Financial Rating Changes and Market Discipline in Property-Liability Insurance

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Abstract

We analyze premium growth surrounding ratings changes by the A.M. Best Company during 1992-1996 for a large panel of property-liability insurers. Consistent with substantial market discipline for rated insurers, univariate comparisons and fixed effects regressions generally provide evidence of significantly lower revenue growth for insurers that experienced rating downgrades in the year of and the year after downgrades. The evidence of revenue declines is strongest for firms that had relatively low ratings (below A-) prior to being downgraded. Our analysis also provides evidence, albeit weaker, that rating upgrades were accompanied by increased premium growth. The overall findings suggest that material market discipline exists for rated insurers despite guaranty fund protection and other factors that dull consumer incentives to seek safe insurers and insurer incentives for efficient risk management.

1. Introduction

In well-functioning markets, firms that experience economic or financial distress generally face substantial discipline by customers, suppliers, and investors. Worsening conditions of trade and the desire to preserve firm-specific assets motivate or compel firms to downsize, merge, sell assets, restructure debt, and so on. Moreover, the expected costs of economic and financial distress provide strong incentives for firms to manage risk ex ante. In the case of financial intermediaries, the extent to which private market incentives for risk management may be weak has received substantial attention, especially for banks and other depository institutions where government deposit insurance substantially protects depositors from losses from firm insolvency.[1]

This paper provides detailed evidence of the relationship between insurer revenue (premium) growth and changes in insurer financial ratings by the A.M. Best Company, the premiere insurance rating agency. The results provide insight into the extent to which market discipline constrains the growth of property-liability insurers that experience deterioration in their financial condition. If a property-liability insurer fails, state guaranty funds provide material protection against loss to most policyholders, thus contributing to moral hazard (see, for example, Harrington and Danzon, 1994, Lee, Mayers, and Smith, 1997, Bohn and Hall, 1999, and Downs and Sommer, 1999). Costly search by prospective insurance buyers and insensitivity to insolvency risk by others (e.g., those compelled to buy liability insurance even though they have few assets at risk if uninsured) also reduce market discipline, at least for some insurers.

[1] See, for example, Keeley (1990), Billet, Garfinkel, and O'Neal (1998), and Calomiris (1999).

On the other hand, limitations on the amounts and types of losses that are covered by guaranty funds encourage many buyers to deal with safe insurers, and moral hazard is plausibly less severe than in banking. Many insurers also have large amounts of firm-specific assets (franchise value) from investments in reputation and book building. Because those assets are exposed to material erosion in the event of economic or financial distress, they provide significant incentives for insurers to reduce insolvency risk ex ante and to take remedial action following poor performance.[2]

We analyze premium growth for a large panel of property-liability insurers surrounding ratings changes by the A.M. Best Company during 1992-1996. Consistent with substantial market discipline, univariate comparisons and fixed effects regressions generally provide evidence of significantly lower revenue growth for insurers that experienced rating downgrades in the year of and the year following downgrades. The evidence of revenue declines is strongest for firms that had relatively low ratings (A.M. Best rating lower than A-) prior to a downgrade. Because solvency regulation was unlikely to be binding for many of those insurers (e.g., Cummins, Harrington, and Klein, 1995, and Grace, Harrington, and Klein, 1998), slower average revenue growth cannot plausibly be attributed to increased regulatory monitoring or pressure. Our univariate comparisons and regression analysis also provide evidence, albeit weaker, that rating upgrades were accompanied by increased premium growth.

A large literature has examined the effects of rating changes on firms' stock and bond prices (e.g., Pinches and Singleton, 1977, Holthausen and Leftwich, 1986, Hand,

[2] Harrington and Danzon (1994) provide detailed discussion of insurer franchise value and its possible effects on insurer risk-taking. Also see Munch and Smallwood (1982) and Finsinger and Pauly (1984), and, for the case of banks, Herring and VanKudre (1987), Keeley (1990), and Demsetz, Saidenberg, and Strahan (1996).

Holthausen, and Leftwich, 1992; also see Wakeman, 1990, and, for the case of insurance, Singh and Power, 1992). We focus instead on product market responses.[3] Our sample encompasses insurers with publicly-traded stock, stock firms that are not publicly traded, mutual firms, and reciprocals. Our main result – that downgrades are accompanied by economically and statistically significant reductions in premium growth – contrasts sharply with evidence provided by Billett, Garfinkel, and O'Neal (1998) that banks increased insured deposits following rating downgrades by Moody's.

Our analysis obviously does not imply that insurance guaranty funds have no effect on insurance market discipline (see, e.g., Harrington and Danzon, 1994, Lee, Mayers, and Smith, 1997, Lee and Smith, 1999, and Bohn and Hall, 1999; also see Brewer, Mondschean, and Strahan, 1997). In particular, it is well known that a significant proportion of insolvent property-liability insurers had rapid premium growth prior to insolvency (see A.M. Best Company, 1991, Grace, Harrington, and Klein, 1995, and Bohn and Hall, 1999). Our results nonetheless suggest that material market discipline exists for many rated insurers, even those with relatively low ratings, despite guaranty fund protection and other factors those dull consumer incentives to seek safe insurers and insurer incentives for risk management. The findings are thus consistent with Crabbe and Post's (1994) analysis of commercial paper markets (non-financial firms reduce outstanding commercial paper following rating downgrades), as well as with Fenn and Cole's (1994) indirect evidence of market discipline in life insurance (life insurer stock price declines during 1989-1991 were concentrated among firms with problem assets).

[3] A number of studies provide evidence that Best's ratings help predict insurer insolvency (e.g., Ambrose and Seward, 1988). Pottier and Sommer (1999) compare Best's ratings with ratings of other rating agencies.

Our analysis also contributes to the growing literature on the effects and costs of economic and / or financial distress.

Section 2 elaborates our main hypotheses concerning premium growth, changes in financial condition, and ratings changes. The data and methodology are described in Section 3. Section 4 presents the results of our univariate and regression comparisons of premium growth for subsamples of high and low-rated insurers that experienced ratings downgrades, upgrades, or no change in rating. The results of similar comparisons for insurers cross classified by size and personal vs. commercial lines premiums are also presented. Section 5 concludes.

2. Conceptual Framework

Given available data and that measurement of insurers' prices and outputs is problematic, we do not attempt to examine the effects of changes in financial ratings (or changes in other measures of insurer financial condition) by estimating models of firm level supply and demand. We adopt the simpler and admittedly more descriptive approach of analyzing premium growth surrounding rating changes. Our objective is to provide evidence of whether changes in financial condition are accompanied by changes in revenue growth that are consistent with either market discipline or moral hazard. Our empirical analysis tests the joint hypothesis that changes in financial condition affect revenue growth and that changes in ratings reflect changes in financial condition. Given our purpose and the available data, we do address the interesting questions of whether rating changes "cause" changes in premium growth and / or convey new information to product markets.

To fix ideas concerning the possible effects of ratings changes (changes in financial condition) on revenue growth, assume that a firm chooses its price (premium rate), p(r), as

a function of its rating, r, and other relevant factors, and that the firm's rating increases monotonically and continuously with its financial strength. Also assume that demand for the firm's policies, q(p,r), depends on the firm's price and rating. Total revenue is $R \equiv p(r)q(p,r)$. Letting ε_{xy} denote the elasticity of x with respect to y, the elasticity of the firm's revenue with respect to a change in its rating can be written as:

$$(1) \qquad \varepsilon_{Rr} = \varepsilon_{qr} + \varepsilon_{pr} (1 + \varepsilon_{qp})$$

Under the plausible assumption that the price elasticity of demand (ε_{qp}) for the firm's policies is less than –1, ε_{Rr} can be rewritten:

$$(2) \qquad \varepsilon_{Rr} = \varepsilon_{qr} - \alpha \varepsilon_{pr}$$

with $\alpha > 0$. If demand elasticity with respect to the firm's rating, ε_{qr}, is positive, expression (2) indicates that the effect of a rating change on revenues is ambiguous if the an increase (decrease) in the firm's rating causes it to charge a higher (lower) price. Thus, a *decline* in revenues following a rating *reduction* would require either (a) that the reduction in demand due to the rating decline is large enough to offset the positive effect of any reduction in price or (b) that the firm instead increases its price in order to reduce output following a downgrade so that ε_{pr} is negative.

Market Discipline / Retrenchment

Well-functioning markets provide incentives for firms to establish socially desirable target levels of financial strength. We focus on a related attribute of such markets: the

provision of incentives for firms to respond efficiently in the face of deteriorating financial condition. Because increasing quality is costly, beyond some minimum threshold of financial strength, price will increase with the level of a firm's rating because it is more costly for the firm to provide coverage with lower risk of default (e.g., holding more capital is costly due to increased tax and agency costs). Ex ante, market discipline encourages firms to desire relatively high levels of financial strength and thus high ratings. The reason is that financial strength protects firm-specific assets and helps the firm to attract customers who value low insolvency risk and who are therefore willing to pay a the higher price needed for safer coverage.[4] Ex post, unintended deterioration in the firm's financial condition and financial rating will have one of two effects. It could alter the firm's target rating, or it could induce the firm to take action to return to its target rating.

Rating Upgrades. Firms can readily take actions to reduce their ratings. As a result, rating upgrades are likely to reflect movement by firms to higher target levels of safety. The effect of an upgrade on revenues is therefore ambiguous for relatively high-rated firms. An improved rating should induce (and allow) the insurer to charge a higher price ($\varepsilon_{pr} > 0$). Whether revenues increase depends on $\varepsilon_{qr.}$ Absent significant moral hazard, this elasticity will reflect the density of potential customers that prefer a particular level of safety. It need not be positive for a given firm. Revenue increases are more likely, however, if a low-rated firm is upgraded, because the number of possible buyers will plausibly increase when a low-rated insurer takes steps to achieve a higher rating ($\varepsilon_{qr} > 0$).

[4] Doherty (1989) and Cagle and Harrington (1995) model the effects of consumer demand for safety on insurer capital decisions. Sommer (1996) provides evidence that insurance prices are inversely related to insurer risk.

Rating Downgrades. Consider first the case where a downgrade reflects or is accompanied by the firm's decision to operate with a lower level of financial strength and rating. Unless the firm's price was previously lower in relation to expected costs than intended, its price will likely decline because expected costs will be lower for the lower level of safety.[5] Whether revenues will decline again depends on the densities of consumers at different quality levels. A revenue decline is more likely to accompany a downgrade of an insurer that already had a relatively low rating, because the number of potential buyers will likely shrink ($\varepsilon_{qr} > 0$).

If instead the firm wishes to return to its previous rating in order to preserve firm-specific assets and/or avoid losing customers concerned with quality, a downgrade will likely be accompanied by a smaller price reduction, if any, and a downgrade could plausibly cause the firm to raise its price or otherwise constrain supply (so that $\varepsilon_{pr} < 0$). A price increase is especially likely if the firm had a relatively low rating prior to the downgrade or if previously inadequate prices in relation to expected costs contributed to the downgrade.

Moral Hazard / Excessive Risk-Taking

As is well known, moral hazard and associated excessive risk-taking have ex ante and ex post dimensions. Relatively low firm-specific assets and/or inelastic consumer demand with respect to insolvency risk could cause firms to have target values of safety that are socially inadequate. If so, there will be too many high-risk (low-quality) firms ex ante. Second, deterioration in a firm's financial condition may be accompanied by excessive

[5] The firm also may desire to cut price following a reduction in its financial strength to hold on to renewal business. See Cummins and Danzon (1997).

risk-taking ex post, e.g., by lowering price and selling more policies, because the expected costs of such strategies are not internalized to the firm or its customers.[6]

Compared with the market discipline / retrenchment hypothesis, moral hazard implies that rating downgrades for relatively high-rated firms are less likely to be accompanied by a revenue declines and more likely to be accompanied by revenue increases. Moreover, rating downgrades for low-rated firms should frequently induce price reductions and increased revenues, at least in the short run ($\varepsilon_{qr} = 0$ and $\varepsilon_{pr} > 0$).

The predicted effects of ratings downgrades on revenues are summarized below:

	Predicted Effects of Downgrades on Revenues		
Hypothesis	High-rated	Low-rated	High-rated – Low-rated
Market discipline	?	< 0	> 0
Moral hazard	?	> 0	< 0

Rating Levels, Firm Characteristics, and Direct vs. Net Premiums

As we elaborate in section 3, our basic approach is to analyze revenue growth in years t, t+1, and t-1for firms with ratings upgrades and downgrades in year t compared to firms with no rating change in year t. In order to allow the "effects" of a rating change on revenue growth to vary depending on the firm's pre-change financial condition, we allow the estimated relationship between revenue growth and rating changes to vary between firms with high and low ratings.

We also examine the relationship between revenue growth and rating changes for four categories of insurers plausibly related to incentives for risk management: small personal

[6] See Harrington and Danzon (1994) and Bohn and Hall (1999) for detailed discussion and analysis of premium growth as a possible manifestation of moral hazard due to guaranty funds and other influences. Also see McGhee (1999).

lines insurers, small commercial lines insurers, large personal lines insurers, and large commercial lines insurers. Small insurers may have relatively low firm-specific assets compared with large firms. Personal lines buyers may be less sensitive to changes in insurer financial condition given relatively greater guaranty fund protection and lower sophistication than commercial lines buyers. However, because firm-specific assets may tend to be greater for personal lines insurers than for commercial lines insurers, a sharp prediction about differences in revenue growth between personal lines and commercial lines insurers is not possible. Also, firm size is a blunt measure of firm-specific assets. The size / product mix comparisons are nonetheless useful given the lack of prior evidence on the relationship between revenue growth and rating changes.

We analyze direct (written) premium growth, i.e., growth in premiums received directly from insurance buyers without regard to reinsurance, and premium growth net of reinsurance (net premiums = direct premiums plus premiums for reinsurance assumed – premiums ceded to reinsurers). Direct premium growth is more likely to reflect the influences of policyholder demand for quality. Net premium growth will reflect the effects of changes in financial condition on the firm's reinsurance decisions. If the costs of reinsurance are less than those of forgoing direct business, market discipline / retrenchment might lead firms that experience a deterioration in financial condition to buy relatively more reinsurance, as opposed to further reducing direct business. The effects of moral hazard on reinsurance decisions are ambiguous. Excessive risk taking might be accompanied by increased reinsurance to evade regulatory scrutiny or action if the supply of low-quality reinsurance is abundant, thus reducing net premium growth in relation to direct premium growth. On the other hand, excessive risk taking could take the form of

increased assumption of reinsurance, and financial problems might be accompanied by increased difficulty in obtaining sufficient reinsurance if the supply of low-quality reinsurance is constrained.

3. Data and Methodology

Sample

We obtained A.M. Best Company ratings for all insurers assigned a letter rating during the five-year period 1992-1996.[7] Firm financial data were obtained from the National Association of Insurance Commissioners (NAIC) database. We report results for analysis of individual insurer revenue growth using the A.M. Best rating assigned to each insurer. Many individual insurers are assigned a group or pooled rating based on group affiliation or pooling arrangements other insurers. Analysis of revenue growth at the individual insurer level is less subject to bias and noise from mergers and acquisitions than analysis of group ratings.[8] We also identified insurers that were grouped/pooled together for rating purposes from listings in *Best's Insurance Reports, Property Casualty Edition* and aggregated firm-specific financial data according to the grouped/pooled rating. Results with similar implications to those reported for individual insurers were obtained using a

[7] Two years of ratings were hand collected. We thank Martin Grace for supplying ratings for the remaining years. Bouzouita and Young (1998) find evidence of a structural shift in ratings stringency from 1991 onward. Blume, Lim and Mackinlay (1998) note a similar change for bond ratings during the period 1978-1995. Many insurers, primarily small ones, are not assigned a letter rating (A++ to F) by Best's. Instead, they are assigned an "NR-#" rating, which identifies the primary reason for the lack of a letter rating. NR rating descriptions include: (1) Limited Data Filing – failure to submit a NAIC annual statement, (2) Insufficient Size and/or Operating Experience, (3) Rating Procedure Inapplicable, and (4) Company Request: disagreement with the Best's rating or rating requirements. Our tests will not reflect any moral hazard or go-for-broke behavior by unrated insurers.

[8] Best's group/pooled classifications for ratings purposes do correspond with Best's group codes in its financial database or NAIC group codes. Best's periodically changes classifications of related companies for the grouped/pooled rating. There sometimes are substantial year-to-year differences in which companies are grouped together. There were many such changes in 1994, when Best's assigned new/temporary rating for many large commercial insurers involved in mergers and acquisitions.

sample consisting of (1) groups/pools with a common rating, (2) individual insurers assigned a rating independent of their affiliated group or pool, and (3) unaffiliated insurers.

Best's updates ratings throughout the year. Most rating changes occur during January-July with a substantial proportion occurring in June. This pattern is illustrated in Figure 1 for 1996. We treat any change between a firm's rating from August of year t-1 through July of year t as a rating change in year t.

In order to be included in the sample, the insurer had to be included in the NAIC database and have positive direct and net premiums written each year during years t-5 through t+1. Given our use of fixed effects estimation (see below), we excluded insurers with fewer than two annual observations. Reinsurers (no direct premiums) were also excluded, as were 90 firm-year observations with large studentized residuals in preliminary analysis. The final sample includes 5,515 firm-year observations.[9]

Methodology

We first conduct univariate comparisons of (log) direct and net premium growth rates in years t, t+1, and t-1 for high rated (rating of A- or higher) and low rated (rating of B++ or lower) insurers that had rating upgrades, downgrades, and no rating change in year t.[10] We then estimate pooled time-series and cross-sectional regression models with fixed firm and time effects. The basic model is:

$$G_{j,t+s} = \alpha_j + \alpha_{t+s} + \alpha_1 \text{HIGH}\Uparrow_{jt} + \alpha_2 \text{LOW}\Uparrow_{jt} + \alpha_3 \text{HIGH}\Downarrow_{jt} + \alpha_4 \text{LOW}\Downarrow_{jt} + \alpha_5 \text{HIGH}_{jt} + \beta' X_{j,t+s} + \varepsilon_{jt}$$

[9] We also reviewed DFBETAS. Collinearity diagnostics without fixed effects indicated a maximum condition index of about 30 with variance proportions above 0.5 for the constant and the log of premiums (see below).

[10] We replicated the analysis using a cutoff of B++ for the high-rating group. The results had similar implications.

where $G_{j,t+s}$ is log premium growth (direct or net) for firm j in year t+s (s = -1, 0, or 1), $HIGH\Uparrow_{jt}$ = 1 if high-rated firm with upgrade in year t, 0 otherwise; $LOW\Uparrow_{jt}$ = 1 if low-rated firm with upgrade in year t, 0 otherwise, $HIGH\Downarrow_{jt}$ = 1 if high-rated firm with downgrade in year t, 0 otherwise, $LOW\Downarrow_{jt}$ = 1 for low-rated firm with downgrade in year t, 0 otherwise, $HIGH_{jt}$ = 1 if firm has a high rating (pre-rating change, if any) in year t, $X_{j,t+s}$ represents a vector of control variables for firm j in year t, α_j is a fixed effect for firm j, α_{t+s} is a fixed effect for year t+s, and ε_{jt} is a disturbance term.[11]

We estimate the model separately for s = -1, 0, and 1, as opposed to including lagged and lead rating change variables, in order to utilize fully our available data on the relationship between revenue growth in year t and rating changes in year t. If we included rating change variables for t-1 and t+1 as regressors, we would be able to analyze revenue growth for 1993-1995 only. We include three main control variables: (1) the log of direct (or net) premiums written in the prior year, (2) the proportion of premiums in the prior year represented by long-tailed lines of business, (3) the average (log) growth rate in direct (or net) premiums during the prior three years.[12]

We use a similar approach to analyze the relationship between revenue growth and rating upgrades and downgrades for insurers cross classified by size and product mix. We first conduct univariate comparisons of direct and net premium growth rates in years t, t+1, and t-1 for small personal lines, small commercial lines, large personal lines, and large

[11] Given possible heteroskedasticity, we use White standard errors to calculate robust t-values. Small sample bias in White standard errors (see Long and Ervin, 2000) is not an issue in view of our sample size.

[12] We also included a dummy variable for independent agency / brokerage insurers and a dummy variable for stock insurers. Given the inclusion of fixed effects, the coefficients on the independent agency and stock dummies will only reflect differences in growth rates for insurers that changed distribution methods and ownership types during the sample period. Given that very few insurers changed methods and ownership form, we do not report the results for those variables.

commercial lines insurers that had rating upgrades, downgrades, and no rating change in year t. Firms with more than (less than) $50 million in surplus are classified as large. Firms with more than (less than) 50 percent of premiums represented by commercial lines coverage are classified as commercial (personal) lines insurers. We then estimate differences in growth rates between size / product mix / rating change categories using a model analogous to equation (3).

4. Empirical Results

Summary of Ratings and Rating Changes

Table 1 summarizes the distribution of Best's ratings, upgrades, and downgrades for seven rating categories. Eighty percent of the sample observations are for firms with ratings of A- and above; 18 percent of the observations are for firms with ratings of B++ through B-. Less than 2 percent of the observations are for firms with ratings below B-. About 80 percent of the insurer-year observations fall within the no change category. Downgrades are rare for the highest rated insurers (A+ and above); upgrades are not uncommon for the low rating categories.

Table 2 summarizes the number of ratings, upgrades, and downgrades for the high-rated (A- and above) and low-rated (B++ and below) groups and for the small and large personal and commercial insurer subgroups. There were 354 upgrades and 316 downgrades in the high-rated group; rating changes represent about 15 percent of the observations for that group. There were 177 upgrades and 175 downgrades in the low-rated group; rating changes represent 33 percent of the observations. Thus both rating upgrades and downgrades are relatively more common for the low-rated group. There are substantial numbers of observations, upgrades, and downgrades for the four subgroups

based on insurer size and commercial vs. personal lines specialization. Rating changes were relatively more frequent for small insurer groups. The number of upgrades exceeds the number of downgrades for each group except for the small personal lines group, where 60 percent of the rating changes were downgrades.

High-Rated vs. Low-Rated Insurers

Univariate Comparisons. Table 3 compares median growth rates for direct and net premiums for high-rated and low-rated insurers with upgrades, downgrades, and no rating change. Medians growth rates are shown for the year of the rating change (year t) and for the prior and following year (years t-1 and t+1). Figures 2 and 3 show differences in median growth rates between upgraded insurers and the no change group and between downgraded insurers and the no change group, respectively.

The results for direct premium growth indicate that the median growth rate for downgraded insurers is significantly lower in years t and t+1 than for insurers with no rating change. Moreover, the median direct premium growth rates in years t and t+1 are significantly higher for insurers with upgrades than for insurers with no change and for those with downgrades. The difference in each case is economically as well as statistically significant. Compared to the no change group, the difference in median growth rates is generally substantially larger in absolute value for the downgrades than the upgrades. The differences between median growth rates for the downgrades and the no change group are especially large for the low-rated insurers. Low-rated insurers with downgrades had negative growth in direct premiums during years t and t+1 (median growth rates of –7.7 and –3.5 percent, respectively). The median growth rate for low-rated insurers with downgrades in year t was 12.5 percentage points lower than for the no change group (-7.7

percent vs. 4.8 percent). The difference in year t+1 was 7.5 percent (-3.5 percent vs. 4.0 percent).

The median direct premium growth rates for year t-1 are similar for high-rated insurers with upgrades, downgrades, and no rating change. The median growth rate in year t-1 is significantly lower for low-rated insurers that had downgrades in year t than for insurers with upgrades or no change. In this case, however, the median growth rate for the downgraded group is still positive and the differences compared to the no change and upgrade groups (1.1 percent vs. 4.2 and 5.0 percent, respectively) are much smaller than in years t and t+1.

The median growth rates for net (i.e., after reinsurance) premiums generally have the same patterns and implications as those for direct premium growth. Median net premium growth rates are significantly lower for downgraded insurers than for the other two groups in years t and t+1, with especially large differences for low-rated insurers. There are two notable differences compared to direct premium growth. First, the difference between the median net premium growth rate for upgraded insurers and insurers with no rating change is small and not statistically significant in year t. The difference is nonetheless material (6.8 percent vs. 4.4 percent) and statistically significant in year t+1. Second, the median net premium growth rate in year t-1 for high-rated insurers with downgrades in year t is significantly lower than for insurers with no ratings change in year t, whereas there was no significant difference for direct premium growth. However, the median net premium growth rate in t-1 is also lower for insurers with upgrades than for the no change group and similar in magnitude to the median for downgrades.

The overall results of the univariate comparisons shown in Table 3 and Figures 2 and 3 suggest that downgraded insurers, especially those with low ratings, experienced significant market penalties in the form of reduced revenue growth in the year of and the year following the downgrade. The results also suggest that upgraded insurers experienced smaller but still significant rewards in the form of higher revenue growth.

Regression Results. The fixed effects estimates of equation (3), which allows the relationship between revenue growth and rating changes to vary between high-rated and low-rated insurers, are reported in Table 4. The coefficients on the rating change variables provide estimates of differences in mean premium growth among the groups controlling for the possible influences of the prior level of (log) premiums ($LPREM_{-1}$), the proportion of the insurer's premiums in long-tailed lines ($LONG_{-1}$), and prior premium growth (G_{-1}) (and thus mean reversion). The use of fixed time and firm effects controls for the influence of omitted time influences and omitted time invariant factors that produce differences in premium growth across firms. The estimated coefficients for $LPREM_{-1}$ are negative and significant: small firms (in terms of premium volume) on average grew more slowly than large firms. The estimates for $LONG_{-1}$ are positive and statistically significant in some cases, providing some evidence that large growth was associated with increased writings of long-tailed business. The estimates for G_{-1} are small and not statistically significant.

The estimated coefficients for high-rated firms with upgrades in year t ($HIGH\Uparrow$) in the equations for direct and net premium growth in year t are negative but small in magnitude. The estimated coefficients for $HIGH\Uparrow$ in the G_{t+1} equations are approximately 2 percent, but the robust t-statistics are less than 1.2. Thus, in contrast to the univariate results, there

is no reliably positive relationship between upgrades and direct or net premium growth in years t and t+1 for high-rated firms. The estimated coefficients for HIGH⇑ in the G_{t-1} equations are approximately –2.6 and –1.8 percent in the direct premium growth and net premium growth equations, respectively. Although these estimates might suggest that upgrades followed relatively slow expansion, the coefficients again are not reliably estimated (t-values of –1.63 and –1.01, respectively).

For high-rated firms with downgrades in year t (HIGH⇓), the estimated coefficients are negative in the equations for direct and net premium growth in years t and t+1, ranging from –1.4 percent to –2.6 percent. The robust t-value is less than –2 in the equation for net premium growth in year t. The results thus provide some, albeit weak, evidence that downgrades for high-rated firms were associated with slower premium growth. In contrast, the estimated coefficients for HIGH⇓ in the G_{t-1} equations equal 3.2 and 3.3 percent and are significantly different from zero. Those results suggest that high-rated firms that subsequently were downgraded grew relatively rapidly prior to being downgraded (and perhaps paid a price – a ratings downgrade – for that growth).

The estimated coefficients for low-rated firms with upgrades in year t (LOW⇑) are positive in the equations for direct and net premium growth in years t and t+1. Although the t-values are less than 2, the coefficients are economically significant (ranging from 1.9 percent to 4.5 percent) and statistically significant at the 0.05 level for a one-tailed test in three of four cases. The estimated coefficients for LOW⇑ in the G_{t-1} equations are negative but not reliably different from zero.

The estimated coefficients for LOW⇓ indicate a negative and significant relationship between downgrades of low-rated firms and premium growth in years t and t+1.

Consistent with Table 3 and Figure 3, the magnitudes of the coefficients for LOW⇓ are especially large in the equations for growth in year t+1 (-11.5 percent and -15.8 percent for direct and net premium growth, respectively). Thus, rating downgrades for low-rated firms are reliably associated with material revenue contractions for those firms. There is, however, no evidence that such firms had different growth rates prior to the downgrades. The estimated coefficients for LOW⇓ in the equations for G_{t-1} are near zero with negligible t-values.

The overall results of the comparisons for high-rated and low-rated firms shown in Tables 3 and 4 and Figures 2 and 3 provide strong evidence of lower premium growth for low-rated firms with downgrades. They also provide some evidence, albeit weaker, of lower growth for high-rated firms that experienced downgrades and of higher growth for low-rated firms with upgrades.

Comparisons for Size / Product Mix Classifications

Univariate Comparisons. Table 5 compares median direct premium growth rates for small personal, small commercial, large personal, and large commercial firms that experienced upgrades, downgrades, and no rating change. Table 6 shows comparable results for net premium growth.

The results in Table 5 indicate significantly lower median growth in direct premiums for downgraded insurers than for upgraded insurers for years t and t+1 at the 0.05 significance level or lower for each size / product mix category. Median growth in direct premiums is also significantly lower for downgraded insurers than for insurers with no rating change in either year t or year t+1 at the 0.10 significance level for each size / product mix category. Median direct premium growth is significantly higher for insurers

with upgrades in either year t or year t+1 at the 0.05 level, with the exception of small personal lines insurers, where the higher median growth rates for upgraded insurers in years t and t+1 are not significantly different from those for insurers without a rating change. Median direct premium growth rates in year t-1 are similar for each rating change category and size / product line group. None of the differences in median growth rates among the rating change categories for year t-1 are statistically significant at the 0.10 level.

The median net premium growth rates shown in Table 6 generally have similar implications. One notable difference is that median net premium growth in year t-1 for small insurers and large personal insurers that were downgraded in year t is significantly lower than median net premium growth for insurers with no rating change in year t at the 0.10 significance level or lower, and the difference for large commercial insurers has a p-value of 0.11. Thus, there is some evidence of slower net premium growth prior to downgrades for each category of insurers, which might suggest increased use of reinsurance in the face of deteriorating financial condition.

Regression Results. Fixed effects regression results for the size / product mix classifications are reported in Table 7. The estimated coefficients on the rating upgrade variables generally are not reliably different from zero. An exception is that direct and net premium growth in year t+1 is significantly higher for small commercial insurers that were upgraded in year t compared to insurers that had no rating change. However, the results generally indicate significantly lower premium growth in year t and /or year t+1 for small insurers (but not large insurers) that were downgraded compared to insurers that had no rating change.

Interestingly, direct and net premium growth in year t-1 are significantly (economically and statistically) lower for small commercial insurers that were subsequently upgraded, and they are significantly higher for large commercial insurers that were subsequently downgraded. Given that the sample period represents a soft market in commercial lines, those results could reflect that insurers engaging in relatively large price cuts to attract and keep business (see Harrington and Danzon, 1994) were more likely to be downgraded, while insurers that were maintaining prices at a cost of slower revenue growth were more likely to be upgraded.

5. Conclusions

Consistent with substantial market discipline, our univariate comparisons and fixed effects regression models of premium growth for property-liability insurers surrounding ratings changes by the A.M. Best Company during 1992-1996 generally provide evidence of significantly lower revenue growth for downgraded insurers in the year of and the year following downgrades. The evidence of a negative relationship between premium growth and downgrades is particularly strong for insurers with low ratings (Best's rating less than A-) prior to the downgrade. Our analysis also provides evidence that rating upgrades for low-rated were accompanied by increased premium growth, at least for low-rated firms.

Given theory, prior work, and our focus on rated insurers, the analysis presented in this paper clearly does not imply that insurance guaranty funds and judgment proof or otherwise credit risk insensitive insurance buyers have no effect on insurance market discipline. The results nonetheless suggest that material market discipline exists for many rated insurers, even those with relatively low ratings, despite factors that dull consumer incentives to seek safe insurers and insurer incentives for efficient risk management. The

alternative hypothesis – pervasive moral hazard and excessive risk taking – is inconsistent with our findings. In particular, the moral hazard hypothesis cannot explain (1) why low-rated firms that were downgraded did not grow more rapidly on average than other insurers prior to being downgraded, (2) why upgrades for low-rated insurers were accompanied on average by increased revenue growth, and (3) why rating upgrades for low-rated firms were as frequent as downgrades.

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Figure 1

Number of Best's rating changes for sample insurers by month in 1996

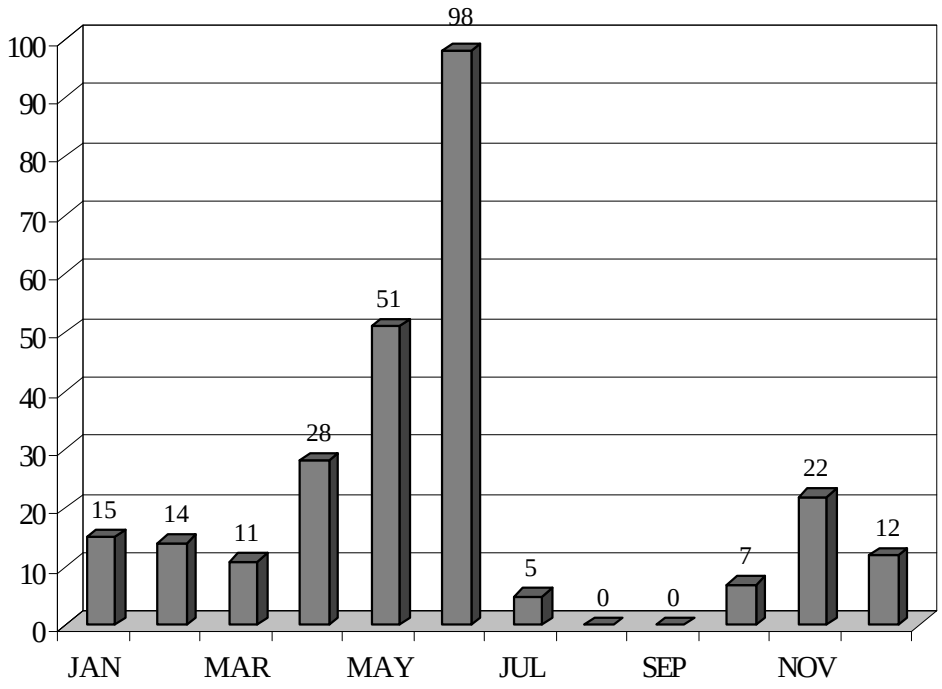

Figure 2
Median direct and net premium growth rates in year t-1, t, and t+1 for high and low-rated insurers with upgrades in year t compared to high and low-rated insurers with no rating change in year t

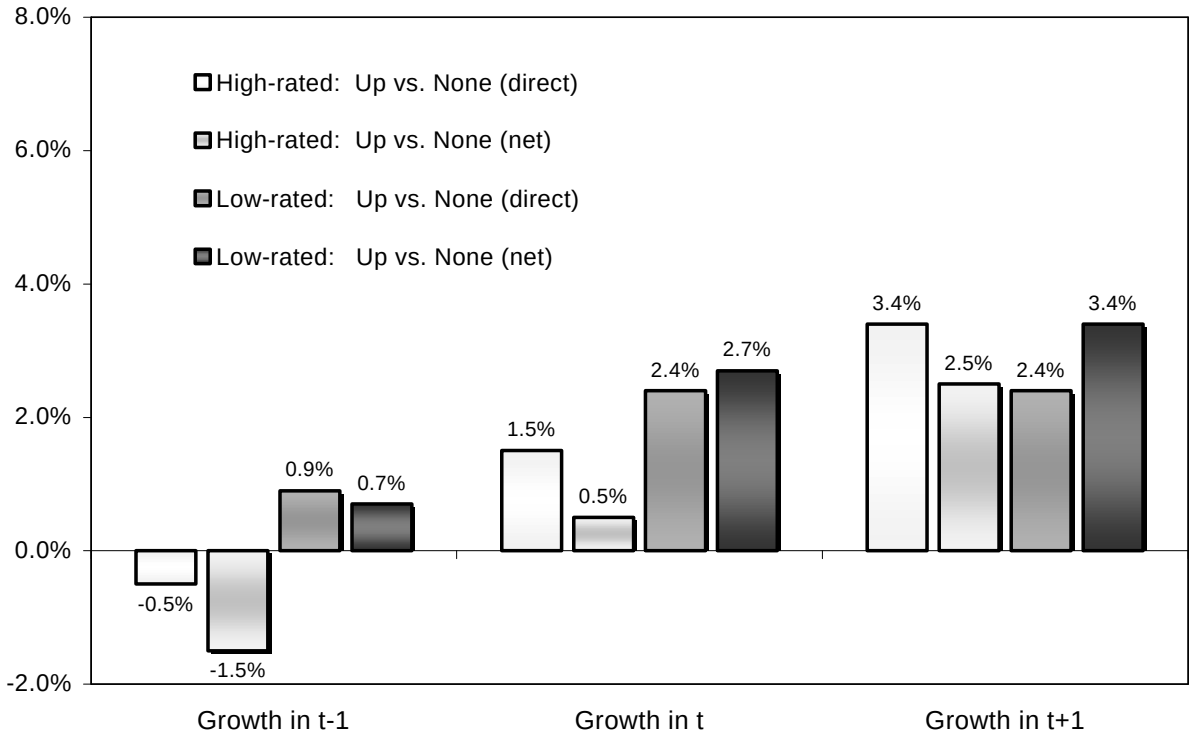

Figure 3
Median direct and net premium growth rates in year t-1, t, and t+1 for high and low-rated insurers with downgrades in year t compared to high and low-rated insurers with no rating change in year t

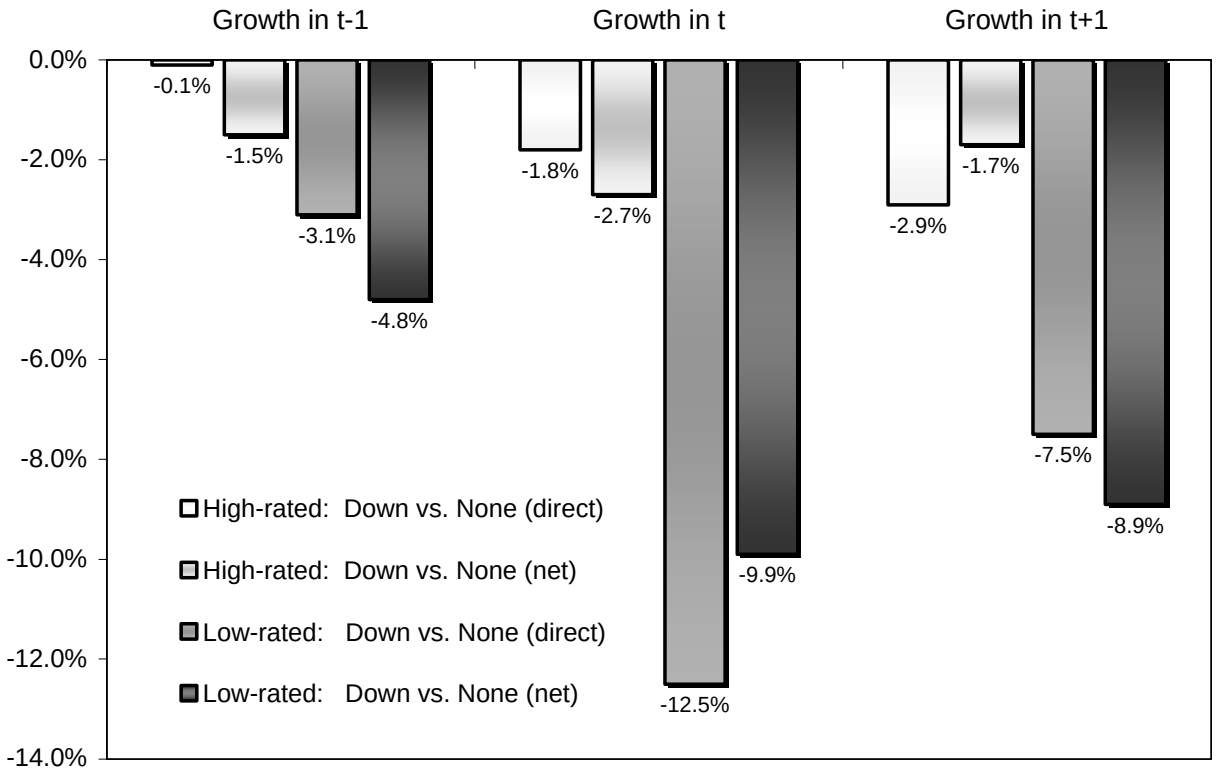

Table 1

Summary of A.M. Best rating changes for all companies with a reported rating change during the period 1992-1996. If an insurer received more than one rating change during August 1st through July 31st, the change is the difference in the rating between the beginning and ending ratings.

Group	Rating	A.M. Best Description	Rating ⇑	Rating ⇓	No Change	Total	%
1	A++, A+	Superior	133	6	1,478	1,617	29.32
2	A, A-	Excellent	221	310	2,287	2,818	51.10
3	B++, B+	Very Good	124	105	487	716	12.98
4	B, B-	Adequate	32	50	194	276	5.01
5	C++, C+	Fair	15	9	11	35	.63
6	C, C-	Marginal	6	10	14	30	.54
7	D, E, F	Vulnerable to Liquidation	0	1	22	23	.42
Total			531	491	4,493	5,515	100

Table 2

Summary of rating changes for high-rated (A- or above), low-rated (B++ or below), small personal, small commercial, large personal, and large commercial lines insurers during 1992-1996. Commercial (personal) lines insurers have more than (less than) 50 percent of their premiums in commercial lines. Large (small) insurers have surplus above (below) $50 million.

	Rating ⇑	Rating ⇓	No Change	Total
High Rating (HR)	354	316	3,765	4,435
Low Rating (LR)	177	175	728	1,080
Small Personal $_{t-1}$ (SP)	129	176	1,107	1,412
Large Personal $_{t-1}$ (LP)	73	55	555	683
Small Commercial $_{t-1}$ (SC)	201	167	1,684	2,052
Large Commercial $_{t-1}$ (LC)	128	93	1,147	1,368

Table 3

Median direct and net (after reinsurance) premium growth rates in year t, t+1, and t-1 for high-rated and low-rated insurers classified by type of rating change each year during 1992-1996. High-rated insurers had rating of A- or above prior to any change in year t; low-rated insurers had rating of B++ or below prior to any change.

			Rating change in year t:			p-value for difference		
	Growth rate in year:	Rating before any change:	Downgrade	None	Upgrade	Downgrade vs. none	Upgrade vs. none	Downgrade vs. upgrade
Direct Premiums	t	High	3.58%	5.41%	6.93%	0.000	0.038	0.000
		Low	-7.74	4.83	7.22	0.000	0.019	0.000
	t+1	High	1.95	4.87	8.33	0.000	0.000	0.000
		Low	-3.50	4.04	6.40	0.000	0.027	0.000
	t-1	High	5.66	5.82	5.28	0.507	0.521	0.538
		Low	1.09	4.24	5.04	0.028	0.607	0.016
Net Premiums	t	High	2.43	5.06	5.60	0.000	0.436	0.000
		Low	-5.25	4.61	7.34	0.000	0.054	0.000
	t+1	High	2.64	4.35	6.80	0.000	0.000	0.000
		Low	-4.70	4.19	7.57	0.000	0.001	0.000
	t-1	High	3.82	5.28	3.78	0.035	0.094	0.897
		Low	-0.34	4.50	5.19	0.009	0.425	0.005

Table 4

Fixed effects estimation results: direct and net premium growth as a function of upgrades (⇑) and downgrades (⇓) for high-rated (A- or higher) and low-rated (B++ or lower) insurers during 1992-1996. G_t is log premium growth in year of rating change (year t), G_{t+1} is log premium growth in year following rating change, and G_{t-1} is log premium growth in year prior to rating change. Coefficients on rating change variables are estimates of differences in growth rates relative to firms with no rating change in year t. Heteroskedasticity consistent t-ratios in parentheses.

	Direct premium growth			Net premium growth		
Variable	G_t	G_{t+1}	G_{t-1}	G_t	G_{t+1}	G_{t-1}
HIGH⇑	-0.006	0.019	-0.026	-0.010	0.022	-0.018
	(-0.46)	(1.17)	(-1.63)	(-0.88)	(1.14)	(-1.01)
HIGH⇓	-0.014	-0.016	0.032	-0.026	-0.024	0.033
	(-1.27)	(-0.92)	(2.95)	(-2.71)	(-1.26)	(2.75)
LOW⇑	0.025	0.036	-0.012	0.019	0.045	-0.013
	(1.86)	(1.78)	(-0.84)	(1.25)	(1.72)	(-0.79)
LOW⇓	-0.065	-0.115	0.008	-0.049	-0.158	0.011
	(-2.51)	(-2.54)	(0.37)	(-1.84)	(-3.02)	(0.48)
HIGH	0.057	0.062	0.052	0.032	0.050	0.102
	(3.08)	(2.31)	(2.79)	(1.79)	(1.58)	(4.14)
$LPREM_{-1}$	-0.397	-0.455	-0.578	-0.309	-0.522	-0.690
	(-8.53)	(-7.70)	(-13.79)	(-12.72)	(-10.08)	(-16.51)
$LONG_{-1}$	0.083	0.210	0.180	0.066	0.261	0.183
	(1.02)	(2.66)	(1.84)	(1.00)	(2.76)	(1.56)
G_{-1}	-0.039	-0.028	0.086	-0.033	0.010	0.089
	(-0.75)	(-0.35)	(1.18)	(-1.01)	(0.12)	(1.41)

Table 5

Median direct premium growth rates in year t, t+1, and t-1 for small and large commercial and personal lines insurers classified by type of rating change each year during 1992-1996. Small (large) insurers had surplus below (above) $50 million in year t. Commercial (personal) lines insurers had more than (less than) than 50 percent of premiums in commercial lines.

Growth rate in year:	Category	Rating change in year t			p-value for difference		
		Downgrade	None	Upgrade	Downgrade vs. none	Upgrade vs. none	Downgrade vs. upgrade
t	Small personal	1.80%	6.20%	6.92%	0.000	0.227	0.007
	Large personal	5.48	5.95	8.70	0.672	0.004	0.003
	Small commercial	1.94	5.53	6.70	0.000	0.497	0.002
	Large commercial	1.69	3.53	5.87	0.161	0.092	0.024
t+1	Small personal	0.89	5.70	7.31	0.000	0.515	0.001
	Large personal	2.73	5.45	7.75	0.007	0.106	0.001
	Small commercial	1.53	4.70	8.76	0.003	0.006	0.000
	Large commercial	0.69	2.93	6.29	0.070	0.005	0.001
t-1	Small personal	5.28	6.14	4.70	0.198	0.403	0.596
	Large personal	5.45	6.48	7.41	0.204	0.384	0.110
	Small commercial	4.08	6.04	4.92	0.170	0.267	0.917
	Large commercial	3.79	4.16	3.73	0.590	0.896	0.845

Table 6

Median net premium growth rates in year t, t+1, and t-1 for small and large commercial and personal lines insurers classified by type of rating change each year during 1992-1996. Small (large) insurers had surplus below (above) $50 million in year t. Commercial (personal) lines insurers had more than (less than) than 50 percent of premiums in commercial lines.

Growth rate in year:	Category	Rating change in year t			p-value for difference		
		Downgrade	None	Upgrade	Downgrade vs. none	Upgrade vs. none	Downgrade vs. upgrade
t	Small personal	1.81%	6.18%	6.19%	0.000	0.926	0.003
	Large personal	3.39	4.92	8.76	0.204	0.004	0.008
	Small commercial	1.97	5.04	6.89	0.009	0.260	0.001
	Large commercial	1.12	3.52	4.67	0.161	0.260	0.087
t+1	Small personal	2.19	5.37	6.71	0.000	0.113	0.000
	Large personal	1.40	4.92	7.49	0.003	0.018	0.000
	Small commercial	1.64	3.55	8.67	0.029	0.001	0.000
	Large commercial	2.74	3.03	5.47	0.914	0.015	0.001
t-1	Small personal	3.79	6.00	5.10	0.077	0.306	0.692
	Large personal	3.82	5.63	6.88	0.016	0.534	0.021
	Small commercial	2.95	5.30	5.10	0.090	0.715	0.174
	Large commercial	2.87	4.00	2.81	0.110	0.268	0.534

Table 7

Fixed effects estimation results: direct and net premium growth as a function of upgrades (⇑) and downgrades (⇓) for small personal lines (SP), small commercial lines (SC), large personal lines (LP), and large commercial lines (LC) insurers during 1992-1996. G_t is log premium growth in year of rating change (year t), G_{t+1} is log premium growth in year following rating change, and G_{t-1} is log premium growth in year prior to rating change. Coefficients on rating change variables are estimates of differences in growth rates relative to firms with no rating change in year t. Heteroskedasticity consistent t-ratios in parentheses.

	Direct premium growth			Net premium growth		
Variable	G_t	G_{t+1}	G_{t-1}	G_t	G_{t+1}	G_{t-1}
SP⇑	0.017	-0.011	0.003	0.012	-0.015	0.002
	(0.92)	(-0.45)	(0.19)	(0.69)	(-0.52)	(0.14)
SP⇓	-0.041	-0.079	0.029	-0.035	-0.055	0.007
	(-2.66)	(-2.62)	(2.01)	(-2.32)	(-1.65)	(0.42)
LP⇑	-0.003	-0.002	0.013	0.022	0.013	0.010
	(-0.19)	(-0.09)	(0.49)	(0.98)	(0.40)	(0.35)
LP⇓	0.022	0.003	0.015	-0.017	0.009	0.002
	(1.27)	(0.21)	(1.044)	(-0.97)	(0.39)	(0.12)
SC⇑	-0.011	0.045	-0.072	-0.025	0.044	-0.090
	(-0.65)	(2.08)	(-3.51)	(-1.57)	(1.82)	(-3.77)
SC⇓	-0.045	-0.023	0.005	-0.043	-0.062	0.019
	(-2.12)	(-0.72)	(0.24)	(-2.34)	(-1.82)	(0.96)
LC⇑	0.004	0.024	-0.016	0.007	0.054	-0.004
	(0.24)	(0.94)	(-0.77)	(0.43)	(1.65)	(-0.15)
LC⇓	0.006	-0.022	0.070	-0.013	-0.067	0.091
	(0.29)	(-0.61)	(2.86)	(-0.63)	(-1.46)	(3.32)
$LPREM_{-1}$	-0.395	-0.447	-0.576	-0.308	-0.512	-0.685
	(-8.49)	(-7.53)	(-13.78)	(-12.89)	(-9.80)	(-16.49)
$LONG_{-1}$	0.082	0.209	0.177	0.067	0.266	0.175
	(1.01)	(2.63)	(1.80)	(1.01)	(2.77)	(1.48)
G_{-1}	-0.037	-0.031	0.083	-0.033	0.009	0.084
	(-0.72)	(-0.39)	(1.14)	(-1.00)	(0.11)	(1.34)