

APRA'S EXPERT JUDGMENT RATINGS AND SOLVENCY COVER OF AUSTRALIAN GENERAL INSURERS

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ABSTRACT

The Australian Prudential Regulation Authority's (APRA's) supervisors use expert judgment to rate the risk of failure of general insurers (GIs). Using statistical data, we model the determinants of GI ratings and solvency cover and find: (1) sufficient predictive power in statistical data to identify GIs for earlier review and assist in quality assurance of APRA's ratings and (2) that profitability, solvency cover, investment, and underwriting risk play different roles in rating foreign branch and Australian-incorporated GIs. We conclude that supervisors generally correctly incorporate our *a priori* expectations of the effects of risk indicators on GI risk into their ratings.

INTRODUCTION

There is an extensive literature relating to the development and testing of failure prediction models and early warning models of financial distress for property-liability insurers (see Chen and Wong, 2004, Table 1 for a listing of U.S. studies and Sharpe and Stadnik's 2007 study of Australian general insurers). Several studies have also examined the ability of statistical solvency screening systems to identify property-liability insurers with higher risk of failure. For example, Cummins, Harrington, and Klein (1995), Grace, Harrington, and Klein (1998), and Cummins, Grace, and Phillips (1999) have studied the Financial Analysis Tracking System (FAST) used by the National Association of Insurance Commissioners (NAIC) in the United States.

Whereas FAST is statistically based, the Australian Prudential Regulation Authority (APRA) has developed a structured framework for expert judgment in determining

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an institution's overall risk of failure (APRA, 2003). Black (2004) provides an overview of the formation of APRA in 1998 and its move toward a risk-based approach. The failure and subsequent appointment of provisional liquidators on March 15, 2001 to HIH, a large general insurer, led to concerns of the adequacy of APRA's approach to prudential regulation and supervision and to the appointment of a Royal Commission to investigate the collapse of HIH. The Commission was critical of APRA, reporting that "the manner in which APRA exercised its powers and discharged its responsibilities under the Insurance Act fell short of that which the community was entitled to expect from the prudential regulator of the insurance industry" (HIH Royal Commission, 2003). In April 2001, APRA's board concluded that it should have had a mechanism for identifying institutions at risk, and that it should require more explicit and timely information about those institutions (Black, 2004, p. 33).

Drawing on Canadian and UK approaches, APRA developed a risk-based approach within the Probability and Impact Rating System (PAIRS) and Supervisory Oversight and Response System (SOARS).¹ PAIRS is a process for determining the likelihood of failure, denoted "Probability" rating, and the potential consequences of failure, denoted "Impact" rating. Although numerically scored, the approach relies on largely qualitative assessments provided by supervisory staff. For the "Probability" ratings, the three categories of ratings drivers are Inherent Risk,² Management and Control Risk,³ and Capital Support Risk.⁴

Supervisors use expert judgment to convert information from APRA's financial institution (FI) statistical collections and qualitative assessments of an FI's performance gained from on-site reviews, into quantitative measures of inherent risks, management and control risks, and capital support risks. Institutions are assigned scores between 0 and 4 for each risk, with 4 representing the riskiest outcome. The components are combined to give an overall rating of risk of failure (*ROF*), an assessment of the likelihood that unexpected losses could exceed an entity's capital support resources. The *ROF* rating is raised to the fourth power to derive the Probability Index, a quantitative measure of the approximate relative likelihood that an institution could fail. This nonlinear relationship between the *ROF* rating and the Probability Index approximates the relationship between the ratings of major international debt rating agencies and their relative default expectations, based on long-term average defaults.

¹ SOARS combines the PAIRS probability and impact ratings to determine the supervisory stance that APRA will adopt in relation to each institution: Normal, Oversight, Mandated Improvement, or Restructure.

² Inherent risk is uncertainty relating to the business operations of an institution that has the potential to affect its financial position. Eight categories of inherent risk are identified: Counterparty Default Risk, Balance Sheet and Market Risk, Insurance Risk, Liquidity Risk, Operational Risk, Legal and Regulatory Risk, Strategic Risk, and Contagion and Related Party Risk.

³ Management and control risk refers to the process by which an institution identifies, measures, monitors, and controls its inherent risks. Seven elements are identified: Board of Directors, Senior Management, Operational Management, Management Information Systems/Financial Control, Risk Management, Compliance, and Independent Review.

⁴ Capital support risk reflects an institution's current capital coverage, as well as its earnings prospects and its ability to raise additional capital, particularly in an adverse environment. It has three elements: Current Capital Coverage, Earnings, and Access to Additional Capital.

As PAIRS ratings are not publicly disclosed, and experience with the system is limited, there has been no prior econometric analysis of the ratings. We address this gap in the literature by undertaking an econometric analysis of the PAIRS ratings of general insurers (GIs) operating in Australia.⁵ We seek answers to three questions. First, can supervisors' ROF ratings be reliably predicted from available statistical data? Being able to predict ratings would allow APRA to identify deteriorating entities in a timely manner and develop statistically based quality assurance programs for the ratings. Second, can we identify indicators of GI risk that are significantly associated with supervisors' ratings, and do those indicators accord with our *a priori* beliefs of the factors likely to be associated with financially deteriorating or distressed GIs? Third, are GI ratings consistent across the two responsible divisions within APRA, the Diversified Institutions Division (DID) and the Specialized Institutions Division (SID). DID is responsible for financial conglomerates (including all foreign branch insurers) whereas SID supervises smaller and specialized entities.⁶

In the section "Risk of Failure," we relate ROF ratings to risk indicators from APRA's GI statistical returns data available to supervisors at the time of the rating and examine the consistency of ratings across divisions. The analysis is undertaken for foreign branch GIs and nonbranch (Australian-incorporated) GIs.⁷ We also examine the variability of ROF ratings in a sample of reratings, while focusing on the relationship between the prior and current rating.

Although the results in that section enhance our understanding of the risk indicators associated with the variability of ratings, a key issue in assessing PAIRS is their appropriateness. A difficulty, however, relates to the criteria for evaluating the ratings. A rating scheme should be able to identify deteriorating or distressed entities with higher risk of failure so that prompt, cost-effective, remedial action can be implemented. During our sample, APRA's Capital Adequacy Prudential Standard GPS110 required GIs to have eligible (tier 1 and tier 2) capital in excess of the minimum capital requirement (MCR).⁸ Although a breach of the Standard would be indicative of a financially deteriorating or distressed GI, there were few breaches of the Standard within our sample. Hence, we adopt an alternative criterion of "low" solvency cover, that is, where the ratio of eligible capital to MCR is less than 1.2. Then, in the section "Risk of Failure and Solvency Cover," we examine the relationship between the risk indicators and low solvency cover. Our concern is whether the risk indicators associated with variability of the ROF ratings correspond to the significant factors in a model explaining low solvency cover.

⁵ In Australia, property-liability insurers are referred to as general insurers.

⁶ Whereas DID activities are centralized in Sydney, SID activities are undertaken in three regions: Central (Sydney), North (Brisbane), and Southwest (Melbourne, Adelaide, and Perth).

⁷ The main distinction lies in the GI's capital. For Australian-incorporated GIs the relevant capital is on the books of the Australian operations whereas for foreign branches the parent's capital is relevant.

⁸ MCR has three main components: (1) the Insurance Risk capital charge for the risk that the true value of net insurance liabilities is greater than that recorded in the balance sheet, (2) the Investment Risk capital charge for the risk of adverse movements in the value of the GI's assets and OBS exposures, and (3) the Concentration Risk capital charge for the risk of loss from a single catastrophic event.

Our modeling has several practical applications for prudential supervision. These are considered in the concluding section of the article and include using the predictions of *ROF* ratings to assist in quality assurance of the PAIRS risk ratings, and in identifying GIs that may require supervisory attention between scheduled supervisory reviews.

Our answers to the three research questions are conditional on the available data. As PAIRS was introduced in late 2002, our study is limited to a period of robust economic growth when GIs were generally not stressed, and may not reflect behavior in more stressful periods. Moreover, there is a problem in extending the analysis of low GI solvency cover to the pre-2003 period because late in 2002, APRA changed the basis of its GI statistical returns and altered the solvency requirements. A longer time period for analysis than the 2003 to 2005 time period could identify a different set of risk indicators associated with *ROF* ratings and low solvency.

Although the data problems may be resolved with the passage of time, a more difficult problem relates to the criteria that should be adopted to evaluate the ratings. As noted above, we use the criterion of “low” solvency cover. Other criteria may produce different results.

RISK OF FAILURE

Modeling PAIRS Ratings

We draw on Sharpe and Stadnik’s (2007) model of financial distress in Australian GIs to model GI *ROF* ratings. The ratings typically incorporate assessments of statistical data with a two-quarter lag including time for: (1) GIs to submit statistical returns, (2) APRA’s Statistics Unit to check the data, (3) supervisors to prepare the rating, and (4) managers to review and approve the rating. Hence we relate the *ROF* rating approved in quarter t to risk indicators in quarter $t-2$ including GI profitability, cession ratio, scale, premium growth, solvency cover, and investment and underwriting risk.

Profitability is proxied by either the after-tax return on equity, *ROE*, or on assets, *ROA*. However, the relationship to *ROF* ratings is uncertain. High profitability may signal greater underwriting or investment risk and an unfavorable (higher) rating (Borde, Chambliss, and Madura, 1994). On the other hand, high profitability may signal a more efficient management, lower risk, and a favorable (lower) rating (BarNiv and McDonald, 1992).⁹ As GIs may transfer risk through reinsurance, we include the cession ratio, *CESSION*, defined as the ratio of outwards reinsurance expense to premium revenue. However, its relationship to *ROF* ratings is uncertain. Although the risk transfer view suggests that reinsurance reduces a GI’s risk (and rating), reinsurance may also increase a GI’s dependence on the reinsurer’s financial health that in some circumstances may increase risk and lead to an unfavorable rating (Kim et al., 1995; Pottier and Sommer, 1999). Larger scale may provide diversification benefits for GIs as claim costs tend to be less volatile. Moreover, higher franchise values provide greater incentives to limit risk (Cummins, Grace, and Phillips, 1999; Sommer, 1996). Hence, we expect large GIs to have favorable ratings. GI scale is proxied by the logarithm of either net assets, $\ln(\text{NET ASSETS})$; total assets, $\ln(\text{TOTAL ASSETS})$; or gross premiums, $\ln(\text{PREMIUMS})$.

⁹ We also used the underwriting loss and expense ratios, but the results were inferior to the profitability proxies.

As rapid GI growth may lead to a reduction in underwriting standards and higher risk (Borde, Chambliss, and Madura, 1994), we expect rapid growth of gross premiums, *PREMIUM GROWTH*,¹⁰ to be associated with unfavorable ratings. Moreover, as capital absorbs unexpected earnings shocks, we include the GI's solvency coverage, *SOLVENCY COVER*, defined as the ratio of the capital base¹¹ to the minimum capital requirement, MCR. We expect high solvency cover to be associated with low *ROF* ratings.

To account for investment risk we include the amounts held in each of the primary asset categories relative to total assets, denoted *EQUITY*, *PROPERTY*, *SECURITIES*, *REINSURANCE ASSETS*, *LIQUID ASSETS*, and *OTHER ASSETS*.¹² With *LIQUID ASSETS* excluded to avoid singularity, the coefficients on the included assets indicate the effect on the *ROF* rating of increasing the proportion of total assets invested in that category matched by an equal reduction in the proportion of total assets held in liquid assets. Relative to liquid assets, investments in property are generally more illiquid and higher risk.¹³ Moreover, Harrington and Nelson (1986) use the equity ratio as a measure of asset risk, noting that equities have greater price volatility. Consequently, we expect large holdings of property and equity to be associated with unfavorable (higher) ratings.

We incorporate insurance product risk by including the proportion of total domestic and international premiums written in six lines: (1) short-tail motor vehicle premiums, *MOTOR VEHICLE*; (2) long-tailed premiums, *LONG-TAIL*, including compulsory third-party motor vehicle insurance, professional indemnity, public and product liability, and employers' liability; (3) consumer credit premiums, *CONSUMER CREDIT*; (4) fire and industrial special risk premiums and householders premiums, *FIRE & HOUSEHOLD*; (5) reinsurance premiums, *REINSURANCE*, including property, casualty, marine and aviation, and other reinsurance; and (6) other miscellaneous premiums, *OTHER PREMIUM*, including travel and accident. With *FIRE & HOUSEHOLD* excluded to avoid singularity, the coefficients on the premium revenue shares indicate the effect on *ROF* ratings of increasing the proportion of premiums written in that business line matched by an equal reduction in fire and household premiums. Relative to *FIRE & HOUSEHOLD* lines, long-tail lines involve a long period between the claim event and claim payments and greater uncertainty of future cash flows (Sommer, 1996). Hence, we expect long-tail lines to be associated with higher risk and higher *ROF* ratings. Finally, we include a time trend, *TIME TREND*.

¹⁰ Because of data limitations, we use the one-quarter growth rate.

¹¹ For locally incorporated insurers the capital base is the sum of tier 1 capital (net of deductions) and tier 2 capital. For foreign branch GIs the capital base is net assets in Australia.

¹² Equity includes listed and unlisted shares and trusts (excluding cash and property trusts). Property includes land and buildings and listed and unlisted property trusts whereas securities include short- and long-term debt securities and listed and unlisted fixed interest trusts. Reinsurance assets include amounts recoverable under reinsurance contracts and deferred reinsurance expense. Liquid assets include cash and liquid assets (including cash management trusts). The remaining assets, including loans, are incorporated in *OTHER ASSETS*.

¹³ If high liquidity encourages reckless investment, it may increase risk (Borde, Chambliss, and Madura, 1994).

Data

Foreign branch GIs differ from nonbranch (Australian-incorporated) GIs in a number of ways that influence their risk and prudential supervision. For example, capital of branches is defined as net assets (Australian assets less Australian liabilities). There are also governance issues as management of branches report to senior management in overseas offices rather than to an Australian Board. Moreover, a branch may appear to be small relative to other GIs, but may derive support from the sizable assets of its parent. Hence, we treat branches separately from nonbranches in the empirical analysis.

For the dependent variable, 254 GI ratings approved between January 2003 and September 2005 were obtained from PAIRS whereas data for the risk indicators were drawn from APRA's quarterly GI statistical returns. To ensure a homogeneous sample, we remove ratings of specialist (often captive) mortgage insurers and insurers in runoff. Also removed were four ratings in the initial year of the PAIRS system that involved scoring errors. The remaining sample includes 148 ratings of 55 nonbranch GIs and 67 ratings of 29 branch GIs.

Summary statistics for the nonbranch and branch samples are presented in Table 1. The far right-hand columns report tests of equality of the sample means and medians. The mean and median ROF rating sit in the low-medium risk category and neither is significantly different across the samples. Nor are the means and medians of the three rating components, *INHERENT ROF*, *MANAGERIAL ROF*, and *CAPITAL ROF*, significantly different across the samples at the 95 percent confidence level. There are, however, significant differences in the mean solvency cover, and in the mean and median values of GI scale, asset composition, and composition of premium lines. Nonbranches have lower solvency cover, are more likely to have "low" solvency cover, have larger scale, hold more assets as equity, property, and other assets and less as liquid assets and securities, and write more premiums in motor vehicle and long-tail lines and less in reinsurance and other premium lines.

Table 2, which reports correlations between the rating components, reveals that nonbranch correlations are higher than those of branches and that correlations involving *CAPITAL ROF* are lower than those involving *INHERENT ROF* and *MANAGERIAL ROF*. Moreover, for nonbranches, the correlations between *INHERENT ROF* and both *MANAGERIAL ROF* and *CAPITAL ROF* are very high (0.82 and 0.79). Although, *a priori* we expect the rating components to be positively correlated, with a poor financial position associated with poor management and control and low capital support, the high correlations suggest that: (1) supervisors may not clearly distinguish the risk components, or (2) they may form an overall judgment of risk and apply similar scores to components; and/or (3) there may be little useful information in the risk component distinction for regulatory purposes.

Regression Results for Nonbranches

Table 3 reports ordinary least squares (OLS) regression results for nonbranches. In Regressions (Regs) 1 to 5 the dependent variable is ROF, but because the functional form of the relationship is uncertain, in Reg 6 we use the probability index, ROF^4 , as the dependent variable. The model has good explanatory power (Reg 1 has an

TABLE 1
Summary Statistics of Australian General Insurers

Variables	Nonbranches					Branches					Equality Tests			
	Obs.	Mean	Std Dev	Med	Min	Max	Obs.	Mean	Std Dev	Med	Min	Max	Mean	Med
ROF	148	1.27	0.38	1.25	0.54	2.53	67	1.30	0.28	1.29	0.70	2.56	-0.59	1.04
INHERENT ROF	148	1.35	0.39	1.35	0.57	2.76	67	1.35	0.32	1.26	0.60	2.60	-0.02	2.96*
MANAGERIAL ROF	148	1.22	0.37	1.23	0.54	2.26	67	1.32	0.25	1.35	0.49	2.00	-1.82*	2.59
CAPITAL ROF	148	1.10	0.49	1.00	0.25	2.84	67	1.12	0.38	1.06	0.50	2.86	-0.31	0.00
SOLVENCY COVER ^b	148	2.10	1.05	2.00	0.19	7.13	67	2.77	1.67	2.15	1.08	8.56	-3.55***	0.53
LOW SOLVENCY COVER	148	0.11	0.31	0.00	0.00	1.00	67	0.01	0.12	0.00	0.00	1.00	2.36**	-
100 × ROF ^b	148	5.10	9.51	4.80	-37.91	33.88	67	3.29	10.25	4.24	-37.91	33.88	1.26	0.70
100 × ROA ^b	148	1.44	2.67	1.41	-12.79	12.57	67	0.79	3.32	1.28	-12.27	13.37	1.54	0.30
CESSION ^e	148	0.23	0.29	0.13	0.00	1.00	67	0.27	0.26	0.20	0.00	1.00	-0.74	1.50
NET ASSETS (\$m)	148	406.87	682.70	82.20	1.63	3,600.81	67	85.74	130.23	34.30	6.09	528.76	3.81***	5.34***
LN(NET ASSETS)	148	18.34	1.93	18.22	14.30	22.00	67	17.43	1.27	17.35	15.62	20.09	3.52***	5.34***
TOTAL ASSETS (\$m)	148	1,522.3	2,187.4	370.0	2.08	10,088.6	67	332.5	537.7	88.4	6.4	2,289.4	4.39***	16.62***
LN(TOTAL ASSETS)	148	19.78	1.95	19.73	14.55	23.03	67	18.49	1.53	18.30	15.67	21.55	4.77***	16.62***
PREMIUMS (\$m)	148	157.91	208.21	53.30	-1.20	740.54	67	29.43	58.61	6.88	-15.56	304.95	4.96***	21.77***
LN(PREMIUMS)	146	17.40	2.37	17.82	6.91	20.42	66	15.79	1.88	15.75	10.82	19.54	4.88***	23.96***
PREMIUM GROWTH ^a	148	-0.37	4.23	-0.02	-10.42	10.47	67	-0.04	5.75	-0.14	-10.42	10.47	-0.47	0.00
EQUITY	148	0.09	0.12	0.06	0.00	0.61	67	0.01	0.04	0.00	0.00	0.20	5.58***	41.39***
PROPERTY	148	0.02	0.05	0.09	0.00	0.48	67	0.00	0.02	0.00	0.00	0.09	1.92*	48.11***
LIQUIDS	148	0.07	0.11	0.03	0.00	0.66	67	0.13	0.21	0.04	0.00	0.93	-3.17***	0.40
SECURITIES	148	0.41	0.20	0.41	0.00	0.96	67	0.56	0.28	0.66	0.00	0.92	-4.65***	7.27***
REINSURANCE ASSETS	148	0.14	0.19	0.09	0.00	0.96	67	0.12	0.14	0.09	0.00	0.52	0.83	0.00
OTHER ASSETS	148	0.27	0.15	0.27	0.01	0.86	67	0.16	0.10	0.14	0.02	0.41	5.51***	24.61***

(continued)

TABLE 1
(Continued)

Variables	Nonbranches					Branches					Equality Tests			
	Obs.	Mean	Std Dev	Med	Min	Max	Obs.	Mean	Std Dev	Med	Min	Max	Mean	Med
FIRE & HOUSEHOLD ^b	148	0.21	0.19	0.21	0.00	0.94	67	0.19	0.31	0.00	-0.02	1.00	0.59	14.31***
MOTOR VEHICLE ^b	148	0.24	0.25	0.19	0.00	1.00	67	0.07	0.16	0.00	0.00	1.00	5.01***	27.62***
LONG-TAIL ^b	148	0.29	0.32	0.20	0.00	1.00	67	0.09	0.18	0.00	-0.05	0.77	4.87***	30.80***
CONSUMER CREDIT ^c	148	0.04	0.17	0.00	-0.04	1.00	67	0.02	0.06	0.00	0.00	0.25	1.22	-
REINSURANCE PREMIUM ^b	148	0.08	0.24	0.00	-0.01	1.00	67	0.35	0.47	0.00	-0.01	1.00	-5.60***	-
OTHER PREMIUM ^b	148	0.14	0.22	0.05	0.00	1.00	67	0.29	0.38	0.08	-0.05	1.00	-3.51***	0.86
DID	148	0.69	0.46	1.00	0.00	1.00	67	1.00	0.00	1.00	1.00	1.00	-5.47***	-

Notes: The test of equal sample means is a *t* test whereas the test of equal sample medians is a continuity-corrected Pearson chi-squared test with one degree of freedom. ^a denotes truncation of the series at the 5th and 95th percentiles; ^b at the 1st and 99th percentiles; and ^c at the 99th percentile. ^d denotes truncation of the series at 0 and the 99th percentile and ^e denotes the series is truncated at 0 and 1. ***, **, * denote significance at the 99%, 95%, and 90% confidence levels, respectively.

TABLE 2
Correlations of Risk of Failure and Its Components

Panel A Nonbranches (N = 148 ratings)				
	ROF	INHERENT ROF	MANAGERIAL ROF	CAPITAL ROF
ROF	1.0000	0.9588	0.8809	0.8798
INHERENT ROF	0.9588	1.0000	0.8210	0.7851
MANAGERIAL ROF	0.8809	0.8210	1.0000	0.6302
CAPITAL ROF	0.8798	0.7851	0.6302	1.0000

Panel B Branches (N = 67 ratings)				
	ROF	INHERENT ROF	MANAGERIAL ROF	CAPITAL ROF
ROF	1.0000	0.9262	0.8645	0.7922
INHERENT ROF	0.9262	1.0000	0.7379	0.5811
MANAGERIAL ROF	0.8645	0.7379	1.0000	0.5720
CAPITAL ROF	0.7922	0.5811	0.5720	1.0000

adjusted R^2 of 0.43) whereas the signs of the regression coefficients are generally consistent with our *a priori* expectations (though not all are significant).

Profitability is proxied in Reg 1 by *ROE* and in Reg 2 by *ROA*. In Reg 1 we find that unfavorable (high) nonbranch *ROF* ratings are significantly associated with high cession ratios, small GI scale, and low solvency cover. The negative scale effect is consistent with risk diversification benefits of increasing scale whereas the negative solvency cover effect is consistent with capital reducing the risk of failure by providing a buffer against unexpected earnings shocks. Although the positive cession ratio relationship is inconsistent with the traditional view of reinsurance as a risk-shifting mechanism, it is consistent with an alternative view that reinsurance may increase a GI's dependence on the reinsurer's financial health and increase its risk (Kim et al., 1995; Pottier and Sommer, 1999).¹⁴ Nonbranch ratings are also significantly associated with underwriting risk. Relative to fire and household insurance, greater dependence on motor vehicle, long-tail, reinsurance, and/or other premium lines are associated with unfavorable ratings. Moreover, the size of the premium line coefficients suggests long-tail lines are associated with higher *ROF* ratings than other lines.

In contrast to underwriting risk, nonbranch investment risk (asset composition) is generally not significantly associated with *ROF* ratings.¹⁵ An exception is reinsurance

¹⁴ Alternatively, high-risk GIs may utilize reinsurance more intensively than low-risk GIs.

¹⁵ Our model assumes that investment and underwriting risk are independent. For a GI with relatively large long-tail exposures, a large portfolio of growth assets (equities and/or property) could be lower risk than a portfolio with small holdings of growth assets. In results that, for space reasons, are not reported, we included $(LONGTAIL) * (LIQUIDS + SECURITIES)$, but it did not improve the results.

TABLE 3
Nonbranch GI Risk of Failure Regressions

Independent Variables	Dependent Variable					
	ROF Reg 1	ROF Reg 2	ROF Reg 3	ROF Reg 4	ROF Reg 5	ROF ^d Reg 6
Constant	2.3339*** (6.66)	2.3380*** (6.68)	2.4419*** (6.72)	2.1208*** (6.29)	1.5936*** (4.70)	19.8868*** (3.37)
ROE	-0.1136 (-0.40)		-0.1047 (-0.37)	0.1541 (0.49)	0.0295 (0.11)	6.6425 (1.38)
ROA		-0.5995 (-0.56)				
CESSION	0.3152** (2.35)	0.3124** (2.34)	0.3030** (2.27)	0.2478 (1.64)	0.1441 (1.17)	6.7389*** (2.98)
LN(NET ASSETS)	-0.0681*** (-4.18)	-0.0685*** (-4.21)			-0.0099 (-0.56)	-1.1333*** (-4.13)
LN(TOTAL ASSETS)			-0.0689*** (-4.26)			
LN(PREMIUMS)				-0.0534*** (-3.68)		
PREMIUM GROWTH	-0.0069 (-1.09)	-0.0067 (-1.05)	-0.0065 (-1.03)	-0.0035 (-0.54)	-0.0002 (-0.03)	-0.1643 (-1.54)
SOLVENCY COVER	-0.0564** (-2.12)	-0.0555** (-2.09)	-0.0744*** (-2.83)	-0.0707*** (-2.64)	-0.0707*** (-2.96)	-1.3729*** (-3.07)
TIME TREND	-0.0067 (-0.82)	-0.0067 (-0.84)	-0.0067 (-0.83)	-0.0074 (-0.90)	-0.0152** (-2.05)	-0.1545 (-1.13)
EQUITY	-0.4760 (-1.41)	-0.4518 (-1.32)	-0.4020 (-1.17)	-0.5909* (-1.69)	-0.8990*** (-2.88)	0.1116 (0.02)
PROPERTY	0.3195 (0.49)	0.2695 (0.40)	0.1201 (0.19)	-0.0129 (-0.02)	-0.5927 (-0.99)	5.3574 (0.49)
SECURITIES	-0.1489 (-0.58)	-0.1506 (-0.59)	-0.1122 (-0.44)	-0.2198 (-0.85)	-0.3085 (-1.34)	-2.6857 (-0.63)
REINSURANCE ASSETS	-0.9183*** (-2.84)	-0.9148*** (-2.83)	-0.7034** (-2.09)	-0.6639* (-1.78)	-0.7413** (-2.54)	-15.5794*** (-2.85)
OTHER ASSETS	-0.0314 (-0.09)	-0.0269 (-0.08)	0.0038 (0.01)	-0.0646 (-0.18)	-0.4656 (-1.47)	4.9192 (0.85)
MOTOR VEHICLE	0.5063** (2.46)	0.5055** (2.47)	0.5170** (2.53)	0.5148** (2.45)	0.4944*** (2.68)	9.9786*** (2.88)
LONG-TAIL	0.9180*** (5.72)	0.9194*** (5.74)	0.9040*** (5.65)	0.7911*** (4.67)	0.6128*** (4.00)	14.5065*** (5.36)
OTHER PREMIUM	0.7106*** (3.96)	0.7153*** (3.98)	0.6516*** (3.58)	0.6409*** (3.42)	0.6067*** (3.75)	11.2408*** (3.71)
CONSUMER CREDIT	0.0191 (0.09)	0.0322 (0.15)	-0.0099 (-0.05)	-0.0040 (-0.02)	-0.0056 (-0.03)	5.3138 (1.49)
REINSURANCE	0.4204** (2.61)	0.4273*** (2.64)	0.4031** (2.51)	0.3296** (2.02)	0.3101** (2.13)	8.1008*** (2.98)
DID					-0.4006*** (-5.76)	
Summary stats						
Number of observations	148	148	148	148	148	148
Adjusted R ²	0.4300	0.4307	0.4327	0.4002	0.5425	0.3966

Notes: OLS regression results with ROF or ROF^d as dependent variable. Independent variables are lagged two quarters. The *t*-statistics are shown in parentheses. ***, **, * denote significance at the 99%, 95%, and 90% confidence levels, respectively.

assets, where large holdings of reinsurance assets are associated with favorable ratings. There is also little evidence of significant relationships between nonbranch ratings and profitability and/or premium growth. Although the coefficients of the profitability measures in Regs 1 and 2 have negative signs, consistent with high profitability signaling more efficient management and lower risk, in each case the

coefficient is insignificant. As our sample is characterized by relatively healthy GI profitability in a period of robust economic growth, there may have been little basis for supervisors to differentiate GI ROF ratings based on recorded profits.

In Regs 3 and 4 we use total assets and gross premiums, respectively, as alternative proxies for GI scale. In each case the coefficient of the scale proxy is negative and significant at the 99 percent confidence level while the coefficients of other independent variables mirror those in Reg 1 in their sign and significance. Although there is little difference in the adjusted R^2 s of Regs 1 and 3 (using net assets and total assets, respectively), when gross premiums are used the explanatory power of the regression is significantly reduced.

GI ratings are undertaken within APRA's DID and SID Divisions. Of the 144 non-branch ratings, 98 were undertaken by DID and 46 by SID. In Reg 5 we add the indicator variable, *DID*, for where the rating was undertaken by DID. Its inclusion has several effects. First, there is a significant increase in the explanatory power of the regression with an adjusted R^2 of 0.54 compared to 0.43 for Reg 1. Second, the estimated coefficient of *DID* is negative and highly significant indicating that, *ceteris paribus*, DID ratings are more favorable (lower) than those of SID. Third, with the inclusion of *DID*, the coefficient of *LN(NET ASSETS)* becomes insignificant. As DID is responsible for large diversified FIs, and *DID* and *LN(NET ASSETS)* are highly positively correlated ($\rho = 0.45$), the *DID* indicator variable in Reg 5 captures much of the scale effect in Regs 1 to 4. To illustrate, when we rerun Reg 5 constraining the coefficients of the independent variables other than *DID* to be equal to those of Reg 1, the estimated coefficient of the *DID* variable is -0.1207 with a *t*-statistic of -3.10 , significant at the 99 percent level. Whereas Reg 5 suggests that DID ROF ratings are 0.40 less than those of a similar GI supervised by SID, this estimate assigns much of the scale effect on ratings to Divisional differences. A more reliable (point) estimate of the divisional difference in ROF ratings for GIs with similar characteristics is the *DID* coefficient of -0.12 from the constrained regression. Consequently, although the divisional difference in ROF ratings is statistically significant, it is not economically significant.¹⁶

In Reg 6 we examine the nonlinear form of the functional relationship with the probability index, ROF^4 , used as dependent variable. A comparison with Reg 1 reveals that although there is a reduction in explanatory power of the regression, the signs and significance of the coefficients mirror those in Reg 1. Hence, Regs 3 to 6 confirm that our nonbranch ROF ratings results are robust to alternative formulations.

In Table 4, Regs 2 to 4, we present OLS estimates¹⁷ for nonbranch *INHERENT ROF*, *MANAGERIAL ROF*, and *CAPITAL ROF*. To facilitate a comparison with the aggregate ROF rating results, Reg 1 repeats the aggregate ROF result from Table 3. The adjusted R^2 of the regressions varies from 0.46 for *CAPITAL ROF* to 0.29 for *MANAGERIAL ROF*, and suggests good explanatory power. Moreover, the lower explanatory power

¹⁶ The point estimate of -0.12 is small relative to the standard error of estimate of Reg 1 of 0.29.

¹⁷ With identical independent variables, OLS produces identical results as SUR (StataCorp, 2005).

TABLE 4
Nonbranch GI Risk of Failure Component Regressions

Independent Variables	Dependent Variable			
	ROF Reg 1	INHERENT ROF Reg 2	MANAGERIAL ROF Reg 3	CAPITAL ROF Reg 4
Constant	2.3339*** (6.66)	1.8340*** (4.81)	2.4238*** (6.36)	2.5288*** (5.79)
ROE	-0.1136 (-0.40)	-0.1015 (-0.33)	-0.1382 (-0.45)	-0.1199 (-0.34)
CESSION	0.3152** (2.35)	0.3890*** (2.67)	0.2929** (2.01)	0.1797 (1.08)
LN(NET ASSETS)	-0.0681*** (-4.18)	-0.0457** (-2.58)	-0.0654*** (-3.69)	-0.0842*** (-4.15)
PREMIUM GROWTH	-0.0069 (-1.09)	-0.0028 (-0.40)	-0.0111 (-1.61)	-0.0038 (-0.48)
SOLVENCY COVER	-0.0564** (-2.12)	-0.0359 (-1.24)	-0.0138 (-0.48)	-0.1227*** (-3.70)
TIME TREND	-0.0067 (-0.82)	-0.0018 (-0.21)	-0.0050 (-0.56)	-0.0138 (-1.37)
EQUITY	-0.4760 (-1.41)	-0.4977 (-1.35)	-0.9432** (-2.56)	0.1496 (0.35)
PROPERTY	0.3195 (0.49)	0.1198 (0.17)	0.7101 (1.01)	-0.4295 (-0.53)
SECURITIES	-0.1489 (-0.58)	-0.1513 (-0.55)	-0.3062 (-1.11)	-0.0790 (-0.25)
REINSURANCE ASSETS	-0.9183*** (-2.84)	-0.8294** (-2.35)	-0.8576** (-2.43)	-1.1413*** (-2.82)
OTHER ASSETS	-0.0314 (-0.09)	-0.0259 (-0.07)	-0.2112 (-0.57)	-0.0224 (-0.05)
MOTOR VEHICLE	0.5063** (2.46)	0.5495** (2.45)	0.4786** (2.14)	0.5875** (2.29)
LONG-TAIL	0.9180*** (5.72)	1.0416*** (5.96)	0.6314*** (3.62)	1.1043*** (5.52)
OTHER PREMIUM	0.7106*** (3.96)	0.7826*** (4.00)	0.4524** (2.31)	0.9139*** (4.08)
CONSUMER CREDIT	0.0191 (0.09)	0.1747 (0.76)	-0.0803 (-0.35)	-0.0182 (-0.06)
REINSURANCE	0.4204** (2.61)	0.5236*** (2.98)	0.2931* (1.67)	0.4205** (2.09)
Summary stats				
Number of observations	148	148	148	148
Adjusted R ²	0.4300	0.3539	0.2926	0.4632

Notes: OLS regression results with ROF or one of its components as the dependent variable. Independent variables are lagged two quarters. ***, **, * denote significance at the 99%, 95%, and 90% confidence levels, respectively. The *t*-statistics are in parentheses.

of the *MANAGERIAL ROF* regression is consistent with the assessment of management and control risk relying more on qualitative judgments than inherent and capital support risks.

The results for the rating components in Regs 2 to 4 are similar, reflecting the high correlations noted previously in Table 2. For all components, unfavorable (high) ratings are associated with small GIs, small holdings of reinsurance assets, and greater reliance on motor vehicle, long-tail, reinsurance, and other premium lines. Moreover, profitability, premium growth, and investment risk are insignificant for the three components. Although the similarity of results across components adds further to our concern relating to the lack of independence of the component *ROF* ratings, there are two areas where we observe different results. First, high solvency cover is significantly associated with low capital support risk but not with inherent or managerial risk. This is not unexpected as supervisors are meant to provide an assessment of capital support in the capital support rating. Second, high cession ratio is significantly associated with high inherent and managerial risk but not with capital support risk. This is not surprising as the cession ratio is unlikely to influence the assessment of capital support.

Regression Results for Foreign Branches

With a small sample of 67 branch ratings and 17 explanatory variables, care needs to be taken in evaluating the foreign branch results in Tables 5 and 6. The regressions in Table 5 have good explanatory power (adjusted R^2 of 0.37), while the coefficient signs are generally consistent with our *a priori* expectations. In Reg 1 we find that unfavorable (high) branch *ROF* ratings are significantly associated with low profitability; small-scale, rapid premium growth; large holdings of equities, securities, and reinsurance assets; and greater reliance on other premium lines. The scale effect is consistent with risk diversification benefits of increasing scale, the profitability effect is consistent with higher profitability signaling more efficient management, and a favorable (lower) rating, and the premium growth effect is consistent with our *a priori* expectation that rapid premium growth may lead to a reduction in underwriting standards and an unfavorable (higher) rating (Borde, Chambliss, and Madura, 1994).

Only two variables (*NET ASSETS* and *OTHER PREMIUM*) have significant coefficients with consistent signs for both nonbranches and branches, suggesting supervisors may take different approaches in assessing nonbranch and branch risk. An important difference is the role played by profitability, solvency cover, investment risk, and underwriting risk. Whereas for nonbranches solvency cover and underwriting risk are significant while profitability and investment risk are insignificant, for branches profitability and investment risk are significant while solvency cover and underwriting risk are insignificant. The different roles may be related to the nature of capital support and composition of premium lines, with branches not holding capital on their Australian books and having an underwriting focus on reinsurance lines.¹⁸

¹⁸ As noted above branches have, on average, 64 percent of premiums in reinsurance and other premium lines and 16 percent in motor vehicle and long-tail lines, whereas the corresponding proportions for nonbranches are 22 percent and 53 percent.

TABLE 5
Branch GI Risk of Failure Regressions

Independent Variables	Dependent Variable				
	ROF Reg 1	ROF Reg 2	ROF Reg 3	ROF Reg 4	ROF ⁴ Reg 5
Constant	2.1807*** (3.72)	2.2447*** (3.80)	1.7662*** (3.50)	1.4496*** (3.93)	14.8804 (1.18)
ROE	-0.6917** (-2.13)		-0.8044** (-2.54)	-0.7843** (-2.45)	-8.1071 (-1.16)
ROA		-1.9528* (-1.88)			
CESSION	-0.0892 (-0.65)	-0.0950 (-0.66)	-0.1202 (-0.87)	-0.1425 (-1.01)	-4.0570 (-1.37)
LN(NET ASSETS)	-0.0739** (-2.07)	-0.0755** (-2.10)			-0.8440 (-1.10)
LN(TOTAL ASSETS)			-0.0451 (-1.52)		
LN(PREMIUMS)				-0.0297 (-1.27)	
PREMIUM GROWTH	0.0116* (1.98)	0.0115* (1.95)	0.0112* (1.90)	0.0113* (1.72)	0.2149* (1.70)
SOLVENCY COVER	-0.0305 (-1.51)	-0.0245 (-1.19)	-0.0341* (-1.73)	-0.0374* (-1.88)	-0.8427* (-1.93)
TIME TREND	-0.0064 (-0.64)	-0.0068 (-0.68)	-0.0070 (-0.70)	-0.0081 (-0.82)	-0.2726 (-1.26)
EQUITY	2.0551** (2.34)	1.9939** (2.23)	1.7783* (2.00)	1.4225 (1.67)	25.8930 (1.37)
PROPERTY	-3.1537 (-1.29)	-2.8710 (-1.17)	-3.6720 (-1.56)	-3.9834 (-1.69)	-66.1528 (-1.26)
SECURITIES	0.5197*** (2.99)	0.4742** (2.61)	0.4476** (2.61)	0.4164** (2.53)	7.4591* (1.99)
REINSURANCE ASSETS	1.6046*** (3.74)	1.4313*** (3.39)	1.7080*** (3.84)	1.6461*** (3.58)	26.0048*** (2.81)
OTHER ASSETS	-0.3424 (-0.75)	-0.3775 (-0.81)	-0.3051 (-0.65)	-0.2438 (-0.50)	-14.0572 (-1.42)
MOTOR VEHICLE	0.3327 (1.08)	0.3304 (1.06)	0.3484 (1.18)	0.3350 (1.13)	8.6270 (1.30)
LONG-TAIL	-0.2627 (-1.31)	-0.2255 (-1.12)	-0.2688 (-1.31)	-0.2745 (-1.35)	-3.8753 (-0.90)
OTHER PREMIUM	0.3778** (2.35)	0.3597** (2.21)	0.3840** (2.56)	0.3980*** (2.69)	9.4304*** (2.72)
CONSUMER CREDIT	0.4094 (0.70)	0.4316 (0.73)	0.5609 (0.95)	0.5670 (0.96)	3.9409 (0.31)
REINSURANCE	0.0680 (0.49)	0.0664 (0.47)	0.0853 (0.62)	0.0776 (0.56)	3.3486 (1.12)
Summary stats					
Number of observations	67	67	68	67	67
Adjusted R ²	0.3659	0.3539	0.3393	0.2990	0.2200

Notes: OLS regression results with ROF or ROF⁴ as dependent variable. Independent variables are lagged two quarters. The *t*-statistics are shown in parentheses. ***, **, * denote significance at the 99%, 95%, and 90% confidence levels, respectively.

TABLE 6
Branch GI Risk of Failure Component Regressions

Independent Variables	Dependent Variable			
	ROF Reg 1	INHERENT ROF Reg 2	MANAGERIAL ROF Reg 3	CAPITAL ROF Reg 4
Constant	2.1807*** (3.72)	1.8406** (2.48)	2.0783*** (3.58)	2.9259*** (4.28)
ROE	-0.6917** (-2.13)	-0.7340* (-1.79)	-0.4764 (-1.48)	-0.8937** (-2.36)
CESSION	-0.0892 (-0.65)	-0.0491 (-0.28)	0.0060 (0.04)	-0.3050* (-1.90)
LN(NET ASSETS)	-0.0739** (-2.07)	-0.0515 (-1.14)	-0.0650* (-1.84)	-0.1436*** (-3.45)
PREMIUM GROWTH	0.0116* (1.98)	0.0139* (1.87)	0.0082 (1.42)	0.0101 (1.47)
SOLVENCY COVER	-0.0305 (-1.51)	-0.0213 (-0.83)	-0.0041 (-0.20)	-0.0625** (-2.65)
TIME TREND	-0.0064 (-0.64)	-0.0128 (-1.02)	0.0002 (0.02)	0.0069 (0.59)
EQUITY	2.0551** (2.34)	2.4552** (2.21)	1.6288 (1.63)	2.3297** (2.28)
PROPERTY	-3.1537 (-1.29)	-2.6271 (-0.85)	-2.1482 (-0.89)	-5.4672* (-1.92)
SECURITIES	0.5197*** (2.99)	0.4835** (2.20)	0.3492** (2.03)	0.8975*** (4.43)
REINSURANCE ASSETS	1.6046*** (3.74)	1.8401*** (3.39)	1.1786*** (2.77)	1.9084*** (3.82)
OTHER ASSETS	-0.3424 (-0.75)	-0.7003 (-1.20)	-0.0092 (-0.02)	0.4782 (0.89)
MOTOR VEHICLE	0.3327 (1.08)	0.4523 (1.16)	0.1184 (0.39)	0.2568 (0.72)
LONG-TAIL	-0.2627 (-1.31)	-0.3059 (-1.20)	-0.2207 (-1.11)	-0.2208 (-0.94)
OTHER PREMIUM	0.3778** (2.35)	0.4155** (2.04)	0.2464 (1.55)	0.3705* (1.98)
CONSUMER CREDIT	0.4094 (0.70)	0.4823 (0.65)	0.0840 (0.14)	0.6128 (0.89)
REINSURANCE	0.0680 (0.49)	0.1795 (1.02)	-0.0421 (-0.31)	-0.0373 (-0.23)
Summary stats				
Number of observations	67	67	67	67
Adjusted R ²	0.3659	0.2015	0.2316	0.5345

Notes: OLS regression results with ROF or one of its components as the dependent variable. Independent variables are lagged two quarters. The *t*-statistics are in parentheses. ***, **, * denote significance at the 99%, 95%, and 90% confidence levels, respectively.

Other differences relate to the cession ratio, premium growth, and reinsurance assets. High cession ratios are significantly associated with unfavorable *ROF* ratings for nonbranches but not for branches, whereas more rapid premium growth is associated with higher ratings for branches but not for nonbranches. Finally, larger holdings of reinsurance assets are significantly associated with lower nonbranch ratings but with higher branch ratings.

Regs 2 to 5 of Table 5 examine the sensitivity of the branch results to modifications of the model. When *ROA* is substituted for *ROE* in Reg 2, the explanatory power of the regression falls while the signs and significance of the coefficients are generally similar. For branches, *ROF* ratings are more closely associated with net assets than total assets or gross premiums. In Regs 3 and 4, when net assets is replaced by total assets and gross premiums, respectively, the explanatory power of the regression falls relative to Reg 1, and the scale variable is insignificant. Finally, the nonlinear formulation of Reg 5, with dependent variable *ROF*⁴, is inferior to the linear formulation. The explanatory power of the regression is less than for Reg 1, whereas the return on equity, scale, and equity variables are insignificant.

The branch *ROF* rating component regressions, Regs 2 to 4 in Table 6, are somewhat mixed. The *CAPITAL ROF* regression has the best explanatory power with an adjusted *R*²s of 0.53 while the *INHERENT ROF* and *MANAGERIAL ROF* regressions have adjusted *R*²s of 0.20 and 0.23, respectively. Although the lower explanatory power of the *MANAGERIAL ROF* regression is consistent with the assessment of management and control risk relying more heavily on qualitative judgment, the poor performance of the inherent risk regression (where underlying risks are expected to be more quantifiable) is disappointing. Although not always statistically significant, in most cases there is consistency in coefficient signs for a variable across the rating component regressions.¹⁹

High branch profitability is associated with favorable (lower) inherent and capital support risks whereas high solvency cover is associated with lower capital support risk but not to inherent or management and control risks. Moreover, larger foreign branches are associated with lower management and control and capital support risks but not to inherent risk. This is consistent with large foreign branches being more likely to receive capital support from parents, and having superior management and control skills, than smaller branches.

Also, high cession ratios are associated with significantly lower capital support risk, but not with inherent or managerial risk. Although risk shifting through reinsurance may reduce risk, and hence the need for capital support, this effect appears more relevant to the assessment of inherent risk than capital support risk. Moreover, while the effect of investment risk is evident in all three rating component regressions (e.g., significance of *EQUITY*, *SECURITIES*, and *REINSURANCE ASSETS*), its significance in the capital support risk regression is of concern as investment risk is expected to be a driver of inherent risk (and possibly managerial risk), not capital support risk. Together with the significant coefficient of the cession ratio in the capital support

¹⁹ In contrast, for nonbranches we observe consistency of results across the rating components, with variables generally statistically significant (or insignificant) across all three regressions.

regression, this adds to our concern that supervisors may not be clearly delineating the factors impinging on the *ROF* rating components.

Rerating Regression Results

In Table 7, we limit the sample to nonbranch reratings in Regs 1 to 3 and branch reratings in Regs 4 to 6. For comparison, in Regs 1 and 4 we replicate Reg 1 of Tables 3 and 5, but on the reratings samples, and find similar results to the full sample. Nonbranch ratings are significantly related to the cession ratio, scale, premium growth, reinsurance assets, and composition of premiums, whereas branch ratings are significantly related to GI size, profitability, holdings of equities, securities, and reinsurance assets, and to other premiums.

In forming a GI's rating the supervisor has details of any prior ratings. In Regs 2 and 5 we include the previous *ROF* rating, denoted *PREVIOUS RATING*, as a determinant of the current rating. Its coefficient is positive and significantly different from both zero and unity in both regressions. Being significantly different from unity suggests that the previous rating is not the optimal predictor of the new rating. Moreover, the inclusion of the prior rating increases the regression's explanatory power, with an adjusted R^2 of 0.86 for nonbranches compared to 0.42 in Reg 1, and 0.56 for branches compared to 0.33 in Reg 4.

The inclusion of the previous rating in the nonbranch regression alters the signs and significance of many of the coefficients. Apart from the constant, premium growth, time trend, and reinsurance asset variables, the coefficients that are significant in Reg 1 are not significant in Reg 2 whereas several variables are significant in Reg 2 that are not significant in Reg 1.²⁰ Moreover, several of the variables that attain significance have coefficients with implausible signs. For example, Reg 2 implausibly suggests that more profitable nonbranches with higher solvency cover and larger holdings of equities have unfavorable (higher) *ROF* ratings.

The coefficient of 0.7076 on the previous rating variable in Reg 2 suggests that the prior nonbranch rating embodies much of the information in the risk indicators. In Reg 3 we include only the constant and previous rating as explanatory variables and find an adjusted R^2 of 0.84 (compared to 0.86 for Reg 2). The stable economic and regulatory environment over the sample, and/or effective GI risk management practices, could have produced relatively small changes in nonbranch *ROF* ratings and lead to the prior rating dominating the risk indicators in predicting nonbranch *ROF* ratings.²¹ In this environment, APRA could consider less frequent reviews of nonbranch GIs.

Although the adjusted R^2 of the branch Reg 5 of 0.5563 is less than for nonbranches, the branch results are more satisfactory as the inclusion of the prior rating does not

²⁰ For example, when the previous rating is added to the regression, the cession ratio, scale, and premium composition variables lose significance, whereas profitability, solvency cover, and holdings of equities, securities, and other assets attain significance.

²¹ The perverse results for several of the independent variables in Reg 2, alluded to in the previous paragraph, are likely to be attributable to the dominance of the previous rating in the regression.

TABLE 7
GI Risk of Failure Regressions for Reratings Subsample

Independent Variables	Dependent Variable ROF					
	Nonbranches			Foreign Branches		
	Reg 1	Reg 2	Reg 3	Reg 4	Reg 5	Reg 6
Constant	2.4746*** (6.83)	0.8766*** (4.45)	0.2670*** (6.75)	2.1538*** (3.66)	1.3112** (2.58)	0.6521*** (-7.56)
ROE	0.3959 (1.14)	0.4265** (2.51)		-0.6236* (-1.88)	-0.5750** (-2.12)	
CESSION	0.3940** (2.22)	-0.0089 (-0.10)		-0.0879 (-0.63)	-0.1081 (-0.96)	
LN(NET ASSETS)	-0.0724*** (-4.16)	-0.0091 (-0.99)		-0.0727** (-2.03)	-0.0468 (-1.57)	
PREMIUM GROWTH	-0.0118* (-1.73)	-0.0077** (-2.28)		0.0093 (1.47)	0.0030 (0.57)	
SOLVENCY COVER	-0.0272 (-0.94)	0.0289** (1.99)		-0.0330 (-1.61)	-0.0103 (-0.60)	
TIME TREND	-0.0156* (-1.84)	-0.0086** (-2.06)		-0.0056 (-0.54)	-0.0108 (-1.27)	
EQUITY	-0.6028 (-1.60)	-0.6578*** (-3.55)		1.9370** (2.19)	0.7262 (0.95)	
PROPERTY	1.6355 (1.65)	0.5048 (1.03)		-3.2085 (-1.30)	-1.1200 (-0.55)	
SECURITIES	-0.1750 (-0.65)	-0.3809*** (-2.89)		0.5380*** (3.07)	0.4713*** (3.28)	
REINSURANCE	-0.9339** (-2.62)	-0.4708*** (-2.67)		1.5471*** (3.48)	0.8831** (2.29)	
ASSETS						
OTHER ASSETS	-0.2851 (-0.76)	-0.5569*** (-3.03)		-0.2891 (-0.62)	0.3091 (0.78)	
MOTOR VEHICLE	0.4780** (2.34)	0.0583 (0.57)		0.3116 (1.00)	-0.0195 (-0.07)	
LONG-TAIL	0.8679*** (5.12)	0.0707 (0.76)		-0.2580 (-1.22)	-0.1034 (-0.59)	
OTHER PREMIUM	0.7964*** (4.16)	0.0545 (0.54)		0.3713** (2.29)	0.0774 (0.54)	
CONSUMER CREDIT	-0.0398 (-0.18)	-0.1202 (-1.08)		0.3794 (0.64)	-0.2168 (-0.43)	
REINSURANCE	0.3750** (2.34)	-0.0085 (-0.10)		0.0737 (0.53)	-0.0147 (-0.13)	
PREVIOUS RATING		0.7076*** (18.92)	0.7619*** (26.06)		0.4237*** (5.01)	0.5142*** (7.92)
Summary stats						
Number of observations	130	130	132	65	65	68
Adjusted R ²	0.4154	0.8594	0.8381	0.3332	0.5563	0.4794

Notes: OLS regression results for the subsample of reratings, with ROF as the dependent variable. Independent variables other than PREVIOUS RATING are lagged two quarters. The *t*-statistics are shown in parentheses. ***, **, * denote significance at the 99%, 95%, and 90% confidence levels, respectively.

dominate the risk indicators. The coefficient of the prior rating of 0.4237 is significantly different from both zero and unity, again confirming that the previous rating is not the optimal predictor of the current rating. As in Reg 4, unfavorable branch ratings are associated with low profitability and large holdings of securities and reinsurance assets. However, the coefficients of the scale, equity, and other premium variables are insignificant.

For branches the previous rating explains much of the current rating, though less than for nonbranches. Reg 6 includes the constant and previous rating as explanatory

variables and has an adjusted R^2 of 0.48. The divergent results may reflect: (1) branch risk being more variable than nonbranch risk (branches are dominant in reinsurance that is more variable in quality than the primary premium lines of nonbranches) and (2) the longer mean time between ratings being longer for branches (10.6 months) than for nonbranches (8.3 months), allowing more time for changes in ROF ratings to emerge.

RISK OF FAILURE AND SOLVENCY COVER

Modeling Low GI Solvency Cover

In this section, we identify risk indicators associated with the low GI solvency cover during the January 2003 to September 2005 period.²² Defining low solvency cover as a solvency cover ratio less than 1.2, our dependent variable, *LOW SOLVENCY COVER*, equals 1 for a solvency cover ratio less than 1.2 and 0 otherwise. As for the ratings model, low solvency cover is expected to be associated with (one-quarter) lagged GI profitability, cession ratio, size, premium growth, asset mix, and composition of premium lines.²³ The model is estimated with the logit random-effects panel estimator on 525 observations of 55 nonbranches drawn from APRA's quarterly GI returns. There are insufficient observations of low solvency cover to estimate a model for branches.

Reg 1 in Table 8 reveals that the incidence of low solvency cover is associated with low profitability, small scale of operations, large holdings of reinsurance assets, and large exposures to motor vehicle, long-tail, other premium, and consumer credit insurance lines. There is little evidence that the likelihood of low solvency cover is associated with the cession ratio, premium growth, and investments in equities, property, and securities.²⁴

Modeling GI Solvency Cover

We also model the determinants of the level of solvency cover, *SOLVENCY COVER*, using the OLS random effects panel estimator. Because *SOLVENCY COVER* is negatively correlated with *LOW SOLVENCY COVER*, we expect the signs of the coefficients to be opposite those in the low solvency cover regression. The nonbranch result is shown as Reg 2 in Table 8 whereas the branch result, using 280 observations for 29 branches, is shown as Reg 3.

A comparison of the nonbranch Regs 1 and 2 reveals that scale and holdings of reinsurance assets are significant and consistent in their effect across the regressions.

²² Accounting for lagged relationships, this is the maximum time series available for the regressions. Following the collapse of HIH and the criticism of APRA in the HIH Royal Commission (2003), the annual GENESIS data collection was replaced by a more extensive collection (known as D2A) based on different data definitions.

²³ Similar results are obtained using lags of up to four quarters.

²⁴ Sharpe and Stadnik (2007) examine the determinants of financial distress of Australian GIs using annual data from 1999 to 2001 and definitions of distress based on the pre-July 2002 Solvency Condition in the *Insurance Act*. They find that distress is inversely related to GI return on assets, cession ratio, size, and equity holdings, and positively related to property and reinsurance asset holdings.

TABLE 8
GI Solvency Cover Regressions

Independent Variables	Nonbranches		Branches
	Dependent Variable		Dependent Variable
	Low Solvency Cover Reg 1	Solvency Cover Reg 2	Solvency Cover Reg 3
Constant	12.1292 (1.40)	−2.6271** (−2.22)	−10.3465*** (−2.64)
ROE	−4.2733** (−1.97)	0.3689 (1.41)	−0.1041 (−0.28)
CESSION	−1.6632 (−1.26)	0.1197 (0.64)	−0.1353 (−0.74)
LN(NET ASSETS)	−1.3974*** (−3.04)	0.2705*** (4.33)	0.7442*** (3.06)
PREMIUM GROWTH	0.0351 (0.72)	−0.0056 (−0.93)	0.0028 (0.35)
TIME TREND	−0.1148 (−1.18)	0.0219*** (2.57)	0.0363* (1.79)
EQUITY	2.3591 (0.58)	−1.0608 (−1.25)	0.3433 (0.20)
PROPERTY	5.9759 (0.55)	0.4308 (0.75)	−3.9111 (−0.59)
SECURITIES	−0.5253 (−0.17)	0.2973 (0.85)	1.3275*** (2.90)
REINSURANCE ASSETS	9.5563** (2.37)	−2.5760*** (−4.87)	−3.5939*** (−3.50)
OTHER ASSETS	0.6514 (0.16)	−0.0870 (−0.20)	0.7070 (0.80)
MOTOR VEHICLE	11.7786*** (2.93)	0.4094 (0.85)	−1.7217** (−2.17)
LONG-TAIL	8.7909*** (2.93)	0.4000 (1.00)	−0.1189 (−0.24)
OTHER PREMIUM	6.9370** (2.09)	0.5355 (1.28)	−0.0462 (−0.15)
CONSUMER CREDIT	9.2954*** (2.65)	0.3827 (0.79)	−0.2592 (−0.24)
REINSURANCE	−88.6675 (−0.33)	−0.0077 (−0.01)	−0.9486** (−2.54)
Summary stats			
Number of observations	525	525	280
Wald χ^2 (15)	34.73***	156.44***	105.45***

Notes: Logit random-effects estimates of determinants of low solvency cover (Reg 1) and OLS random-effects estimates of solvency cover (Regs 2 and 3). Independent variables are lagged one quarter. The z-statistics are in parentheses. ***, **, * denote significance at the 99%, 95%, and 90% confidence levels, respectively.

Large nonbranches with large holdings of reinsurance assets have significantly higher levels of solvency cover and are less likely to have low solvency cover. Although there is evidence of an increasing trend in the level of nonbranch solvency cover, there is little evidence of a trend in the likelihood of nonbranches having low solvency cover. Also, profitability and composition of premium lines are significantly associated with the likelihood of low solvency cover, but not with the level of solvency cover.

For branches, in Reg 3 we find that high levels of solvency cover are significantly associated with large-scale, large security holdings, small holdings of reinsurance assets, and low concentration of premiums in motor vehicle and reinsurance lines. There is also evidence of an increasing trend in the level of branch solvency cover over the sample.

Comparison of Risk Indicators Associated With *ROF* Ratings and Low Solvency Cover

For nonbranches there are several common risk indicators associated with the incidence of low solvency cover and *ROF* ratings. Small entities with large exposures to motor vehicle, long-tail, and other premium lines are associated with unfavorable (high) ratings and have a higher likelihood of a low solvency cover. On the other hand, profitability and cession ratios have different relationships with nonbranch ratings and solvency cover. Low profitability is significantly associated with the incidence of low solvency cover but not to *ROF* ratings, whereas high cession ratios are significantly associated with unfavorable *ROF* ratings but not with the incidence of low solvency cover.²⁵

For branches two risk indicators are significantly associated with both *ROF* ratings and levels of solvency cover in Tables 5 and 8, scale and holdings of reinsurance assets. Large branches with small holdings of reinsurance assets are associated with favorable ratings and high levels of solvency cover. On the other hand, low profitability, rapid premium growth, large equity holdings, and large exposure to other premiums are significantly associated with unfavorable ratings but not to solvency cover, whereas high exposures to motor vehicle and reinsurance lines are associated with low levels of solvency cover but not to *ROF* ratings.²⁶

An important caveat, however, is that a finding that ratings are not significantly associated with risk indicators but are significantly associated with low solvency cover (or vice versa) does not necessarily imply that supervisors are incorrectly assessing risk. Given the relatively small samples, the limited sample period available for the statistical analysis, and the favorable economic environment for GIs during that period, our findings are specific to the sample and may not generalize to other periods when GIs could be under greater stress.

²⁵ An inconsistent result relates to large holdings of reinsurance assets that are significantly associated with favorable (lower) ratings, but are associated with a higher likelihood of low solvency cover.

²⁶ Another inconsistency in the branch *ROF* ratings and solvency cover results is that large holdings of securities are associated with high *ROF* ratings and with high solvency cover.

SUMMARY AND APPLICATIONS

Our primary objectives in this article are to enhance our understanding of the risk indicators associated with variability in APRA's GI ROF ratings, to ascertain if there are differences in GI ratings across the responsible divisions in APRA, and to examine whether the risk indicators associated with variability of ROF ratings correspond to the significant risk indicators in a model explaining low solvency cover.

There are five principal findings. First, a reasonable proportion of the variability in supervisors' ROF ratings can be predicted by statistical returns data. Moreover, for nonbranches, the prior rating predicts a very high proportion of the current rating and dominates the risk indicators in predicting the current rating. That is, nonbranch statistical data have negligible information content *vis-à-vis* the prior rating in predicting the current rating. A potential policy implication is that APRA could consider lengthening the time between nonbranch reviews as a means of more efficiently allocating its limited supervisory resources.

Second, we find that different risk indicators are associated with branch and nonbranch ROF ratings, consistent with supervisors adopting different approaches to their assessment. For example, profitability, solvency cover, investment risk, and underwriting risk play different roles. Whereas solvency cover and underwriting risk are significant in nonbranch ratings while profitability and investment risk are insignificant, for branch ratings the roles are reversed with profitability and investment risk significant while solvency cover and underwriting risk are insignificant. We also find that while high ROF ratings of nonbranches are associated with small-scale, low-solvency cover; small holdings of reinsurance assets; high cession ratios; and large exposures to motor vehicle, long-tail, reinsurance, and other premium lines, only two of these risk indicators are consistent in their direction of influence and statistically significant for branches (scale and other premium lines). Although unfavorable branch ratings are associated with low profitability, high premium growth, and high investment risk (relatively large holdings of equities, securities, and reinsurance assets), these indicators are not significantly associated with nonbranch ratings.

Third, the estimated models for inherent, management and control, and capital support risks are strikingly similar, reflecting the high correlation between the components of ROF ratings, and suggests that supervisors may not clearly distinguish the component risks. APRA is currently changing the PAIRS model, incorporating a different set of PAIRS categories, or building blocks to better align to the work performed by its frontline supervisory divisions when undertaking prudential reviews. These changes will facilitate a clearer distinction between inherent risk and management and control risk (though not between inherent and capital support risk).

Fourth, we find evidence of differences in GI ratings across APRA's supervisory divisions, DID and SID. Although average ratings for nonbranches prepared by DID are significantly lower than those of SID, much of the difference is attributable to fundamental differences in the size and operations of the GIs supervised by the divisions. Controlling for these differences, a point estimate of the difference in ratings across divisions is 0.12 (in a scale of 0 to 4), which, while statistically significant, is relatively small in economic terms.

Finally, in comparing risk indicators that are significantly associated with both nonbranch ratings and low solvency cover, we find mostly common elements. That is,

small-scale and large exposures to motor vehicle, long-tail, and other premium lines are each associated with both unfavorable ratings and the likelihood of low solvency cover. This is consistent with supervisors correctly incorporating our *a priori* expectations of the effects of the risk indicators on GI risk into their *ROF* ratings.

Our research has a number of potential applications that could enhance APRA's supervision. For example, the models may be used for quality control within PAIRS. Deviations of predictions of *ROF* ratings from actual ratings could be identified and evaluated in light of the supervisor's written text that accompanies the rating. If the text does not provide an adequate (qualitative) justification for the exceptional rating this could provide grounds for a rating review. Alternatively, the models may be used in scheduling formal on-site reviews to give priority to GIs with significant increases in the predicted *ROF* rating. With reviews typically undertaken at approximately 8- to 12-month intervals, the modeling may identify significant changes in predicted ratings as updated quarterly statistical data become available. Finally, predictions of ratings may form an input to the rating process with supervisors provided predictions based on the latest statistical data. This would ensure consistency in interpretation of the statistics while allowing supervisors to exercise expert judgment in identifying qualitative factors impinging on the GI's risk.

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