempts have been made to investigate the effect of product substitutability degree on price and production quantity dynamics instead of their values at any given of time. However, the dynamic property is important with regard to the optimum price and quantity postponement decision, at which every player has no reason to change his price or production quantity decision. Our effort in this paper broadly follows Singh and Vives (1984), except that we take into account the possible effects of long term price and production quantity postponement strategic decision, resulting from the presence of product substitutability, as a result of common product platform application, and Dr. C.F Ross (1925) in terms of the possible effect of change in the rate of price and production quantity resulting from demand variety. In particular, unlike most of the existing literature on repeated games under product differentiation, we explicitly model those demand uncertainty effects which affect firms’ production quantities as well as prices.

In addition to recent literature, the open loop water tank analogy is a special case of price and production postponement for a continuous product substitutability distribution. This new approach is quite different to previous methods in the differentiated duopoly game (Singh and Vives, 1984) or price and production postponement (Fine & Freund, 1986; Miegham, 1998; Miegham & Dada, 1999), where the decision is assumed to depend merely on the price or production quantity at any given time, without considering whether the price or production quantity is increasing or decreasing at this time. Even this new approach also quite different to Lambertini et al. (2002), where competition is assumed under Cournot solely, without considering production quantity competition under the Bertrand game or impact of price postponement to capacity and flexible investment (Biller et al., 2005), where price postponement is used to balance between available supply and demand, without considering time the demand is increasing or decreasing at this time or Birge et al. (1988) where price and capacity postponement is used to substitutable product, without considering the demand variety. Indeed, in order to comprehend price and production quantity postponement application appropriately, we compare price and production quantity postponement in terms of their profitability at several product substitutability degrees and under varied demand.

The following sections first introduce related literature on dynamic analysis in competition, product substitutability in duopoly competition and the research area of this paper (Related Literature Section). Analytical model section is started by price postponement analysis using the Cournot game model, which continues with production quantity postponement (hereafter called production postponement) by applying the Bertrand game model. Discussion section presents and discusses the simulation results, which are concluded in Conclusion and further research, which explores the information behind the simulation results in the previous section and discusses some future research opportunities.

RELATED LITERATURE

Dynamic analysis in competition was firstly presented by Ross (1925) and it was discussed further by Smithies and Savage (1940).
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