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Automatica 42 (2006) 1371–1380
www.elsevier.com/locate/automatica

Dynamic brand-image-based production location decisions☆

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Received 29 December 2004; received in revised form 19 September 2005; accepted 20 January 2006
Available online 22 March 2006

Abstract

In this paper, we study the dynamic production location decisions of a manufacturer of a certain branded product. Considering brand-image as a form of goodwill, we extend the well-known Nerlove–Arrow dynamic model by adding both country-image and price. Formulating an optimal control problem for a group of countries in which the cost of production is convexly increasing with country-image, we are able to develop optimal decision rules for a manufacturer regarding the location of production and pricing over time. The resulted optimal policy has a very interesting pattern. Assuming that the demand rises by more than the value of the new brand-image in percentage terms, then, if brand-image is increasing toward a stationary value level, the optimal policy should be to initially locate production in countries with high image and set a high price that signals high quality. Later, the production should gradually shift to countries with lower production costs and lower image and the price lowered until the stationary value level is reached. For brand-images beyond the stationary value level, the location of production should start in a country with low costs and country-image while setting prices that signal relatively low quality. Over time, production should be shifted to countries with gradually higher costs and images while setting higher prices until the brand-image approaches the level of stationary value.
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Keywords: Country-of-origin; Manufacturing country; Production sourcing; Brand-image; Price-quality; Country-image; Goodwill; Optimal control; Decision-rules

1. Introduction

Brand-image is defined as perceptions about a brand as reflected by the brand associations (attributes, benefits and overall brand attitudes) held in consumer memory (Keller, 1993). Country-image is the total of all descriptive, inferential and informational beliefs that a consumer has about a particular country (Martin & Eroglu, 1993). Both current and past images of sourcing countries play a role in determining brand and product perceptions. For example, the perceived image of a product made in a country having a strong image (USA) and brand-image (GE) may deteriorate by sourcing production in countries with weak images such as the emerging economies in Eastern Europe (cf. Brodowsky, Tan, & Meilich, 2004; Nebenzahl & Jaffe, 1996). Selecting a country of manufacture has become a critical decision variable for managers of global companies. They may decide to design a product in one country and manufacture it in another. Their decision may be based on cost considerations or proximity to end user markets, but country-image has also now become a major managerial decision variable (Brodowsky et al., 2004). The influence of current and future country-images on production sourcing decisions is the focus of this work. The sourcing country may improve or erode brand-image and consequently sales. Reducing costs of production by means of sourcing may improve profits. If the low cost is associated with a weak-image of the sourcing country, the erosion of brand-image may have a greater effect and thus reduce profits. However this is not always the case. For example,

☆ This paper was not presented at any IFAC meeting. This paper was recommended for publication in revised form by Editor Suresh Sethi.

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0005-1098/$ - see front matter © 2006 Elsevier Ltd. All rights reserved.
doi:10.1016/j.automatica.2006.01.020

strong Japanese brands such as Sony, which have developed a substantial brand reputation, have been able to overcome such stereotyping, at least sufficiently enough to compete with Korean or Taiwanese firms, despite having a "made in" label of a Southeast Asian country such as Malaysia (Choi, 1992).

Previously, the location of production has been generally viewed as a function of transaction costs, country-specific attributes such as cost of raw materials and wage rates, negotiating and monitoring costs, environmental considerations such as political risk and competition, and strategic variables such as first mover advantages. Thus, in most, if not all production location studies, the focus have been exclusively on the supply side, ignoring the effect location has on the demand side, that is, on brand-image and its implications (Li, Murray, & Scott, 2000). In this paper, we examine location of production as a function of costs, of country and brand-images, as well as the short and long-run effects of price. We consider a monopolist manufacturer that needs to decide where to locate the production of a certain branded product. We posit that the perceived quality of a given product is based on its brand-image, country-image and price, all of which determine the demand for the particular product (cf. Darling & Arnold, 1988; Hastak & Hong, 1991; Teas & Agarwal, 2000; Thorelli, Lim, & Ye, 1989). Considering brand-image as a form of goodwill, we extend the well-known Nerlove–Arrow dynamic model by adding both country-image and price effects. Formulating an optimal control problem for a group of countries in which the cost of production is convexly increasing with country-image, we are able to develop optimal decision rules for a manufacturer regarding the location of production and pricing over time. The resulted optimal policy has a very interesting pattern. Assuming that the demand rises by more than the value of the new brand-image in percentage terms, then, if brand-image is increasing toward a stationary value level, the optimal policy should be to initially locate production in countries with high image and set a high price that signals high quality. Later, the production should gradually shift to countries with lower production costs and lower image and the price lowered until the stationary value level is reached. For brand-images beyond the stationary value level, the location of production should start in a country with low costs and country-image while setting prices that signal relatively low quality. Over time, production should be shifted to countries with gradually higher costs and images while setting higher prices until the brand-image approaches the level of stationary value.

The rest of this paper is organized as follows. In Section 2, we present our model. In Section 3, an optimal production policy is determined based on the current brand-image and on model's parameters. In Section 4, conclusions and managerial implications of the model are discussed. In Section 5, we present our conclusions and future research directions.

2. Model formulation and notation

We consider a monopolist manufacturer that needs to decide in which country to produce a certain branded product. Each potential country has a certain image and cost of production.

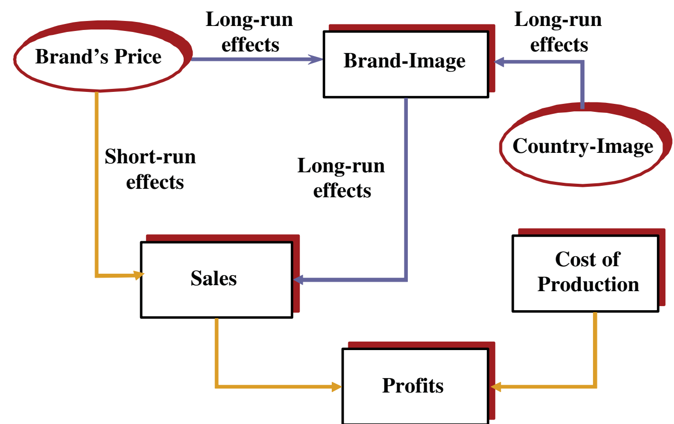

Fig. 1. Country-image, Brand-image and price effects on profits.

The image of the country can improve or impair the manufacturer's brand-image; the better the country-image, the higher the brand-image and vice versa (Papadopoulos, Heslop, & Avlontis, 1987). Since consumers tend to associate high prices with high quality, the price assigned to the product has similar long-run effects on brand-image, where higher prices improve the long-run brand-image. The brand-image resulting from both effects directly impacts the sales of the particular product. In addition, following the classical demand function, price is negatively related to sales in the short run. Thus, price has both long-run and short-run effects on sales. On the other hand, the cost of production negatively affects the resulted profits from the sales of the branded product. We summarize these relationships in a block diagram described in Fig. 1. To better understand the problem, and eventually select a target country in which to locate production, we present a formal decision-making model below.

Let $x = x(t)$ be the image of the brand at time t. This image summarizes the previously perceived quality of similar products sold under the same brand name, as well as all past effects of countries of production where similar branded products were produced and of past prices of such products. This can be thought as accumulated goodwill of the brand at time t.

Let $p = p(t)$ be the price of the brand at time t. There is ample evidence in the literature that consumers perceive high prices as indicators of high quality, and thereby, brand reputation (Feichtinger, Luhmer, & Sorger, 1988; Kotowitz & Mathewson, 1979a, 1979b; Spremann, 1985). For good reviews of this topic see Sethi (1977) and Feichtinger, Hartl, and Sethi (1994). Following this approach and noting that brand-image may be considered as a measure of reputation, we relate price with brand-image. Based on past experience, consumers form a price expectation for every brand within a given product line. We argue that there is a certain range of prices in which a decrease in price increases sales according to the classical demand function. However, a decrease under the *expected price* $\bar{p}$ signals low quality and, thereby, low brand-image. It should be noted that $\bar{p}$ is a brand attribute. Consumers expect different

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