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

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Abstract

This study investigates whether the converting U.S. property-liability insurers improve their efficiency performance before and after the conversion. The evidence shows that converting insurers experience larger gains in cost efficiency scores and total factor productivity change than mutual control insurers before the 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 control insurers before the conversion when the financial intermediary approach is used. The two seemly 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 control insurers after the 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 control insurers in cost efficiency after conversion using the both approaches.

Keyword: demutualization, efficiency, DEA, property-liability insurers.

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1. Introduction

Mutual-to-stock conversion, a process know as demutualization, has been occurring in the U.S. insurance markets for many decades. These conversion activities have raised much attention from insurance regulators, policyholders, and academics and become an important issue in the insurance literature. To understand why insurers demutualize, we need to ask: Which form of organizational structure, mutual or stock, is more efficient? A number of studies have explored this issue and provide many meaningful insights. Spiller (1972), Frech (1980), Cummins, Weiss and Zi (1999), Brockett et al. (2004, 2005) among others examine the efficiency issue of stock versus mutual insurers. Mayers and Smith (1986), McNamara and Rhee (1992), and Cagle et al. (1996) further examine the performance issue for the insurers who go through the conversion process.

Mayers and Smith (1986) suggest two competing hypotheses to explain why mutual insurers convert: the expropriation hypothesis and the efficiency hypothesis. The expropriation hypothesis alleges that conversions may be used as a mechanism to transfer wealth from policyholders to officers and directors of converting firms and policy owners 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 over 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 studies have examined the performance changes during conversion period. For example, McNamara and Rhee (1992) examine the performance change of the conversion in life insurance industry by investigating the product variables, financial variables, and management welfare variables. Their empirical evidence suggests that converting life insurers did improve their performance after conversion. Cagle et al. (1996) further investigates the results of conversion for property-liability insurers by examining the financial status, business mix, and management welfare variables. Their evidence shows that the converting insurers experience no change in accounting profitability.

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 the issue from the input/output efficiency perspectives. More recently, Jeng, Lai, and McNamara (2006) utilize the 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. This paper intends to fill up this gap.

The main purpose of this paper is to evaluate the pre- verse post-conversion efficiency performance of property-liability insurers and test 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 also

conducted 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). This study investigates whether the converting U.S. property-liability insurers improve their efficiency performance before and after the conversion. The evidence shows that converting insurers experience larger gains in cost efficiency scores and total factor productivity change than mutual control insurers before the 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 control insurers before the conversion when the financial intermediary approach is used. The two seemly 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 control insurers after the 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 control insurers in cost efficiency after conversion using the both approaches.

The contributions of this study are as below. First, this study is the first to utilize the data envelopment analysis (DEA) of production frontier method to examine the efficiency performance change resulting from the conversion in the U.S. property-liability insurance industry. Prior studies do not consider this type of efficiency. 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 the total productivity change into technical change and technical efficiency change. The additional two

measures can provide more insights to the efficiency performance change. Another advantage of the DEA method and Malmquist method is that they produce a uniform measure such as efficiency scores to make comparisons among insurers easier. Finally, this study provides evidence supports the efficiency hypothesis developed by Mayers and Smith (1986).

The rest of the paper proceeds as follow. First, research questions are reviewed and data and methodology are described. Next, we present the results of the efficiency performance changes by using value-added approach and further conduct a regression analysis of the relationships between the efficiency performance and insurance firm characteristics. Similar analyses are then performed by using the financial intermediary approach. Finally, the important findings are summarized and conclusion is discussed.

2. Research Questions

Our first research question is whether converting insurers improve their efficiency performance and productivity before conversion. Please note that it is not the intention of this paper to investigate the motivations of demutualization. Viswanathan and Cummins (2003) have done a great job in examining the motivations for the conversion in the insurance industry. But they have not looked into the issue of efficiency changes using the DEA method. 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).

3. Data and Methodology

3.1 Data

We examine recent property-liability conversion activities that occur during 1993-1998.

Please see Appendix A for all sample insurers. 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 match 60 mutual and stock control insurers and thus need to rely on NAIC (National Association of Insurance Commissioners) tapes rather than hand-collecting data. The overall sample period is from 1989 to 2001.

3.2 Methodology

There are two major classes of efficiency estimation methods: the econometric (parametric) approach and the mathematical programming (non-parametric) approach.[1] In this paper, we utilize the data envelopment analysis (DEA), a non-parametric approach, as our major methodology. Two different approaches of the DEA method are used: 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 provides more detail estimates of technical efficiency change, technical change and total factor productivity change. Cummins and Weiss (2000) provide excellent reviews about the DEA method and Malmquist Index analysis, and discuss all major efficiency studies in the insurance industry.

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

[1] The advantages and disadvantages of the two methods are well summarized and discussed in Cummins and Weiss (2000).

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

3.2.1. 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 amounts 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 loss incurred for different product lines as proxies for outputs. 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. All output numbers are deflated to the base year 1997 with the Consumer Price Index (CPI)[2].

Inputs

The inputs used in measuring the efficiency performance include labor (x1), business service

[2] The base year is 1997.

(x2), equity (x3), and debt capital (x4). Labor input is the labor cost divided by average weekly employee wages. We measure the price of labor (p1) as average weekly wages for insurance agent (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 service and price of labor are deflated to the base year 1997. The price of business services (p2) is the average weekly earnings of workers in SIC 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 price of policyholder because insurers with poor performance are more likely to have negative net incomes and price cannot be negative. Consequently, we utilize the debt-equity ratio of the insurer as the price of equity (p3).[3] 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 ratio of the difference between total investment income and investment income attributed to equity capital to debt capital.

[Insert Table 1 here]

Table 1 reports the descriptive statistics for both inputs and outputs that used in the value-added approach. One interesting result is that some outputs of the converting insurers are lower than those of the mutual control insurers in three of the four lines (short-tail and long-tail personal lines, and short-tail commercial lines) before conversion. In addition, some inputs of converting insurers (i.e., labor cost and equity) are also significantly lower than those of the mutual control insurers. This means that we are not able to tell whether converting insurers or

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

mutual control insurers are more efficient by simply examining the outputs or inputs.

3.2.2 The Financial Intermediary Approach

Brockett et al. (2004) suggest that, compared with other financial intermediaries, the insurer plays a different role because their future obligation is intangible and the policyholders' claims are contingent on the future losses. Thus, the ability to pay the claims and the financial health of an insurer are important in terms of financial intermediary function. We employ the financial intermediary approach to examine the efficiency performance change of the converting insurers from the financial perspective because the financial intermediary service 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 of 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) ratio as insurer outputs. These six output variables include: change in policyholder surplus (y1), capitalization ratio (y2), change in invested assets (y3), investment yield (y4), change in net premiums (y5) and liquid assets to liabilities (y6). In addition, we also identify return on assets (y7) as one output because another major objective goal of manager is to maximize the shareholders' profits.

Inputs

The first input is policyholder surplus. We further divide surplus into surplus previous year (x1) and change in surplus (x2) since the amount of surplus supplied by the policyholder can be invested during any period of time. The prices for surplus previous year and change in surplus

are the ratio of debt to equity for previous year (p1) and the ratio for current year (p2). The reason of taking leverage ratio as input price for surplus is mentioned above. The third input comprises of underwriting and investment expenses (x3). We use the average weekly employee wages as the proxy for input price (p3). Another input is debt capital consisting of unpaid net losses, unpaid loss adjustment expenses. We further separate the debt capital into two categories: the short-term and long-term debt capital (x4, x5). The prices for short term and long-term debt capital are the interest rates of one-year term and five-year term treasury (p4, p5) respectively.

[Insert Table 2 here]

Table 2 reports the descriptive statistics for both inputs and outputs used in the financial intermediary approach. One interesting result is that change in surplus of converting insurers ($620,742) is significantly less than that of mutual control insurers (358,426) before the conversion. In the year of conversion, change in surplus of converting insurer (4,876,841) becomes significantly higher than that of the mutual control insurers (1,107,906) and stock mutual control insurers (1,163,973), respectively. This result is expected because demutualized insurers have 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 control insurers in the year of conversion, but becomes higher than mutual control insurers in year 3.

4. 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.

4.1 Efficiency Results of 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 practice production frontier consisting of converting insurers and control insurers and estimate the control insurers' best practice production frontier consisting of only control insurers. The efficiency scores and Malmquist indices indicate whether insurers improve their performance or not. We also examine the ratio of efficiency score or indices of the converting insurers to that of the control insurers to compare the performance differences between the converting insurers and their control insurers during conversion period. The ratio indicates whether converting insurers perform better or worse than their control insurers.

[Insert Table 3 here]

4.1.1 DEA Efficiency Score Calculation

Panel A, Table 3 reports the comparison between the converting insurers and mutual control insurers. We first focus on the analyses of the efficiency change before demutualization. Top section of Panel A, Table 3 indicates that the efficiency scores of technical efficiency, allocative efficiency, and cost efficiency of converting insurers increases 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 control insurer ratio of technical efficiency also increases from 1.042 in year -3 to 1.084 in year -1, suggesting converting insurers perform better than mutual control insurers during the period.

We next examine the efficiency scores after the demutualization. Panel A of Table 3 shows that all efficiency measures, including technical efficiency, allocative efficiency and cost efficiency also increase after the demutualization. For example, 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 that all converting/mutual control insurer ratios also increase from year 0 to year 3, implying that the converting insurers perform better than their mutual control insurers after conversion.

One may argue that the frontier for converting insurers may change after conversion because converting insurers have changed their organizational structure from mutual to stock insurers. Thus, we also conduct the analyses based on the pooled frontier of converting insurers and stock control insurers. Panel B of Table 3 shows the comparison between the converting insurers and stock control insurers 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 the conversion and perform better than the stock control insurers after conversion.[4]

4.1.2 Malmquist Index Analysis

We utilize the Malmquist index approach to further 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 of technical change is greater (less) than 1 implies "innovation (technical regress)".

[Insert Table 4 here]

Table 4 reports the results of Malmquist analysis using the value-added approach. Panel A

4 The allocative efficiency scores of converting insurers decrease after the demutualization, but so do stock control insurers. In fact, the allocative converting/stock control insurer ratios increase after the demutualization.

presents the Malmquist indices based on the pooled production frontier of the converting insurers and mutual control insurers. 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.

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 presents the cumulative results. The cumulative results for a certain year are the product of index in the start year and index in the end year. For example, bottom section of Panel A the cumulative index 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 of (bottom section) Panel A of Table 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 converting/mutual control insurer ratios in year -1 for all three indices are also greater than 1, suggesting converting insurers perform better than the mutual control insurers before the conversion.

Cumulative results (Bottom section) of Panel A also 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 control insurer ratios are 1.003, 1.059, and 1.091 in year 3, respectively. These values are greater than one, suggesting that converting insurers are “catching up” to the frontier and experience “innovation” and productivity progress.

Panel B presents the Malmquist indices based on the pooled frontier of the converting insurers and stock control insurers. The cumulative results (bottom section) of Panel B of Table

4 show that technical change and total factor productivity efficiency are 1.014 and 1.004, respectively in year -1, suggesting converting insurers improve in term of these two indices before the conversion. The cumulative results of Panel B of Table 4 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 experience ”falling behind” in efficiency and suffer “technical regress” and productivity deterioration after the conversion. However, the cumulative scores of technical efficiency change and total factor productivity change at t=3 are higher than those at t=0 (0.957 and 0.973, respectively). This means converting insurers improve their technical efficiency change and total factor productivity change since t=0.

4.2 The 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 can provide additional insights about the efficiency performance change regarding “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.

[Insert Table 5 here]

Table 5 reports the DEA efficiency score using the financial intermediary approach. Panel A, Table 5 shows all 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 show the converting insurers improve their performance before the demutualization. Interestingly, Jeng, Lai, and McNamara (2006) 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 related variables such as the change in policyholder surplus, capitalization ratio, and liquidity ratio.

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 higher price at IPOs 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.

We next analyze after conversion results. As compared to their mutual control insurers, we find that the converting firms enjoy efficiency improvement in all efficiency scores but underperform the mutual control insurers in terms of technical and cost efficiency after the conversion (Panel A, Table 5).

When the indices are based on the pooled frontier of converting insurers and stock insurers, we find converting insurer suffer deterioration in efficiency measures after the conversion (Panel B, Table 5).

[Insert Table 6 here]

Table 6 shows the results of the Malmquist analysis using the financial intermediary approach. The results of Panel A show that compared to mutual control insurers, the converting insurers are "falling behind" and suffer total factor predictability change before the conversion when the pooled frontier is based on the converting insurers and mutual control insurers. We also find

converting insurers experience favorable technical efficiency changes and total factor productivity change and perform better than the mutual control insurers after the conversion (Panel A, Table 6).

Panel B shows, compared to stock insurers, converting insurers improve their technical change (innovation) and enjoy total factor productivity improvement after the conversion.

5. Regression Analysis

The above analyses of DEA scores and Malmquist provide evidence of efficiency changes. We further use ratios of converting/control insurers to examine the relative efficiency performance and productivity between the converting insurers and the control insurers. The ratios analyses are univariate analyses. Thus, we further use the regression analysis to examine the efficiency and productivity changes between the converting insurers and control insurers. Specifically, we examine whether converting insurers outperform and underperform control insurers. The dependent variables are various efficiency scores and cumulative Malmquist indices and independent variables are firm characteristics.

We use four sets of dependent variables of 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 in 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 and measure the same way as the DEA efficiency scores. Finally, the last set of dependent variables is cumulative Malmquist indices after the conversion.

Based on the 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 balance to direct premium written and reinsurance ratio. Note these characteristics variables serve as control variables to control differences in insurers' different characteristics. The detailed discussion of independent variables and models will be presented in the empirical results section.

The regression model is as follow:

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

[Insert Table 7 here]

The independent variables include conversion dummy (DEMU, equal to 1 if the insurer is a converting insurers and zero for control insurers), 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 premium written (AD) and reinsurance ratio (RE). Table 7 presents the summary statistics for variables that are included in the regression models.[5] Specifically, it shows the total assets of converting insurers are significantly higher after the conversion. This is due to the infusion of capital during the conversion. We find that Herfindahl index of converting insurers are lower than that of the stock control insurers before the conversion but become significantly higher than that of converting insurers after the conversion. The results also show that that on average the reinsurance ratio of converting insurers is consistently significantly higher (lower) than that of mutual (stock) control insurers during conversion period.

5.1 Regression Results of the Value-added Approach

Table 8 reports the results of regression analysis for the value-added approach. Panel A of

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

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

[Insert Table 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 firms are more efficient. However, Meador et al. (1997) suggests that diversification across multiple insurance and product lines resulted in greater efficiency than a more focused production strategy for life insurance industry. Similar to the finding in Meador et al. (1997), we find insurers with focus strategy perform worse than with 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 more efficiency gains before conversion. The results of Panels A and B show that converting insurers with higher agent balance to direct premium written and lower reinsurance ratio are more likely to improve efficiency during converting period. Finally, consistent with the findings in the previous literature, we find that insurers with lower reinsurance ratio are more likely to improve their efficiency during

converting period.

Panels C and D of Table 8 present the regression result of cumulative Malmquist indices. Panel C shows that DEMU is negatively related to efficiency change, suggesting that converting insurers underperform the control mutual insurers before the conversion. On the other hand, the coefficients of 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 their 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 with higher agent balance to direct premium written and lower reinsurance ratio are more likely to improve their total productivity growth during converting period. To save the space of the paper, we do not provide the discussion of the control variables for the rest of analyses.

[Insert Table 9 here]

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

5.2 Regression Results of the Financial Intermediary Approach

We also conduct the regression analyses for efficiency performance changes using the financial intermediary approach and report the results in Tables 10 and 11. The financial intermediary approach considers more on overall financial strength (e.g., change in policyholder

surplus, capitalization ratio, and liquid assets to liabilities) and profit of insurers, whereas value-added approach more focuses on underwriting performance (e.g., losses incurred).

Panel A of Table 10 shows converting insurers perform worse than mutual control insurers in terms of technical efficiency performance before the 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 control firms after conversion (Panel B). Consequently, the empirical results of both the value-added approach and the financial intermediary approach support the efficiency hypothesis especially in term of cost and allocative efficiency.

[Insert Table10 here]

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

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

[Insert Table 11 here]

Panels C and D in Table 11 present the regression result of cumulative Malmquist indices. We find that converting insurers perform better than their mutual control insurers in term of efficiency change before conversion. However, we did not find that converting insurers perform

better than their mutual control insurance in total productivity growth before or after conversion.

In summary, comparing to the value added approach, the result of the financial intermediary approach provides weaker evidence, but the overall results of both the value-added and financial intermediary approaches are complementary. In both two approaches, we find that converting insurers improve their efficiency performance after conversion. Thus, the overall empirical evidence provides evidence to support the efficiency hypothesis.

6. Summary and Conclusion

This study investigates the pre- versus post-conversion efficiency and productivity changes of U.S. property-liability insurance 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 the conversion. With so many results, it is almost impossible to examine the issues without a summary. For example, we provide the results of a total of 48 regression models. Thus, we provide a summary in Table 12.

Our summary (Panel A, Table 12) focuses on the cost efficiency score and total factor productivity index because they are the two most important measures.[6] In addition, we do not summarize the results related to stock control insurers before the conversion, because converting insurers are mutual insurers before the conversion.

The empirical results are discussed below. First, we find converting insurers improve their performance before the conversion using the value-added approach. On the other hand,

[6] 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.

converting insurers experience deterioration in efficiency before the conversion using the financial intermediary approach. As we mentioned above, the two seemly contradictory results from the two approaches may be complementary. The converting insurers improve performance before the 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 capital infusion through the conversion.

Second, the evidence based 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 performance of converting insurers improve their performance using the value added approaches. On the other hand, the evidence indicates that performance of converting insurers deteriorate 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 mutual control insurers should be weighted more than those on stock control insurers. The reason is that even converting insurers change their organizational structure from mutual to stock, they may not have become stock insurers within three years after conversion.

It should be noted that the regression results examine whether the converting insurers outperform mutual or stock control insurers, while the DEA scores and Malmquist indices examine whether converting insurers improve their performance. Thus, we should give more weights to the DEA scores and Malmquist indices when we examine the efficiency hypothesis.

Panel B, Table 12 shows the summarized regression results which examine whether the converting insurers outperform or underperform the control insurers. Again, we only

summarize the results of models where 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 performance than mutual control insurers before 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 are summarized next. The evidence support that the converting insurers experience larger gains in cost efficiency than mutual control insurers. The results are robust with respect to both the value added approach and the financial intermediary approach. Using the financial intermediary approach, we also find that converting insurers outperform mutual control insurers in terms of total factor productivity change and outperform stock control insurers in terms of cost efficiency. These results shed light on the efficiency hypothesis.

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

This table shows the means of output, input, and input price of converting Insurers, mutual Control Insurers, and stock Control Insurers for the U.S. property liabilities Insurers during the conversion period. Data are gathered from National Association of Insurance Commissioners from 1989 to 2001. All input prices are deflated to 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

*** Statistically significant difference at the 1% level.
** Statistically significant difference at the 5% level.
* Statistically significant difference at the 10% level.

Table 2 Descriptive Statistics Of Inputs/Outputs Using Financial Intermediary Approach

This table shows the means of output, input, and input price of converting Insurers, mutual Control Insurers, and stock Control Insurers for the U.S. property liabilities Insurers during the conversion period. Data are gathered from National Association of Insurance Commissioners from 1989 to 2001. All input prices are deflated to 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	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	364.60	365.48		397.13		398.31		396.43	424.09		424.61		424.07
'=average weekly employee wages													
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

*** Statistically significant difference at the 1% level.
** Statistically significant difference at the 5% level.
* Statistically significant difference at the 10% level.

Table 3 The DEA Efficiency Score Results Using 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) control insurers. 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 Control Insurers									
-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 Control Insurers									
-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 4 Malmquist Analysis Using 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) control insurers. 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 Control Insurers									
-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 Control Insurers									
-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 5 The DEA Efficiency Score Results Using 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) control insurers. 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 Control Insurers									
-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 Control Insurers									
-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 6 Malmquist Analysis Using 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) control insurers. 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 Control Insurers									
-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 Control Insurers									
-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 7 Summary Statistics On Converting Insurers And Mutual Control Insurers

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

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	***	0.4866011	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		0.6584384	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	***	0.1375201	0.166		0.146		0.123
	(0.010)		(0.019)		(0.123)	(1.281)		(0.174)		(0.139)
Reinsurance ratio	0.290	**	0.318	***	0.3730771	0.292	**	0.383	***	0.428
	(0.011)		(0.059)		(0.316)	(0.459)		(0.304)		(0.319)

*** Statistically significant difference at the 1% level.
** Statistically significant difference at the 5% level.
* Statistically significant difference at the 10% level.

Table 8
Regression Analysis using Value-Added Approach-Mutual Control Insurers

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

where the observable dummy variable DEMU=1 if the firm is converting Insurer and 0 if the firm is mutual Control Insurer; 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	

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

Table 8 (Continued)

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

where the observable dummy variable DEMU=1 if the firm is converting Insurer and 0 if the firm is mutual Control Insurer; 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 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 (LP)	0.051	***	-0.077	***	-0.026		0.0136		-0.04		-0.033	
	(0.019)		(0.025)		(0.033)		(0.015)		(0.026)		(0.031)	
Agents balances/Direct premium written (AD)	0.0395		0.1087	***	0.1464	***	0.0052		0.1335	***	0.1359	***
	(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	

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

Table 9

Regression Analysis using Value-Added Approach-Stock Control Insurers

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

where the observable dummy variable DEMU=1 if the firm is converting Insurer and 0 if the firm is mutual Control Insurer; 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	

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

Table 9 (Continuous)

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

where the observable dummy variable DEMU=1 if the firm is converting Insurer and 0 if the firm is mutual Control Insurer; 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 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

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

Table 10
Regression Analysis of the Property-Liability Conversion using Financial Intermediary Approach-Mutual Control Insurers
The model estimated is $Efficiency\ \ Change = \beta_0 + DEMU\ \beta_1 + NA\ \beta_2 + HI\ \beta_3 + LP\ \beta_4 + AD\ \beta_5 + RE\ \beta_6 + \varepsilon$

where the observable dummy variable DEMU=1 if the firm is converting Insurer and 0 if the firm is mutual Control Insurer; 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	

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

Table 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

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

Table 11
Regression Analysis of the Property-Liability Conversion using Financial Intermediary Approach--Stock Control Insurers
The model estimated is $Efficiency\ \ Change = \beta_0 + DEMU\ \beta_1 + NA\ \beta_2 + HI\ \beta_3 + LP\ \beta_4 + AD\ \beta_5 + RE\ \beta_6 + \varepsilon$

where the observable dummy variable DEMU=1 if the firm is converting Insurer and 0 if the firm is mutual Control Insurer; 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	

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

Table 11 (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	-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	

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

Table 12 Summary Of Empirical Results

This table provides the summary of empirical results for Table 4 through Table 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	●	●	+	+	+	●

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

APPENDIX A

Converting Property-Liability Insurers

Property-liability Mutual	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