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Technological progress, inefficiency, and productivity growth in the US securities industry, 1980–2000

Wei David Zhang [a,*], Shuo Zhang [b], Xueming Luo [c]

[a] School of Global Management and Leadership, Arizona State University, PO Box 37100, Phoenix, AZ 85069, United States
[b] Statistics and Analysis, Ministry of Community and Social Services, Toronto, Canada
[c] College of Business Administration, University of Texas at Arlington, United States

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Abstract

Employing a Data Envelopment Analysis (DEA) approach, we investigate the technological progress, efficiency, and productivity of the US securities industry between 1980 and 2000. Our results indicate that the US securities industry in general is less efficient than the existing technology allows. The relative productivity of the US securities industry in general declined. The failure of most firms to catch up with the production frontier pushed forward by a few large investment banks is the major reason behind the declines of relative productivity. Smaller regional firms, due to their inability to respond to technological innovation, experienced especially large decreases in both efficiency and productivity.

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1. Introduction

All financial transactions in the US are essentially conducted by three industries: banking, securities, and insurance. The securities industry performs key services such as investment banking, brokerage activity, corporate strategy development, and portfolio management. With annual global revenue reaching $450 billion (see, e.g., Securities Industry Association (SIA) Research Report, Vol. II, No. 6), the US securities industry plays a vital part in providing financial services both in the United States and abroad.

However, while there has been a critical stream of studies that examines the efficiency performance of the banking industry (e.g., Alam, 2001; Wheelock and Wilson, 1999; see Berger and Humphrey, 1997 for an excellent review of 130 studies of efficiency performance of financial institutions), there is virtually no academic study that examines the securities industry in spite of its magnitude and importance. The main reason for the lack of research in this industry is that, unlike other financial industries, such as banking, regulators do not collect and make publicly available the type of information necessary to analyze the industry.

To address the gap, this study, in an exploratory nature, examines the US securities industry in a dynamic setting. Measuring productivity change can employ either parametric or non-parametric methods. Parametric methods employ stochastic models that necessitate a large sample size to make a reliable estimation. The non-parametric approach of data envelopment analysis (DEA) is less data demanding. It works well with small sample size and does not require knowledge of the proper functional forms (Grifell-Tatje and Lovell, 1997; Wheelock and Wilson, 1999). In this study, we adopt DEA to measure the performance of US securities firms and decompose the Malmquist productivity index into its mutually exclusive and exhaustive components. Our results indicate that the US securities industry in general is quite inefficient with respect to the leading firms. The relative productivity of the US securities industry in general declined during the period of study. Our study indicates that in a world of technological innovation, the differential ability of different

* Corresponding author. Tel.: +1 602 543 6238; fax: +1 602 543 6221.
E-mail address: david.zhang@asu.edu (W.D. Zhang).

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firms to respond to changes has enormous implications. The failure of most firms to catch up with the production frontier pushed forward by a few large investment banks is the major reason behind the declines in relative productivity. Smaller regional firms, due to their inability to respond to changing technology, experienced especially large decreases in both efficiency and productivity.

The contributions of this paper are as follows: First, this study focuses on efficiency changes and productivity in the US securities industry; our quarterly data cover the period from the first quarter of 1980 to the last quarter of 2000, resulting in an unprecedented long chain of ex post performance indices. Second, our study is the first to employ a DEA-type Malmquist index to examine managerial efficiency and total factor productivity change in the US securities industry. Third, we identify the driving force behind these productivity changes by decomposing total factor productivity change into its exclusive and exhaustive components–change in efficiency (catching-up or falling behind) and change in technology (innovation or shock).

The paper is structured as follows: Following a review of the securities industry in Section 2, we describe the methodology in Section 3. In Section 4, we present the data and analyze the managerial efficiency and productivity change of US broker–dealer firms. Section 5 concludes.

2. The securities industry

In the 1990s, major value drivers such as technological innovation and globalization have caused enormous changes in the securities industry. Perhaps no other industry has embraced the new technology more than the securities industry. The technological advances of the Internet have created a new information economy that has transformed the industry. The instant accessibility and depth of information available to anyone by a computer have permitted firms to deconstruct value chains, creating new price and value propositions for the customer. Internet provides the industry with the ability to deliver personalized content in a global context.

Table 1 shows a synopsis of changes in the US securities industry during the period between 1980–2000. Profitability, as measured by return on equity, has in general declined, despite occasional rebounds, from mid 1980s to mid 1990s. It seems to have recovered after 1995, but never reached the lofty number of 42% in 1980. It should be noted that the US securities industry remains enormously profitable compared to the US banking industry (see, e.g., Berger and Mester, 2003). The alternative measure of profitability, return on asset, exhibits the same general trend. The revenue/costs ratio declined sharply from 16.4% in 1980 to 9.4% in 2000. Cost ratios declined through the late 1980s to the mid-1990s and returned to essentially the same level in 2000 as that in 1980. Table 1 also shows that most of the changes in cost and profit ratios occurred between 1980 and 1995. Based on these data, we examine the data in two segmented intervals 1980–1995 and 1995–2000 as well as the entire 1980–2000 interval.

Table 1
Descriptive statistics of the US securities industry from 1980–2000

Year	# of firms	ROA	ROE	Costs/asset	Costs/equity	Revenue/costs
1980	386	0.022	0.422	0.135	2.570	1.164
1981	388	0.018	0.321	0.145	2.642	1.121
1982	384	0.018	0.338	0.117	2.250	1.150
1983	405	0.018	0.324	0.120	2.183	1.149
1984	392	0.006	0.125	0.107	2.310	1.054
1985	370	0.011	0.249	0.088	2.070	1.120
1986	370	0.012	0.257	0.099	2.082	1.124
1987	393	0.003	0.046	0.122	2.027	1.023
1988	369	0.005	0.093	0.102	1.841	1.051
1989	351	0.003	0.071	0.104	2.234	1.032
1990	329	0.000	0.007	0.098	2.358	0.997
1991	316	0.010	0.226	0.091	2.124	1.107
1992	308	0.008	0.217	0.076	1.989	1.109
1993	303	0.009	0.248	0.069	1.864	1.133
1994	302	0.001	0.034	0.083	2.108	1.016
1995	310	0.006	0.196	0.077	2.359	1.083
1996	309	0.008	0.286	0.080	2.765	1.103
1997	301	0.007	0.244	0.078	2.657	1.092
1998	283	0.006	0.171	0.092	2.819	1.061
1999	280	0.008	0.230	0.085	2.366	1.097
2000	271	0.009	0.251	0.096	2.684	1.094

Finally, the second column of Table 1 shows the industry has been consolidating dramatically, with the number of firms declining by one-third over the 20-year period.

3. Methodology

The basic description of the DEA methodology employed in this paper is provided by Isik and Hassan (2003). Essentially, the managerial (technical) efficiency (TE) can be decomposed into pure technical efficiency (PTE) and scale efficiency (SE). If TE=PTE, then SE=1 (fully scale efficient), because overall technical efficiency is TE=PTE × SE.

Following Farrell (1957) and Fare et al. (1994), we specify the Malmquist total factor productivity change (TFPCH) index, M, simply as the product of efficiency change (EFFCH), which indicates how much closer a broker–dealer firm gets to the efficient frontier (*catching-up effect* or *falling behind effect*), and technological change (TECHCH), which indicates how much the benchmark production frontier shifts at each firm's observed input mix (*technical innovation* or *shock*):

$$M(t,t+1) = \overbrace{\underbrace{\frac{D_{t+1}^{\mathrm{VRS}}(x_{t+1},y_{t+1})}{D_t^{\mathrm{VRS}}(x_t,y_t)}}_{\mathrm{PEFCH}} \times \underbrace{\left[\frac{D_{t+1}^{\mathrm{CRS}}(x_{t+1},y_{t+1})/D_{t+1}^{\mathrm{VRS}}(x_{t+1},y_{t+1})}{D_t^{\mathrm{CRS}}(x_t,y_t)/D_t^{\mathrm{VRS}}(x_t,y_t)}\right]}_{\mathrm{SECH}}}^{\mathrm{EFFCH}} \times \underbrace{\left[\frac{D_t^{\mathrm{CRS}}(x_{t+1},y_{t+1})}{D_{t+1}^{\mathrm{CRS}}(x_{t+1},y_{t+1})} \times \frac{D_t^{\mathrm{CRS}}(x_t,y_t)}{D_{t+1}^{\mathrm{CRS}}(x_t,y_t)}\right]^{1/2}}_{\mathrm{TECHCH}} \quad (1)$$

TFPCH (M) index can attain a value greater than, equal to, or less than unity depending on whether the securities firm