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Journal of Asian Economics 16 (2005) 847–860
JOURNAL OF ASIAN ECONOMICS

The estimation of efficiency for life insurance industry: The case in Taiwan

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Received 10 December 2004; received in revised form 1 August 2005; accepted 15 August 2005

Abstract

Using 23 years of data, (1977–1999), we estimate the translog cost function for 26 life insurance companies. We employ the distribution free approach (DFA) and Battese and Coelli (DFP) model to estimate inefficiency. We then test the constants or residuals to see if they are related to the so-called X-efficiencies, because of market share, diversification of product strategy, scale efficiency, and market growth ratio. Results show that the efficiency relates to the occurrence of market share, diversification products strategy, and scale efficiency.

JEL classification: F14

Keywords: Life insurance industry; X-efficiency, Economies of scale; Diversification of product strategy; Market power theory

1. Introduction

The competitive environment faced by Taiwan's life insurers has undergone a myriad of changes during the past decade. Such changes were facilitated, in part, by financial services' deregulation, entry by non-Taiwanese life insurance companies into the Taiwan market, interest rate volatility, and technological advances in information processing. The life insurance companies' responses include innovations in product design and the problem of insolvencies.

Researchers have recently been examining insurers' cost structure and industry performance (Doherty, 1981; Skogh, 1982; Grace & Timme, 1991; Weiss, 1986). Traditional research focuses

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1049-0078/$ – see front matter
doi:10.1016/j.asieco.2005.08.004

on economies of scale and scope, but some research examines the industry's efficiency (Yuengert, 1993; Cummins & Zi, 1997; Hao & Chou, 2002). Hao and Chou (2002) employ Schmidt and Sickles' (1984) distribution free approach (DFA) to estimate eight firms' efficiency and find that the efficiency relates to the occurrence of some optimal scale and diversification of product strategy. These studies find that the life insurance sector has an average inefficiency of around 30–50% (Fecher, Kessler, Perelman, & Pestieau, 1993; Yuengert, 1993; Gardner & Grace, 1993; Hardwick, 1997; Hao & Chou, 2002).

We also use Schmidt and Sickles' (1984) distribution free approach and the Battese and Coelli model (1992) to estimate 26 Taiwanese life insurance companies' efficiency, and then analyze the market share, optimal scale, and diversification of product strategy implications for efficient firm operations in the life insurance industry. First, a brief review of efficiency is presented, and then Section 3 explains variable definitions and presents the relationships to be examined. Section 4 describes the models. Section 5 offers the estimation and results. Section 6 discusses the results and is followed by a conclusion.

2. Background

Production theory identifies several types of inefficiencies, including allocative, technical, scale, scope, and X-efficiency. Allocative inefficiency arises when a company uses a costly combination of inputs in producing output. Technical inefficiency occurs when the company fails to produce on the efficient production frontier. Scale inefficiencies arise when the firm cannot lower average costs by increasing or decreasing its output levels. Finally, scope efficiencies exist if the firm can lower average costs by changing its output mix.

Leibenstein (1966) identifies a fifth approach for examining efficiency, and called the term ''X-efficiency'' to describe the resulting difference between actual and minimum cost. After Leibenstein (1966) define X-efficiency, Aigner and Chu (1968) follow Farrell (1957) and Leibenstein (1966) in methodologically developing frontier production function estimation. Today there exists a multitude of approaches, such as Schmidt and Sickles (1984) measuring efficiency relative to the distribution free approach, Aigner, Lovell and Schmidt (1977) calculating efficiency relative to the stochastic frontier approach (SFA) and Banker, Charnes, and Cooper (1984) computing efficiency relative to data envelopment analysis (DEA). Battese and Coelli (1992, 1995) employ log-likelihood functions to test the residual scores, and they assume that the residuals follow truncated normal density functions.

Schmidt and Sickles (1984) show that the Jondrow, Knox Lovell, Materov, and Schmidt (1982) method using cross-sectional data to estimate efficiency has three problems. First, the technical efficiency of a particular firm (observation) can be estimated, but not consistently. Second, the estimation of the model and the separation of technical inefficiency from statistical noise require specific assumptions about the distribution of technical inefficiency and statistical noise. It is not clear how robust one's results are to these assumptions. Third, it may be incorrect to assume that inefficiency is independent of the regression.

Schmidt and Sickles' (1984) distribution free approach and the Battese and Coelli model (1992) to analyze 26 Taiwanese firms' efficiency, and analyze the market share, optimal scale, and diversification of products' strategy implications for efficient firm operations in the life insurance industry.

Battese and Coelli (1995) employ the one-stage model to excess the issue of X-efficiency, but we are not sure that all variables (output, product factor, and environmental influences) are independent, and so we still use a two-stage method.