Efficiency and Demutualization: Evidence From the U.S. Life Insurance Industry in the 1980s and 1990s

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Abstract

This article examines the efficiency changes of U.S. life insurers before and after demutualization in the 1980s and 1990s. We use two frontier approaches (the value-added approach and the financial intermediary approach) to measure the efficiency changes. In addition, we use Malmquist indices to investigate the efficiency and productivity change of converted life insurers over time. The results using the value-added approach indicate that demutualized life insurers improve their efficiency before demutualization. On the other hand, the evidence using the financial intermediary approach shows the efficiency of the demutualized life insurers relative to mutual control insurers deteriorates before demutualization and improves after conversion. The difference in the results between the two approaches is due to the fact that the financial intermediary approach considers financial conditions. The results of both approaches suggest that there is no efficiency improvement after demutualization relative to stock control insurers. There is, however, efficiency improvement relative to mutual control insurers when the financial intermediary approach is used.

Introduction

Which form of insurance company ownership structure—mutual or stock—is more efficient has been an important research topic in the insurance literature since the 1970s. Several earlier studies examined the performance of competing insurance ownership structures using cross-sectional analysis (e.g., Spiller, 1972; Frech, 1980). Recent studies have examined the performance of insurers that underwent the conversion[1] process from the stock form of organization to the mutual form (Mayers and

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[1] We define conversion here as a mutual insurer demutualizing and becoming a stock insurer or a stock insurance company mutualizing ("going private") to become a mutual insurer.

Smith, 1986) and from the mutual form of organization to the stock form (McNamara and Rhee, 1992; Cole, McNamara, and Wells, 1995; Cagle, Lippert, and Moore, 1996; Mayers and Smith, 2002; Viswanathan and Cummins, 2003).

Mayers and Smith (1986) proposed the efficiency hypothesis to explain why stock life insurance companies converted to the mutual form (mutualization). This hypothesis states that insurers change their organizational structure in an effort to improve financial and operational performance given the costs and benefits inherent in each type of organizational structure. Under agency theory, the disadvantages of the mutual form are well known. Specifically, policyholders of mutual insurers exercise less effective control over managers than do shareholders at stock companies. However, mutuals eliminate the cost associated with owner–customer conflicts by unifying these interests in a single group of claimholders. The stock form of organization increases control over management and thus may improve efficiency.[2] However, stock organizations separate the customer and owner functions, which may increase contracting costs. If improved efficiency is the goal of insurer conversions, then we should observe improved operating performance after conversion.

Both Mayers and Smith (1986) and McNamara and Rhee (1992) found that no claimholders were harmed through the conversion process, and therefore concluded that the conversions had been efficiency-enhancing. However, both studies employed a limited number of variables, such as financial ratios, as proxies for "performance," and these studies did not examine input–output efficiency. In addition, these studies examined all of the conversions that occurred up to the time of the studies, including conversions from the early 20th century. We would like to see whether efficiency is one of the reasons for recent life and health insurer demutualizations, specifically those conversions occurring in the 1980s and 1990s. As suggested by Viswanathan and Cummins (2003), examining a shorter period also provides insights based on more homogeneous market conditions.

A number of researchers have recently applied data envelopment analysis (DEA) to the examination of mutual vs. stock insurance company efficiency. Cummins and Zi (1998), for example, explore a variety of efficiency measures, including DEA, to examine the efficiency of a sample of mutual and stock life insurance companies. They find no support for the expense preference hypothesis, which predicts that mutual insurers will have higher costs than stock insurers. Cummins and Zi conclude, instead, that difference organizational forms may achieve efficiency in market segments where they enjoy a competitive advantage. They refer to this idea as the "efficient sorting" hypothesis. Cummins, Weiss, and Zi (1999) apply DEA analysis to examine the coexistence of mutual and stock insurance companies in the property and liability insurance industry, testing agency hypotheses about organizational structures. They conclude that the firms operate on different cost and production frontiers. As with the results for life insurers, the property and liability insurance companies sort themselves by area of competitive advantage. For an excellent review of the literature on the application of

[2] Although incentive problems analogous to stockholder–bondholder conflicts exist for stock insurers, the fact that policyowners have to approve the demutualization plan before conversion suggests that policyowners should be made better off through demutualization, and this implies the efficiency hypothesis.

frontier efficiency and productivity analysis in the insurance industry, see Cummins and Weiss (2000).

The purpose of our article is to examine the efficiency changes of U.S. life insurance companies before and after demutualization in the 1980s and 1990s. Specifically, we ask two questions. First, is efficiency a reason for demutualization? Second, do demutualized insurers improve their efficiency after demutualization?

Our article contributes to the literature in several ways. We use the value-added approach of DEA to measure the efficiency changes, whereas previous studies have employed financial and operating performance variables. The DEA approach considers both inputs and outputs in the analyses. This approach also considers the two components of cost efficiency: technical efficiency, which measures the ability of a firm to obtain maximal output from a given set of inputs, and allocative efficiency, which reflects the ability of the firms' managers to allocate resources based on input prices. In addition, we use Malmquist indices to investigate the efficiency and productivity change of demutualized insurers over time. The Malmquist analysis aids our investigation because it can further separate the productivity change into two components: technology change and technical efficiency change. This method allows us to investigate whether a firm's productivity improvement is due to its adoption of new technology or is due to efficiency improvement.

We also utilize the financial intermediary approach of DEA analysis. The financial intermediary approach allows us to examine the financial conditions of demutualized insurers before and after conversion. The results of the value-added approach indicate that demutualized insurers improve their efficiency before demutualization. On the other hand, the evidence from the financial intermediary approach shows that the efficiency of demutualized insurers deteriorates before conversion. The difference in results between the two approaches is attributable to the fact the outputs and inputs are different. Specifically, the financial intermediary approach considers financial conditions as outputs, whereas the value-added approach considers benefits as the main output.[3] The results of both approaches suggest that there is no efficiency improvement after demutualization, except improvement relative to mutual control insurers under one of the approaches. The overall evidence does not support the efficiency hypothesis.

Demutualization Background

We first describe the process of demutualization. As mentioned by Viswanathan and Cummins (2003), states have different regulations about demutualization; the following description is an overview of the general process of demutualization.[4] The first step of demutualization for a mutual insurer is to obtain the authorization from the board of directors. Second, the insurer needs to develop a proposal that should be approved by the state insurance regulator before seeking the approval of the policyholders. All eligible policyholders receive the demutualization plan and a voting

[3] We discuss the reasons for the different results in detail in the financial intermediary approach section.

[4] Viswanathan and Cummins (2003) provide a detailed description of the demutualization process.

form. Typically, a mandatory public hearing is held before the vote. Some states, such as California, require a simple majority for the plan's approval, whereas other states require two-thirds or three-fourths of votes for the approval. After the final approval from the policyholders and the regulator, the plan becomes effective.

We next provide an example of a recent demutualization IPO. On May 12, 1998, John Hancock Mutual Life Insurance Company made an announcement about its plan to demutualize and issue stock through an initial public offering (IPO). The board of directors approved the plan on August 31, 1999. On November 17, 1999, John Hancock held a public hearing as required under Massachusetts General Laws. The purpose of the public hearing was to provide an opportunity for the board of directors, officers, employees, and policyholders to address their concerns about the demutualization plan. After the public hearing, the Massachusetts Commissioner of Insurance determined that the plan conformed with the requirements of Massachusetts General Laws. On November 30, 1999, John Hancock held a special policyholder meeting. Over 93 percent of the eligible policyholders approved the conversion plan. Finally, the Massachusetts Commissioner of Insurance approved the plan. On January 27, 2000, John Hancock made the conversion from a mutual life insurance company to a stock life insurance company. John Hancock's IPO ultimately raised about $1.7 billion.

Data Selection

Data for the insurers in the sample were collected from various issues of *Best's Insurance Reports, Life and Health Edition*. As input–output efficiency studies require similar economic conditions, our sample is limited to a subsample of recent demutualizations, specifically, those that occurred from 1984 to 1995. The sample period is chosen for several reasons. Viswanathan and Cummins (2003) suggest that "market conditions changed significantly for life insurers beginning in the late 1980s due to bank entry into the market" (p. 403). In addition, for each of the demutualized insurers in our sample, we calculate efficiency scores 5 years prior to conversion through 5 years after demutualization.[5] In other words, for each demutualization sample firm, we need 11 years of data. Thus, our sample period spans from 1979 through 2001.

We use admitted assets of the demutualized insurers in the year before conversion ($t = -1$) in selecting matching control insurers. It is appropriate to select matching mutual and stock control insurers using admitted assets of demutualized insurers at $t = -1$ and conduct analyses before demutualization. One may question whether it is appropriate using the same matching insurers to conduct the analysis after demutualization because the demutualized insurers could have capital infusions in $t = 0$ and the size of the demutualized insurers could increase. Although this is a valid concern, the advantage of using the same matching sample is that it is a better comparison if we use the same matching insurers for the sake of consistency. If we choose a new set of insurers of larger size and use them to conduct analyses, it may not be a fair comparison because the efficiency of the new set of insurers may not be the same as those of the original set. The issue of different size is not a major one for

[5] We believe 5 years is a sufficient time for investigating the efficiency of demutualized insurers before and after demutualizations.

the following two reasons. First, the DEA approach is an input–output model; thus, the size is not a major concern. In fact, to the best of our knowledge, the literature has not used matching samples for DEA analyses. Second, in our later analyses, we do control for size.

Because the demutualized insurers were mutual insurers before demutualization and stock insurers after conversion, the selection of our sample insurers was twofold. For each of the demutualized insurers, we first select 10 mutual life insurers of similar size as group 1 and 10 stock life insurers also by size, as group 2. We then calculate the efficiency score of the demutualized insurers and the control mutual insurers based on the sample that combines demutualized insurers and group 1 (control mutual insurers). We also calculate the efficiency score of the demutualized insurers and control stock insurers based on the sample that combines demutualized insurers and group 2 (control stock insurers).[6] Our analysis is comprehensive because it considers both group 1 and group 2 as control samples, matching the demutualized insurers with mutual companies before conversion, and with stock companies after conversion. This analysis is important because prior literature, such as Cummins, Weiss, and Zi (1999), find that mutuals and stocks operate on different frontiers.

An additional comment about the control samples is necessary. The demutualized insurers were required to have 11 years' worth of data available to be included in the sample. However, this requirement was not used with the control samples. Therefore, the possibility of survivorship bias exists in the analysis. For example, a less efficient control firm is more likely to become insolvent or be acquired. Another possibility is that a more efficient control firm may be merged into another insurer, so data no longer would be available for the firm. However, of the 110 (11 × 10) control insurers in our mutual sample and the 110 control insurers in our stock sample, only 7 and 5 insurers, respectively, did not have data available for all 11 years. We believe survivorship bias is not severe in our analysis and thus it does not materially affect our results.[7]

Methodology

There are two major efficiency frontier methodologies: the econometric (parametric) approach and the mathematical programming (nonparametric) approach. The econometric approach requires specification of a production, cost, and revenue or profit function, as well as assumptions about the error terms. The mathematical programming approach imposes fewer constraints on the optimization problem. We adopt the mathematical programming approach since it avoids the problem of vulnerability to specification errors frequently encountered when using the econometric approach.[8] The mathematical programming approach employed in this article is based on the work of Farrell (1957) and Färe, Grosskopf, and Lovell (1985). Specifically, we follow the approach developed by Cummins, Weiss, and Zi (1999).

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[6] The reason that we did not pool all three sets of insurers (demutualized insurers, mutual control insurers, and stock control insurers) to calculate efficiency scores is that Cummins, Weiss, and Zi (1999) found that mutual and stock insurers operate on different frontiers.

[7] We thank the anonymous referees for pointing out this potential bias.

[8] See Cummins and Weiss (2000) for a detailed discussion of the pros and cons of the nonparametric programming approach.

The literature suggests that the efficiency of a firm consists of two components: *technical efficiency*, which reflects the ability of a firm to obtain the maximum output from a given set of inputs, and *allocative efficiency*, which reflects the ability of a firm to utilize inputs in optimal proportions given the price of the inputs. Technical efficiency and allocative efficiency are combined to provide a measure of *cost efficiency* (Coelli, 1996). These three efficiency measures (technical, cost, and allocative) vary between 0 and 1, with an efficiency score of 1 implying full efficiency.

Technical Efficiency

The efficiency measures are illustrated in Figure 1 using a simple example involving a firm using two inputs, x_1 and x_2, to produce a single output, y. In this example, isoquant SS′ in Figure 1 represents the various combinations of the two inputs needed to produce a fixed amount of output. Firms using the best available technology are located on the isoquant, and these firms are considered to be technically efficient. The technical efficiency (TE) of a firm has a value ranging from 0 to 1, with a value of 1 indicating full technical efficiency. If a firm has an input–output combination defined by a point P, then its technical inefficiency is defined as the ratio QP/0P, which represents the percentage by which the firm could reduce inputs by adopting the best technology. So technical efficiency is represented by the ratio

$$TE = 0Q/0P,$$

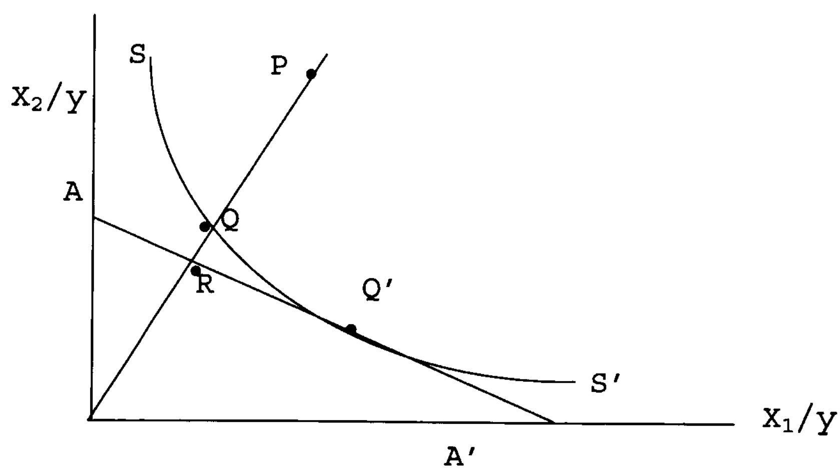
which is equal to 1 minus QP/0P. Point Q is technically efficient, as it lies on the efficient isoquant.

Allocative and Cost Efficiency

Isocost line AA′ in Figure 1 represents the ratio of input prices. The allocative efficiency (AE) of a firm operating at point P is defined as the ratio

$$AE = 0R/0Q.$$

FIGURE 1
Technical Efficiency



The distance between points R and Q represents the reduction in costs that would occur if the firm operated at allocatively efficient point Q′, instead of point Q. Total cost efficiency, CE, is defined as the ratio 0R/0P, which is the product of technical and allocative efficiency:

$$\text{Technical Efficiency} \times \text{Allocative Efficiency} = \text{Cost Efficiency}$$

or

$$(0Q/0P) \times (0R/0Q) = 0R/0P. \tag{1}$$

To determine cost efficiency (CE), the linear programming approach is used. The first step is to calculate the minimum cost, MC, of producing the output. For a multiple input–output scenario, the following linear programming (LP) problem is solved:

$$\begin{aligned} \text{Minimize:} \quad & px_i^* \\ & y_i \leq \lambda Y \\ \text{Subject to:} \quad & x_i \geq \lambda X \\ & \lambda \in R_+. \end{aligned} \tag{2}$$

In this constrained optimization problem, y is an m-dimensional vector of output produced by a particular firm; x_i is the n-dimensional vector of inputs used by the firm; Y is the $(k \times m)$ matrix of outputs, where k is the number of firms; X is the $(k \times n)$ matrix of inputs; λ is the $(m \times 1)$ vector of weights (intensity parameters) attached to each observation when determining minimum cost; and p is the n-dimensional vector of input prices. The input values (x_i^*) generated by solving the above problem represent the minimum cost vector of inputs for the ith firm. Total cost efficiency (CE) of ith firm can then be calculated as

$$\text{CE} = px_i^*/px_i.$$

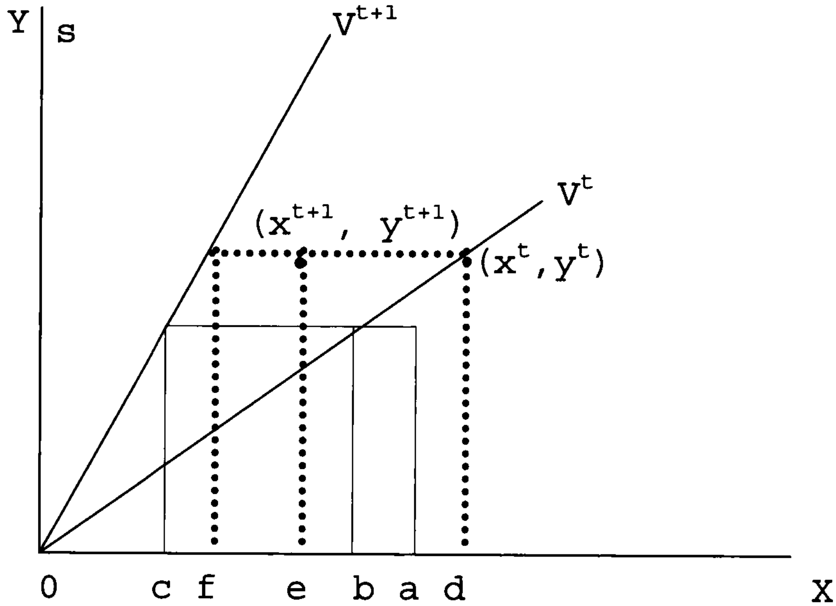
This measure is the ratio of minimum cost to the actual observed cost, and it corresponds to 0R/0P in Figure 1.

A measure of technical efficiency (TE) is determined by solving another linear programming problem. This problem is stated as

$$\begin{aligned} \text{Minimize:} \quad & \text{TE} \\ & y_i \leq \lambda Y \\ \text{Subject to:} \quad & \text{TE} * x_i \geq \lambda X \\ & \lambda \in R_+. \end{aligned} \tag{3}$$

In this problem, TE is a scalar and all of the other variables are as defined previously. In Figure 1, the TE of point P corresponds to 0Q/0P. After calculating technical efficiency and cost efficiency, allocative efficiency (AE) can be determined through Equation (1) (AE = CE/TE).

FIGURE 2
Productivity and Efficiency Change



Evolution of Technical Efficiency and Technical Change

The cross-frontier distance function concept is attributed to the Malmquist index approach (Malmquist, 1953). The Malmquist index measures productivity changes. Its application was improved through an extension by Färe and Grosskopf (1992). The Malmquist index and productivity change are illustrated in Figure 2. Consider a firm operating at point (x^t, y^t). The distance function (D) value for the firm relative to the frontier in time period t is $D^t(x^t, y^t) = 0a/0b$. The superscript of the distance function represents the time period of the frontier, whereas the input and output superscripts represent the time of production. The input distance function is computed with respect to both periods, t and $t + 1$, to determine whether a change in productivity has occurred between the periods. An input-oriented Malmquist productivity index for the period t frontier (V^t) is defined as

$$M^t = \frac{D^t(x^t, y^t)}{D^t(x^{t+1}, y^{t+1})}. \tag{4}$$

The input-oriented Malmquist productivity index for the period $t + 1$ frontier (V^{t+1}) is

$$M^{t+1} = \frac{D^{t+1}(x^t, y^t)}{D^{t+1}(x^{t+1}, y^{t+1})}. \tag{5}$$

To avoid selecting one frontier arbitrarily to compute the index, the geometric mean of the input-oriented Malmquist productivity index, M^t and M^{t+1} is used:

$$M(x^{t+1}, y^{t+1}, x^t, y^t) = \left[\frac{D^t(x^t, y^t)}{D^t(x^{t+1}, y^{t+1})} \times \frac{D^{t+1}(x^t, y^t)}{D^{t+1}(x^{t+1}, y^{t+1})}\right]^{1/2}. \quad (6)$$

Malmquist analysis is well suited for this analysis, as it permits separation of shifts in the frontier (*technology change*) from improvements in efficiency relative to the frontier (*technical efficiency change*). By analyzing the two components comprising total productivity change, we can explore technology change in the life insurance industry. Efficiency change is the ratio of the distance from the frontier in period t to the distance from the frontier in period $t + 1$, that is, $D^t(x^t, y^t)/D^{t+1}(x^{t+1}, y^{t+1}) = [(0a/0b)/(0e/0f)]$ in Figure 2. If the firm is closer to the present frontier in period $t + 1$ than it was in period t, then technical efficiency has improved between period t and period $t + 1$. Technology change is the geometric mean of shifts in the frontier between period t and period $t + 1$. It is computed as

$$\begin{aligned} \textit{Technology change} &= \left[\frac{D^{t+1}(x^{t+1}, y^{t+1})}{D^t(x^{t+1}, y^{t+1})} \times \frac{D^{t+1}(x^t, y^t)}{D^t(x^t, y^t)}\right]^{1/2} \\ &= \left[\left(\frac{0e/0f}{0e/0d}\right) \times \left(\frac{0a/0c}{0a/0b}\right)\right]^{1/2}. \end{aligned} \quad (7)$$

If there is a technical improvement, the frontier will shift to the left, and both ratios constituting the geometric mean will exceed 1. If the technology change value is greater than 1, technical progress has occurred. A value less than 1 implies technical regress.[9] The distance functions are measured by solving mathematical programming problems similar to Equation (3).

Results

Appendix A lists the life insurance companies that demutualized in the 1980s and 1990s that comprise our sample. To be included in the sample, a company needed to have at least 5 years of data before and after its demutualization available. A total of 11 companies are included in our sample. The control samples were described previously.

The Valued-Added Approach

Outputs. Following recent insurance and banking literature (see Yuengert, 1993; Cummins, Tennyson, and Weiss, 1999), we first adopt the value-added approach to measure the outputs. We define outputs as different types of benefit payments by life insurers. Cummins and Weiss (2000) suggest that insurers provide real services relating to insured losses, risk pooling, and risk bearing. We believe that benefit payments are useful proxies for the risk pooling and risk bearing functions because they measure the amount of funds pooled by insurers and redistributed to policyholders. Benefit payments are also correlated with real services provided by insurers such as benefit

[9] The factors that have an impact on the technology changes are not limited to computer-related technology. For example, distribution channel technology, underwriting, and claim adjustment technology also can shift the frontier.

administration. We further disaggregate benefit payments into four categories: death benefits (Y_1), annuity benefits (Y_2), surrender benefits (Y_3), and accident and health benefits (Y_4). All outputs are deflated to the base year 1989 using the consumer price index (CPI).

Inputs. The inputs used in the calculation of the efficiency measures include: labor (X_1), business services (X_2), and equity capital (X_3). Data for the number of employees or hours worked in the insurance industry are not available. Accordingly, we follow other insurance efficiency research (e.g., Berger, Cummins, and Weiss, 1996) in measuring the quantity of labor. It is defined as commissions divided by a salary deflator, which refers to average weekly wages for Standard Industrial Classification (SIC) sector 6411, insurance agents, using U.S. Department of Labor data. The wage values are expressed in 1989 dollars deflating by the CPI. Labor accounts for about two-thirds of total nonloss insurer expenses, with the remaining insurer expenses including such things as computers and business services (advertising, legal fees, and communications). The quantity of business services is defined similarly as above. It is equal to business service expenses as defined above divided by the price of business services. The price of business services is the average weekly wage in SIC sector 7300, business services, deflated to 1989 dollars.

The final input is financial capital. Capital is measured by the book value of equity capital. The cost of capital in the life insurance industry is difficult to measure. Although most of the insurers are stock companies, many are tightly held and few are publicly traded. We first used the ratio of an insurer's net income to capital (ROE). However, firms with low efficiency tended to have negative net income (net loss) during the sample period. A negative ROE would create a negative input price for some firms and result in a zero cost efficiency score in DEA analysis. Therefore, we adopt the debt-equity ratio of the firm[10] as the second price measure.[11] The input and output variables are defined in Panel A of Table 1.

Descriptive statistics for the input and output variables used are provided in Panel B of Table 1. Panel B shows the mean of input and output prices in years −5, 0, and 5, respectively. Because the demutualized (sample) insurers were mutual insurers before conversion and stock insurers after conversion, we compare the demutualized insurers and *mutual* insurers in year −5 and year 0. As the sample companies were stock insurers after conversion, we compare the demutualized companies and *stock* insurers in year 0 and year 5.

In year −5, we find that the annuity benefits and surrender benefits for the sample insurers are significantly larger than for the control (mutual) insurers, whereas the death benefits and accident and health insurance benefits for the sample insurers

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[10] In the context of corporate finance, we know $r_E = r_A + D/E \times (r_A - r_D)$, where r_E is the price of equity, r_A return on assets, r_D return on debts, and D/E is the debt–equity ratio. We often assume that the return on assets is equal across firms in the same industry. If we further assume that the return on debt capital (r_D) is the same across firms, we should observe the price of equity (r_E) to be a function of a firm's debt–equity ratio.

[11] As a robustness check, we also conducted the analysis using the ratio of net income to capital as the price of capital. The results of this alternative price variable are found to be very similar to the results using the debt–equity ratio.

TABLE 1

Descriptive Statistics of Inputs/Outputs Using the Value-Added Approach

Panel A: Definition of Inputs/Outputs

Outputs:

Y_1 = Death benefits
Y_2 = Annuity benefits
Y_3 = Surrender benefits
Y_4 = Accident and health insurance benefits

Inputs

X_1 = Labor (number of agents)
X_2 = Business services
X_3 = Capital (equity)

Input prices

P_1 = Average weekly earnings of insurance agents
P_2 = Average weekly wages for business services
P_3 = Debt/capital (the D/E ratio)

Panel B: Descriptive Statistics of Inputs/Outputs

	Year $t=-5$		Year $t=0$			Year $t=5$	
	Demutualized Insurers	Mutual Control Insurers	Demutualized Insurers	Mutual Control Insurers	Stock Control Insurers	Demutualized Insurers	Stock Control Insurers
Output							
Y_1	15,737	18,026	9,087	19,162	16,418	26,271	22,115
Y_2	48,943**	11,213	33,724	15,686	27,285	43,911	70,003
Y_3	205,664*	48,251	137,604	71,406	62,387	201,952	127,515
Y_4	10,328	34,063	10,523	33,104	29,105	35,027	19,619
Input							
X_1	108.22	93.71	35.78	89.27	122.74	177.14	135.4
X_2	282.74	228.61	181.04	245.21	160.38	419.76	198.95
X_3	57,602	52,016	62,501	61,254	75,895	113,238	130,148
Input price							
P_1	281.58	284.83	355.93	358.87	365.62	441.28	441.37
P_2	244.49	247.12	297.2	298.67	302.18	345.36	345.69
P_3	13.07	11.36	8.9	10.5	8.45	12.72*	9.07

**Statistically significant difference at the 5% level.
*Statistically significant difference at the 1% level.

are smaller than for the control (mutual) insurers. In addition, all of the inputs (labor, business services, and capital) for the sample insurers are larger than the inputs for the control insurers. However, when we compare the sample insurers and mutual control insurers in year 0, labor and business services for the sample insurers are smaller than for the mutual control insurers, whereas the output measures are about the same. The demutualized insurers reduced their inputs relative to the control insurers before demutualization.

Panel B of Table 1 also compares the demutualized insurers and the matching control *stock* insurers in year 0 and year 5. Although the comparison of outputs between demutualized insurers and stock insurers does not change much in the period from year 0 to year 5, we find that the inputs of the demutualized insurers increase dramatically, especially the business services. One possible reason for this increase is that the outputs increased significantly. For example, annuity inputs and surrender benefits increased by 180 and 182 percent, respectively. Increased business expenses of the demutualized insurers could also affect the efficiency of our sample of demutualized insurers.[12] In the next section, we examine how this issue affects the efficiency of our sample insurers.

Table 2 reports the DEA efficiency scores. We first focus our analysis on the comparison between demutualized insurers and mutual control insurers from year −5 to year 0. This comparison is relevant as the converted insurers were mutuals prior to conversion. We define demutualized insurer efficiency as the average efficiency performance of the demutualized insurers and the demutualized/control insurer efficiency ratio as the ratio of the efficiency score of the demutualized insurers to that of the control insurers. It is necessary to consider the demutualized/control insurer efficiency ratio because the performance of the sample insurers may improve but the improvement may be less than the improvement of the control insurers. The results of Panel A show that both technical efficiency and allocative efficiency (thus, cost efficiency) increases from year −5 to year 0 for demutualized insurers and their efficiency performance is also better than the control insurers. These findings suggest that the demutualized insurers tried to increase their efficiency before demutualization. One potential explanation is that the managers of demutualized insurers were trying to improve their firms' efficiency so that the probability of success for the demutualization would be higher because regulators and policyholders would likely approve the demutualization.[13] Another possible explanation is that higher efficiency may improve the firm's IPO price. Higher IPO prices are consistent with the goal of shareholder wealth maximization.

We next analyze the efficiency scores of demutualized firms by comparing them to stock insurers for year 0 to year +5. This comparison is appropriate as the demutualized insurers are stock companies after conversion. The results in Panel B in Table 2 show that the demutualized–control insurer ratio of technical efficiency scores declines from 1.113 in year 0 (right after the demutualization) to 0.983 in year 5. The demutualized/control insurer cost efficiency ratio decreases as well, from 1.099 in year 0 to 1.027 in year 5.

We use the Malmquist index to measure productivity changes around the time of demutualization. Detailed discussion of the Malmquist index can be found in Malmquist (1953) and Färe et al. (1992). The results of the Malmquist productivity analysis are presented in Table 3. The Malmquist indices and their components for alternative ownership groups are presented in two panels. Panel A compares the results between demutualized insurers and mutual control insurers, whereas Panel B compares the results between demutualized insurers and stock control insurers.

The top section of each panel presents the year-to-year Malmquist index and its components. The value of efficiency change between year −5 and year −4 is 1.081, suggesting the demutualized insurers on average improved efficiency by 8.1 percent

[12] One possible reason for the dramatic increase in business expenses is that that demutualized firms may heavily invest in new computer technology (hardware and software) or new distribution systems after demutualization.

[13] Even though regulators and policyholders do not conduct DEA analysis, they would notice demutualized insurers' improvement in traditional financial ratios such as ROE or ROA.

TABLE 2
DEA Efficiency Score Results Using the Value-Added Approach

Panel A: Demutualized Insurers vs. Mutual Insurers

	Cost Efficiency		Technical Efficiency		Allocative Efficiency	
Year	Demutualized Insurers	Demutualized/ Mutual Insurers	Demutualized Insurers	Demutualized/ Mutual Insurers	Demutualized Insurers	Demutualized/ Mutual Insurers
−5	**0.751**	**1.053**	**0.940**	**1.043**	**0.789**	**1.011**
−4	0.834	1.219	0.979	1.120	0.847	1.102
−3	0.813	1.145	0.949	1.066	0.838	1.071
−2	0.818	1.170	0.996	1.132	0.820	1.046
−1	0.800	1.103	0.982	1.099	0.816	1.009
0	**0.827**	**1.163**	**0.983**	**1.110**	**0.838**	**1.043**
+1	0.778	1.086	0.852	0.964	0.862	1.079
+2	0.821	1.111	0.939	1.032	0.866	1.081
+3	0.841	1.134	0.965	1.067	0.863	1.073
+4	0.676	0.906	0.920	1.054	0.722	0.857
+5	0.637	0.860	0.873	0.990	0.713	0.865

Panel B: Demutualized Insurers vs. Stock Insurers

	Cost Efficiency		Technical Efficiency		Allocative Efficiency	
Year	Demutualized Insurers	Demutualized/ Stock Insurers	Demutualized Insurers	Demutualized/ Stock Insurers	Demutualized Insurers	Demutualized/ Stock Insurers
−5	0.834	1.176	0.917	1.039	0.895	1.138
−4	0.855	1.202	0.959	1.110	0.891	1.119
−3	0.862	1.205	0.998	1.170	0.864	1.048
−2	0.911	1.219	1.000	1.118	0.911	1.111
−1	0.868	1.225	1.000	1.163	0.868	1.086
0	**0.825**	**1.099**	**0.994**	**1.113**	**0.831**	**1.013**
+1	0.711	0.956	0.919	1.060	0.747	0.900
+2	0.776	1.040	0.984	1.109	0.788	0.959
+3	0.840	1.142	0.970	1.115	0.854	1.038
+4	0.824	1.128	0.953	1.089	0.866	1.051
+5	**0.765**	**1.027**	**0.895**	**0.983**	**0.865**	**1.088**

Notes: This table reports the average efficiency score results using the value-added approach. Panel A provides the results for the converting insurers and 10 mutual insurers of similar size as the control sample. Panel B provides the results for the converting insurers and 10 stock companies of similar size as the control sample. Demutualized/mutual insurers is the average efficiency performance of the demutualized insurers relative to the average efficiency of the mutual control insurers. Demutualized/stock insurers is the average efficiency performance of the converting insurers relative to the average efficiency of the stock control insurers. The years with a minus sign in front refer to the predemutualization years, and the years with a positive sign in front refer to the postdemutualization years.

between year −5 and year −4. Cumulative changes from year to year are provided in the lower section. The cumulative change for a given year is the product of the year-to-year indices from the beginning of the period to the end of that year: e.g., for $t = -3$, the cumulative index for technical efficiency change (1.006) in Panel A, Table 3 is the product of the −5 to −4 index (1.081) and −4 to −3 index (0.931). For $t = -2$, the cumulative index (1.109) is the product of cumulative index (1.006) at $t = -3$ and the $t = -3$ to $t = -2$ index (1.103). The cumulative index measures the productivity change from the beginning of our sample period to the end of the year noted. Thus, the cumulative index has the advantage of examining the consecutive productivity change from year $t = -3$ to year $t = 5$. For example, the cumulative index for efficiency change at $t = -3$ in Panel B, Table 3, is 1.006 and is 1.095 at year $t = 0$, indicating that demutualized insurers improve their efficiency by 8.9 percent.

The Malmquist index can be further divided into two components: technical efficiency change and technology change. A favorable technical efficiency change is interpreted as evidence of "catching up" to the frontier, whereas a favorable technology change is interpreted as innovation (Färe, Grosskopf, and Lovell, 1994). It is also possible to observe insurers "falling behind," that is, becoming less efficient, as well as technical regress, interpreted as unfavorable shifts in the production frontier.

In Panel A of Table 3, the top section (bottom section) shows the year-to-year (cumulative) Malmquist indices for the demutualized insurers based on the pooled frontier of the demutualized insurers and the mutual control insurers. The cumulative results show some positive efficiency increases from year −5 to year 0. Specifically, the demutualized/mutual control insurer ratio of both technology change and total productivity change for demutualized insurers (1.729 and 1.496 at $t = 0$, respectively) show evidence of technical progress as their productivity change increases. These results are consistent with those of Table 2 and suggest that demutualized insurers try to improve their efficiency before demutualization.

Table 3
Malmquist Analysis Using Value-Added Approach

Panel A: Demutualized Insurers vs. Mutual Insurers

	Technical Efficiency Change		Technology Change		Total Productivity Change	
Year	Demutualized Insurers	Demutualized/ Mutual Insurers	Demutualized Insurers	Demutualized/ Mutual Insurers	Demutualized Insurers	Demutualized/ Mutual Insurers
−4	**1.081**	**1.055**	**1.062**	**0.813**	**1.139**	**0.890**
−3	0.931	0.819	1.238	0.766	1.124	0.654
−2	1.103	0.978	1.133	1.370	1.238	1.284
−1	0.982	0.957	1.384	1.064	1.365	1.027
0	**1.006**	**1.026**	**1.462**	**1.905**	**1.467**	**1.952**
+1	0.936	0.915	0.735	0.674	0.684	0.613
+2	1.012	1.012	0.945	0.921	0.956	0.932
+3	1.110	1.110	1.135	1.002	1.264	1.116
+4	1.086	1.086	1.071	0.511	1.164	0.555
+5	0.967	0.968	1.160	0.997	1.126	0.969
Cumulative results						
−3	**1.006**	**0.865**	**1.314**	**0.623**	**1.281**	**0.582**
−2	1.109	0.846	1.489	0.853	1.586	0.747
−1	1.089	0.810	2.059	0.907	2.165	0.767
0	**1.095**	**0.831**	**3.010**	**1.729**	**3.176**	**1.496**
+1	1.025	0.760	2.213	1.165	2.172	0.917
+2	1.037	0.769	2.090	1.073	2.077	0.854
+3	1.151	0.854	2.372	1.075	2.626	0.954
+4	1.250	0.927	2.540	0.549	3.055	0.529
+5	1.209	0.898	2.945	0.547	3.439	0.513

(Continued)

TABLE 3
(Continued)

Panel B: Demutualized Insurers vs. Stock Insurers

	Technical Efficiency Change		Technology Change		Total Productivity Change	
Year	Demutualized Insurers	Demutualized/ Stock Insurers	Demutualized Insurers	Demutualized/ Stock Insurers	Demutualized Insurers	Demutualized/ Stock Insurers
−4	1.203	1.171	0.885	0.871	0.904	0.893
−3	1.015	0.980	1.039	0.952	1.111	1.008
−2	0.985	0.738	1.189	0.880	1.212	0.472
−1	0.962	0.994	1.384	1.069	1.427	1.157
0	**0.981**	**0.914**	**1.396**	**1.428**	**1.436**	**1.410**
+1	0.934	0.946	0.767	0.636	0.721	0.606
+2	1.094	0.887	0.965	0.945	1.034	0.830
+3	1.083	0.945	1.336	0.862	1.350	0.819
+4	0.884	0.841	1.097	0.978	1.060	0.910
+5	**0.964**	**0.841**	**1.191**	**1.069**	**1.132**	**0.918**
Cumulative results						
−3	1.221	1.148	0.920	0.829	1.003	0.900
−2	1.202	0.847	1.093	0.729	1.216	0.424
−1	1.156	0.842	1.514	0.779	1.736	0.491
0	**1.134**	**0.770**	**2.114**	**1.113**	**2.492**	**0.693**
+1	1.059	0.728	1.622	0.708	1.797	0.420
+2	1.159	0.646	1.564	0.669	1.859	0.348
+3	1.256	0.611	2.089	0.577	2.511	0.285
+4	1.110	0.514	2.293	0.564	2.661	0.260
+5	**1.070**	**0.432**	**2.732**	**0.603**	**3.012**	**0.239**

Notes: This table presents the results of the Malmquist Analysis. Panel A provides the results for demutualized insurers using 10 mutual insurers of similar size as the control sample. Panel B provides the results for demutualized insurers using 10 stock insurers of similar size as the control sample. The top section of each panel presents the year-to-year Malmquist index and its components. The cumulative changes from year to year are reported in the lower section. The cumulative change for a given year is the product of the year-to-year indices from the beginning of the period to the end of the year. For example, for year −3, the cumulative index is the product of the −5 to −4 and the −4 to −3 indices. Demutualized/mutual insurers is defined as the average efficiency performance of the demutualized insurers divided by the average efficiency performance of the control mutual insurers. Demutualized/stock insurers is defined as the average efficiency performance of the demutualized insurers divided by the average efficiency performance of the stock control insurers. Year 0 refers to the year firms demutualized, whereas the years with a minus sign in front refer to the predemutualization years and the years with a positive sign refer to the postdemutualization years.

Panel B reports the Malmquist indices for the demutualized insurers based on the pooled frontier of the demutualized insurers and stock control insurers. We find that the demutualized insurers become less efficient ("fall behind") in terms of technical efficiency change after demutualization. The demutualized/stock control insurer ratio decreases from 0.770 to 0.432. The results of technology change suggest that demutualized insurers experience deterioration in technology change relative to the stock control decreases from 1.113 to 0.603. As the product of technical efficiency change and technology change, the total productivity changes are similar in that the relative performance of total productivity change declines from 0.693 to 0.239.

The Financial Intermediary Approach

In this section, we examine the efficiency of demutualized insurers using the financial intermediary approach. Although the majority of the literature uses the value-added approach, some recent literature utilizes the financial intermediary approach (e.g., Brockett et al., 2004, 2005) or both approches (e.g., Jeng and Lai, 2005). Brockett et al. (2004, 2005) discuss the differences between the value-added (production) approach and the financial intermediary approach.[14] More important, Brockett et al. provide excellent insight on why the financial intermediary approach should be used in the insurance industry. Our selection of inputs and outputs is mainly based on Brockett et al. (2004, 2005).

Outputs. This approach views an insurance company as a financial intermediary. In offering insurance, the life insurer borrows from policyholders because premiums are paid first and benefits are paid much later, on average, especially for a whole-life policy. The managers of the insurers then invest the borrowed funds in financial assets. A critical objective for the managers is therefore maximization of the profit of the firm. Moreover, as suggested by Moridaira, Urrutia, and Witt (1992) and Brockett et al. (2004), insurers are different from other financial institutions, such as banks, in that their debtholders' (policyholders) claims are contingent on experiencing losses. The debtholders (policyholders) of an insurer are in fact "purchasing a long-term financial commitment" from the insurer (see Brockett et al., 2004). Therefore, in addition to maximizing profits as a goal of evaluating performance, we believe the ability to pay claims and the financial health of an insurer are also important goals.

Return on assets (ROA) was used as the proxy for firm value maximization. This measure represents a general goal that ordinary business firms share with financial services firms. As a proxy for the firms' financial situation, we use the variables selected by Brockett et al. (2004) and a system of performance ratios, known as the Insurance Regulatory Information System (IRIS) ratios and adopt six variables that are important in the context of the demutualization process. The IRIS system was developed by the National Association of Insurance Commissioners (NAIC) and is used by regulatory agencies to evaluate company performance and solvency. These variables are listed in Panel A of Table 4. However, because our population size is small, it may not be appropriate to include all six variables as outputs. We therefore choose to adopt principal-components analysis and use the important components as our proxy for financial condition. The results in Panel B of Table 4 show that the first three components combined explain 75 percent of the total variance of the original six variables. Therefore, we use the first three components in Panel B as a proxy for the financial condition of an insurer.

Inputs. Following Brockett et al. (2004), we define four different variables as our inputs. The first two inputs represent equity capital, the amount of the owners' stake in the firm. Because the amount of equity acquired by the firm can be invested at different

[14] While most banking literature utilizes the production approach, McCabe and Witt (1980) and Lai and Witt (1992) suggest that one needs to consider the differences between insurers and other financial intermediaries in analyzing the insurance industry.

TABLE 4
Financial Conditions Variables Using the Financial Intermediary Approach

Panel A: Variables Selected for the Financial Condition of the Insurer

1. Change in policyholder surplus
2. Capitalization ratio
3. Change in invested assets
4. Investment yield
5. Change in net premiums
6. Liquid assets to liabilities

Panel B: Principal-Components Analysis
Eigenvalues of the Correlation Matrix

	Eigenvalue	Difference	Proportion	Cumulative
$Prin_1$	1.764	0.247	0.294	0.294
$Prin_2$	1.517	0.302	0.253	0.547
$Prin_3$	1.215	0.460	0.203	0.749
$Prin_4$	0.756	0.294	0.126	0.875
$Prin_5$	0.462	0.176	0.077	0.952
$Prin_6$	0.286	0.048	1.000	

Eigenvectors

	$Prin_1$	$Prin_2$	$Prin_3$	$Prin_4$	$Prin_5$	$Prin_6$
Var_1	0.508	0.497	−0.079	0.153	0.271	0.627
Var_2	−0.189	−0.592	0.448	0.163	0.425	0.454
Var_3	−0.122	0.375	0.575	0.664	−0.155	−0.221
Var_4	−0.530	0.378	−0.188	−0.046	0.709	−0.189
Var_5	−0.135	0.325	0.591	−0.699	−0.123	0.151
Var_6	0.627	−0.117	0.279	−0.136	0.452	−0.542

points of time, we further separate equity capital into surplus the previous year and change in capital and surplus. The third input consists of underwriting and investment expenses. It reflects the expenses associated with the two important operations of an insurance company—underwriting contingent losses and investing the proceeds borrowed from policyholders and owners. The last input is debt capital supplied by policyholders, which consists primarily of funds borrowed from policyholders. The prices of the first two inputs, P_1 and P_2, are equal to the debt–equity ratio of the previous year and current year, respectively.[15] The price for the third input is expenses per policy and is derived by taking the third input divided by total expenses (X_3). The price of the debt input is equal to investment income attributed to debt divided by total debt capital (X_4). To standardize comparisons, all the inputs are divided by the total assets of the firm.

The definitions of output and input variables are reported in Panel A of Table 5. As discussed in Table 1 for the value-added approach, we compare demutualized insurers and mutual control insurers in year −5 and year 0, and demutualized insurers and

[15] Please see footnote 3 for the rationale of calculating P_1 and P_2.

TABLE 5
Descriptive Statistics of Inputs/Outputs Using Financial Intermediary Approach

Panel A: Definition of Inputs/Outputs

Output
- Y_1 = Return on assets
- Y_2 = Principal component 1 of financial conditions
- Y_3 = Principal component 2 of financial conditions
- Y_4 = Principal component 3 of financial conditions

Input
- X_1 = Surplus in previous year/assets
- X_2 = Change in surplus/assets
- X_3 = (Underwriting + investment expenses)/assets
- X_4 = Debt capital/assets

Input price
- $P_1 = D/E$ for previous year
- $P_2 = D/E$ for current year
- P_3 = Expenses/number of policies
- P_4 = Investment income attributed to debt

Panel B: Descriptive Statistics of Inputs/Outputs

	Year $t = -5$		Year $t = 0$			Year $t = 5$	
	Demutualized Insurers	Mutual Control Insurers	Demutualized Insurers	Mutual Control Insurers	Stock Control Insurers	Demutualized Insurers	Stock Control Insurers
Output							
Y_1	0.115	0.026	0.001*	0.050	0.050	0.019*	0.049
Y_2	1.714	0.529	0.732	0.659	0.400	0.460	2.595
Y_3	0.001	1.729	0.059	0.326	0.185	0.190	0.932
Y_4	3.772	0.347	0.730	0.164	0.573	0.535	0.558
Input							
X_1	0.208	0.170	0.174	0.134	0.195	0.192	0.300
X_2	0.001	0.045	0.082	0.014	0.026	0.078	0.001
X_3	0.068	0.059	0.085	0.064	0.061	0.047	0.062
X_4	0.871	0.867	0.745	0.855	0.779	0.801	0.770
Input price							
P_1	34.118	34.763	36.484	41.537	32.385	32.251	33.094
P_2	24.882	28.747	25.554	29.481	25.293	25.437	22.651
P_3	246.488	246.488	302.411	302.411	302.411	303.275	296.596
P_4	0.243	0.139	0.219	0.190	0.216	0.318	0.226

Note: The sample (demutualized) firms used in our analysis need to have at least 5 years of data before and after demutualization.
*Statistically significant difference at 10% level.

stock control insurers in year 0 and year 5. We find that during the period from year 0 to year 5, the inputs and input prices between demutualized and stock control insurers do not change much, but all the outputs for demutualized insurers are relatively smaller than the inputs for stock control insurers in year 5.

Table 6
DEA Efficiency Score Results Using the Financial Intermediary Approach

Panel A: Demutualized Insurers vs. Mutual Insurers

Year	Cost Efficiency		Technical Efficiency		Allocative Efficiency	
	Demutualized Insurers	Demutualized/ Mutual Insurers	Demutualized Insurers	Demutualized/ Mutual Insurers	Demutualized Insurers	Demutualized/ Mutual Insurers
−5	**0.907**	**1.292**	**0.976**	**0.983**	**0.933**	**1.322**
−4	0.869	1.189	0.998	1.003	0.878	1.196
−3	0.860	1.207	0.994	1.004	0.865	1.203
−2	0.864	1.259	0.970	0.979	0.892	1.289
−1	0.802	1.145	0.988	0.995	0.810	1.148
0	**0.781**	**1.104**	**0.997**	**1.007**	**0.782**	**1.096**
+1	0.902	1.319	0.972	1.004	0.928	1.322
+2	0.835	1.178	1.000	1.011	0.835	1.167
+3	0.730	1.042	1.000	1.015	0.730	1.028
+4	0.794	1.163	1.000	1.010	0.794	1.153
+5	0.803	1.194	1.000	1.011	0.803	1.182

Panel B: Demutualized Insurers vs. Stock Insurers

Year	Cost Efficiency		Technical Efficiency		Allocative Efficiency	
	Demutualized Insurers	Demutualized/ Stock Insurers	Demutualized Insurers	Demutualized/ Stock Insurers	Demutualized Insurers	Demutualized/ Stock Insurers
−5	0.704	1.106	0.975	1.016	0.718	1.098
−4	0.758	1.114	1.000	1.012	0.758	1.100
−3	0.781	1.154	0.989	1.005	0.787	1.143
−2	0.817	1.169	1.000	1.013	0.817	1.153
−1	0.782	1.100	0.999	1.007	0.782	1.093
0	**0.759**	**1.092**	**1.000**	**1.025**	**0.759**	**1.067**
+1	0.687	1.114	0.976	1.003	0.703	1.104
+2	0.623	0.936	1.000	1.024	0.623	0.920
+3	0.542	0.793	0.983	0.999	0.549	0.795
+4	0.641	0.930	0.999	1.011	0.641	0.926
+5	**0.702**	**1.037**	**1.000**	**1.009**	**0.702**	**1.031**

Notes: This table reports the average efficiency score results using the value-added approach. Panel A provides the results for the converting insurers and ten mutual insurers of similar size as the control sample. Panel B provides the results for the converting insurers and ten stock companies of similar size as the control sample. Demutualized/mutual insurers is the average efficiency performance of the demutualized insurers relative to the average efficiency of the mutual control insurers. Demutualized/stock insurers is the average efficiency performance of the converting insurers relative to the average efficiency of the stock control insurers. The years with a minus sign in front refer to the predemutualization years, and the years with a positive sign in front refer to the postdemutualization years.

Table 6 further examines the effect of the input and output changes during our sample period. Table 6 reports the results of demutualized insurer efficiency and the demutualized/control insurer ratio using the financial intermediary approach. We first focus our analyses on the comparison between the demutualized insurers and mutual control insurers before demutualization. The results in Panel A show that demutualized insurer efficiency and the demutualized/mutual control insurer ratio deteriorates from year −5 to year 0, whereas the technical efficiency of demutualized insurers shows some improvement. The cost efficiency results suggest that demutualized insurers suffer some efficiency loss in performance (from 0.907 to 0.781) and the relative to mutual control insurer ratio (from 1.292 to 1.104) before the demutualization when the financial condition of demutualized insurers is considered.

The results of the financial intermediary approach differ from the results of the value-added approach. Recall that the cost efficiency of the demutualized insurers improved before demutualization when the value-added approach is used (Table 2). It should be no surprise that the two results are different because the inputs and outputs for the two approaches are different. The inputs for the value-added approach are labor, business services, and capital, and the outputs are benefits paid. On the other hand, the inputs for the financial intermediary approach are surplus-related items, underwriting and investment expenses, and debt capital. The outputs are financial-related variables such as the change in policyholder surplus, capitalization ratio, investment yield, and the liquidity ratio. Please note that the outputs of the financial intermediary approach are related to financial conditions, whereas the outputs of the value-added approach are benefits paid and related to production. We believe the inputs and outputs employed in the two approaches are appropriate as long as the results are interpreted carefully.

The seemingly contradictory results of the two approaches are, in fact, complementary. The results of the financial intermediary approach suggest one reason that insurers go through the demutualization process is that their cost efficiency deteriorates when financial conditions are considered. One way to improve financial condition efficiency is to increase surplus or equity by issuing shares of stock, which is made possible through demutualization. At the same time, the demutualized insurers try to improve their efficiency[16] before the demutualization such that they are able to maximize new shareholder (old policyholder) wealth when the companies go public through an IPO.[17] In addition, demutualization is more likely to be approved by regulators when a firm is more efficient.[18]

We next examine the efficiency performance of the demutualized insurers after demutualization and focus our analyses on comparing the demutualized insurers and stock control insurers. Panel B of Table 6 shows that allocative efficiency, technical efficiency, and cost efficiency all deteriorate, with the exception that the absolute measure of technical efficiency remains at the same level. These results do not support the efficiency hypothesis.

Table 7 provides the results for the Malmquist index. Similar to our results in Panel A of Table 6, Panel A of Table 7 shows that the demutualized/mutual control insurer ratio of technical efficiency change, technology change, and total productivity change all

[16] The improvement in this case is obtained by using the value-added approach.

[17] A more efficient firm would be more profitable other things being equal. A more profitable firm will be able to charge a higher price during the IPO, which maximizes new shareholder (or old policyholder) wealth.

[18] Even though regulators do not calculate efficiency scores, the scores should reflect the efficiency improvement. Specifically, if a firm improves its efficiency, then it would appear to be more cost-effective using traditional financial ratios such as the expense ratio (one of the IRIS ratios).

deteriorate from before demutualization. Cumulative results (Panel B, Table 7) also show that demutualized/mutual control insurer ratio of total productivity shows slight deterioration before demutualization.

The results of Panel B of Table 7 indicate that technical efficiency change, technology change, and total productivity change all deteriorate after demutualization. These results are consistent with our results in Panel B of Table 6 and are also consistent with the results in Table 5. As shown in Table 5, during the period year 0 to year 5, inputs and input prices of demutualized and stock insurers do not change much, but all of the outputs of the demutualized insurers are relatively smaller than for stock control insurers in year 5. Apparently, insurers may intend to demutualize to increase surplus or equity through issuing stock, but their rate of return or financial condition does not improve after conversion. Our results based on the financial intermediary approach thus do not support the efficiency hypothesis.

In the previous discussion, we focused our analyses on a comparison between demutualized insurers and mutual control insurers before demutualization. We also focused on a comparison between demutualized insurers and stock control insurers because the technology may change after demutualization. An argument can be made that we may want to compare the efficiency between demutualized insurers and mutual control insurers. Specifically, demutualized insurers may not change their technology

TABLE 7
Malmquist Analysis Using the Financial Intermediary Approach

Panel A: Demutualized Insurers vs. Mutual Insurers						
	Technical Efficiency Change		Technology Change		Total Productivity Change	
Year	Demutualized Insurers	Demutualized/ Mutual Insurers	Demutualized Insurers	Demutualized/ Mutual Insurers	Demutualized Insurers	Demutualized/ Mutual Insurers
−4	**1.028**	**1.023**	**0.718**	**1.088**	**0.741**	**1.112**
−3	0.995	1.001	1.034	1.014	1.029	1.013
−2	0.976	0.974	1.236	1.190	1.210	1.164
−1	1.025	1.022	0.897	0.880	0.918	0.898
0	**1.010**	**1.013**	**1.038**	**1.060**	**1.048**	**1.073**
+1	0.976	0.997	2.462	2.358	2.431	2.395
+2	1.038	1.008	5.796	0.537	5.826	0.539
+3	1.001	1.003	0.929	0.897	0.929	0.900
+4	1.000	0.995	0.952	0.946	0.952	0.941
+5	1.000	0.997	0.980	0.970	0.980	0.967
Cumulative results						
−3	**1.023**	**1.024**	**0.742**	**1.103**	**0.762**	**1.127**
−2	0.998	0.998	0.917	1.313	0.923	1.312
−1	1.023	1.020	0.823	1.155	0.847	1.178
0	**1.033**	**1.033**	**0.854**	**1.225**	**0.887**	**1.265**
+1	1.008	1.030	2.103	2.888	2.156	3.028
+2	1.047	1.038	12.188	1.551	12.563	1.632
+3	1.047	1.041	11.320	1.391	11.675	1.468
+4	1.047	1.036	10.781	1.316	11.120	1.381
+5	1.047	1.032	10.570	1.277	10.902	1.336

(Continued)

TABLE 7
(Continued)

Panel B: Demutualized Insurers vs. Stock Insurers

	Technical Efficiency Change		Technology Change		Total Productivity Change	
Year	Demutualized Insurers	Demutualized/ Stock Insurers	Demutualized Insurers	Demutualized/ Stock Insurers	Demutualized Insurers	Demutualized/ Stock Insurers
−4	1.032	0.942	0.951	0.657	0.975	0.656
−3	0.988	0.993	0.993	1.039	0.983	1.035
−2	1.012	1.003	1.201	1.182	1.213	1.177
−1	0.999	0.986	0.935	0.906	0.935	0.895
0	**1.001**	**1.017**	**2.631**	**2.519**	**2.631**	**2.571**
+1	0.976	0.970	1.171	0.298	1.145	0.292
+2	1.033	1.013	0.904	0.885	0.926	0.905
+3	0.983	0.980	0.994	0.872	0.984	0.860
+4	1.003	1.011	1.012	0.875	1.014	0.886
+5	**1.001**	**0.996**	**1.068**	**0.870**	**1.069**	**0.867**
Cumulative results						
−3	1.020	0.935	0.944	0.683	0.958	0.679
−2	1.031	0.938	1.134	0.807	1.162	0.800
−1	1.031	0.925	1.061	0.732	1.086	0.716
0	**1.031**	**0.941**	**2.791**	**1.843**	**2.858**	**1.839**
+1	1.007	0.912	3.269	0.549	3.272	0.537
+2	1.039	0.924	2.956	0.485	3.028	0.486
+3	1.022	0.905	2.938	0.423	2.979	0.418
+4	1.025	0.915	2.972	0.370	3.021	0.370
+5	**1.026**	**0.912**	**3.174**	**0.322**	**3.228**	**0.321**

Notes: This table presents the results of the Malmquist Analysis. Panel A provides the results for demutualized insurers using 10 mutual insurers of similar size as the control sample. Panel B provides the results for demutualized insurers using 10 stock insurers of similar size as the control sample. The top section of each panel presents the year-to-year Malmquist index and its components. The cumulative changes from year to year are reported in the lower section. The cumulative change for a given year is the product of the year-to-year indices from the beginning of the period to the end of the year. For example, for year −3, the cumulative index is the product of the −5 to −4 and the −4 to −3 indices. Demutualized/mutual insurers is defined as the average efficiency performance of the demutualized insurers divided by the average efficiency performance of the control mutual insurers. Demutualized/stock insurers is defined as the average efficiency performance of the demutualized insurers divided by the average efficiency performance of the control insurers. Year 0 refers to the year firms demutualized, whereas the years with a minus sign in front refer to the predemutualization years and the years with a positive sign refer to the postdemutualization years.

immediately after conversion. The results displayed in Panel A of Tables 2 and 3 show that the efficiency of demutualized insurers deteriorates after demutualization when the value-added approach is used. There is some evidence (Panel A of Tables 6 and 7) that demutualized insurers improve their efficiency after demutualization when the financial intermediary approach is used.

Regression Analysis

To further examine the efficiency of U.S. life insurers that converted from the mutual form to stock form, we use regression analysis to test for changes in efficiency over the pre- and postdemutualization period. We control for characteristics hypothesized to be related to efficiency changes in our regression analysis. The regression model is expressed as

$$\text{Changes in efficiency} = \beta_0 + \beta_1 * \text{size} + \beta_2 * \text{ORG} + \beta_3 * \text{GLP} + \beta_4 * \text{GAP} + \beta_5 * \text{IAP} + \beta_6 * \text{AHP} + \beta_7 * \text{LIQ} + \varepsilon.$$

Two sets of dependent variables are used. One set of dependent variables is used before demutualization. The dependent variable for this period is a ratio equal to the efficiency score 5 years prior to the demutualization ($t = -5$) to the efficiency score of the demutualization year ($t = 0$). The other set of dependent variables is used after demutualization. The dependent variable for this period is a ratio equal to the efficiency score in the year of demutualization ($t = 0$) to the efficiency score 5 years after demutualization ($t = +5$). Various efficiency measures (technical efficiency, allocative efficiency, and cost efficiency) are examined in the analysis. The most important independent variable is the dummy variable for organizational form (ORG), which equals 1 when the firm converted from the mutual form to the stock form and 0 otherwise. We expect to see a positive coefficient for this variable if demutualized insurers try to improve their efficiency before or after demutualization. We also add size as one of the control variables, and use the log of total assets of the firm as a proxy for size. Other control variables include percentage of group life premium (GLP), percentage of group annuity premium (GAP), percentage of individual annuity premiums (IAP), percentage of accident and health premium (AHP), and percentage of assets that are short-term assets (LIQ). These variables are used as control variables to capture the possible effect on efficiency.

The regression results are summarized as follows. We first focus our analyses on efficiency scores before demutualization. Panel A of Table 8 reports the regression results when cost efficiency scores are used as the dependent variable and are calculated according to the value-added approach. The regression results do not show there is a relationship between the demutualized/nondemutualized dummy variable (ORG) and efficiency scores when we compare demutualized insurers to nondemutualized mutual insurers. Note that the cost efficiency scores using the value-added approach show improvement before demutualization occurred. Apparently, the efficiency improvement becomes insignificant after we control for other variables. It should be noted that the results are robust to other efficiency score measures (technical efficiency and allocative efficiency).[19] We next report the regression results (Panel B, Table 8) when the cost efficiency scores are calculated by the financial intermediary approach and are used as the dependent variable. We find that there is a negative and significant relationship between the demutualized/nondemutualized dummy variable and cost efficiency when the control insurers are demutualized insurers. The results suggest that cost efficiency deteriorates relative to nondemutualized mutual insurers before demutualization. The evidence is consistent with the results of the univariate DEA approach.

We next report the regression results (Panel A, Table 9) when the cost efficiency scores after demutualization are calculated using the value-added approach and are used

[19] These results are not tabulated.

TABLE 8
Regression of Changes in Efficiency Before Demutualization

	Demutualized Insurers vs. Mutual Insurers
Regression Coefficient	Coefficient
Panel A: Value-Added Approach	
Intercept	0.86767
ORG	−0.06186
Size	0.02667
GLP	−1.05259
GAP	0.23957
IAP	0.3326
AHP	0.32593
LIQ	−0.64896
R^2 (%)	0.0227
N	89
Panel B: Financial Intermediary Approach	
Intercept	1.64268***
ORG	−0.27695*
Size	−0.03493**
GLP	−0.53017
GAP	0.64593
IAP	−0.15
AHP	−0.38116
LIQ	−0.95573
R^2 (%)	0.2197
N	78

Notes: This table presents the cross-sectional regression results of changes in efficiency before demutualization. Efficiency changes are defined as efficiency scores 5 years before demutualization divided by efficiency scores in the demutualization year. ORG is the dummy variable for organizational form, which equals 1 when the firm converted from the mutual form to the stock form and 0 otherwise. Size is log of total assets of the firm. GLP is percentage of group life premiums, GAP is percentage of group annuity premiums, IAP is percentage of individual annuity premiums, AHP is percentage of accident and health premiums, and LIQ is percentage of assets that are short-term.
***Significantly different from 0 at the 1% level (two-tailed test).
**Significantly different from 0 at the 5% level (two-tailed test).
*Significantly different from 0 at the 10% level (two-tailed test).

as the dependent variable. There is no evidence that demutualized insurers improve their efficiency relative to stock or mutual control insurers after demutualization. The regression results of no efficiency improvement after demutualization are consistent with the univariate DEA approach.

Panel B, Table 9, reports the regression results when the cost efficiency scores after demutualization are calculated by the financial intermediary approach and are used as the dependent variable. We find that there is a positive and significant relationship between the demutualized/nondemutualized dummy variable (ORG) and

TABLE 9
Regression of Changes in Efficiency After Demutualization

Regression Coefficient	Demutualized Insurers vs. Mutual Insurers Coefficient	Demutualized Insurers vs. Stock Insurers Coefficient
Panel A: Value-added Approach		
Intercept	1.2978***	5.5393***
ORG	−0.3073	−0.9931
Size	−0.0049	−0.2285***
GLP	−0.4272	−1.6541
GAP	−0.1407	−0.2589
IAP	−0.5484	−1.7152
AHP	−0.1295	−1.5351
LIQ	0.0171	−2.0254
R^2 (%)	0.0655	0.21
N	79	63
Panel B: Financial Intermediary Approach		
Intercept	0.8753*	1.0314
ORG	1.1177***	1.0671
Size	0.01872	−0.0126
GLP	0.1973	0.1422
GAP	−1.4283	−0.7703
IAP	−1.0554	0.0436
AHP	−0.3963	−0.7703
LIQ	1.8304	0.3517
R^2 (%)	20.82	0.1799
N	67	69

Notes: This table presents the cross-sectional regression results of changes in efficiency after demutualization. Efficiency changes are defined as efficiency scores 5 years after demutualization divided by efficiency scores in the demutualization year. ORG is the dummy variable for organizational form, which equals 1 when the firm converted from the mutual form to the stock form and 0 otherwise. Size is log of total assets of the firm. GLP is percentage of group life premiums. GAP is percentage of group annuity premiums, IAP is percentage of individual annuity premiums, AHP is percentage of accident and health premiums, and LIQ is percentage of assets that are short-term.

***Significantly different from 0 at the 1% level (two-tailed test).

**Significantly different from 0 at the 1% level (two-tailed test).

*Significantly different from 0 at the 5% level (two-tailed test).

cost efficiency when the control insurers are nondemutualized insurers. The results suggest that cost efficiency improves relative to nondemutualized mutual insurers after demutualization. The evidence is consistent with the results of the univariate DEA approach.

There is no evidence that demutualized insurers improve their efficiency relative to stock insurers after demutualization when cost efficiency scores are calculated by the financial intermediary approach and are used as the dependent variable. The regression results of no efficiency improvement after demutualization are consistent with the univariate DEA approach.

The overall evidence provided by the regression results indicates that there is no improvement in efficiency for demutualized insurers before or after demutualization when efficiency scores are calculated by the value-added approach. There is some evidence of improvement in efficiency for demutualized insurers before and after demutualization when efficiency scores are calculated using the financial intermediary approach and when the scores are compared to the mutual control insurers.

We also conducted logistic regression analyses to examine whether efficiency is a reason for demutualization. The logistic model is expressed as follows.

$$\begin{aligned} \text{ORG} &= \beta_0 + \beta_1 * \text{size} + \beta_2 * \text{Changes in efficiency} + \beta_3 * \text{GLP} + \beta_4 * \text{GAP} \\ &\quad + \beta_5 * \text{IAP} + \beta_6 * \text{AHP} + \beta_7 * \text{LIQ} + \varepsilon. \end{aligned}$$

All of the variables are as defined in discussion of the first regression model. Our results do not show that any of the changes in various efficiency variables is statistically significant. Thus, the evidence does not support the efficiency hypothesis.

Conclusion

The efficiency hypothesis has been proposed to explain why mutual insurers convert to the stock form of organization. We utilize the value-added approach and the financial intermediary approach of DEA to examine whether efficiency improves over time for insurers before and after demutualization. The value-added univariate DEA results show that demutualized insurers experience efficiency improvement relative to other mutual control insurers before demutualization. But the regression evidence does not show there is a significant and positive relationship between efficiency changes and the demutualization/nondemutualization variable. In addition, the univariate and regression evidence do not show there is improvement relative to stock insurers after demutualization.

The univariate and regression results of the financial intermediary approach, which considers financial conditions, indicate that demutualized insurers relative to mutual control insurers experience efficiency deterioration before demutualization. The evidence is consistent with the view that demutualized firms need to demutualize to obtain more capital. There also is evidence that demutualized insurers relative to mutual control insurers experience efficiency improvement after demutualization, but not relative to stock control insurers.

The overall evidence suggests that demutualized insurers in the 1980s and 1990s failed to improve efficiency after demutualization when we use a value-added approach. The results imply that efficiency is not a major reason for demutualization if we use the value-added approach. One possible reason for no efficiency gain may be the time and expense devoted to the actual process. This explanation may not be a major reason, however, as efficiency scores were calculated up to 5 years after demutualization, and the results still did not show improvement.

When we consider financial condition and use the financial intermediary approach, we find some evidence of improvement in efficiency for demutualized insurers after demutualization when efficiency scores are compared with mutual control insurers. This result makes sense—it implies that demutualized insurers improve their financial condition after they raise more capital. There is no improvement in efficiency when we compare demutualized insurers with stock control insurers.

At first glance, the finding of no efficiency gains before or after demutualization using the value-added approach may be somewhat surprising. This evidence, however, does not come as a surprise for some life insurance company executives.[20] According to an expert, many executives are more interested in their own self-interest, such as securing a better compensation package after conversion, than with improving efficiency.

Appendix A

Demutualized Life Insurance Companies, 1980–1995

Company Name	Approval Year
Old Equity Mutual Life Insurance Company	1984
Utah Farm Bureau Insurance Company	1984
Inter-State Assurance Company	1985
National Term Life Insurance Company	1985
Union Mutual Life Insurance Company	1986
Grinnell Mutual Life Insurance Company	1988
Rushmore Mutual Life Insurance Company	1989
Equitable Life Assurance Society	1992
Midland Mutual Life Insurance Company	1994
Guarantee Mutual Life Insurance Company	1995
State Mutual Life Assurance Company of America	1995

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[20] Dr. Bill Rabel, former president of LOMA, was interviewed by the authors. Dr. Rabel stated that insurance executives do not believe that efficiency is the overriding reason for demutualization. Instead, executives of demutualized insurers may be more interested in their own self-interests, including compensation.

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