An Empirical Analysis of X-Efficiency Effects of Horizontal Mergers: A Distribution Free Approach

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I. INTRODUCTION

During the past three decades, there been a dramatic increase in the use of merger or acquisition as a means for implementing corporate growth strategy. The effects of mergers and the ex post performance of the combined new companies are an important topic for policy makers as mergers could replace inefficient management, helping to allocate limited resources more efficiently. Although finance researchers have studied merger effects extensively for various industries including banking, little attention has been paid to another financial institutions’ mergers: insurance company mergers.

Under the threat of federal regulation, due to increasing insolvency problems, the National
Association of Insurance Commissioners has recommended that state regulators implement more stringent solvency regulatory standards, such as risk-based capital requirements. It is suspected that this regulatory movement will encourage more consolidation through merger or acquisition. In this regard the effects of mergers of property and casualty companies seem a timely topic to examine.

The purpose of this paper is to determine if there are any ex post cost efficiency gains of merged property and liability insurance companies. The study tries to answer this question by employing Berger and Humphrey's (1992) relative efficiency approach derived from a hybrid tranlog ultiproduct cost function. This approach examines the cost function derived efficiency measure prior to merger and compares it to the post-merger efficiency measure. The hypotheses of this paper are that, first, acquiring (or survived) firms are more efficient than acquired (or retired) firms, and second, that post-merger consolidated insurance companies are more efficient than the pre-merger acquiring companies.1)

The remainder of this paper is organized as follows. Literature regarding insurance mergers is discussed first. Then, discussion of data and methodology is presented. Finally empirical results are explained, and discussions on merger regulation and conclusions are offered.

II. LITERATURE REVIEW

2.1 Economic efficiency and X-efficiency2)

Economic efficiency relates to the economic theory of a firm. The theory assumes that firms try to minimize costs for a given outputs (or maximize profits for given inputs). Deviation from this efficient behavior causes economic inefficiency. Economic (in)efficiency includes scale, scope, allocative and technical (in)efficiency. Some economists classify scale and scope inefficiency as output inefficiency and allocative and technical inefficiency as input inefficiency or cost efficiency.

Output efficiency is an optimizing production behavior of efficient firms. Output efficiency includes optimizing output level (scale efficiency) and output mix (scope efficiency). Cost efficiency can be defined as the ratio of the minimum required costs to be the actual costs utilized to produce a given output. It can be written formally as

\[
\text{Cost Efficiency} = \frac{\text{Minimum Cost Required}}{\text{Actual Cost Utilized}}
\]

The cost efficiency ratio varies from zero to one. The higher the ratio, the more efficient the

1 If a firm 'A' merges (absorb) a firm 'B' and becomes 'AB', the first one, A is the acquiring (or survived) firm, and B is an acquired (or retired) firm. The firm 'AB' is referred as a consolidated firm or ex post acquiring firm.
2. This section is based on Chapter 2 of Kim(1996).
firm. Therefore, firms on the cost frontier will have an efficiency ratio of one. By the same logic, the ratio may indicates the proportion of inputs optimally utilized in producing a given output. Economic theory suggests that cost efficiency (or input efficiency) consists of allocative and technical efficiency.

Allocative inefficiency results from the use of a suboptimal input mix to produce a given level of output while technical inefficiency is caused by the excessive use of resources to produce a given output. For example, allocative inefficiency persists if a firm utilizes four units of labor and six units of capital to produce a widget when the optimal mix is five units of labor and five units of capital. On the other hand, technical inefficiency exists if a firm employs six units of labor and six units of capital under the same optimal input mix.

X-efficiency is something different. According to its originator, Leibenstein, X-inefficiency is neither technical nor allocative inefficiency. X-inefficiency relates to the psychological nature of a human behavior. Leibenstein observes that human organizations (i.e., firms) do not maximize their potential because of some aspects of human nature, for example, lack of motivation, bad customs, or inertia. (Leibenstein, 1966, 1987) Therefore Leibenstein’s X-inefficiency or ‘pure’ X-inefficiency can be described as the gap between actually attained and minimum attainable production cost.

Empirically, researchers have not been successful in separating ‘pure’ X-inefficiency from neither technical nor allocative inefficiency. Empirical researchers have constructed a cost frontier using cost functions and have measured X-inefficiency by the distance from the cost frontier. This empirical notion of X-inefficiency includes not only Leibenstein’s X-inefficiency (or pure X-inefficiency) but also allocative and technical inefficiency. Recent bank efficiency studies generally adapt this broad X-inefficiency definition to represent broad management inefficiency which includes allocative, technical and ‘pure’ X-inefficiency.3) Following this tradition, this paper employs this broad notion of X-inefficiency rather than the ‘pure’ X-inefficiency definition.

Recent literature generally agrees that X-efficiency dominates both scope and scale efficiency in large bank mergers.4) In fact, Berger and Humphrey assert that X-efficiencies account for 20 percent or more of an average cost differences among banks. X-efficiencies results from suboptimal behavior of firms such as rent-seeking activities or inefficient customs and habits. (Leibenstein, 1987) This paper focuses on X-efficiency improvement resulting from mergers of property and casualty insurer and attempts to determine whether efficiency gains exist from insurance company mergers.

2.2 Post-Merger Effects

A merger is broadly defined as any transaction that forms one economic unit from two or more

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3See Berger, Hunter and Timme (1993) and the issue of the Journal of Banking and Finance (vol.17, 1993) on efficiency. Most authors define the term X-inefficiency as inefficiency which includes technical and allocative as well as pure X-inefficiency.
4 See Berger and Humphrey (1992) for a general discussion about the X-efficiency improvement of mergers. See also Mester (1987) and Clark (1988) for discussions about scale and scope efficiencies of the banking industry.
previous ones. Of the many reasons prosed to account for merger activities, the synergy hypothesis is the most dominant view. The hypothesis asserts that two enterprises have greater profit earning power when they are combined than when they operate separately.

Jensen (1984) argues that mergers and takeovers reflect efforts to realize a full potential of a firm’s assets from inefficient management. Limited resources are better distributed through these mergers. The synergy effect of mergers could come not only from improvement of economic efficiency (including superior management) but also from achievement of monopoly power, tax advantages, or simply (in certain cases) an aura of profitability that makes the new firm’s stock attractive. Since the efficiency improvement argument under the synergy hypothesis has been and still is the most convincing defense for horizontal mergers, researchers and policy makers should be concerned with the efficiency implication of insurance mergers.

Marshall (1972) extensively studies life insurance mergers during the period of 1956-1968. The research focuses on the extent of mergers and the characteristics of the participants based on survey and accounting data. It finds that most merger participants are relatively small and young companies and that majority of merged firms are in, or close to, financial difficulty. The research, however, does not go further: The effects of mergers and post-merger performance are not explored.

Although few studies exist examining the ex post performance of insurance mergers, recent insurance efficiency studies do imply possible benefits of consolidation through mergers. For example, Cummins and Weiss (1993) in a study of U.S. property and liability insurance companies, find that large companies operate more efficiently than do medium and small companies. The authors suggest that “...mergers and acquisition activity may have a beneficial effect on the market if they lead to the removal of inefficient firms...” (p.479). Grace and Timme (1992) study the scale efficiency of life companies, and also note that “public policy may require incentives for small to medium size companies to merge to better exploit cost...” (p. 100). number of mergers in the 1980s. Since banking is one of the closest industries to insurance (and as a powerful competitor), it is hoped that we could uncover some insights for insurance mergers by examining bank mergers. Extensive finance and applied economics literature deals with the ex post performance or efficiency of mergers in banks and other industries. Three major approaches have been employed for this purpose: a traditional approach, event studies, and simulation.

A traditional approach to measure ex post merger performance is to compare the financial ratios (e.g., ROE, ROA and Operating Cost Ratio) of firms of pre-mergers with those of post-mergers. Horvitz and Shull (1964) investigate the financial ratios of 63 banks that merged into national banks during 1962 and found no significant difference after mergers. Johnson and Meinster (1975) employ multiple discriminant analysis and find some modest performance improvement after mergers. Goldberg (1976) and Burke (1978) employ market share change instead of financial ratios but

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5 Steiner (1975)
6 For example see Mueller (1980) and Steiner (1975).
7 These synergy gains can be as simple as cost savings or can be resulting from economies of scope or scale.
8 Gothenburg (1983) and Mueller (1980)
9 See, e.g., American Bar Association (1992)
observe insignificant results.

Ravenscraft and Scherer (1987) compare the performance of units bought with control groups if similar units that stayed independent using the Federal Trade Commission’s Line of Business Data. Their extensive study shows that most acquisitions, which were made an average of eight to nine years earlier, are disappointing financially.

Two recent studies also use this traditional methodology. Srinivasan and Wall (1992) perform ratio comparison up to four years after a merger for their 240 company sample over 1982–1986. Cornett and Tehranian (1992) investigate a sample of 30 bank mergers, with acquisition prices of at least $100 million. While the first study finds no significant performance difference, the latter observes net merger benefits. Overall, except for Johnson and Meinster and Cornett and Tehranian, most traditional ratio comparison studies do not find significant post-merger performance improvement.

Another widely used approach, especially for financial economists, is stock market response studies, so-called “event studies.” Surprisingly, most event studies provide consistent evidence to support the existence of positive merger effects. Jensen and Ruback (1983) succinctly summarize seven “event studies” and assert that mergers benefit shareholder, society, and the corporate form of organization. According to Jensen and Ruback, the target firm’s shareholder gain 20 percent from mergers but the bidding firm’s shareholders gain nothing. Bradley, Desai, and Kim (1988) also find the notion that total dollar value of the gain to the targets and bidders taken together is positive, which evidences, they assert, that mergers improve the efficiency of resource use. The conclusion of those event studies is that mergers always entail a large gain (abnormal return) for the target firm’s shareholders. Franks et al. (1991) again support the notion of Jensen and Ruback using 399 acquisitions during the period of 1975–1984.

2.3 Simulation Approach

Some researchers take a different approach using simulation techniques. These studies try to predict the potential effects by substituting a hypothetical consolidated firm’s value of output into estimated cost functions. Shaffer (1993) finds that the cost reduction from scale and scope economies of the average random merger is minimal (0.2 percent) but the effect of X-efficiency gains (or losses) could be as much as 21 percent of the cost of a firm. Combining firms’ output by simple randomization, Savage (1991) tries to predict cost effects of mergers for both large banks and small banks. She finds that relatively large banks increased the predicted costs but that mergers of smaller banks reduced the cost slightly.

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10 See Hawawini and Swary (1990) for a detailed explanation for the event study methodology and its application.

11 Abnormal returns are usually calculated as follows. First, regression analysis is used to estimate the performance of a merging firm’s shares to the market over a period of time before the merger announcement is made. Then the expected performance is forecast as a basis for comparing what actually happens to the share price after the merger is announced. The forecast price is subtracted from the actual share price for a time period after the acquisition. The resulting residual is interpreted as the ‘abnormal’ gain (or loss).
Research results of the above three approaches are not conclusive. Simulation studies imply scale diseconomies for large bank mergers and do not provide any significant evidence for smaller bank mergers. Financial economists employing the stock market response approach argue for the positive effects of mergers, while industrial organization economists using the ratio comparison approach tend to deny the existence of ex post merger efficiency gains.

There are methodological weaknesses in each approach. For example, the financial ratio comparison studies usually do not consider differences in product mix and differences in input prices. Simulation studies are merely predictions based on several important assumptions such as the consistency of the cost structure of firms, either pre-merger or post-merger. Event studies, on the other hand, provide only ex ante evidence but not ex post evidence. Furthermore, although financial economists assert that event studies gave produced enough evidence for the efficiency of resource reallocation, there is growing criticism from the industrial organization camp. The industrial organization camp believes that financial economists have not had much success in relating ex ante merger efficiency (abnormal returns) to ex post performance improvements.

Berger and Humphrey (1992) try to remedy the methodological problems of previous approaches. Although their approach appears to follow the tradition of the industrial organization camp, they improve the traditional method in several aspects, recognizing the difference in input prices of scale and product mix in production behavior of firms (see 3.3. Methodology section for a further discussion). Berger and Humphrey find some improvement of X-efficiency but conclude that the improvement is not statistically significant.

III. METHODOLOGY

3.1 Data

Three sources provide the data used in this study: (1) National Association of Insurance Commissioners (NAIC) property and casualty insurance company data tapes (1985-1991); (2) Best’s Reports (P/C); and (3) the Bureau of Labor Statistics. All property and casualty insurance company merger cases from 1986 through 1990 were collected from Best’s Reports. Of the 51 merger cases reported, 6 were in 1986, 5 in 1987, 13 in 1988, 14 in 1989, and 13 in 1990. Unfortunately, however, only 10 mergers survived the data cleaning processes which are as follows.(see Table 1) First, some firms were eliminated because the merger involves non-U.S. firms or non-insurance firms. Mergers containing "shell" firms or "inactive" insurers also had to be excluded because efficiency scores could not be measured for the companies involved. Finally, others were deleted because available data sources (both National Association of Insurance Commissioners data tape and Best’s Reports) do not contain the merging firms’ annual statement data.

12 See, e.g., Caves (1989) for the argument of this group of thought.
13 Since their total earned premium or total expenses are zero, their input prices or total outputs often become zero.
Table 1 Sample Merging Companies

<table>
<thead>
<tr>
<th>Merger ID No.</th>
<th>Acquired Companies (Total Assets *)</th>
<th>Acquiring Companies (Total Assets)</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Iowa Kemper Insurance Co. ($56,894,643)</td>
<td>Economy Fire and Casualty Co. ($370,568,692)</td>
<td>1986</td>
</tr>
<tr>
<td>2</td>
<td>Lykens Valley Mutual Insurance Co. ($1,572,340)</td>
<td>Yorktown Mutual Insurance Co. ($3,934,687)</td>
<td>1986</td>
</tr>
<tr>
<td>3</td>
<td>United Farm Mutual Reinsurance Co. ($3,894,777)</td>
<td>Rockford Mutual Insurance Co. ($17,648,253)</td>
<td>1986</td>
</tr>
<tr>
<td>5</td>
<td>Multi-Medical Insurance Co. ($2,261,255)</td>
<td>American Continental Insurance Co. ($15,625,893)</td>
<td>1987</td>
</tr>
<tr>
<td>7</td>
<td>Employee Benefits Insurance Co. of Illinois ($25,671,496)</td>
<td>EBI Indemnity Co. ($26,651,800)</td>
<td>1988</td>
</tr>
<tr>
<td>8</td>
<td>Triumph Mutual Fire of Beaver County ($68,036)</td>
<td>Farmers Mutual Fire Insurance Co. of McCandless Township ($809,880)</td>
<td>1988</td>
</tr>
<tr>
<td>9</td>
<td>American Farmers Mutual Casualty Co. ($866,405)</td>
<td>IMT Insurance Co. ($64,514,285)</td>
<td>1989</td>
</tr>
</tbody>
</table>

*Total assets are obtained from NAIC Annual Statements. The merger year data is primarily used. If the merger year data is not available, prior year’s data is utilized.
3.2. Variable Definitions

Outputs. The outputs produced by insurance companies are intangible and therefore confusion continues to surround the nature of outputs provided by insurers.\footnote{See Hornstein and Prescott (1991) for a useful discussion about insurance company’s outputs.} Although this paper follows traditional output definition as the dollar amount of premium income (See e.g., Suret [1991] and Gardner and Grace [1992]), the paper does not employ written premium concept in which it includes earned premium and unearned premium. Earned premium is that a insurer actually earned during a period but unearned premium is that has been paid in advance for insurance that has not yet been provided. Therefore, as output proxies, we used net earned premium which is also superior to total earned premium because reinsurance is treated as an independent output (Y4).\footnote{Cummins and Weiss (1993) use new output proxies(discounted loss payments). this adjustment could correct some of the problems caused by the long-tail claim experience.}

Four main products of property and liability insurers are considered in this paper: automobile insurance (Y1), property casualty insurance (Y2), liability insurance (Y3), and reinsurance (Y4).\footnote{While Y1 involves only automobile insurance(Auto Liability, Auto Physical, , Y2 includes 112 lines(Fire, Allied, Farmowner, Homeowners, Commercial Multiple, Ocean, Inland Marine, Earthquake, Glass, Theft, Boiler, and 50% of International). Y3 covers 10 lines(Financial Guaranty, Medical Malpractice, Group Health, Other Accident and Health, WC, Other Liability, Fidelity, Surety, Credit, and 50% of International). Y4 includes all reinsurance lines.} Reinsurance is treated as a separate line because many property and liability insurers—including a few merged firms—deal with reinsurance exclusively.

Input. Three different inputs are used to produce outputs: (1) labor (W1), (2) physical capital (W2), and (3) miscellaneous items (W3). Following Gardner and Grace, the average statewide wage published by the Bureau of Labor Statistics is used to calculate the price of labor (W1). W1 is calculated using a weighted average of state wage rate and total premiums in the NAIC Annual Statement Schedule T. The price of miscellaneous items (W3) is assumed to equal over the firms, the price of physical capital (W2) equals physical capital expenses divided by the value of physical capital assets.

3.3 Hypotheses:

This paper has two hypotheses to be tested. The hypotheses are as follows.

Hypothesis 1: Acquiring firms are more X-efficient than acquired firms.
Hypothesis 2: Ex post acquiring firms are more X-efficient than ex ante acquiring firms.

The Hypothesis I(one) relates to the market efficiency hypothesis, which asserts that efficient firms dominates inefficient firms and, eventually, inefficient firms will be merged or exit the market. Therefore, the efficient market hypothesis predicts that merging(acquiring) firms should be more efficient than merged(acquired) firms. If the efficient market hypothesis is true in property and liability insurer mergers, the hypothesis 1 should be supported. Otherwise, the hypothesis 1 should
be rejected.

The Hypothesis II(two) relates to the theory that firms merge other firms in order to increase their efficiency.(efficiency gain hypothesis). Substantial number of studies have tested this hypothesis employing stock market data or financial statement data. Few studies, however, have used the efficiency measurement in order to prove this hypothesis. This study will test the hypothesis measuring relative efficiency gains using a distribution free method.

3.4 Methodology

This research has two stages. First, cost functions are estimated using hybrid translog approximations and, then, the efficiency scores of all firms are derived by Berger and Humphrey’s (1992) ranking approach.

Following Grace and Timme (1992) and Gardner and Grace (1993), hybrid translog approximations are used to estimate a multiproduct cost function. Using the Box-Cox transformation we are able to treat zero output of insurance companies.\(^{17}\)

The general form of the hybrid translog model is a second-order Taylor-series expansion. The basic form of the cost function of firm s with \( y_i \) products and \( W_j \) inputs is given by:

\[
\text{Cost} = f(W_j, y_i) + \text{error term}
\]

We have a hybrid traslog cost equation function:

\[
a_0 + \sum_{i=1}^{I} b_i(Y_{is}) + \sum_{j=1}^{J} c_j \ln(W_{js})
+ \frac{1}{2} \sum_{i=1}^{I} \sum_{j=1}^{J} d_{ij}(Y_{is}) \times (Y_{ js})

\ln(\text{Cost})_s = + \frac{1}{2} \sum_{j=1}^{J} \sum_{i=1}^{I} f_{is} \ln(W_{js}) \times \ln(W_{si})
+ \sum_{j=1}^{J} \sum_{i=1}^{I} g_{ij}(Y_{is}) \times \ln(W_{js}) + \text{error}
\]

where \( Y_i = \frac{y_i^\lambda - 1}{\lambda}, \ (y_i = \text{Output}) \)

By taking the first order partial derivative of Equation (1) with respect to \textit{input}, the share equation is given as:

\(17\) See Caves et al. (1980) for a technical explanation.
\[ S_j = \frac{\partial \ln(Cost)}{\partial \ln(W_j)} = c_j + \sum_{g=1}^{m} f_{ij} \ln(W_{gj}) + \sum_{i=1}^{n} g_{ij}(Y_{ij}) + (\text{error})_j \]  

where \( \ln \) is natural log and \( Y_{ij} \) is transformed outputs. \( S_j \) is the cost equation shared by labor. The shared equations must sum to one by definition, i.e., \( S_1 + S_2 + S_3 = 1 \). Since it is assumed that the miscellaneous input prices are equal over the firms, \( S_3 \) (miscellaneous shared equation) is eliminated. To avoid excessive parameter estimation the price of capital is divided by the price of capital and employed in the labor share equation. Restrictions implying homogeneity of degree one in input prices and symmetry of second order coefficients are imposed. The equations (1) and (2) represent a system of equations. Maximum Likelihood Estimation provides asymptotically efficient estimates and it is used to jointly estimate the cost function of the cost function of 1985 through 1991. The insurance company with the lowest average residual is assumed to define the efficient frontier for that time interval; then each insurance company is ranked according to its closeness to this frontier.

IV. ESTIMATION AND RESULTS

4.1. Deriving Efficiency Scores

All property and liability insurance companies that had less than $800 million in total assets throughout 1985-1991 are selected. We examine this set of firms rather than larger firms because no merged firms had total assets greater than $800 million. Both insurers that did and did not merge are included. The average annual size of the data sets in the cost function is 1168 (1163 in 1985; 1171 in 1986; 1172 in 1987; 1168 in 1988; 1172 in 1989; 1160 in 1990; 1172 in 1991). The variation is due to the mergers. Seven cost functions from 1985 through 1991 are estimated separately. The \textit{ex ante} efficiency measure is based on all years prior to the merger, until 1991. For example, if A acquired B in 1988, \textit{ex post} data would be on A's performance over the period of 1989-1991, and \textit{ex ante} acquiring insurers' data would be on A's performance over the period of 1985-1987; similarly \textit{ex ante} acquired insurers' data would be on B's performance over the same period. Data from the year of merger is excluded is tradition in other merger studies.

The most efficient firm is defined here as the firm with the lowest residual. Relative ranking is used rather than exact measures to accommodate business environments changes and the variation

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18 Total cost is defined as operating cost which includes all costs associated with operation of an insurance company
of the sample size over the period of study. In addition by ranking the firms from highest to lowest efficiency, no ad hoc distribution is imposed on the efficiency measures. The most efficient firm has the efficient score of one and the least efficient firm has a zero efficient score. The closer to one an efficiency score is, the more efficient a firm. The median company attains a 0.5.

X-efficiency score for acquired (or acquiring) firm, determined as follows. First, rank all sample firms based on their residuals. For example, the firm with the least residual (the most X-efficient firm) in 1988 is assigned 1168 since the sample size is 1168 and the firm with the largest residual is given 1. Second, original ranks are transformed using the formula:

\[ \text{SCORE}_{x,i} = \frac{(x_i - 1)}{(n_y - 1)} \]

\[ x_i = \text{the original score of firm}_i \]

\[ n_y = \text{the number of firms in the sample for year, } y. \]

NOW, the most efficient firm is assigned one and the least efficient firm assigned zero. Finally, pre-merger average efficiency score of an acquired (or acquiring) firm is calculated by:

\[ \text{PRE-SCORE}_i = \frac{\sum_{\text{year}=1985}^{1985} \text{SCORE}_i}{TB} \]

where TB = number of years before the merger starting from 1985.

By the same logic, post-merger average efficiency score of an acquiring firm is also calculated by:

\[ \text{POST-SCORE}_i = \frac{\sum_{\text{years after merger}}^{1991} \text{SCORE}_i}{TB} \]

where TB = number of years after the merger up to year 1991.

4.2 Results

<table>
<thead>
<tr>
<th>Table 2 Ex Ante X-efficiency Scores of Acquired and Acquiring Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean Score</strong></td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Mean Score</td>
</tr>
<tr>
<td>Median Score</td>
</tr>
<tr>
<td>Total Assets (Mean)</td>
</tr>
</tbody>
</table>
As expected, acquiring firms tend to have larger total assets than do acquired firms. The mean value of efficiency scores of insurance companies is 0.50285, which is slightly greater than but almost equivalent to that of acquiring insurance firms (0.49642) and, second, that both mean values are close to the mean of the total sample, 0.5. Each merged and merging firms’ efficiency scores are listed at Appendix 1.

Wilcoxon Signed-rank test is performed to see if the median acquiring company is more efficient than the median acquired company. The null hypothesis of the Wilcoxon test is: \( H_0 : M_{acquiring} \leq 0 \). That is, the median of the score of the acquiring insurer’s population is less than or equal to that of the score of the score of the acquired insurer’s population. Alternative hypothesis is: \( H_1 : M_{acquired} - M_{acquiring} < 0 \).

We are unable to reject the null hypothesis. The exact P value of the Wilcoxon test statistic is 0.461 and we fail to reject the null. Any table of binomial distribution can be used to calculate the test statistic either for the Wilcoxon signed-rank test or for the Sign test. Test statistic calculation and decision procedure are tedious.\(^\text{19}\)

This observation implies not only that ex ante acquiring firms are not necessarily more efficient than acquired firms, but also either of the group does not perform differently from other non-merging firms based on pre-merger economic efficiency. This is consistent with the general findings of previous studies in bank mergers.\(^\text{20}\)

The second hypothesis of this paper is that post-merger acquiring firms are more X-efficient than pre-merger acquiring firms. In order to test the hypothesis, the Wilcoxon signed-rank test was performed just like the first hypothesis test. P value of the Wilcoxon test is 0.385 and, thus, we have to accept the null hypothesis. It indicates that no efficiency improvement has been achieved through mergers. The Sign test was also performed to get the same result. This result agrees with general findings of the industrial organization school which believes that the performance of post-merger firms is not significantly different from that of pre-merger firms.

\[\text{Table 3 The Mean Pre-merger and Post-merger X-efficiency Scores}\]

<table>
<thead>
<tr>
<th></th>
<th>Pre-merger (acquiring firms)</th>
<th>Post-merger (acquiring firms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Score</td>
<td>.49642</td>
<td>.48627</td>
</tr>
<tr>
<td>Median Score</td>
<td>.51495</td>
<td>.54956</td>
</tr>
<tr>
<td>Total Assets (Mean)</td>
<td>$78,885,485</td>
<td>$111,319,819</td>
</tr>
</tbody>
</table>

It is premature to generalize the above results due to a limited sample size. Increasing the sample size seems necessary to generalize this type of research result. The study has not controlled for a certain characteristics of mergers due to a small sample size. For example, it does not distinguish

\(^{19}\)See any nonparametric statistics book, e.g., Daniel (1978), for details.

\(^{20}\) For example, see Ravenscraft and Scherer (1987), Curry (1981), and Hobson, Maston and Severien (1978).
'rescue' type mergers from hostile mergers and 'in-house' mergers (in the same corporate family) form normal mergers. Because of these problems, the results of this study may not be robust.

V. MERGER REGULATIONS AND FUTURE RESEARCH

Horizontal mergers in the U.S. have been scrutinized by both the Department of Justice and the Federal Trade Commission. In particular, insurance company mergers have to meet not only those regulations at the federal level, but also those at the state level.\(^{21}\) Insurance company takeovers must be approved by the insurance commissioners of the state in which the acquired firm is domiciled. Additionally, other states where the acquired firm is licensed may also become involved in the merger process. The Departments of Insurance in California and New York issued guidelines that restrict certain debt financing behaviors of purchasing firms. Several states regulate "commercially domiciled" insurance companies as well as their domestic insurers. It appears that such stringent regulations deter leveraged buyouts (LBO) in the insurance industry.

These regulatory requirements are deemed reasonable and necessary since the foremost regulatory goal is to protect policyholders. Policy makers and the public tend to presuppose that insurance mergers should be discouraged, without considering the possibility of efficiency improvement in the insurance industry. There has been little scientific evidence of effects—costs or benefits—of insurance mergers. In a global economy, non-U.S. competitors may see multiple and duplicative U.S. state and federal regulations as a trade barrier (e.g., see Skipper and Gardner [1992]).

As seen in Sir James Goldsmith's acquisition attempt over B.A.T. in 1989, regulators and the public are overwhelmingly concerned about the acquisition of insurance firms. Actually, this hostile takeover attempt perhaps was given more attention than necessary because of the prejudice against hostile takeovers. Contrary to the popular view against hostile mergers, many financial economists argue that corporate takeovers are a logical outgrowth of competitive struggles in the free market (e.g., Jensen [1984]). In this view, mergers serve a unique economic function, to eliminate inefficient management rather than create monopoly power. Whether we believe in a 'special negative treatment' of insurance mergers by imposing demanding regulations or the positive effects of mergers and acquisitions, it is important to explore the efficiency effects of insurance mergers.

The results of this paper are insufficient to provide complete information on the efficiency implications of insurance mergers. Admittedly, some areas of possible improvement are as follows: First, data availability appears to be a serious obstacle to the conduct of insurance merger studies. At least 30 merger cases are necessary for a statistically significant result. As mentioned earlier, distinctions should be made between voluntary mergers and involuntary mergers and between 'in-house' mergers and other mergers.

\(^{21}\) The federal government would be involved in insurance mergers through the Hart-Scott-Rodino Antitrust Improvement Act, and state regulators would be engaged in the mergers through their Insurance Holding Company Act and issued guidelines.
VI. CONCLUSION

This paper investigates whether post-merger efficiency gains are achieved from property and liability insurance company mergers. From the analysis, no evidence is found to distinguish acquired firms from acquiring firms. This result supports 'under-performance hypothesis' raised by many industrial organization economists.

Should insurance mergers be treated differently from other financial service industry mergers? Would the cost of protecting inefficient insurers be greater than the benefits gained for society? Could less stringent insurance merger laws help sort out inefficient insurers? Finance literature has not yet explored rigorously these areas. This paper initiates a small piece of these research questions, but poses more questions than answers. Further studies to explore more information on insurance company consolidation should follow.

References

73:16-33.
Harvard University Press.


### Appendix 1

**X-Efficiency Scores of Acquiring/Acquired Firms**

<table>
<thead>
<tr>
<th>Merger ID No.</th>
<th>Pre-Merger ACQUIRED Firms</th>
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