Conversion and Efficiency Performance Changes:
Evidence from the U.S. Property-Liability Insurance Industry

Abstract

This study investigates whether the conversion of U.S. property-liability insurers improves their efficiency performance before and after conversion. The evidence shows that converting insurers experience larger gains in cost efficiency and total productivity change than mutual counter samples before conversion using the value-added approach. The empirical evidences of the value-added approach and the financial intermediary approach indicate converting insurers experience improvement in their efficiency relative to mutual counter samples after the conversion. The results are robust with respect to cost efficiency scores and total factor productivity change. The overall results support the efficiency hypothesis.

Keyword: Demutualization, Efficiency, DEA, Property-Liability Insurers.

1. Introduction

Organizational structure change has been received much attention from academic researches. Specifically, the mutual-to-stock organizational structure change, known as demutualization, has been occurring in the U.S. insurance markets and been studied for many decades. Exploring which form of organizational structure, mutual or stock, is more efficient may shed new light on the effect of organizational structure change.

Mayers and Smith (1986) developed the expropriation hypothesis and the efficiency hypothesis to explain why mutual insurers convert. The expropriation hypothesis alleges that conversions may be used as a mechanism to transfer wealth from policyholders to officers and directors of converting insurers and policyholders may be harmed through the conversion process. The efficiency hypothesis, on the other hand, suggests that the purpose of conversion is to improve financial and operational performance of the converting insurer. Based on agency theory, there are many disadvantages of mutual insurers. Mutual insurers are less effective in monitoring and controlling management than stock insurers. In other words, the conflict between the policyholder and the mangers is much higher for mutual insurers. Moreover, mutual insurers are less effective in operation because of their restricted access to capital and inability to diversify. Thus, the efficiency hypothesis states that mutual insurers convert to stock insurers in an effort to improve efficiency.

A few literatures have investigated the performance changes during conversion period. McNamara and Rhee (1992) and Cagle et al. (1996) shed insight on the efficiency issue, but they use conventional financial ratios and operational ratios as proxies for “performance” and do not examine efficiency from the input/output efficiency perspective. More recently, Jeng, Lai, and McNamara (2007) utilize input/output efficiency to examine the efficiency performance changes of converting life insurers but not property-liability insurers. In fact, there is no study investigating the input/output efficiency performance change of converting

property-liability insurers.

The main purposes of our essay are to evaluate the pre- verse postconversion efficiency performance of property-liability insurers and to test the efficiency hypothesis proposed by Mayers and Smith (1986). Our first research question is whether converting insurers improve their efficiency performance and productivity before conversion. Our second research question is whether converting insurers improve their efficiency performance and productivity after conversion. The answer to this question will shed new light on the efficiency hypothesis proposed by Mayers and Smith (1986).

We utilize the data envelopment analysis (DEA) approach to evaluate the efficiency changes of converting insurers. Both the value-added approach and the financial intermediary approach of the DEA method are used. Malmquist index analyses are employed to examine the productivity changes of converting insurers over the sample period.

Our results are based on the overall sample period from 1989 to 2001. The evidence shows that converting insurers experience larger gains in cost efficiency scores and total factor productivity change than mutual counter samples before conversion when the value-added approach is used. On the other hand, converting insurers experience deterioration in cost efficiency scores and total factor productivity change relative to mutual counter samples before conversion when the financial intermediary approach is used. These two seemingly contradictory results may be complementary because the outputs and inputs of the two approaches are different. The empirical evidences of the value-added approach and the financial intermediary approach indicate converting insurers experience improvement in their efficiency relative to mutual counter samples after conversion. The results are robust with respect to cost efficiency scores and total factor productivity change. These overall results support the efficiency hypothesis. The regression evidence also shows that converting insurers outperform their mutual counter samples in cost efficiency after

conversion using the both approaches.

The present study goes beyond existing demutualization research of insurance industry in several important aspects. First, this study is the first to utilize the data envelopment analysis (DEA) methodology to examine the efficiency performance change resulting from conversions in the U.S. property-liability insurance industry. Prior studies do not consider this type of efficiency analysis. The DEA method measures the efficiency performance from both input and output perspectives. Second, we analyze efficiency performance change by using the Malmquist index method, which further separates total productivity change into technical change and technical efficiency change. The additional two measures can provide more insights into the efficiency performance change. Another advantage of the DEA method and Malmquist method is that they produce a uniform efficiency score so that comparisons among insurers are possible. Finally, this study provides evidence of the efficiency hypothesis developed by Mayers and Smith (1986).

The structure of this essay is organized as follows. First, data and research methodology is described, including value-added approach and the financial intermediary approach. Next, we present the empirical results of the efficiency performance changes by using the value-added approach and the financial intermediary approach in Section 3. In Section 4, we further conduct a regression analysis of the relationship between efficiency performance and insurer characteristics. Finally, the important findings are summarized and conclusions are offered in Section 5.

2. Data and Research Methodology

2.1. Data

We examine recent property-liability conversions that occurred during the 1993-1998 period. Only insurers that have complete data during the sample period are included in this

essay. There are two reasons for the short sample period. First, we can evaluate the efficiency performance change of converting insurers based on homogeneous economic conditions (see Viswanathan and Cummins (2003)). Second, for each converting insurer we identify 30 mutual/stock counter samples by matching their asset size and thus need to rely on NAIC (National Association of Insurance Commissioners) data tapes rather than hand-collected data. The overall sample period is from 1989 to 2001.

2.2. Methodology

There are two major classes of efficiency estimation methods: the econometric (parametric) approach and the mathematical programming (non-parametric) approach. The main disadvantages of the parametric approach are the possibility of specification error and the difficulty of separating efficiency into different components. In this essay, we utilize the data envelopment analysis (DEA), a non-parametric approach, to avoid above disadvantages.

Two different DEA methods are used in this essay: the value-added approach and the financial intermediary approach. In addition, we use Malmquist Index analysis to track the efficiency changes and productivity growth during the sample period. Malmquist Index evaluation can also provide more detailed estimates of technical efficiency change, technical change and total factor productivity change over a given period. Cummins and Weiss (2000) review the DEA methodology and Malmquist Index analysis in detail, and discuss several major efficiency studies in the insurance industry.

We chose to employ the DEA analysis for the following four reasons. First, the DEA analysis has been used extensively in estimating efficiency in the banking and insurance literature. Second, this non-parametric approach allows us to avoid an inappropriate assumption about the distribution of error terms used in the parametric approach. Third, the DEA analysis separately evaluates the efficiency of every decision making unit (DMU) relative to its reference set, thus providing a more meaningful measurement of efficiency.

Finally, the use of the DEA analysis enables us to provide consistent analysis since the Malmquist index is also DEA-based. We next discuss the input-output vectors used in this study for the efficiency measurement. Both the value-added approach and the financial intermediary approach are employed.

2.2.1. The Value-Added Approach

We first evaluate the efficiency performance of insurance companies using the value-added approach, which considers asset or liability categories that have the most value added important outputs, as judged by operating cost allocation (see Berger and Humphrey, 1992). We identify the input/output measures according to Cummins and Weiss (1993), Berger, Cummins, and Weiss (1997), Cummins, Weiss and Zi (1999), and Jeng and Lai (2005).

Outputs

The output variables include the loss payments for different product lines and total invested assets. Cummins and Weiss (1993) suggest that insurers provide consumers with services associated with insured losses, risk-pooling, and risk-bearing. Following Cummins and Weiss (1993), Cummins, Weiss and Zi (1999), and Cummins et al. (2004), we use incurred losses for different product lines as proxies for outputs. The rationale for choosing the incurred loss as an output is that insurers collect premiums from policyholders and redistribute the premiums to the insured who incurred losses. The amount of incurred loss could relate to the risk-bearing function, risk-pooling function, and real service provided by insurers. We further separate the losses into four categories: losses incurred in short-tail personal lines (y1), losses incurred in long-tail personal lines (y2), losses incurred in short-tail commercial lines (y3) and losses incurred in long-tail commercial lines (y4). Based on Berger, Cummins, and Weiss (1997), we also include invested assets (y5) as an output variable to capture the insurer's function of financial intermediation. All output

numbers are deflated using the Consumer Price Index (CPI)[12].

Inputs

The inputs used in measuring the efficiency performance include labor (x1), business services (x2), equity capital (x3), and debt capital (x4). The labor input is labor cost divided by average weekly employee wages. We measure the price of labor (p1) as average weekly wages for insurance agents (Standard Industrial Classification (SIC) Class 6411) using U.S. Department of Labor data. The second input, business services, consists of agent commissions and loss adjustment expenses. Both the business services and price of labor variables are deflated to the base year 1997. The price of business services (p2) is the average weekly earnings of workers in SIC Code 7300. The third input is equity capital. We use policyholder surplus as the proxy for equity capital. To avoid the problem of improper estimates, we do not take the ratio of an insurer's net income to capital (ROE) as the cost of policyholder equity because insurers with poor performance are more to have negative net income and price cannot be negative. Consequently, we utilize the debt-equity ratio of the insurer as the price of equity (p3).[13] Following Cummins, Weiss and Zi (1999), and Cummins et al. (2004), we consider debt capital as an input variable and use insurance reserves as the proxy for debt capital. The price of debt (p4) is the ratio of the difference between total investment income and investment income attributed to equity capital to debt capital.

Table 3-1 reports the descriptive statistics for both the inputs and outputs that are used in the value-added approach. One interesting result is that some outputs of the converting insurers are lower than those of the mutual counter samples in three of the four lines (short-tail and long-tail personal lines, and short-tail commercial lines) before conversion.

[12] The base year is 1997.

[13] Price of equity should be a function of a firm's debt-equity ratio. Please see Jeng and Lai (2005) for detailed discussions.

In addition, some inputs of converting insurers (e.g., labor cost and equity) are also significantly lower than those of the mutual counter samples. This means that we are not able to tell whether converting insurers or mutual counter samples are more efficient by simply examining the outputs or inputs.

[Insert Table 3-1 here]

2.2.2. The Financial Intermediary Approach

The Financial Intermediary Approach has been used both in the bank and insurance literature (Kwan, 2006 and Brockett et al., 2004). Brockett et al. (2004) suggest that, compared with other financial intermediaries, an insurer plays a different role because its future obligations are intangible and the policyholders' claims are contingent on future losses. Thus, the ability to pay the claims and the financial health of an insurer are important in terms of the financial intermediary approach and should be considered in evaluating firm performance. We employ the financial intermediary approach to examine the efficiency performance change of the converting insurers from the financial perspective because financial intermediation is one of the major services. Brockett et al. (2004 and 2005) and Jeng and Lai (2005) also utilize the financial intermediary approach. Moreover, since the inputs and outputs of the financial intermediary approach are different from those of the value-added approach, the results using the financial intermediary approach may provide different insights about the insurers' efficiency changes.

Outputs

Following Brockett et al. (2004, 2005), we employ a set of performance ratios and the IRIS (Insurance Regulatory Information System) ratios as insurer outputs. The rationale for the use of these variables to estimate performance from the financial intermediation view is that these measurements reflect the solvency, the quality of investment, and the claim paying ability. The IRIS ratios were established by the NAIC (National Association of Insurance

Commissioners) to investigate the solvency status and performance for the insurers. Hence, the IRIS ratios are likely to be associated with the claim paying ability and should be considered as an output of insurers.

These six output variables include: change in policyholder surplus [14] (y1), capitalization ratio[15] (y2), change in invested assets (y3), investment yield (y4), change in net premiums (y5) and the ratio of liquid assets to liabilities (y6). In addition, we also use return on assets (y7) as one output because another major objective of managers is to maximize the shareholders' profits. However, since we have negative value for outputs and outputs cannot be negative, a constant is added to insurer's outputs so that the output is taken of a positive number[16].

Inputs

The first input is policyholders' surplus. We further divide surplus into surplus the previous year (x1) and change in surplus (x2) because the amount of surplus supplied by the policyholders can be invested during any period of time. The prices for surplus the previous year and change in surplus are the ratio of debt to equity for the previous year (p1) and the ratio for current year (p2). The reason for using the leverage ratio as the input price for surplus was discussed previously. The third input considers underwriting and investment expenses (x3). The underwriting expenses arise from the function of risk-bearing and risk-pooling of the insurance firm. The investment expenses are incurred because they are needed for the productive usage of capital. Both of underwriting and investment expenses are considered as inputs for performing the insurer's risk management and intermediary functions in this essay. We use average weekly employee wages as the proxy for input price

[14] The change in policyholder surplus is the difference between the surplus of last year and current year and is divided by the surplus of last year.
[15] The capitalization ratio is the ratio of the current surplus to the total assets.
[16] See Berger and Mester (1997, p. 899).

(p3). We also use debt capital as input proxy. The debt capital mainly consists of reserves and premiums borrowed from the policyholders. Different lines of business may incur different underwriting risks, thus, needs different maturities of debt capital. We further separate the debt capital into two short-term and long-term debt capitals (x4, x5).[17] We use the U.S. treasury rates as the proxy for the price of debt capital. The prices for short-term and long-term debt capital are the interest rates of one-year and five-year U.S. Treasury rates, (p4, p5) respectively.

Table 3-2 reports the descriptive statistics for both inputs and outputs used in the financial intermediary approach. In the year of conversion, change in surplus of converting insurers ($4,876,841) becomes significantly higher than that of the mutual counter samples ($1,107,906) and stock mutual counter samples ($1,163,973), respectively. This result is expected because demutualized insurers received a capital infusion during the conversion process. Another interesting result is that return on assets (ROA) of demutualized insurers is significantly lower than that of the mutual counter samples in the year of conversion, but it becomes higher than mutual counter samples in year 3.

[Insert Table 3-2 here]

3. Empirical Results

The analysis of empirical results in this section is separated into two parts: the value-added approach section and financial intermediary approach section.

3.1 Efficiency Results of the Value-Added Approach

This section discusses the empirical results of the value-added approach including the DEA scores and Malmquist indices. Specifically, we estimate converting insurers' best

[17] The short-term debt capital equals the product of debt capital and the short-term lines of business position. The short-term line of business position is the ratio of short-term lines net premium to total net premium. The "short-term" or "long -term" signify the length between the policy issuing and payment dates.

practice production frontier consisting of converting insurers and counter samples and estimate the counter samples' best practice production frontier consisting of only counter samples. The efficiency scores and Malmquist measurement indicate whether insurers improve their performance and productivity. We also examine the ratio of efficiency score or indices of the converting insurers to that of the counter samples to compare the performance differences between the converting insurers and their counter samples during conversion period. The ratio indicates whether converting insurers perform better or worse than the counter samples.

3.1.1 DEA Efficiency Score Calculation

Panel A of Table 3-3 reports the comparison between the converting insurers and mutual counter samples. We first focus on the analyses of the efficiency change before demutualization. The top section of Panel A in Table 3-3 indicates that technical efficiency, allocative efficiency, and cost efficiency scores of converting insurers increase before demutualization. For example, the technical (cost) efficiency score for converting insurers increases from 0.867 (0.508) in year –3 to 0.922 (0.574) in year –1. Consistent results are found when we examine the demutualized/control insurer efficiency ratio. For example, the converting/mutual counter sample technical efficiency ratio also increases from 1.042 in year -3 to 1.084 in year -1, suggesting converting insurers perform better than mutual counter samples during the pre-conversion period. One possible explanation is that the converting insurers need to seek the regulatory and the policyholder approval of stock offerings before conversions and conduct initial public offering after conversions. In order to obtain the approval of the demutualization, the converting insurers may have the incentive for window dressing and lead to the higher efficiency performance of the converting insurers than that of the matching mutuals before conversions.

[Insert Table 3-3 here]

We next examine the efficiency scores after demutualization. Panel A of Table 3-3 shows that all efficiency measures, including technical efficiency, allocative efficiency and cost efficiency increase after the demutualization. For example, the technical (cost) efficiency score for converting insurers increases from 0.894 (0.547) in year 0 to 0.912 (0.618) in year 3. In addition, the results show that all of the ratios of the converting/mutual counter samples increase from year 0 to year 3, implying that the converting insurers perform better than the mutual counter samples after conversion. This is consistent with the prediction of the efficiency hypothesis that the financial and operational efficiency improvement motivates the conversions for these demutualized insurers in the sample period.

One may argue that the frontier for converting insurers may change after conversion because converting insurers have changed their organizational structure from the mutual form to the stock form. Thus, we also conduct the analyses based on the pooled frontier of converting insurers and stock counter samples. Panel B of Table 3-3 shows the comparison between the converting insurers and stock counter samples before and after demutualization. Specifically, Panel B shows that technical and cost efficiency scores increase from year 0 to year 3, implying the converting insurers improve their performance after conversion and perform better than the stock counter samples after conversion.[18]

3.1.2 Malmquist Index Analysis

We utilize the Malmquist index approach to analyze technical efficiency change, technical change, and total factor productivity change over the sample period. The Malmquist index of total factor productivity change consists of technical efficiency change and technical change. If the Malmquist index of total factor productivity greater than 1 implies that total factor productivity progress has occurred. A favorable (unfavorable) technical efficiency change implies "catching–up (falling behind)." If the Malmquist index

18 The allocative efficiency scores of converting insurers decrease after the demutualization, but so do the scores of stock counter samples. In fact, the allocative converting/stock counter sample ratios increase after demutualization.

of technical change is greater (less) than 1 implies “innovation (technical regress)”.

Table 3-4 reports the results of Malmquist analysis using the value-added approach. Panel A presents the Malmquist indices based on the pooled production frontier of the converting insurers and mutual counter samples. The top section of each panel shows the year to year Malmquist indices. Panel A shows the value of technical efficiency change (total factor productivity change) in year -2 is 1.008 (1.005), suggesting the converting insurers on average improved efficiency by 0.8% (0.5%) between year -3 and year -2. It also indicates that the improvement in total factor productivity of converting insurers comes mainly from the favorable technical efficiency change before conversion, rather than from the technical change.

[Insert Table 3-4 here]

We focus on the cumulative results for the Malmquist indices because they indicate the cumulative changes during the time period examined. The bottom section of Panel A of Table 3-4 presents the cumulative results. The cumulative results for a certain year are the product of the index at the start of the year and the index the end of the year. For example, the bottom section of Panel A shows the cumulative index of technical efficiency change for year -1 (1.080), is the product of the -3 to -2 index (1.008) and -2 to -1 index (1.071). The results in the bottom section of Panel A of Table 3-4 show that converting insurers experience efficiency improvement before conversion in terms of technical efficiency change (1.080) and total factor productivity change (1.093). The cumulative results of the converting/mutual counter samples in year -1 for all three indices are also greater than 1, suggesting converting insurers perform better than the mutual counter samples before the conversion.

Cumulative results (bottom section of Panel A) show technical efficiency change, technical change and the total factor productivity are 1.079, 1.007, and 1.116 in year 3,

respectively. In addition, the cumulative results for converting/mutual counter sample ratios are 1.003, 1.059, and 1.091 in year 3, respectively. These values are greater than 1, suggesting that converting insurers are "catching up" to the frontier and experiencing "innovation" and productivity progress. Thus, the improvement in total factor productivity of converting insurers results mainly from both the favorable technical efficiency change and technical change after conversion.

Panel B presents the Malmquist indices based on the pooled frontier of the converting insurers and stock counter samples. The cumulative results (bottom section) of Panel B show that technical change and total factor productivity efficiency are 1.014 and 1.004, respectively, in year -1. These results suggest converting insurers improve in terms of these two indices before the conversion. It also indicates that the improvement in total factor productivity of converting insurers comes mainly from the favorable technical change before conversion. After conversion, the cumulative results in Panel B show that technical efficiency change, technical change indices, and total factor productivity efficiency are 0.988, 0.989, and 0.978, respectively, in year 3. All three values are less than 1, suggesting converting insurers "fall behind" in efficiency and suffer "technical regress" and "productivity deterioration" after the conversion when compared with control stock insurers. Thus, it indicates that productivity deterioration results from being less efficient and from technical regress after conversion.

However, the cumulative scores of technical efficiency change and total factor productivity change at t=3 are higher than those at t=0 (0.969 and 0.973, respectively). This means converting insurers improve their technical efficiency change and total factor productivity change after t=0.

3.2 Efficiency Results of Financial Intermediary Approach

Since the inputs and outputs of the financial intermediary approach are different from

those of the value-added approach, we believe our analysis in this section provides additional insights about the efficiency performance change with respect to "financial condition" before and after the demutualization. We report only the final results because the analysis is similar to that of the value-added approach.[19]

3.2.1 DEA Efficiency Score Calculation

Table 3-5 reports the DEA efficiency scores using the financial intermediary approach. Panel A shows that the efficiency scores of converting insurers based on the pooled frontier of converting insurers and mutual insurers decrease before the conversion. These results are different from those of the value-added approach which shows the converting insurers improve their performance before the demutualization. Interestingly, Jeng, Lai, and McNamara (2007) also find seemly contradictory results between the two approaches using U.S. life insurance demutualization data. The reason for the different results of the two approaches is that they use different outputs and inputs. The outputs for the value-added approach are losses incurred, while the outputs for the financial intermediary approach are financial condition variables such as the change in policyholder surplus, capitalization ratio, and the liquidity ratio.

[Insert Table 3-5 here]

A possible explanation for the improvement of the converting insurers before the conversion using the value-added approach is that converting insurers improve their efficiency to maximize the existing policyholders' (future stockholders') wealth. Other things being equal, more efficient insurers are able to offer shares at a higher IPO price because efficiency usually translates to profitability. A possible explanation for the deterioration of the converting insurers before the conversion using the financial intermediary approach is that converting insurers need new capital infusions.

[19] Because the measured units of outputs and inputs are different in the financial intermediary approach, we multiply all outputs in all firms by 100 to keep the units of outputs and inputs the same.

We next analyze the postconversion results. As compared to their mutual counter samples, we find that the converting insurers enjoy efficiency improvement in all efficiency scores, supporting the efficiency hypothesis.

When the indices are based on the pooled frontier of converting insurers and stock insurers, we find converting insurers suffer deterioration in efficiency measures after the conversion (Panel B, Table 3-5). It is worth noting that the allocative efficiency is lower for the converting insurers than for the stock insurers for year -3 to year 2. It implies that the converting insurers are less successful in minimizing the cost than their matching stock insurers. This is consistent with the expense preference behavior regarding the mutual form of ownership (e.g., Mester, 1989; Cummins et al., 1999a). One possible explanation is that the mutual ownership form has less monitoring mechanisms to control for manager's unnecessary perquisite consumption than stock ownership forms. Although the converting insurers conduct business under the stock form after demutualization, the evidence of allocative efficiency shows that their expense preference behavior is still similar to that of mutual insurers in the first two years of demutualization.

3.2.2 Malmquist Index Analysis

Table 3-6 shows the results of the Malmquist analysis using the financial intermediary approach. The results of Panel A show that compared to mutual counter samples, the converting insurers are "falling behind" and suffer total factor productivity change before the conversion. It also indicates that total factor productivity deterioration results from falling behind in technical efficiency change before conversion. Consistent with the efficiency hypothesis prediction, we also find converting insurers experience favorable technical efficiency changes and total factor productivity change and perform better than the mutual counter samples after the conversion (Panel A). It also indicates that the improvement in total factor productivity of converting insurers comes mainly from the favorable technical change

after conversion. Panel B shows that, compared to stock insurers, converting insurers enjoy total factor productivity improvement after conversion and this improvement comes from the favorable technical change (innovation).

[Insert Table 3-6 here]

4. Regression Analysis

The analyses of DEA scores and Malmquist indices provide evidence of efficiency changes. The efficiency scores analyses are univariate analyses in the previous section. We next further use ratios of converting/counter samples as dependent variable to examine the relative efficiency performance and productivity of the converting insurers and the counter samples. We use ordinary least square regression analysis to examine efficiency and productivity changes between the converting insurers and counter samples.[20] Specifically, we examine whether converting insurers outperform or underperform counter samples. The dependent variables are various efficiency scores and cumulative Malmquist indices and the independent variables are firm characteristics.

We use four sets of dependent variables for efficiency change. The first set of dependent variables (cost efficiency, technical efficiency, and allocative efficiency) is the DEA efficiency scores in one year before the conversion (t=-1) to those in three years before the conversion (t=-3). The second set of dependent variables is the DEA efficiency scores 3 years after conversion (t=3) to those in one year before the conversion (t=-1). The third set of dependent variables is cumulative Malmquist indices (technical efficiency change, technical change, and total factor productivity change) before the conversion, measured in the same way as the DEA efficiency scores. Finally, the last set of dependent variables is

[20] Previous literature on the efficiency uses the Tobit regression model to analyze the efficiency dependent variable ranging from zero to one. Our dependent variable is the ratio of efficiency score after conversions to efficiency score before conversion, thus, the range of dependent variable is not between zero and one as the range of the efficiency score. Hence, we do not use the Tobit regression model for analysis.

cumulative Malmquist indices after the conversion.

Based on Cummins, Tennyson, and Weiss (1999b), we choose some insurer's financial/operational characteristics as independent variables, such as firm size, Herfindahl index for lines of business, percent of premiums in long-tail lines, the ratio of agents' balances to direct premiums written, and the reinsurance ratio. Note that these variables serve as control variables for insurers' different characteristics.

The reasons for choosing the control variables are explained as follows. First, the previous literature on scale efficiency shows that the median-sized firms is more cost efficient than either small firms or large firms (e.g. Berger et al. (1992)). Hence, it is hypothesized that the cost efficiency may vary with firm size. We take the natural logarithm of total assets as the proxy for firm size. Second, Cummins, Tennyson, and Weiss (1999b) study the efficiency change associated with ownership structure change and find that more concentrated firms experience smaller changes in the efficiency performance than more diversified firms. Hence, the business concentration may relate to the efficiency performance. We take the Herfindahl index of line of business as the proxy for the concentration measurement to examine the relation between the concentration of lines of insurance and efficiency change. Third, because the underwriting risk, service intensity, and level of market competition may vary with different lines of business[21], the strategic focus of different lines of insurances may lead to different efficiency performance. This efficiency difference could be revealed by examining the relation between the business mix and efficiency change. We disaggregate business mix into two categories: the long-tail lines and the short-tail lines.[22] We use the premium percentage in two categories as proxy for the business mix position. To avoid multicollinearity problem in regression analysis, we only

[21] See Cummins et al. (1999a) and Cummins et al. (1999b).

[22] The long-tail and short-tail line refer to the length of the period between the issue date of the insurance contract and the claim paying date.

keep the long-tail business mix in the regression model. Fourth, agent's balance asset account indicates the amount of money that should be forwarded to the insurer but still in the hands of the agent. The agent's balance relates to the financial liquidity strain or cash management since it is difficult to convert the agent's balance into cash (Viswanathan and Cummins (2003)). Hence, we predict that the level of agent's balance may affect the efficiency change of the insurers, especially in the cost efficiency and allocative efficiency. Finally, reinsurance plays an important role in the property liability insurance industry. The reinsurance company provides both the real risk management service and financing function to the primary insurers. Since the reinsurance ease the financial constraints of the insurers, we predict that the level of reinsurance may affect the efficiency performance change of the insurers. A detailed discussion of independent variables and models will be presented in the empirical results section.

The regression model is as follows:

$$Efficiency\ \ Change = \beta_0 + \beta_1 DEMU + \beta_2 NA + \beta_3 HI + \beta_4 LP + \beta_5 AD + \beta_6 RE + \varepsilon$$

The independent variables include a conversion dummy (DEMU, equal to 1 if the insurer is a converting insurers and zero for counter samples), firm size (NA, log of total assets), Herfindahl index (HI), percent of premiums in long-tail lines (LP), the ratio of agents' balances to direct premiums written (AD), and the reinsurance ratio (RE). The values used in independent variables in the regression analysis are for one year before conversion. Table 3-7 presents the summary statistics for variables that are included in the regression models.[23] The results show that the total assets of converting insurers are significantly higher after conversion. This is due to the infusion of capital during the conversion. We find that the Herfindahl index of converting insurers is lower than that of

[23] The original value of dependent variables has been reported in Tables 3-3, 3-4, 3-5, and 3-6.

the stock counter samples before the conversion but becomes significantly higher than that of converting insurers after the conversion. The results also show that, on average, the reinsurance ratio of converting insurers is consistently significantly higher (lower) than that of the mutual (stock) counter samples during the conversion period.

[Insert Table 3-7 here]

4.1 Regression Results of the Value-Added Approach

Table 3-8 reports the results of regression analysis for the value-added approach. Panel A of Table 3-8 shows that the coefficient of the constant and conversion dummy (DEMU) variables in technical efficiency model are significant and positive, indicating that converting insurers improve their technical efficiency and perform better than the mutual control group before conversion. In addition, we find that the converting insurers perform better than the mutual counter samples after conversion for all the efficiency measures (Panel B). The evidence is consistent with the result of the DEA analysis in the previous section. Thus, the regression results provide strong evidence to support the efficiency hypothesis.

[Insert Table 3-8 here]

Consistent with the finding of Cummins et al. (1999), we find that large insurers experience lower efficiency improvement than small insurers during converting period (Panels A and B). The predicted sign of Herfindahl index is ambiguous. Comment and Jarrell (1995) among others suggest that diversified firms perform worse than firms with focus strategy. On the other hand, Jeng and Lai (2005) find specialized insurers are more efficient. However, Meador, Ryan, and Schellhorn (2000) suggest that diversification across multiple insurance and product lines resulted in greater efficiency than a more focused production strategy for the life insurance industry. Similar to the finding in Meador et al. (2000), we find insurers with focus strategy perform worse than insurers with diversified strategy after the conversion. The positive and significant coefficient of percent of

premiums in long-tail lines (LP) in Panel A implies that mutual insurers with more business in long-tail lines experience greater efficiency gains before conversion. The results of Panels A and B show that converting insurers with higher agents' balances to direct premiums written are more likely to improve efficiency during the conversion period. Finally, consistent with the findings in the previous literature, we find that insurers with a lower reinsurance ratio are more likely to improve their efficiency during the conversion period.

Panels C and D of Table 3-8 present the regression results of the cumulative Malmquist indices. Panel C shows that DEMU is negatively related to efficiency change, suggesting that converting insurers underperform the control mutual insurers before conversion. On the other hand, the coefficients of the DEMU variables in the technical change and total productivity change models are statistically positive at the 1% level after conversion, implying that converting insurers perform better than the mutual control group in technical change and total productivity change after the conversion. In addition, consistent with the results found in Panel A and B, we find that converting insurers that have a higher agent's balances to direct premiums written ratio and a lower reinsurance ratio are more likely to improve their total productivity growth during the conversion period. To save space, we do not provide the discussion of the control variables for the rest of analyses, but these results are available from the authors.

Since the converting insurers operate under the stock organizational structure after demutualization, we also compare the difference in the efficiency performance between converting insurers and stock counter samples after conversion. The results presented in Table 3-9 indicate that none of the coefficients of the conversion dummy variables in the efficiency and Malmquist index models are significant after conversion, suggesting that converting insurers do not outperform or underperform their stock control group after the

conversion.

[Insert Table 3-9 here]

4.2 Regression Results of the Financial Intermediary Approach

We also conduct regression analyses to examine efficiency performance changes using the financial intermediary approach and report the results in Tables 3-10 and 3-11. The financial intermediary approach considers overall financial strength (e.g., change in policyholder surplus, the capitalization ratio, and liquidity) and profit of insurers, whereas the value-added approach focuses on underwriting performance (e.g., losses incurred).

Panel A of Table 3-10 shows converting insurers perform worse than mutual counter samples in terms of technical efficiency performance before conversion. After conversion, the DEMU variables are positive and significant in the cost and allocative efficiency models, suggesting converting insurers experience larger gains in cost and allocative efficiency performance than mutual counter samples (Panel B). Consequently, the empirical results of both the value-added approach and the financial intermediary approach support the efficiency hypothesis especially in terms of cost and allocative efficiency.

[Insert Table 3-10 here]

Panels C and D of Table 3-10 display the regression results for the cumulative Malmquist indices before conversion and after conversion. They show that the converting insurers experience more favorable efficiency change than mutual counter samples before and after conversion.

We next present the regression results of converting insurers and stock counter samples in the Table 3-11. The results in Panel A show the coefficients of the DEMU variables in the cost efficiency and technical efficiency models are negative and significant, implying that converting insurers are, on average, to underperform stock counter samples before the conversion. The results in Panel B indicate that converting insurers perform better in terms

of cost and technical efficiency than stock counter samples after the demutualization.

[Insert Table 3-11 here]

Panels C and D in Table 3-11 present the regression results of cumulative Malmquist indices. We find that converting insurers perform better than the stock counter samples in term of efficiency change before conversion. However, we did not find that converting insurers perform better than the stock control insurance in total productivity growth before or after conversion.

In summary, the overall results of both the value-added and financial intermediary approaches are complementary. In both two of the approaches, we find that converting insurers improve their efficiency performance after conversion. Thus, the overall empirical evidences support the efficiency hypothesis.

5. Conclusions

This study investigates the pre- versus postconversion efficiency and productivity changes of U.S. property-liability insurers. For robustness, we provide various DEA scores (cost efficiency, technical efficiency, and allocative efficiency scores), Malmquist indices (total factor productivity change, technical efficiency change and technical change), and regression results of the value-added approach and the financial intermediary approach before and after conversion.

Given the breadth of the analysis, a summary table 3-12 is necessary. The results of 48 regression models are summarized in Table 3-12. Our summary table 3-12 focuses on the cost efficiency score and total factor productivity index because they are the two most important measures.[24] The empirical results are discussed below.

[24] Cost efficiency can be decomposed into technical efficiency and allocative efficiency, and total factor productivity change can be decomposed into technical efficiency change and technical change. Results for the stock counter samples before conversion are not summarized because converting insurers were mutuals before conversion.

First, in Panel A of Table 3-12, we find converting insurers improve their performance before conversion using the value-added approach. On the other hand, converting insurers experience deterioration in efficiency before conversion using the financial intermediary approach. As we mentioned above, the two seemingly contradictory results from the two approaches may be complementary. The converting insurers improve performance before conversion to maximize their policyholders' (stockholders after conversion) wealth. At the same time, the evidence shows the converting insurers suffer deterioration in financial condition and need to seek a capital infusion through the conversion.

[Insert Table 3-12 here]

Second, the evidence based on the pooled frontier of mutual insurers and converting insurers shows that converting insurers improve their performance after the conversion using the two approaches. These results strongly support the efficiency hypothesis developed by Mayers and Smith (1986). The evidence, based on the pooled frontier of converting insurers and stock insurers, indicates that converting insurers improve their performance using the value-added approach. On the other hand, the evidence indicates that performance of converting insurers deteriorates using the financial intermediary approaches. It should be noted that the mixed results do not necessarily invalidate the efficiency hypothesis. We believe that the results based on the mutual counter samples should be weighed more heavily than those for stock counter samples. The reason is that even though converting insurers change their organizational structure from mutual to stock, they may not behave as stock insurers within three years after conversion because it takes time to adjust the changes.

It should be noted that the regression results examine whether the converting insurers outperform mutual or stock counter samples, while the DEA scores and Malmquist indices examine whether converting insurers improve their performance. Thus, we should give

more weight to the DEA scores and Malmquist indices when we examine the efficiency hypothesis. Panel B of Table 3-12 shows the summarized regression results which examine whether the converting insurers outperform or underperform the counter samples. Again, we only summarize the results of models where the dependent variables are cost efficiency and total factor productivity change. The efficiency and productivity changes before the conversion are summarized first. We cannot conclude converting insurers perform better or worse than mutual counter samples before the conversion. However, the empirical evidences of comparison between converting insurers and mutual insurers indicate converting insurers experience improvement in their efficiency relative to mutual counter samples after the conversion. The results are robust with respect to both the value-added approach and the financial intermediary approach.

The regression results of the efficiency and productivity changes after the conversion for comparison between converting insurers and stock insurers are summarized next. Using the financial intermediary approach, we find that converting insurers outperform stock counter samples in terms of cost efficiency performance. We believe the empirical results shed additional light on the efficiency hypothesis.

An important avenue for extending this research would be to empirically test on which frontier the efficiency of converting firms should be measured after demutualization. Since the converting firms operate under mutual form before demutualization and operate under stock charter after demutualization, it may lead to invalid comparison to compare the demutualized insurers with mutual insurers to a pooled efficient frontier after conversion or compare demutualized insurers with stock insurers to a pooled efficient frontier after conversion. Artificially selecting efficiency frontier may lead to misleading results. Hence, the analysis of this issue should receive additional scrutiny in the future study.

References

Berger, Allen N. and Humphrey, David B., 1992, "Measurement and Efficiency Issues in Commercial Banking" in Zvi Griliches, ed. *Output Measurement in the Service Sectors,* University of Chicago Press, Chicago, IL.

Berger, Allen N., Cummins, J. David and Weiss, Mary A., 1997, "The Coexistence of Multiple Distribution Systems for Financial Services: The Case of Property-Liability Insurance," *The Journal of Business*, 70(4): 515-546.

Berger, A.N., Mester, L.J., 1997, "Inside the black box: What explains the differences in the efficiencies of financial institutions?" *Journal of Banking and Finance*, 21 (7), 895–947.

Brockett, P. L., Cooper, W. W., Golden, L. L., Rousseau, J., and Wang, Y., 2004, "Evaluating Solvency versus Efficiency Performance and Dif ferent Forms of Organization and Marketing in US Property-Liability Insurance Companies," *European Journal of Operational Research*, 154:492-514.

Brockett, P. L., Cooper, W. W., Golden, L. L., Rousseau, J., and Wang, Y., 2005, "Financial Intermediary Versus Production Approach to Efficiency of Marketing Distribution Systems and Organizational Structure of Insurance Companies, " *Journal of Risk and Insurance, 72*, 393-412.

Cagle, Julie, Lippert, Robert L. and Moore, William T., 1996, "Demutualization in the Property-Liability Insurance Industry," *Journal of Insurance Regulation*, 14 (3): 343-369.

Coelli, T., 1996, "A guide to DEAP Version 2.1: A Data Envelopment Analysis Program," *Working Paper*, University of New England, Armidale, Australia.

Comment, R., and Jarrell, G. A., 1995, "Corporate Focus and Stock Returns," *Journal of Financial Economics*, 37: 1, 67-88.

Cummins, J. David, and Weiss, Mary A., 1993, "Measuring Cost Efficiency in the Property-Liability Insurance Industry," *Journal of Banking and Finance*, 17: 463-481.

Cummins, J. David, Weiss, Mary A. and Zi, Hongmin, 1999a, "Organizational Form and Efficiency: The Coexistence of Stock and Mutual Property-Liability Insurers," *Management Science* 45: 1254-1269.

Cummins, J. D., Tennyson, S. and Weiss, M. A., 1999b, "Consolidation and Efficiency in the U.S. Life Insurance Industry," *Journal of Banking and Finance*, 23: 325-357.

Cummins, J. D., and Weiss, M. A, 2000, "Analyzing Firm Performance in the Insurance Industry Using Frontier Efficiency and Productivity Approaches" in Georges Dionne, ed., *Handbook of Insurance,* Boston: Kluwer Academic Publishers, Massachusetts, USA.

Cummins, J. D., Rubio-Misas, M. and Zi, H., 2004, "The Effect of Organizational Structure

on Efficiency: Evidence from the Spanish Insurance Industry," *Journal of Banking and Finance,* 28: 3113-3450.

Jeng, V., and Lai, G..C., 2005, "Ownership Structure, Agency Costs, Specialization, and Efficiency: Analysis of Keiretsu and Independent Insurers in the Japanese Nonlife Insurance Industry," *Journal of Risk and Insurance*, 72: 105-158.

Jeng, V., Lai, G..C., and McNamara, M. J., 2007, "Efficiency and Demutualization: Evidence From the US Life Insurance Industry in the 1980s and 1990s," *Journal of Risk and Insurance*, 683-711.

Kwan, S.H., 2006, "The X-efficiency of commercial banks in Hong Kong," *Journal of Banking and Finance*, 30:1127-1147.

Mayers, D., and Smith, C. W., 1986, "Ownership Structure and Control-The Mutualization of Stock Life Insurance Companies," *Journal of Financial Economics*, 16：73-98.

McNamara, M. J. and Rhee, S. G., 1992, "Ownership Structure and Performance：The Demutualization of Life Insurers," *Journal of Risk and Insurance*, 59: 221-238.

Meador, J.W., Ryan, H.E. and Schellhorn, C.D., 2000, Products focus versus diversification: Estimate of X-efficiency for the U.S. life insurance industry, In: Harker, P. T. and S. A. Zenios (Ed.), *Performance of Financial Institutions: Efficiency, Innovation, Regulation*, pp. 175-198.

Mester, L.J., 1989, "Testing for expense preference behavior: Mutual versus stock savings and loans," *The Rand Journal of Economics*, 20:483-498.

Viswanathan, K. S. and Cummins, J. D., 2003, "Ownership Structure Changes in the Insurance Industry: An Analysis of Demutualization," *Journal of Risk and Insurance*, 70: 401-437.

Table 3-1 Descriptive Statistics for Inputs/Outputs Using the Value-Added Approach

This table shows the means of output, input, and input price variables of converting insurers, mutual counter samples, and stock counter samples for the U.S. property and liability insurers during the conversion period. Data are gathered from the National Association of Insurance Commissioners from 1989 to 2001. All input prices are deflated using the 1997 the Consumer Price Index..

	Year t= -3		Year t= 0			Year t= 3	
	Converting Insurer	Mutual Control Insurer	Mutual Control Insurer	Converting Insurer	Stock Control Insurer	Converting Insurer	Stock Control Insurer
Output							
Y1= Losses incurred in short-tailed personal lines	1,082,401***	1,341,529	1,586,621***	1,195,797	1,616,102	1,402,381	1,883,590
Y2= Losses incurred in long-tailed personal lines	3,391,965***	4,255,840	4,172,100***	3,237,806	4,214,472***	3,640,500	4,502,850*
Y3= Losses incurred in short-tailed commercial lines	800,769***	1,068,847	1,096,791**	819,636	1,150,554	1,015,999	1,430,148
Y4= Losses incurred in long-tailed commercial lines	2,670,176	2,095,934	2,211,151***	1,951,120	2,995,023	2,583,530	3,135,560
Y5= Total Invested Assets	29,260,309***	26,006,789	29,109,239***	37,020,115	28,336,583***	35,640,371	35,709,377
Input							
X1=Labor	3,719***	4,582	4,542***	4,053	3,319**	3,723	3,840
X2=Business Service	13,947	12,378	12,116	12,726	9,623***	13,228	11,626**
X3=Equity	9,080,032***	11,149,565	13,536,625	15,520,216	13,835,786	14,497,961	16,019,904**
X4=Debt Capital	20,425,411	15,684,359	16,616,821	20,608,244	14,855,266***	21,007,025	21,297,690
Input Price							
P1=Price of Labor	364.60	364.60	400.66	400.66	397.85	423.98	392.11
P2= Price of Business Service	233.76	233.76	240.20	240.20	240.42	262.02	248.32
P3= Price of Equity	2.01***	1.43	1.27**	1.26	1.19**	1.38	1.77
P4= Price of Debt	0.09	0.08	0.08	0.10	0.15	0.09	0.18***

Note:
*** Difference between demutualized insurer and control insurer sample means at the 1% level.
** Difference between demutualized insurer and control insurer sample means at the 5% level.
* Difference between demutualized insurer and control insurer sample means at the 10% level.

Table 3-2 Descriptive Statistics of Inputs/Outputs Using the Financial Intermediary Approach

This table shows the means of output, input, and input price variables of converting insurers, mutual counter samples, and stock counter samples for the U.S. property and liability insurers during the conversion period. Data are gathered from the National Association of Insurance Commissioners from 1989 to 2001. All input prices are deflated using the 1997 the Consumer Price Index.

	Year t=-3		Year t=0			Year t=3		
	Converting Insurer	Mutual Control Insurer	Mutual counter sample	Converting Insurer	Stock Control Insurer	Mutual Control Insurer	Converting Insurer	Stock Control Insurer
Output								
Y1=Change in Policyholder Surplus	-0.002**	0.050	0.092***	0.891	0.208***	0.045***	0.109	0.074
Y2=Capitalization Ratio	0.390	0.470	0.489	0.481	0.463	0.504	0.475	0.485
Y3=Change in Invested Assets	0.033	0.438	0.061***	0.251	4.409	0.039	-0.004	0.054
Y4=Investment Yield	0.063***	0.051	0.051	0.050	0.108	0.050	0.062	0.058
Y5=Change in Net Premiums	0.040	0.073	0.153	0.095	0.619	0.071	-0.087	0.246
Y6=Liquid Assets to Liabilities	4.338	1.109	1.109	1.952	0.822	0.892	0.201***	2.847
Y7=ROA	0.014	0.016	0.023**	-0.001	0.028***	0.017***	0.021***	0.033
Input								
X1=Surplus previous year	8,577,845.95***	10,885,462.91	11,922,915.47***	7,859,886.88	15,448,793.04***	16,054,665.84***	16,816,770.17**	21,322,954.65
X2=Change in Surplus	620,742.33	358,426.39	1,107,906.31***	4,876,840.86	1,163,937.32***	735,141.54***	382,494.33	1,094,193.87
X3=Underwriting +Investment Expenses	8,476,318.17	8,564,331.49	9,388,508.01***	10,023,370.56	9,408,668.08***	11,517,533.10***	12,234,127.93*	16,261,809.97
X4=Short Term Debt Capital	21,693,884.45***	15,282,645.64	18,785,236.38***	18,849,628.87	22,091,465.85*	22,848,800.67*	33,004,032.22	46,053,242.58
X5=Long Term Debt Capital	5,089,445.94	4,190,545.22	5,449,700.14**	5,964,478.94	7,337,784.76	6,713,830.33	6,890,778.44	12,068,932.11
Input Price								
P1=Debt/Equity for previous year	1.96***	1.64	1.50***	2.69	1.66***	1.30***	1.68*	1.54
P2=Debt/Equity for current year	2.26***	1.68	1.44**	1.47	1.83	1.34	1.56	1.56
P3=Price of Labor =average weekly employee wages	364.60	365.48	397.13	398.31	396.43	424.09	424.61	424.07
P4= One-year Treasury constant maturities	5.54	5.49	5.08	5.11	5.02	5.39	5.51	5.43
P5= Five-year Treasury constant maturities	6.82	6.78	5.97	5.99	5.98	5.78	5.85	5.81

Note:
*** Difference between demutualized insurer and control insurer sample means at the 1% level.
** Difference between demutualized insurer and control insurer sample means at the 5% level.
* Difference between demutualized insurer and control insurer sample means at the 10% level.

Table 3-3 DEA Efficiency Score Results Using the Value-Added Approach

This table provides the averages of DEA efficiency scores using the value-added approach. Panel A (B) provides the results based on the pooled frontier of the converting insurers and mutual (stock) counter samples. Converting/Control Insurer is the ratio of converting score to control insurer score. The year with a minus (positive) sign in front refer to the pre (post) -converting years. Year 0 is the converting year.

	Technical Efficiency			Allocative Efficiency			Cost Efficiency		
Year	Converting Insurer Efficiency	Control Insurer Efficiency	Converting/ Control Insurer	Converting Insurer Efficiency	Control Insurer Efficiency	Converting/ Control Insurer	Converting Insurer Efficiency	Control Insurer Efficiency	Converting/ Control Insurer
Panel A: Converting Insurers vs. Mutual counter samples									
-3	0.867	0.832	1.042	0.590	0.593	0.996	0.508	0.499	1.018
-2	0.868	0.821	1.058	0.671	0.651	1.031	0.573	0.540	1.061
-1	0.922	0.850	1.084	0.625	0.643	0.972	0.574	0.550	1.043
0	0.894	0.873	1.024	0.612	0.665	0.920	0.547	0.585	0.934
1	0.889	0.854	1.041	0.630	0.692	0.911	0.555	0.596	0.932
2	0.899	0.858	1.048	0.649	0.705	0.921	0.581	0.608	0.956
3	0.912	0.874	1.044	0.674	0.702	0.961	0.618	0.618	1.000
Panel B: Converting Insurers vs. Stock counter samples									
-3	0.904	0.907	0.996	0.531	0.618	0.859	0.481	0.566	0.850
-2	0.841	0.870	0.967	0.468	0.577	0.811	0.398	0.512	0.777
-1	0.888	0.876	1.014	0.861	0.588	1.464	0.665	0.526	1.264
0	0.824	0.846	0.974	0.664	0.676	0.982	0.548	0.573	0.956
1	0.834	0.853	0.977	0.473	0.528	0.896	0.393	0.454	0.865
2	0.872	0.871	1.001	0.568	0.553	1.028	0.499	0.481	1.037
3	0.860	0.869	0.990	0.654	0.655	0.999	0.553	0.561	0.986

Table 3-4 Malmquist Analysis Using the Value-Added Approach

This table provides the averages of Malmquist indices using the value-added approach. Panel A (B) provides the results based on the pooled frontier of the converting insurers and mutual (stock) counter samples. Converting/Control Insurer is the ratio of converting score to control insurer score. The year with a minus (positive) sign in front refer to the pre (post) -converting years. Year 0 is the converting year.

	Technical Efficiency Change			Technical Change			Total Factor Productivity Change		
Year	Converting Insurer Efficiency	Control Insurer Efficiency	Converting/ Control Insurer	Converting Insurer Efficiency	Control Insurer Efficiency	Converting/ Control Insurer	Converting Insurer Efficiency	Control Insurer Efficiency	Converting/ Control Insurer
Panel A: Converting Insurers vs. Mutual counter samples									
-2	1.008	0.990	1.019	0.996	1.022	0.975	1.005	1.011	0.994
-1	1.071	1.045	1.025	1.002	0.967	1.037	1.088	1.009	1.078
0	0.971	1.033	0.940	0.953	0.959	0.994	0.930	0.991	0.938
1	0.995	0.979	1.016	1.065	1.028	1.037	1.062	1.006	1.056
2	1.017	1.007	1.010	0.995	0.991	1.004	1.013	0.998	1.015
3	1.017	1.022	0.995	0.999	0.985	1.014	1.020	1.007	1.013
Cumulative Results									
-1	1.080	1.034	1.044	0.998	0.988	1.011	1.093	1.020	1.072
0	1.048	1.068	0.982	0.952	0.948	1.004	1.017	1.011	1.006
1	1.043	1.046	0.997	1.014	0.974	1.041	1.080	1.017	1.062
2	1.061	1.053	1.007	1.009	0.966	1.044	1.094	1.015	1.078
3	1.079	1.076	1.003	1.007	0.951	1.059	1.116	1.022	1.091
Panel B: Converting Insurers vs. Stock counter samples									
-2	0.954	0.934	1.021	1.047	1.077	0.972	0.998	1.001	0.997
-1	1.038	1.038	1.001	0.969	0.953	1.016	1.006	0.986	1.020
0	0.979	1.006	0.973	0.990	0.993	0.997	0.969	0.997	0.972
1	0.988	0.983	1.005	1.033	1.024	1.009	1.020	1.006	1.014
2	1.040	1.041	0.999	0.972	0.964	1.008	1.011	1.005	1.006
3	0.992	0.985	1.008	0.982	1.046	0.939	0.974	1.030	0.946
Cumulative Results									
-1	0.990	0.970	1.021	1.014	1.027	0.987	1.004	0.987	1.017
0	0.969	0.975	0.994	1.004	1.020	0.984	0.973	0.985	0.988
1	0.957	0.959	0.999	1.037	1.044	0.993	0.993	0.991	1.002
2	0.996	0.998	0.998	1.007	1.006	1.001	1.004	0.996	1.008
3	0.988	0.983	1.005	0.989	1.052	0.940	0.978	1.025	0.954

Table 3-5 DEA Efficiency Score Results Using the Financial Intermediary Approach

This table provides the averages of DEA efficiency scores using the financial intermediary approach. Panel A (B) provides the results based on the pooled frontier of the converting insurers and mutual (stock) counter samples. Converting/Control Insurer is the ratio of converting score to control insurer score. The year with a minus (positive) sign in front refer to the pre (post) -converting years. Year 0 is the converting year.

	Technical Efficiency			Allocative Efficiency			Cost Efficiency		
Year	Converting Insurer Efficiency	Control Insurer Efficiency	Converting/ Control Insurer	Converting Insurer Efficiency	Control Insurer Efficiency	Converting/ Control Insurer	Converting Insurer Efficiency	Control Insurer Efficiency	Converting/ Control Insurer
Panel A: Converting Insurers vs. Mutual counter samples									
-3	0.954	0.947	1.007	0.983	0.773	1.272	0.938	0.734	1.278
-2	0.964	0.956	1.009	0.786	0.756	1.039	0.759	0.724	1.048
-1	0.930	0.932	0.998	0.769	0.745	1.033	0.717	0.696	1.029
0	0.893	0.872	1.023	0.747	0.721	1.036	0.670	0.631	1.062
1	0.935	0.919	1.017	0.737	0.728	1.011	0.691	0.671	1.029
2	0.958	0.954	1.004	0.764	0.732	1.044	0.733	0.699	1.048
3	0.966	0.958	1.008	0.759	0.727	1.044	0.735	0.697	1.055
Panel B: Converting Insurers vs. Stock counter samples									
-3	0.681	0.706	0.964	0.806	0.807	0.999	0.558	0.580	0.962
-2	0.777	0.716	1.085	0.711	0.840	0.846	0.564	0.600	0.940
-1	0.731	0.718	1.018	0.741	0.875	0.847	0.549	0.625	0.878
0	0.796	0.729	1.093	0.705	0.812	0.868	0.576	0.587	0.980
1	0.787	0.762	1.034	0.763	0.863	0.885	0.613	0.656	0.934
2	0.778	0.755	1.029	0.574	0.604	0.950	0.462	0.460	1.005
3	0.792	0.767	1.033	0.611	0.594	1.028	0.510	0.460	1.109

Table 3-6 Malmquist Analysis Using the Financial Intermediary Approach

This table provides the averages of Malmquist indices using the financial intermediary approach. Panel A (B) provides the results based on the pooled frontier of the converting insurers and mutual (stock) counter samples. Converting/Control Insurer is the ratio of converting score to control insurer score. The year with a minus (positive) sign in front refer to the pre (post) -converting years. Year 0 is the converting year.

	Technical Efficiency Change			Technical Change			Total factor Productivity Change		
Year	Converting Insurer Efficiency	Control Insurer Efficiency	Converting/ Control Insurer	Converting Insurer Efficiency	Control Insurer Efficiency	Converting/ Control Insurer	Converting Insurer Efficiency	Control Insurer Efficiency	Converting/ Control Insurer
Panel A: Converting Insurers vs. Mutual counter samples									
-2	1.014	1.010	1.004	0.988	0.986	1.002	1.002	0.996	1.006
-1	0.970	0.975	0.995	1.018	1.027	0.991	0.986	1.002	0.984
0	0.964	0.940	1.025	1.113	1.066	1.044	1.077	1.002	1.075
1	1.046	1.054	0.993	0.884	0.942	0.939	0.927	0.993	0.934
2	1.024	1.036	0.988	1.008	0.965	1.044	1.030	1.000	1.030
3	1.010	1.002	1.008	0.993	0.997	0.996	1.004	0.999	1.005
Cumulative Results									
-1	0.984	0.985	0.999	1.005	1.013	0.993	0.988	0.998	0.990
0	0.948	0.926	1.024	1.119	1.079	1.037	1.064	1.000	1.064
1	0.992	0.976	1.016	0.990	1.017	0.973	0.987	0.993	0.994
2	1.015	1.011	1.004	0.997	0.981	1.016	1.017	0.993	1.024
3	1.025	1.013	1.012	0.991	0.978	1.013	1.021	0.992	1.029
Panel B: Converting Insurers vs. Stock counter samples									
-2	1.018	1.022	0.996	0.984	0.969	1.015	1.002	0.995	1.007
-1	0.808	0.816	0.990	1.175	1.178	0.997	0.949	0.946	1.003
0	1.247	1.245	1.002	0.870	0.934	0.932	1.086	1.119	0.970
1	0.994	1.043	0.953	0.914	1.003	0.912	0.908	0.978	0.929
2	0.947	0.980	0.966	1.096	1.060	1.034	1.038	1.055	0.984
3	1.033	0.936	1.104	1.009	1.134	0.890	1.043	1.071	0.974
Cumulative Results									
-1	0.822	0.834	0.960	1.156	1.142	1.013	0.951	0.941	1.011
0	1.026	1.039	0.961	1.006	1.066	0.944	1.033	1.053	0.980
1	1.019	1.083	0.916	0.920	1.069	0.861	0.938	1.030	0.911
2	0.965	1.062	0.884	1.008	1.133	0.890	0.973	1.086	0.896
3	0.997	0.994	0.976	1.018	1.285	0.792	1.015	1.163	0.872

Table 3-7 Summary Statistics for Converting Insurers and Mutual Counter Samples

This table reports the averages of the financial and operational characteristics of converting insurers and mutual counter samples.

Variables	Panel A： Summary Statistics one year before conversion					Panel B： Summary Statistics three years after conversion				
	Mutual Control Insurers Mean		Converting Insurers Mean		Stock Control Insurers Mean	Mutual Control Insurers Mean		Converting Insurers Mean		Stock Control Insurers Mean
Natural log of total assets (millions)	49.895	***	55.722	***	55.633	61.187		72.709		87.716
	(65,573,131)		(84,919,487)		(64,773,847)	(80.198)		(112.681)		(102.201)
Herfindahl index	0.432		0.455	***	0.487	0.422	***	0.530	***	0.452
	(0.011)		(0.083)		(0.301)	(0.270)		(0.348)		(0.314)
Percent of premiums in long-tail lines	0.679		0.693		0.658	0.682		0.697		0.626
	(0.012)		(0.070)		(0.318)	(0.281)		(0.312)		(0.316)
Agents balances/Direct premium written	0.081	***	0.032	***	0.138	0.166		0.146		0.123
	(0.010)		(0.019)		(0.123)	(1.281)		(0.174)		(0.139)
Reinsurance ratio	0.290	**	0.318	***	0.373	0.292	**	0.383	***	0.428
	(0.011)		(0.059)		(0.316)	(0.459)		(0.304)		(0.319)

Note: Standard errors are in the parenthesis.
*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 3-8 Regression Analysis using the Value-Added Approach-Mutual Counter Samples

The model estimated is $Efficiency\ Change = \beta_0 + \beta_1 DEMU + \beta_2 NA + \beta_3 HI + \beta_4 LP + \beta_5 AD + \beta_6 RE + \varepsilon$

where the observable dummy variable DEMU=1 if the firm is converting Insurer and 0 if the firm is mutual counter sample; NA= firm size, measured by log of total assets; HI= Herfindahl index; LP= percent of premiums in long-tail lines; AD= the ratio of agents balances to direct premium written; RE=reinsurance ratio. Numbers in parentheses are standard errors.

Variables	Panel A: Efficiency one year before conversion / Efficiency three years before conversion						Panel B: Efficiency three year after conversion / Efficiency one years before conversion					
	CE		TE		AE		CE		TE		AE	
Constant	1.3155	***	1.3164	***	0.9502	***	2.8398	***	1.1116	***	2.645	***
	(0.177)		(0.059)		(0.149)		(0.232)		(0.065)		(0.211)	
Demutualization (DEMU)	-0.0098		0.02923	**	-0.04777		0.16861	***	0.04051	***	0.18791	***
	(0.037)		(0.013)		(0.031)		(0.056)		(0.015)		(0.051)	
Natural log of total assets (NA)	-0.03016	***	-0.0202	***	-0.00825		-0.10647	***	-0.00415		-0.09779	***
	(0.011)		(0.004)		(0.009)		(0.016)		(0.004)		(0.014)	
Herfindahl index (HI)	0.13735	***	0.01091		0.13852		-0.27482	***	-0.04181	**	-0.19841	***
	(0.046)		(0.016)		(0.039)		(0.069)		(0.018)		(0.063)	
Percent of premiums in long-tail lines (LP)	0.39472	***	0.06036	***	0.33424	***	0.10972		0.02222		0.08172	
	(0.047)		(0.016)		(0.040)		(0.071)		(0.018)		(0.064)	
Agents balances/Direct premium written (AD)	0.11418	*	-0.03427		0.14528	***	0.24354	**	0.05424	**	0.17518	*
	(0.066)		(0.023)		(0.056)		(0.099)		(0.026)		(0.090)	
Reinsurance ratio (RE)	-0.046		0.02487		-0.06399	***	-0.40712	***	-0.06948	***	-0.31204	***
	(0.053)		(0.018)		(0.045)		(0.079)		(0.021)		(0.072)	
Adjusted R-square	0.1199		0.0806		0.1284		0.1103		0.034		0.1061	

Note: Standard errors are in the parenthesis. Independent variable values are for year-1.

*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 3-8 (Continued)

Variables	Panel C: Cumulative Malmquist indices before conversion						Panel D: Cumulative Malmquist indices after conversion					
	Efficiency Change		Technical change		Total Productivity		Efficiency Change		Technical change		Total Productivity	
Constant	0.9098	***	1.2556	***	1.2026	***	1.1104	***	1.1166	***	1.2218	***
	(0.074)		(0.097)		(0.126)		(0.058)		(0.102)		(0.119)	
Demutualization (DEMU)	-0.026	*	-0.004		-0.031		0.0181		0.0547	***	0.0711	***
	(0.015)		(0.020)		(0.026)		(0.012)		(0.021)		(0.024)	
Natural log of total assets (NA)	0.008	*	-0.015	***	-0.009		-0.005		-0.005		-0.009	
	(0.004)		(0.006)		(0.007)		(0.003)		(0.006)		(0.007)	
Herfindahl index (HI)	-0.022		-0.013		-0.04		-0.042	***	-0.002		-0.042	
	(0.018)		(0.024)		(0.032)		(0.014)		(0.026)		(0.030)	
Percent of premiums in long-tail lines	0.051	***	-0.077	***	-0.026		0.0136		-0.04		-0.033	
(LP)	(0.019)		(0.025)		(0.033)		(0.015)		(0.026)		(0.031)	
Agents balances/Direct premium written	0.0395		0.1087	***	0.1464	***	0.0052		0.1335	***	0.1359	***
(AD)	(0.027)		(0.035)		(0.046)		(0.021)		(0.037)		(0.043)	
Reinsurance ratio (RE)	-0.05	**	-0.041		-0.089	**	-0.012		-0.071	**	-0.08	**
	(0.021)		(0.028)		(0.036)		(0.017)		(0.030)		(0.034)	
Adjusted R-square	0.0325		0.0424		0.0203		0.0116		0.0309		0.0292	

Note: Standard errors are in the parenthesis. Independent variable values are for year-1.
*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 3-9 Regression Analysis using the Value-Added Approach-Stock Counter Samples

The model estimated is $Efficiency\ \ Change = \beta_0 + \beta_1 DEMU + \beta_2 NA + \beta_3 HI + \beta_4 LP + \beta_5 AD + \beta_6 RE + \varepsilon$

where the observable dummy variable DEMU=1 if the firm is converting Insurer and 0 if the firm is mutual counter sample; NA= firm size, measured by log of total assets; HI= Herfindahl index; LP= percent of premiums in long-tail lines; AD= the ratio of agents balances to direct premium written; RE=reinsurance ratio. Numbers in parentheses are standard errors.

Variables	Panel A: Efficiency one year before conversion / Efficiency three years before conversion						Panel B: Efficiency three year after conversion / Efficiency one years before conversion					
	CE		TE		AE		CE		TE		AE	
Constant	0.72081		0.68521	***	1.12726	**	1.88717	**	0.96834	***	2.03053	***
	(0.591)		(0.107)		(0.545)		(0.739)		(0.101)		(0.726)	
Demutualization (DEMU)	-0.28761	**	0.01795		-0.30491	**	-0.09718		-0.02709		-0.03337	
	(0.135)		(0.024)		(0.125)		(0.169)		(0.023)		(0.166)	
Natural log of total assets (NA)	0.02807		0.01957	***	0.00277		-0.02881		0.0085		-0.04492	
	(0.034)		(0.006)		(0.032)		(0.043)		(0.006)		(0.042)	
Herfindahl index (HI)	-0.13296		-0.0059		-0.12966		-0.30067	**	-0.03827	**	-0.24943	**
	(0.100)		(0.018)		(0.093)		(0.126)		(0.017)		(0.124)	
Percent of premiums in long-tail lines (LP)	0.12503		-0.07506	***	0.20503	*	0.49677	***	-0.12506	***	0.66099	***
	(0.113)		(0.020)		(0.104)		(0.141)		(0.019)		(0.138)	
Agents balances/Direct premium written (AD)	-0.00023		1.27E-05		-0.00026		0.00246		-0.00064	**	0.00332	*
	(0.002)		(0.000)		(0.001)		(0.002)		(0.000)		(0.002)	
Reinsurance ratio (RE)	-0.05919		0.01062		-0.07503		-0.0812		-0.02189		-0.0815	
	(0.123)		(0.022)		(0.114)		(0.154)		(0.021)		(0.152)	
Adjusted R-square	0.0172		0.0689		0.0337		0.079		0.205		0.1225	

Note: Standard errors are in the parenthesis. Independent variable values are for year-1.
*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 3-9 (Continued)

Variables	Panel C: Cumulative Malmquist indices before conversion						Panel D: Cumulative Malmquist indices after conversion					
	Efficiency Change		Technical change		Total Productivity		Efficiency Change		Technical change		Total Productivity	
Constant	1.1741	***	0.688	***	0.8615	***	0.8682	***	1.0233	***	0.8962	***
	(0.050)		(0.048)		(0.059)		(0.050)		(0.052)		(0.067)	
Demutualization (DEMU)	-0.019		0.0065		-0.012		-0.007		-0.008		-0.015	
	(0.012)		(0.011)		(0.014)		(0.012)		(0.012)		(0.016)	
Natural log of total assets (NA)	-0.008	***	0.0166	***	0.009	***	0.0066	**	-0.002		0.0044	
	(0.003)		(0.003)		(0.003)		(0.003)		(0.003)		(0.004)	
Herfindahl index (HI)	-0.02	*	0.0182	*	-0.001		0.006		-0.007		-0.002	
	(0.010)		(0.010)		(0.012)		(0.010)		(0.011)		(0.014)	
Percent of premiums in long-tail lines (LP)	-0.034	***	0.009		-0.025	**	0.0227	**	-0.023	**	-8E-04	
	(0.010)		(0.009)		(0.012)		(0.010)		(0.010)		(0.013)	
Agents balances/Direct premium written (AD)	-0.001	*	0.0008		-4E-04		-0.001	*	0.0013		-1E-04	
	(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)	
Reinsurance ratio (RE)	-0.014	**	0.0063		-0.008		-9E-04		0.0677	***	0.0665	***
	(0.007)		(0.006)		(0.008)		(0.006)		(0.006)		(0.007)	
Adjusted R-square	0.0909		0.144		0.0373		0.0506		0.4341		0.2762	

Note: Standard errors are in the parenthesis. Independent variable values are for year-1.
*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 3-10 Regression Analysis of the Property-Liability Conversion using the Financial Intermediary Approach-Mutual Counter Samples

The model estimated is $Efficiency\ \ Change = \beta_0 + \beta_1 DEMU + \beta_2 NA + \beta_3 HI + \beta_4 LP + \beta_5 AD + \beta_6 RE + \varepsilon$

where the observable dummy variable DEMU=1 if the firm is converting Insurer and 0 if the firm is mutual counter sample; NA= firm size, measured by log of total assets; HI= Herfindahl index; LP= percent of premiums in long-tail lines; AD= the ratio of agents balances to direct premium written; RE=reinsurance ratio. Numbers in parentheses are standard errors.

Variables	Panel A: Efficiency one year before conversion / Efficiency three years before conversion						Panel B: Efficiency three year after conversion / Efficiency one years before conversion					
	CE		TE		AE		CE		TE		AE	
Constant	1.06481	***	0.8899	***	1.18016	***	1.24022	***	1.12634	***	1.11674	***
	(0.049)		(0.013)		(0.044)		(0.056)		(0.017)		(0.053)	
Demutualization(DEMU)	-0.0104		-0.00896	*	-0.00153		0.03885	*	0.00176		0.03584	*
	(0.020)		(0.005)		(0.017)		(0.022)		(0.007)		(0.021)	
Natural log of total assets(NA)	-0.00701	**	0.00597	***	-0.01327	***	-0.01589	***	-0.00799	***	-0.00806	***
	(0.003)		(0.001)		(0.002)		(0.003)		(0.001)		(0.003)	
Herfindahl index(HI)	0.00734		0.01539	***	-0.00795		0.01536		0.00423		0.01218	
	(0.012)		(0.003)		(0.011)		(0.014)		(0.004)		(0.013)	
Percent of premiums in long-tail lines(LP)	0.01277		-0.01349	***	0.02576	**	-0.00701		-0.01052	**	0.00197	
	(0.012)		(0.003)		(0.011)		(0.014)		(0.004)		(0.013)	
Agents balances/Direct premium written(AD)	0.00001888		0.00000412		0.00001473		-3.37E-06		0.00000439		-0.0000077	
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
Reinsurance ratio(RE)	0.04738	***	0.00209		0.04429	***	-0.02459	*	0.00020407		-0.02523	**
	(0.012)		(0.003)		(0.011)		(0.014)		(0.004)		(0.013)	
Adjusted R-square	0.0366		0.133		0.0875		0.054		0.1408		0.0195	

Note: I Standard errors are in the parenthesis. ndependent variable values are for year-1.
*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 3-10 (Continuous)

Variables	Panel C: Cumulative Malmquist Indices before Conversion						Panel D: Cumulative Malmquist Indices after Conversion					
	Efficiency Change		Technical change		Total Productivity		Efficiency Change		Technical change		Total Productivity	
Constant	0.99217	***	0.91778	***	0.89781	***	0.98899	***	1.04265	***	1.03262	***
	(0.017)		(0.154)		(0.172)		(0.005)		(0.012)		(0.014)	
Demutualization (DEMU)	0.02265	***	0.03289		0.05884		0.00536	**	-0.00283		0.00328	
	(0.007)		(0.060)		(0.067)		(0.002)		(0.005)		(0.005)	
Natural log of total assets (NA)	-0.00318	***	0.00565		0.00267		0.00093301	***	-0.00269	***	-0.00182	**
	(0.001)		(0.009)		(0.010)		(0.000)		(0.001)		(0.001)	
Herfindahl index (HI)	0.00922	**	0.0709	*	0.08758	**	0.00014126		0.00151		0.00167	
	(0.004)		(0.037)		(0.042)		(0.001)		(0.003)		(0.004)	
Percent of premiums in long-tail lines (LP)	-0.00591		0.05179		0.04921		0.00038191		-0.0028		-0.0025	
	(0.004)		(0.039)		(0.044)		(0.001)		(0.003)		(0.004)	
Agents balances/Direct premium written (AD)	0.00106		0.00209		0.00326		-0.0006153	**	-0.0001775		-0.0007966	
	(0.001)		(0.008)		(0.009)		(0.000)		(0.001)		(0.001)	
Reinsurance ratio(RE)	0.00413		-0.01114		-0.00754		-0.00169	*	0.00177		0.00009615	
	(0.004)		(0.038)		(0.043)		(0.001)		(0.002)		(0.002)	
Adjusted R-square	0.0607		0.0008		0.0012		0.0333		0.0276		0.0055	

Note: Standard errors are in the parenthesis. Independent variable values are for year-1.
*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 3-11 Regression Analysis of the Property-Liability Conversion using the Financial Intermediary Approach-Stock Counter Samples

The model estimated is $Efficiency\ \ Change = \beta_0 + \beta_1 DEMU + \beta_2 NA + \beta_3 HI + \beta_4 LP + \beta_5 AD + \beta_6 RE + \varepsilon$

where the observable dummy variable DEMU=1 if the firm is converting Insurer and 0 if the firm is mutual counter sample; NA= firm size, measured by log of total assets; HI= Herfindahl index; LP= percent of premiums in long-tail lines; AD= the ratio of agents balances to direct premium written; RE=reinsurance ratio. Numbers in parentheses are standard errors.

Variables	Panel A: Efficiency one year before conversion / Efficiency three years before conversion						Panel B: Efficiency three year after conversion / Efficiency one years before conversion					
	CE		TE		AE		CE		TE		AE	
Constant	1.05479	***	1.46733	***	0.5644	***	1.17935	***	0.29892	***	1.73592	***
	(0.107)		(0.074)		(0.077)		(0.179)		(0.093)		(0.115)	
Demutualization (DEMU)	-0.0459	*	-0.0409	**	-0.0061		0.08456	**	0.07175	***	0.00936	
	(0.025)		(0.017)		(0.018)		(0.041)		(0.021)		(0.026)	
Natural log of total assets (NA)	-0.0166	***	-0.0354	***	0.01942	***	0.00304		0.04875	***	-0.038	***
	(0.006)		(0.004)		(0.004)		(0.010)		(0.005)		(0.007)	
Herfindahl index (HI)	0.11174	***	0.07163	***	0.04881	***	-0.1071	***	-0.0558	***	-0.046	*
	(0.022)		(0.015)		(0.016)		(0.037)		(0.019)		(0.024)	
Percent of premiums in long-tail lines (LP)	-0.04	**	-0.0218		-0.0222		0.06361	*	0.03944	**	0.01934	
	(0.020)		(0.014)		(0.015)		(0.034)		(0.018)		(0.022)	
Agents balances/Direct premium written (AD)	-0.0007	***	-0.0003	*	-0.0004	**	0.00076	*	0.00027		0.00043	*
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
Reinsurance ratio (RE)	0.04599	**	0.02192		0.02544		-0.1007	**	-0.0274		-0.0573	**
	(0.023)		(0.016)		(0.017)		(0.039)		(0.020)		(0.025)	
Adjusted R-square	0.2687		0.4661		0.1462		0.1185		0.4845		0.1952	

Note: Standard errors are in the parenthesis. Independent variable values are for year-1.
*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 3-11 (Continued)

Variables	Panel C: Cumulative Malmquist Indices before Conversion						Panel D: Cumulative Malmquist Indices after Conversion					
	Efficiency Change		Technical change		Total Productivity		Efficiency Change		Technical change		Total Productivity	
Constant	-1.1568	***	2.79593	***	1.75489	***	0.36956	**	1.79643	**	0.74847	
	(0.280)		(0.487)		(0.627)		(0.162)		(0.790)		(1.061)	
Demutualization (DEMU)	0.1677	***	-0.0739		0.02874		-0.037		-0.0404		-0.1146	
	(0.053)		(0.093)		(0.119)		(0.031)		(0.150)		(0.202)	
Natural log of total assets (NA)	0.1275	***	-0.1019	***	-0.0383		0.03788	***	-0.0352		0.02618	
	(0.015)		(0.027)		(0.035)		(0.009)		(0.044)		(0.058)	
Herfindahl index (HI)	-0.1366	***	0.09395		-0.0056		0.01594		0.04225		0.1025	
	(0.048)		(0.083)		(0.107)		(0.028)		(0.135)		(0.181)	
Percent of premiums in long-tail lines (LP)	0.18613	***	-0.1758	**	-0.0518		0.08682	***	-0.029		0.11154	
	(0.042)		(0.073)		(0.094)		(0.024)		(0.119)		(0.160)	
Agents balances/Direct premium written (AD)	0.14417	**	-0.0891		0.01911		-0.1172	***	-0.4403	**	-0.639	**
	(0.064)		(0.112)		(0.144)		(0.037)		(0.182)		(0.244)	
Reinsurance ratio (RE)	0.11386	**	-0.106		-0.0291		-0.0557	**	-0.23		-0.3368	*
	(0.047)		(0.081)		(0.104)		(0.027)		(0.131)		(0.176)	
Adjusted R-square	0.5448		0.1665		-0.0387		0.2072		0.0259		0.0151	

Note: Standard errors are in the parenthesis. Independent variable values are for year-1.
*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

Table 3-12 Summary of Empirical Results

This table provides a summary of empirical results for Table 3-3 through Table 3-11. CE is cost efficiency scores and TFPC is total factor productivity change factor productivity change.

Panel A: Results of DEA Scores And Malmquist Indices

	Before Conversion		After Conversion			
	Mutual Control Insurers		Mutual Control Insurers		Stock Control insurers	
	CE	TFPC	CE	TFPC	CE	TFPC
Value-added approach	+	+	+	+	+	+
Financial Intermediary approach	-	-	+	+	-	-

Panel B: Results of Regression Analysis

	Before Conversion		After Conversion			
	Mutual Control Insurers		Mutual Control Insurers		Stock Control Insurers	
	CE	TFPC	CE	TFPC	CE	TFPC
Value-added approach	●	●	+	+	●	●
Financial Intermediary approach	●	●	+	●	+	●

\+ positive and significant at the 10% level or less.
\- negative and significant at the 10% level or less.
● not significant.

APPENDIX A

Table 3-A1 Converting Property-Liability Insurers

Company Name	Demutualization Year
Minnesota Mutual Fire &Casualty Co.	1993
Union Automobile Indemnity Association	1993
Pioneer Mutual Insurance Co.	1993
Delaware Mutual Insurance Co.	1994
Georgia Mutual Insurance Co.	1994
Union Mutual Insurance Co. of Providence	1994
Mutual Fire Insurance Co. of Saco	1995
Interstate Bankers Mutual Casualty Co.	1995
Farm Family Mutual Insurance Co.	1996
Preferred Physicians Mutual RRG	1996
Allegheny Mutual Casualty Co.	1997
Goschenhoppen-Home Mutual Insurance Co.	1997
National Chiropractic Mutual Insurance Co.	1997
Old Guard Mutual Fire Insurance Co.	1997
Patrons Oxford Mutual Insurance Co.	1997
Old Guard Mutual Insurance Co.	1997
Southern Michigan Mutual Insurance Co.	1998
FCCI Mutual Insurance Co.	1998