Production, Manufacturing and Logistics

Balancing productivity and consumer satisfaction for profitability: Statistical and fuzzy regression analysis ☆

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Abstract

This paper examines the relationships among productivity, consumer satisfaction and profitability using the conventional statistical regression and the new fuzzy regression approaches. For service firms in the context of Hong Kong, we verify the *profit hypothesis* that individually both productivity and consumer satisfaction are positively linked to profitability as well as the *tradeoff hypothesis* that aggregately there are negative interactions between productivity and consumer satisfaction for enhancing profitability. Hence service firms should balance their efforts in productivity and consumer satisfaction, possibly by employing appropriate information technologies to improve productivity while without hurting consumer satisfaction, to optimize their profitability. The study takes advantage of the Hong Kong Consumer Satisfaction Index and deliberately focuses on total rather than partial productivity. Several models are first estimated using the ordinary least squares (OLS) method and the results generally support the two hypotheses, but the OLS approach also leaves two puzzles that estimates of the regression coefficients are: (1) not significant before considering the interactions between consumer satisfaction and productivity but significant after introducing the interaction term, and (2) significant although sample data for productivity and the interaction term are highly correlated. These puzzles, together with the observed imprecision in productivity and profitability measurements and especially the subjectivity in measuring consumer satisfaction, lead us to adopt the fuzzy linear regression (FLR) techniques to further examine the two hypotheses. The popular FLR model continues to favor our research hypotheses but fail to offer any additional insights into the examined relationships over the OLS models. We then propose a revised FLR model which, in addition to reconfirming the hypotheses, does help to explain the encountered puzzles and fuzziness, and hence suggests an encouraging methodology for marketing.
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1. Introduction

Productivity is an everyday word and has long been viewed as an influential element for economic growth and corporate development (Craig and Clark, 1973; Miller, 1984; Sink, 1985; Solow, 1957). On the other hand, consumer satisfaction has widely been recognized in marketing thought and practice as a central concept as well as an important goal of all business activities (Johnson and Gustafsson, 2000; Rust et al., 2002; Yi, 1990; Zeithaml, 2000). However, there have been conflicting viewpoints in the literature regarding the possible combined effects of productivity and consumer satisfaction in profitability, with some advocating for positive interactions (Edvardsson et al., 2000; Huff et al., 1996; Krishnan et al., 2000; Westlund and Lothgren, 2001) while others supporting for negative tradeoffs (Eklöf et al., 1999; Rust et al., 2002; Sterman et al., 1997; Zeithaml, 2000), which make it difficult for firms to decide which results they should adopt to formulate effective corporate strategies. Using data from the Swedish Customer Satisfaction Barometer (SCSB) (Fornell, 1992), Anderson et al. (1997) demonstrate a clear pattern that, while both productivity and consumer satisfaction are positively related to profitability for any business, the tradeoffs between the two in achieving profitability are positive for goods but negative for services. Other similar findings from the Swedish experience (Edvardsson et al., 2000; Eklöf et al., 1999) also largely support the said tradeoff proposition.

While the tradeoff proposition is a very useful guide for different firms to develop different strategies to balance their efforts in productivity and consumer satisfaction for higher profitability, its generality needs to be tested across different samples for universal applications. The current paper is for this purpose by examining the tradeoffs based on the Hong Kong Consumer Satisfaction Index (HKCSI) (Chan et al., 2003). In addition to using the popular ordinary least squares (OLS) method to estimate the relationships between productivity and consumer satisfaction in achieving profitability, we especially consider several issues related to the fuzziness of the relationships between and the measurements for the variables investigated. As Chan et al. (1999) and Varki et al. (2000) point out, data in marketing research always involve certain degree of fuzziness for which conventional quantitative methods may not be well suited. In our study, we argue that the imprecision involved in firms' financial data for calculating productivity and profitability and especially human beings' subjectivity involved in the consumer satisfaction data are inevitable. Hence fuzzy linear regression (FLR) techniques (Tanaka, 1987; Tanaka et al., 1982) could be employed to handle the fuzziness embedded in the data and relationships to seek possibly new results and/or interpretations.

This paper unfolds as follows. Relationships among productivity, consumer satisfaction and profitability are first investigated and research hypotheses are then proposed in Section 2. In Section 3, measurements for the three variables and especially for productivity are discussed, and data for a number of Hong Kong listed service firms are collected based on the HKCSI database and a recognized financial source. Several models are estimated using the OLS method in Section 4 to explore the relationships among the variables, and the tradeoff proposition is verified between productivity and consumer satisfaction for enhancing profitability. In Section 5, possible fuzziness inherited in the measurements of productivity, consumer satisfaction and profitability is discussed, and conventional FLR models are introduced and then a revised FLR model is proposed to examine the fuzzy relationships among the variables. The FLR results further confirm the tradeoff proposition and also provide some additional insights into the variables' relationships. Summary and concluding remarks are presented in Section 6.

2. Relationships and hypotheses

2.1. Productivity and consumer satisfaction

Productivity—outputs produced in relation to inputs used—is a conventional measure of a firm's performance. In the literature, productivity improvement has long been viewed as the major source of economic