Modeling Market Shares of the Leading Personal Automobile Insurance Companies

Jason Hecht

Private passenger automobile insurance companies employ a range of strategies and tactics to achieve their growth and profitability objectives. Gains and losses in market share among insurers suggest a fair degree of rivalrous behavior; however, previous econometric analyses have not adequately addressed the sources of firm-level advantages. Although prior studies have tested hypotheses about differential efficiency and/or service, the unit of observation has usually been a cross-section of firms or states. Recent work in the insurance competitive strategy literature tends to support the differential efficiency hypothesis, where market share is inversely related to pricing and commission ratios, but positively related to firm-level technological change and advertising expenses. This investigation employs ordinary least squares (OLS), weighted least squares (WLS) and seemingly unrelated regression (SUR) models to analyze the market share of the leading personal auto liability insurers from 1980 to 1994. The results indicate that while automation and advertising are significant sources of competitive advantage, price-cutting, reductions in commission rates and concentration in the private passenger line of insurance are not always associated with increases in market share. © 1999 Elsevier Science Inc.

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I. Introduction

Over the last two decades, the distribution of market shares within the private passenger automobile insurance industry has increasingly shifted toward direct writers and away
from multiline agency companies. Industry and financial analysts have generally relied upon the competitive strategy literature [e.g. Porter (1980); Bell (1992)] to explain why low-cost producers have persistently gained market share in this industry. According to this view, the business of selling personal lines insurance has come to resemble other commodified sectors such as personal computers, telecommunications, and airlines where the battle for market share is dominated by cost as opposed to service considerations. A recent study by Conning & Company suggests that this trend is also indicative of a deeper reconfiguration in the production and demand for automobile insurance. In their [Conning & Company (1995a, p. 54)] analysis, the industrial organization of the private passenger insurance sector will be governed by a “new paradigm,” where:

1. Agency companies will be compelled to adopt direct writer strategies regarding cost reduction, market focus, and distribution;
2. Competitive advantage will increasingly be determined by the “commodity-like nature of personal insurance,” where:
3. An insurer’s reputation for providing quality service, establishes policyholder loyalty, so that:
4. A direct response marketing strategy will become the best means for “realizing significant distribution efficiencies.”

Although the above claims appear to have garnered widespread acceptance in the trade and business press, they have not been subjected to any systematic or rigorous empirical verification. In addition, although several factors have been identified as critical determinants of market position, no attempt has been made to rank or quantify their importance using multivariate statistical techniques.

This study seeks to test the major claims put forward by the competitive strategy insurance literature in the context of a pooled cross-sectional econometric model of the leading personal auto liability insurance carriers. In particular, this analysis will test whether price-cutting and commission reductions have been successful business strategies. Thus, changes in individual insurer market share will be modeled as a function of changes in relative costs, automation, promotional efforts, agent remuneration, specialization, and underwriting capacity. The paper proceeds as follows: Section II provides a review of the literature; Section III states and describes the four competitive strategy hypotheses to be tested; Section IV provides a summary of the data and econometric methods, and the results; and Section V contains the major conclusions of this investigation.

II. Literature Review

Previous studies have tended to address issues related to either service and/or efficiency differentials between agency companies and direct writers. In many of the models, the expense ratio is regressed against price and quality measures, as well as other proxies of regulatory stringency, geographic concentration, marketing system, and/or production costs. Several studies have concluded that independent agency companies are less efficient due to higher expense ratios [Joskow (1973); Cummins and VanDerhei (1979); Cather et al. (1985); Flanigan et al. (1993)].

Alternatively, other studies have supported the differential service hypothesis, where higher expense ratios reflect an insured’s need for greater service and/or preference for
personal attention offered by an independent insurance agent [Pauly et al. (1986)]. Recent work by Barrese and Nelson (1992) found that differences in expense ratios reflect the additional costs associated with an agent’s effective resolution of certain types of insurer-insured conflicts (e.g., timeliness of claim payments). Barrese et al. (1995) examined the number of insured complaints against auto insurers that were registered with the state insurance commissioner. Agency companies were found to have fewer complaints compared to direct writers, although the difference tended to diminish with larger carriers. A recent survey by Consumer Reports (1995) identified four of the top ten personal auto insurers as agency companies. Finally, Hogan et al. (1995) concluded that agency companies which underwrite a range of commercial and personal lines of businesses appear to have distinct competitive advantages over direct writers.

Despite the breadth and sophistication of previous econometric studies of the private passenger insurance industry, there has been almost no attempt at directly modeling firm-level market share. Pauly et al. (1986) developed a model to explain aggregate differences between agency and direct writer market shares and loss ratios. Their model was based on a more general supply-demand framework, which simultaneously solved for both price (as proxied by the loss ratio) and quantity (as proxied by market share). Carroll (1993) employed a similar approach to test the differential service hypothesis for workers compensation insurance. Nevertheless, none of the previous studies have attempted to explain the recent evolution of market shares for specific auto insurers in terms of both competitive and technological factors (especially automation) identified by Conning & Company and other insurance analysts [e.g., Culbert (1989); Doyle (1991); Bell (1992)].

III. Research Hypotheses

This investigation seeks to test the primary determinants of an auto insurer’s market share based upon hypotheses developed in the competitive strategy literature. Porter (1980) emphasized three generic strategies that are available to most firms: low-cost, product/service differentiation, or market focus. A strategy which emphasizes cost leadership generally works best in industries which produce a relatively homogeneous or standardized product. Moreover, in industries with low barriers to entry but significant exit barriers, price competition is also likely to persist. Both Bell (1992) and Conning & Company (1995a) have applied the Porter (1980) schema to the private passenger auto insurance sector, and concurred on the industry’s low barriers to entry and high exit barriers. As it is relatively easy to enter the auto insurance market, competition tends to generate little brand loyalty and/or product identification. Therefore, despite the diversity of service and distribution systems, a low-cost strategy is claimed to be the most successful long-term approach to gaining market share.

Nevertheless, it is recognized that regulatory considerations may also play an important role in molding the competitive environment. For example, restrictions on withdrawals from particular markets or confiscatory pricing and profitability statutes often result in excess capacity which allows weak competitors to linger in the market. This type of competitive environment often prompts further irrational pricing which results in insolvencies and greater consumer dissatisfaction [Conning & Company (1995a, p. 43)].

One of the central issues related to the heightened competitive environment in the auto insurance market is to identify the primary determinants of market share. Based on the a priori logic described in the competitive strategy literature, this investigation attempts to
quantify the impact of four main factors: the ability to reduce prices and commissions, automation, and advertising. Thus, four hypotheses concerning each of these determinants of an underwriter's market share will be tested:

**Pricing**

**Ho₁**: The change in a personal auto insurer’s market share is inversely related to the change in its price, lagged one year.

If insurers follow Porter’s generic low-cost strategy, then the ability to profitably gain market share should be predicated on a low-cost structure of production. It is expected that proactive price-cutting will lead to an increase in market share during the following year. Standard accounting ratios such as the loss, expense, and combined ratios have been used as comparative measures of operational efficiency and overall underwriting profitability. Unfortunately, these measures neglect investment income, suffer from calendar year-accident year distortions, and provide only a very rough measure of actual prices (usually proxied by the loss ratio).

The measure of auto insurance prices used in this analysis is based on a financial model developed by Culbert (1989) and is similar to a model described in Cummins (1990). Standard accounting ratios such as the loss, expense, and combined ratios have been used as comparative measures of operational efficiency and overall underwriting profitability. The approach used by Culbert (1989) is to estimate a breakeven loss ratio which equates the present value of a policy’s cash inflows (net written premiums plus after-tax investment income) to total post-tax cash outflows (underwriting expenses, plus loss and loss adjustment expenses) over the lifetime of a private passenger auto liability insurance policy. This measure is equivalent to computing the internal rate of return (IRR) of an investment project; however, for an insurance policy, the signs are reversed (i.e., cash inflows are obtained before disbursements).

Equation (1) presents the standard IRR formula in terms of underwriting ratios:

\[ C_1 - \sum_{t=1}^{10} \frac{C_{t+1}}{(1+R)^{t+1}} = 0, \]  

(1)

where \( C_1 \) is one dollar of premium received during the first year, net of reinsurance, underwriting expenses, loss and loss adjustment expenses, policyholder dividends, and federal income taxes; \( C_{t+1} \) is the expected stream of loss and loss adjustment payments which will be disbursed by the insurer during years two through ten; \( R \) is the policy’s internal rate of return (to be solved for). Equations (2) and (2a) illustrate how the breakeven loss ratio operates as a lever to equate the initial cash inflows with the present value of future cash outflows, given the actual and underwriting, loss and loss adjustment expense ratio,² corporate tax rate, and an assumed after-tax return on invested reserves.³

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¹ Cummins (1990) noted that the interpretation of an IRR in the context of an insurance pricing model can be ambiguous because of the sign reversals.

² Following Culbert (1988), the loss and loss adjustment ratios use net written premium as the divisor rather than net earned premium.

³ The payout pattern is based on an IRS schedule for discounting personal auto liability loss reserves.
Breakeven Cash Inflow \((C_1)\) in Year 1:

\[
(C_1) = 1 - \text{UWER} - [(\text{LAER} + \text{BELR})\% \text{ Paid Loss Reserve}] - \\
[1 - (\text{UWER} + \text{LAER} + \text{BELR})]\% \text{ FIT}\%.
\]  
(2)

Breakeven Cash Outflow \((C_{t+1})\) in Year 2–10:

\[
(C_{t+1}) = [(\text{BELR} + \text{LAER})\% \text{ Paid Loss Reserve}],
\]  
(2a)

where \(\text{UWER}\) is the underwriting expense ratio; \(\text{BELR}\) is the breakeven loss ratio; \(\text{LAER}\) is the loss adjustment expense ratio; and \(\% \text{ FIT}\) is the corporate federal income tax rate.

The internal rate of return can be computed by substituting the incurred loss ratio for the breakeven loss ratio.

Table 1 illustrates how the above data and equations are used to compute the breakeven loss ratio and IRR. The top portion of Table 1 displays the actual underwriting experience for the aggregate private passenger auto liability insurance industry. For example, in 1994, the industry incurred about 70 cents in losses, 22 cents in loss adjustment expenses and 12 cents in underwriting expenses. Thus, without accounting for the time value of money, the industry lost about $1.04 in claims for each dollar of net written premiums taken. The bottom portion of Table 1 demonstrates how the financial ratios, tax and payout assumptions determine the initial cash inflows and prospective outflows arising from the issuance of a personal auto liability insurance policy. For example, column (2) displays the 10-year loss development pattern of claims while columns (3), (4), and (5) display the pretax bond yield, tax rate, and net bond yield, respectively, from a portfolio of bonds set to mature just in time to pay off the entire claim and associated legal costs as they come due. Column (6) shows the inflows and expected outflows, which produce an actual IRR. Column (7) employs equation (2) to compute the initial breakeven cash inflows\(^4\) at the end of Year 1, and equation (2a) to compute breakeven cash outflows in Year 2–10.\(^5\) Determining the appropriate breakeven loss ratio requires information contained in columns (8) and (9). Column (8) represents the annual discount factors implied by the post-tax bond yields shown in column (5); column (9) is the discounted breakeven cashflows, equal to column (7) multiplied by column (8).

An auto insurer’s objective is get column (9) to sum to zero, which will generate a risk-free price of funds. The means available to an insurer are fairly limited; bond yields and tax rates are determined outside the industry and the underwriting expense ratios are largely determined at the policy’s inception. Therefore, the swing factor is the pure cost of the contract—the incurred loss plus loss adjustment expense factor. To find this factor, the breakeven loss ratio is hand-adjusted (arbitrarily iterating from 0.73 to 0.72 to 0.71, etc.) until the discounted cash flows exactly equal zero at a breakeven loss ratio of 0.70985. A detailed description of the procedures used to compute an insurer’s breakeven loss ratio may be found in Hecht (1995).

\(^4\) Equal to $1.00 of net written premiums minus: underwriting expenses of $0.22, plus breakeven incurred loss and loss adjustment expense ratio of $0.39 ($0.70985 + $0.12092, multiplied by 471—the complement of the payout weight in column (2) for Year 1), plus federal income taxes of ($0.02), due to an underwriting loss.

\(^5\) The actual and breakeven IRR are displayed at the bottom of columns (6) and (7). The breakeven IRR of 4.22% is the risk-free cost of funds, which, when subtracted from the actual IRR of 3.47%, indicates that the industry had a positive net interest margin in 1994.
After both the breakeven and actual loss ratios have been computed, an annual proxy for the price of a personal auto liability insurance policy may be obtained by dividing the breakeven loss ratio by the actual incurred loss ratio:

\[
\text{BELRILR} = \frac{\text{BELR}}{\text{ILR}}.
\]  

(3)

In order to profitably gain market share, an insurer will strive for a breakeven loss ratio that is greater than or equal to its actual loss ratio. The denominator in equation (3) also controls for business risk across companies. In jockeying for market shares, underwriters with a low cost of underwriting funds have the best capacity to reduce their rates or, equivalently, allow the actual loss ratio to rise or breakeven ratio to fall. Or, to put it more
dynamically: a decline in BELRILR in the prior year should lead to a positive change in
market share for the current year. Therefore, a negative coefficient on the lagged value of
BELRILR is expected.

On the other hand, the econometric model employed in this analysis also has the
flexibility to perform a test of the differential service hypothesis which presumes a
positive relationship between pricing and market share. This hypothesis will be tested in
a second specification which will allow the pricing variable to vary by insurer, while also
controlling for differing levels of business risk.

Automation

Ho_2: Higher relative rates of automation/mechanization reflect greater labor
productivity which leads to an increase in market share.

Since the 1960s, auto insurers have made significant investments in computers and
information-processing hardware and software to improve labor productivity and reduce
both underwriting and indemnity costs. During the 1980s and 1990s, the rightsizing and
re-engineering of the U.S. insurance industry has been characterized by two major trends:
1) a slowdown/decline in employment growth (especially clerical employment), and 2) the
widespread introduction and adoption of computer and other information-processing
technologies. Economic theory suggests that the substitution of machines for people in the
production process should lead to higher labor productivity and, thus, lower costs to
consumers who purchase insurance products and services. Indeed, Wolff (1991) has
confirmed a significant increase in both the capital-labor ratio and labor productivity for
the insurance industry from 1979 to 1986. From the perspective of an individual personal
auto insurer, a higher ratio of computers plus other equipment, to salaries should reflect
a higher level of worker productivity. Hecht (1995) has shown a positive correlation
between gains in market share and this type of capital-labor proxy for the leading personal
auto insurers from 1980 to 1992. Moreover, the adaptation of new computer technologies
and continued automation will likely remain a critical feature of the private passenger auto
insurance industry. Further investments in advanced telecommunication and information
technologies will be needed to meet consumer demands for electronic information and
transactions via the internet. Therefore, a positive coefficient on the lagged value of an
insurer’s capital-labor proxy is expected in the market share models.

Agent Remuneration

Ho_3: Commission rates should either be inversely or not associated with
market share as insurers seek to reduce policy acquisition costs and/or
increase agent productivity.

In recent times, several large multiline insurers of private passenger automobiles have
stated their intentions to gain market share by lowering commission ratios [Best (1995);
Independent Agent (1994)]. For example, State Farm recently announced that their new
agent contract, AA97, will reduce commissions by one third [Pasher (1998)]. Sass and

— Ideally, the number of employees should be used as the denominator in a capital to labor ratio; however,
carrier-level employment data are proprietary. Though salaries are an imperfect substitute, they probably
overstate the denominator and, thus, understate a firm’s actual capital-labor ratio.
Gisser (1989) also found a negative relationship between commission rates and insurance companies which utilize exclusive agents to distribute policies. Although raising the commission ratio has been the traditional procedure for securing a greater share of the market, in the current competitive environment, companies are claimed to be under greater pressure to wring efficiencies from the premium/policy procurement process. For example, agency companies recently surveyed by Conning & Company stated that their commission rates must be brought into line with those paid by direct writers and “overwhelmingly [agreed] that commissions on new and renewal personal auto business will be cut” [Conning & Company (1995b, p. 56)]. In addition, alternative distribution systems, such as banks and the internet, pose additional challenges to independent agents. Given this changed regime in agent remuneration, a reciprocal relationship between market share and lagged commission rates is expected. Nevertheless, a second econometric specification will also allow for a test of the differential service hypothesis which suggests that increasing the commission ratio will lead to an increase in market share.

Advertising

$H_{04}: \text{With limited potential for higher commission rates, sales promotion should be the most cost-effective method for increasing market share.}$

Although reduced advertising expenses would appear to be part of a generic low-cost strategy, the auto insurance industry has several unique characteristics which suggest a positive relationship between sales promotion and market share. First, advertising expenses constitute a very small share of net written premium (less than half a cent per premium dollar for most of the carriers under investigation). Second, as auto insurance is compulsory in most states, it behooves an insurer to maintain good visibility in the marketplace so that it is a consumer’s first choice when shopping for an insurer. Third, a direct writer which seeks to increase market share has to employ a different strategy than an agency company because it does not have to devote the same amount of resources to motivate its proprietary sales force. Marvel (1982) has suggested that this is due to differences in policy-renewal rights between the two major distribution systems of personal auto insurance. Unlike independent agency companies, direct writers own the renewal rights to their auto insurance policies. Because a direct writer’s sales force is largely captive, Marvel (1982) suggested that its own advertising efforts will not be undermined by a competitor who may respond by paying a higher commission rate to the agent but spend relatively less on sales promotion. Marvel (1982, p. 20) observed that direct writers have a higher ratio of advertising expenses to net written premiums and should be expected to achieve the deepest penetration in lines of business where “commission expenses are of lesser importance than other marketing expenditures.”

Most of the recent research into the effects of advertising on the auto insurance market has emphasized the role of ownership structures on the efficacy of promotional expenses. For example, Kim et al. (1996, p. 212) analyzed the “strategic complementarity” between insurance distribution systems and advertising policy, and expected that “in insurance lines for which centralized insurance promotion is more effective and opportunities for agent opportunism are greater, the value of the exclusive agent system is higher.” They found a statistically significant positive relationship between the ratio of advertising to premiums and nongroup insurance companies.
For agency companies, Bailey (1989, p. 24) noted that their loss in personal lines market share is largely due to the poor quality of their advertising campaigns: “We must lead [agency] companies to understand that great sums of money spent on national advertising is largely wasted if it is not designed to sell insurance and does not specifically direct the customer to the independent agent.” These comments suggest that agency companies need to improve both the relative scale and quality of their advertising expenditures. Therefore, an increase in the ratio of advertising to net written premiums should be positively associated with an increase in market share.\footnote{Unlike commissions, advertising expenditures are not allocated to a particular line of business. Thus, a stronger correlation may exist for insurers which concentrate on personal automobile insurance even though less specialized underwriters might devote a considerable share of their advertising budgets to this particular line. The mix of total business derived from private passenger auto insurance was used to control for this effect.}

**Specialization Effects**

The share of total premium derived from private passenger insurance (\(PPSHR\)) is included to control for specialization advantages, such as those derived from economies of scale and scope. In addition, this ratio also controls for the fact that advertising expenses are not allocated to any particular line of business.

**IV. Econometric Analysis**

The econometric analysis of the ten leading private passenger auto liability insurers will focus on explaining their respective market share from 1980 to 1994. Because the sample of prominent auto insurers changed from year to year, three additional companies—who rotated in and out of the top ten positions during this period—were also included.\footnote{There were two other companies which also appeared in the top 10 positions during this period (California State Auto Association and International Auto Club of Southern California). Both companies were omitted from the analysis because they generally limit their underwriting to the California market.} The time period was chosen because 1980 was generally the first year that insurance companies began reporting the amortized value of their electronic data processing (EDP) equipment on the balance sheet of the uniform statutory accounting statement as prescribed by the NAIC. All data come from the A.M. Best Aggregates & Averages 1980 to 1995 and their facsimiles of company annual statements for consolidated insurer groups.

The top portion of Table 2 displays the average level of private passenger liability (excluding no-fault), physical damage and combined market shares for the leading underwriters. Column (4) shows the difference between an auto insurer’s liability market share in 1994 and 1980; column (5) presents the coefficient of variation (standard deviation/mean) for an insurer’s market share from 1980 to 1994. The latter is a relative measure of rivalrous behavior among these firms. For example, a company which has experienced relatively significant growth/loss in market share will likely have a higher coefficient of variation. The average mix of business within the private passenger line is also shown in the bottom portion of Table 2.

**Econometric Methodology**

*Motivation.* Before addressing the econometric results, a few comments are in order about the appropriateness and justification for using pooled cross-sectional data and
comparing results from ordinary least squares (OLS), weighted least squares (WLS), and the Zellner (1962) seemingly unrelated regression (SUR) techniques. First, pooling annual data across firms significantly increases the sample size, which permits econometric testing of more regressors. Hausman and Taylor (1981) also suggested that in models of interfirm market share, pooled cross-sectional data should be employed to control for firm-specific unobservable effects, which may be correlated with the independent variables in models based only on cross-sectional observations.

Second, fixed effects (i.e., varying intercepts by cross section) was employed to account for the non-linear hierarchy of personal auto liability market share. For example,
the average difference in market share between the leading firm (State Farm, 19.43%) and the second (Allstate, 11.72%), third (Farmers, 5.69%) and fourth (Nationwide, 4.12%) largest companies from 1980 to 1994 was 7.71, 13.74, and 15.31 percentage points, respectively.

Third, although a fixed-effects pooled OLS model may be able to account for a significant amount of overall variation in the dependent variable, unequal error variances are also expected. Therefore, a WLS model which employs a standard weighting (i.e., inverse) transformation of the variance-covariance matrix was also estimated.

Fourth, the Zellner (1962) SUR estimation procedure was employed to account for contemporaneous residual correlation between cross sections. For example, a strong negative correlation may illuminate a particular competitive relationship that is difficult or impossible to ascertain due to the highly proprietary nature of an underwriter’s strategic plan. Greene (1993, p. 486) noted that the residual configuration may reflect factors which are both common to all firms (e.g., macroeconomic growth) as well as factors which are specific to particular auto insurers (e.g., managerial talent). Moreover, unobservable effects such as managerial acumen, special skills/capabilities or other unmeasurable factors are also likely to influence an insurer’s competitive position. Therefore, SUR estimation is appropriate for capturing these as well as other interfirm relations. It should also be noted that SUR techniques have been employed to model by line underwriting cycles of profitability [Fields and Venezian (1989)] and cost differentials and complementarities between distribution systems for different lines of insurance [Hogan et al. (1995)].

Because market share oftentimes has an embedded trend, it is important to test for stationarity. Furthermore, stationarity of the independent (righthand side) variables are also assumed when employing regression and associated statistical inference procedures. Unit root tests, such as the standard and augmented Dickey-Fuller tests, as well as the Phillips-Perron test, were used to test for stationarity. The tests indicated that stationarity would be achieved if the models were estimated using first differences.

Specifications. Two fixed-effects pooled cross-sectional specifications were compared. In the first model, all regressors (with the exception of the y-intercepts) were specified to have common coefficients for the OLS, WLS and SUR equations. This model represents a test of the four competitive strategy hypotheses. Equation (4) shows the pooled model specification:

$$MS_{it} = B_{0i} + B_{1i} * BELRILR_{it}(-1) + B_{2i} * KL_{it}(-1) + B_{3i} * ADVTNWP_{it}(-1) + B_{4i} * LICOMNWP_{it}(-1) + B_{5i} * PPSHR_{it}(-1) + e_{ij},$$

where, for the ith underwriter of private passenger auto liability insurance in time period t:

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9 Computing SUR coefficients is a two-step procedure which initially involves estimating error covariances between OLS equations. These estimates are then used in a WLS format to produce more efficient parameters [Judge (1988, p. 447)]. Moreover, Greene (1993, p. 489) noted that greater efficiency will be obtained when there is a high degree of cross-equation residual correlation.

10 Unit root tests performed on the level of the individual insurer market share generated Dickey-Fuller t statistics which were smaller (in absolute value) than the reported critical values. Therefore, I could not reject the hypothesis of nonstationarity and the existence of a unit root. Using a first-difference of the market share produced a stationary series as confirmed by t statistics which were higher than the reported critical value.
MS = net written premium (NWP)/industry NWP for PP liability insurance;

BELRILR = breakeven/actual incurred loss ratio;

KL = [EDP + equipment expenditures]/NWP;

ADVTNWP = advertising expenses/NWP;

LICOMNW = net commissions/NWP;

PPSHR = total personal auto NWP/total group NWP.

It should also be reiterated that the one-year lag on all the regressors reflects the delay between the implementation and execution of managerial directives and/or other strategic actions. The lag may also reflect regulatory considerations, such as the delay between rate filings and approvals. Mean values of the dependent and independent variables are displayed in the top portion of Table 3.
The second set of models (OLS, WLS, SUR) have the same form as equation (4); however, the price (BELRILR) and commission (LICOMNWP) coefficients were allowed to vary by carrier (i.e., by cross section). This is a less restrictive model which allows for more detailed testing of the respective pricing and remuneration hypotheses. In particular, it permits individual insurers to pursue an alternative strategy other than one which presumes that price-cutting and reductions in commission ratios always dominate. The specific econometric procedure is outlined in Judge (1988, Chapter 10) and is equivalent to allowing a company-dummy variable to interact with the specified continuous regressor. The models were estimated using the “Econometric Views 2.0” (1995) for Windows software, specifically designed for handling pooled data.

**Econometric Results**

Without any specific knowledge about the strategic plans of individual auto insurers, it is difficult to know the *a priori* strength and direction of particular pair-wise residual correlations. Nevertheless, the motivation and ability of one insurer to take market share away from another competitor presumably follows the logic described in the insurance competitive strategy literature found in Conning & Company (1995a, 1995b), Culbert (1988, 1989), Doyle (1991), and Bell (1992).

**Cross-Equation Residual Correlation.** The bottom portion of Table 3 displays a subsample of negative cross-equation residual correlation coefficients generated from the OLS equations. Evidence of the redistribution of market shares away from higher-cost agency companies and toward lower-cost direct writers is supported by the cross-equation correlation coefficients. For example, the strongest negative correlations occurred between some of the leading direct writers and agency companies. In addition, negatively-correlated residuals between the leading direct writers also indicate heightened competition between companies which have been steadily gaining market.

**Regression Results.** Table 4 displays the results from each estimation technique used to test the competitive strategy hypotheses. The OLS and WLS models produced roughly similar results for both overall explanatory power and statistically significant coefficients. The automation proxy (KL) was the most robust estimator, being both consistently significant and having the expected (positive) sign across models. Unfortunately, support could not be found for the pricing and compensation hypotheses; in two of the three models (OLS, WLS), both variables were statistically insignificant. The Zellner SUR specification produced significant coefficients; however, the coefficients on the pricing and commission ratio were both positive and statistically significant. Thus, support could not be found for two of the four competitive strategy hypotheses.

**Varying Pricing and Sales Commission Parameters By Underwriter.** As was previously noted in the review of the literature, the differential service hypothesis expects a positive relationship between market share and a carrier’s price and commission rate. That is, a higher insurance rate signals to the buyer a superior insurance policy (especially with respect to service and financial soundness of the underwriter). Moreover, higher commission rates should induce an agent to increase sales and, thus, market share for a particular insurer. By allowing the price and commission rate parameters to vary by company, it is
possible to evaluate whether some insurers pursue the competitive low-cost strategy, while others emphasize service and/or have an efficient incentive structure to gain market share (even after controlling for differing levels of business risk).

The lower portion of Table 5 displays the results for individual insurers. Note, as the most significant results were obtained from the more generalized SUR estimation technique, the discussion of the results will focus on these parameters. As expected, the larger agency companies had a positive and statistically significant coefficient on the price proxy, while the larger direct writers had negative coefficients (although there were some notable exceptions). On the other hand, there was no consistent pattern for the commission ratio. Whereas all but one of the agency companies had a significant negative coefficient, several direct writers had both statistically significant positive and negative values.

### Table 4. Competitive Strategy Hypothesis Pooled Models

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>OLS (Coeff./SE)</th>
<th>WLS (Coeff./SE)</th>
<th>SUR (Coeff./SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakeven loss ratio/</td>
<td>(BELRILR)</td>
<td>(0.01821, -0.02003)</td>
<td>(0.03698)***</td>
</tr>
<tr>
<td>incurred loss ratio</td>
<td></td>
<td>(0.13555, 0.09071)</td>
<td>(0.00876)</td>
</tr>
<tr>
<td>[EDP + equipment]/</td>
<td>(KL)</td>
<td>(0.00528*, 0.00248)</td>
<td>(0.00505)***</td>
</tr>
<tr>
<td>salaries</td>
<td></td>
<td>(0.00315, 0.00202)</td>
<td>(0.00035)</td>
</tr>
<tr>
<td>Advertising/net written premiums</td>
<td>(ADVTNWP)</td>
<td>(0.10921, 0.09300)</td>
<td>(0.0961)***</td>
</tr>
<tr>
<td>(0.18833, 0.15584)</td>
<td>(0.02387)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PP liability commissions/PP liability NWP</td>
<td>(LICOMNWP)</td>
<td>(0.00897, -0.00389)</td>
<td>(0.01093)***</td>
</tr>
<tr>
<td>PP NWP/Total NWP</td>
<td>(PPSHR)</td>
<td>(0.00189, 0.00213)</td>
<td>(0.00179)***</td>
</tr>
<tr>
<td>Constants (Fixed Effects)</td>
<td></td>
<td>(0.00590, 0.00470)</td>
<td>(0.00053)</td>
</tr>
<tr>
<td>Aetna</td>
<td>-0.18**</td>
<td>-0.18**</td>
<td>-0.18**</td>
</tr>
<tr>
<td>Allstate</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>American Family Group</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>Farmers</td>
<td>0.06</td>
<td>0.04</td>
<td>0.06</td>
</tr>
<tr>
<td>GEICO</td>
<td>0.04</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>Hartford</td>
<td>0.01</td>
<td>0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>Liberty Mutual</td>
<td>-0.04</td>
<td>-0.04</td>
<td>-0.04</td>
</tr>
<tr>
<td>Nationwide</td>
<td>-0.01</td>
<td>-0.01</td>
<td>-0.01</td>
</tr>
<tr>
<td>Progressive</td>
<td>0.13**</td>
<td>0.13***</td>
<td>0.13**</td>
</tr>
<tr>
<td>Prudential</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>State Farm</td>
<td>0.32***</td>
<td>0.33**</td>
<td>0.33**</td>
</tr>
<tr>
<td>Travelers</td>
<td>-0.08</td>
<td>-0.08**</td>
<td>-0.08**</td>
</tr>
<tr>
<td>USAA</td>
<td>0.11*</td>
<td>0.11***</td>
<td>0.11***</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>17.77%</td>
<td>15.13%</td>
<td>17.73%</td>
</tr>
<tr>
<td>Standard error of the regression (SER)</td>
<td>0.216</td>
<td>0.214</td>
<td>0.216</td>
</tr>
<tr>
<td>Log of likelihood</td>
<td>248.97</td>
<td>248.52</td>
<td>257.78</td>
</tr>
<tr>
<td>F statistic</td>
<td>14.03***</td>
<td>13.11***</td>
<td>12.02***</td>
</tr>
<tr>
<td>Durbin-Watson statistic</td>
<td>1.63</td>
<td>1.51</td>
<td>1.64</td>
</tr>
<tr>
<td>Number of observations</td>
<td>182</td>
<td>182</td>
<td>182</td>
</tr>
</tbody>
</table>

*** Significant at the 0.001 level.
** Significant at the 0.05 level.
* Significant at the 0.1 level.
### Table 5. Competitive Strategy Hypothesis: Unrestricted Parameters
Dependent Variable: First-Differenced Market Share

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>OLS (Coeff./SE)</th>
<th>WLS (Coeff./SE)</th>
<th>SUR (Coeff./SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDP + equipment/salaries</td>
<td>(KL)</td>
<td>0.00617* (0.00334)</td>
<td>0.00220 (0.00208)</td>
</tr>
<tr>
<td>Advertising/net written premiums</td>
<td>(ADVTNWP)</td>
<td>0.28533 (0.21521)</td>
<td>0.19521 (0.16670)</td>
</tr>
<tr>
<td>PP NWP/Total NWP</td>
<td>(PPSHR)</td>
<td>−0.00503 (0.00644)</td>
<td>−0.00536 (0.00497)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Breakeven Loss Ratio</th>
<th>(BELRILR)</th>
<th>Differential Slopes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agency Companies:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aetna</td>
<td>0.74</td>
<td>0.65</td>
</tr>
<tr>
<td>Hartford</td>
<td>0.06</td>
<td>0.01</td>
</tr>
<tr>
<td>Progressive</td>
<td>0.20</td>
<td>0.21</td>
</tr>
<tr>
<td>Travelers</td>
<td>0.08</td>
<td>0.12</td>
</tr>
<tr>
<td>Direct Writers:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allstate</td>
<td>0.41</td>
<td>0.40</td>
</tr>
<tr>
<td>American Family Grp</td>
<td>0.18</td>
<td>0.15</td>
</tr>
<tr>
<td>Farmers</td>
<td>0.17</td>
<td>0.25</td>
</tr>
<tr>
<td>GEICO</td>
<td>−0.65</td>
<td>−0.70</td>
</tr>
<tr>
<td>Liberty Mutual</td>
<td>−0.92</td>
<td>0.86</td>
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<td>Nationwide</td>
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<td>−0.47</td>
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<tr>
<td>Prudential</td>
<td>0.49</td>
<td>0.47**</td>
</tr>
<tr>
<td>State Farm</td>
<td>−1.37</td>
<td>−1.37</td>
</tr>
<tr>
<td>USAA</td>
<td>−0.29</td>
<td>−0.30***</td>
</tr>
<tr>
<td>Sales Commissions/NWP</td>
<td>(LICOMNWP)</td>
<td></td>
</tr>
<tr>
<td>Agency Companies:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aetna</td>
<td>−0.05</td>
<td>−0.05</td>
</tr>
<tr>
<td>Hartford</td>
<td>−0.08</td>
<td>−0.08**</td>
</tr>
<tr>
<td>Progressive</td>
<td>−0.08</td>
<td>−0.07</td>
</tr>
<tr>
<td>Travelers</td>
<td>−0.03</td>
<td>−0.04</td>
</tr>
<tr>
<td>Direct Writers:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allstate</td>
<td>−0.16</td>
<td>−0.15</td>
</tr>
<tr>
<td>American Family Grp</td>
<td>−0.10</td>
<td>−0.12***</td>
</tr>
<tr>
<td>Farmers</td>
<td>0.04</td>
<td>0.03*</td>
</tr>
<tr>
<td>GEICO</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>Liberty Mutual</td>
<td>−0.01</td>
<td>−0.01</td>
</tr>
<tr>
<td>Nationwide</td>
<td>0.00</td>
<td>−0.01</td>
</tr>
<tr>
<td>Prudential</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>State Farm</td>
<td>0.46</td>
<td>0.49</td>
</tr>
<tr>
<td>USAA</td>
<td>0.00</td>
<td>−0.03</td>
</tr>
</tbody>
</table>

| Adjusted $R^2$ | 18.89% | 20.25% | 16.81% |
| Standard error of the regression (SER) | 0.215 | 0.212 | 0.217 |
| Log of likelihood | 260.36 | 263.26 | 331.33 |
| $F$ statistic | 2.97*** | 3.11*** | 1.89*** |
| Durbin-Watson statistic | 1.73 | 1.56 | 1.79 |
| Number of observations | 182 | 182 | 182 |

*** Significant at the 0.001 level.
** Significant at the 0.05 level.
* Significant at the 0.01 level.
The conflicting statistical evidence suggests that companies may be employing a variety of strategies to gain market share. Although there were auto insurers which appear to have employed a low-cost strategy, there was no statistical evidence that consistently supported the competitive strategy hypotheses for the leading firms. Instead, some insurers reduced their prices but also increased commission rates, while others took the opposite approach.

V. Conclusion

The empirical results of this investigation did not provide consistent support for all the competitive strategy hypotheses examined in this investigation. In particular, the econometric evidence did not support the idea that private passenger automobile insurance companies consistently cut their prices and commission ratios to gain market share. When the price and commission variables were allowed to vary by insurer, there was support for the price-cutting hypothesis or the commission-reduction hypothesis, but not both (with the exception of one company).

On the other hand, there was fairly consistent statistical evidence to support the hypothesis that an auto insurer’s ability to mechanize the production process, through greater automation and computerization, is an important determinant of market position. In addition, increasing advertising expenditures as a proportion of premium volume also appears to be a significant determinant of gains in market share. These results were quite robust across specifications and estimation techniques, and suggest that efforts to improve competitive position rely upon improving both technological prowess and promotional activities. Alternatively, increasing an insurer’s concentration in the private passenger line of business did not have a positive impact on market share.

Another interesting (but unanticipated) result was the positive coefficient on the price proxy for some agency and direct writers, which provides support for the differential service claim that consumers may prefer to pay higher prices to obtain personalized attention from either exclusive or independent insurance agents. The recent merger of two leading multiline agency companies, followed by a subsequent merger with a major commercial bank, suggests that agency companies are striving to achieve greater cost efficiencies and improved customer service from their property-casualty business. Crucial to these consolidations is the expectation that labor productivity can be increased via economies of scale, process re-engineering and greater returns from investments in automation and information technologies. By combining strategies which emphasize cost and service, agency companies will be in a better position to offer products and services to both consumers who demand low-cost auto insurance and those with more service-intensive requirements.

In sum, the competitive environment found within the private passenger automobile insurance industry does not appear to be evolving toward a single, monolithic strategy for growth. Although automation and computerization improve productivity and efficiency across marketing systems, they may also improve customer service and product quality. Alternatively, price-cutting and reductions in commission ratios do not appear to be singularly effective strategies for increasing market share. Nevertheless, there is ample room in the personal auto insurance market for a diversity of managerial strategies to improve an insurer’s competitive position.
The author wishes to thank Kenneth J. Kopecky, Robert Taggart and two anonymous referees for their comments and constructive criticisms on earlier drafts of this paper.

References


