

Predicting P&C Insurer Solvency in Canada

by:

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Introduction

The solvency of an insurance company is of utmost concern to the regulatory bodies charged with monitoring their financial performance on behalf of policyholders. In addition to regulators and policyholders, interested parties also include the stockholders of these firms as well as industry competitors who may be asked to contribute to guaranty funds that will pay for claims on insolvent firms. Additionally, these competitors may also pay careful attention to troubled firms in hopes of finding a bargain acquisition.¹ Although a recent Standard & Poor's Report has stated that the number of insurance company insolvencies has declined in recent years, the report also suggests that we are likely at the beginning of an upward trend in insurer insolvencies.²

While there is a great deal of literature related to insolvency prediction in the United States, there is little research on these issues for Canada with the majority being of a non-academic nature. Further, although there are many similarities between the property and casualty (P&C) markets in Canada and the U.S., there are also some significant differences. Such differences include the choice between federal and provincial licensing, the auto insurance market making up half of all premiums written, the large number of non-Canadian owned insurers, and the much smaller market. Given these differences, models for predicting insolvency for U.S. insurers may not be appropriate for the Canadian market.

The purpose of this research is to test the efficacy of U.S.-based insolvency models for Canadian firms. Recognizing there are significant differences between the two markets, this paper will:

¹ See Barniv and Hathorn (1997) and Lee (2001) for more discussion on the merger versus insolvency alternative and relevant arguments for merging with a financially distressed firm.

² While the authors have not viewed this report, this summary information is taken from Greenwald, 2006.

- 1) Describe the differences in the P&C market in Canada versus the U.S. and identify how these differences impact solvency.
- 2) Using U.S. based insolvency prediction models as a reference point, we test these models on their ability to predict Canadian P&C insolvencies.

The paper is organized as follows. The next section provides a short review of related literature. This is followed by a description of the Canadian P&C market and then a discussion of variables used to predict insolvency. Next, data and methodology are described, followed by results and a conclusion.

Literature Review

Many articles address how to predict insolvency in the P&C insurance industry. Studies have looked at individual company data (see BarNiv and McDonald, 1992 for a review of this early literature), macroeconomic industry-wide data (Browne and Hoyt, 1995), and more recently group-level data (Pottier and Sommer, 2006). Various rating tools have also been investigated including ratings from external parties (Pottier and Sommer, 2002), Financial Analysis Solvency Tools (FAST) scores (Grace, Harrington and Klein, 1998), and Risk-Based Capital measures (Cummins, Harrington and Klein, 1995). As well, Gaver and Pottier (2005) find that the financials of the holding company impact credit ratings at the insurance subsidiary level suggesting that more comprehensive financial analysis may be beneficial in insolvency monitoring.

A review of previous studies (e.g., Trieschmann and Pinches, 1973; Ambrose and Seward, 1988; BarNiv and Raveh, 1989; BarNiv and McDonald, 1992; Pottier and Sommer,

2006) reveals that researchers have used many different variables in developing models to predict insolvency. While some standard measures are used in most of the studies, such as net premiums written (NPW) divided by surplus, there are also significant differences across studies in terms of how variables are defined. As a result, there is not strong evidence to imply that a given set of variables is superior in predicting P&C insurer insolvency.

Overview of the Canadian Property and Casualty Insurance Industry

P&C insurers in Canada choose whether to be registered at either the provincial or federal level. There are approximately 194 federally registered insurers and 158 provincial insurers, with the majority of provincial insurers being in Ontario and Quebec.³ For insurers that are provincially licensed, their solvency is monitored by provincial authorities (normally in the form of Superintendents of Insurance). Federally licensed insurers are monitored at the federal level by the Office of the Superintendent of Financial Institutions (OSFI). OSFI-supervised insurers represent 80.1 percent of NPW, while provincially supervised insurers represent the remaining 19.9 percent.⁴ Historically, two-thirds of insolvencies in Canada have involved provincially regulated insurers (Harris, 2004). However, for insolvencies since 1980, only 39 percent involved provincially regulated insurers.⁵

In 2004 NPW for the industry were \$32.8 billion and assets were \$92 billion. Half of premiums written are for auto insurance, and the remaining half represents commercial property (14.4 percent), personal property (14.2 percent), liability (13 percent), other⁶ (5.4 percent), and

³ In addition, there are four Crown corporations that are government run monopolies for the mandatory auto insurance product sold by province.

⁴ PACICC, based on data from Superintendent of Insurance.

⁵ Taken from data collected by PACICC.

⁶ Aircraft, boiler & machinery, credit, credit protection, fidelity, marine, hail, legal expense, mortgage, surety, title.

accident/sickness (2.8 percent). Given that automobile insurance is highly regulated, there are expected differences between the U.S. and Canada in terms of the effect on solvency. In addition, given the smaller market in Canada, it may be more difficult for insurers to achieve a sufficiently diversified book of business, especially given that it is considered a competitive market. The top ten insurers have 54.23 percent of the market share (based on total NPW), while the top 25 have 79.88 percent. This also may have important implications for solvency.

Canadian-owned companies represent slightly over 50 percent of NPW in the P&C market (see Table 1). As well many companies operating in Canada are members of international, and in some cases national, financial conglomerates. Such firms are expected to face different competitive pressures than stand-alone insurers affecting their operating decisions influencing solvency. Firms that are members of a large conglomerate might also benefit from expense sharing across member companies.

Table 1: Summary Results by Nationality of Company *

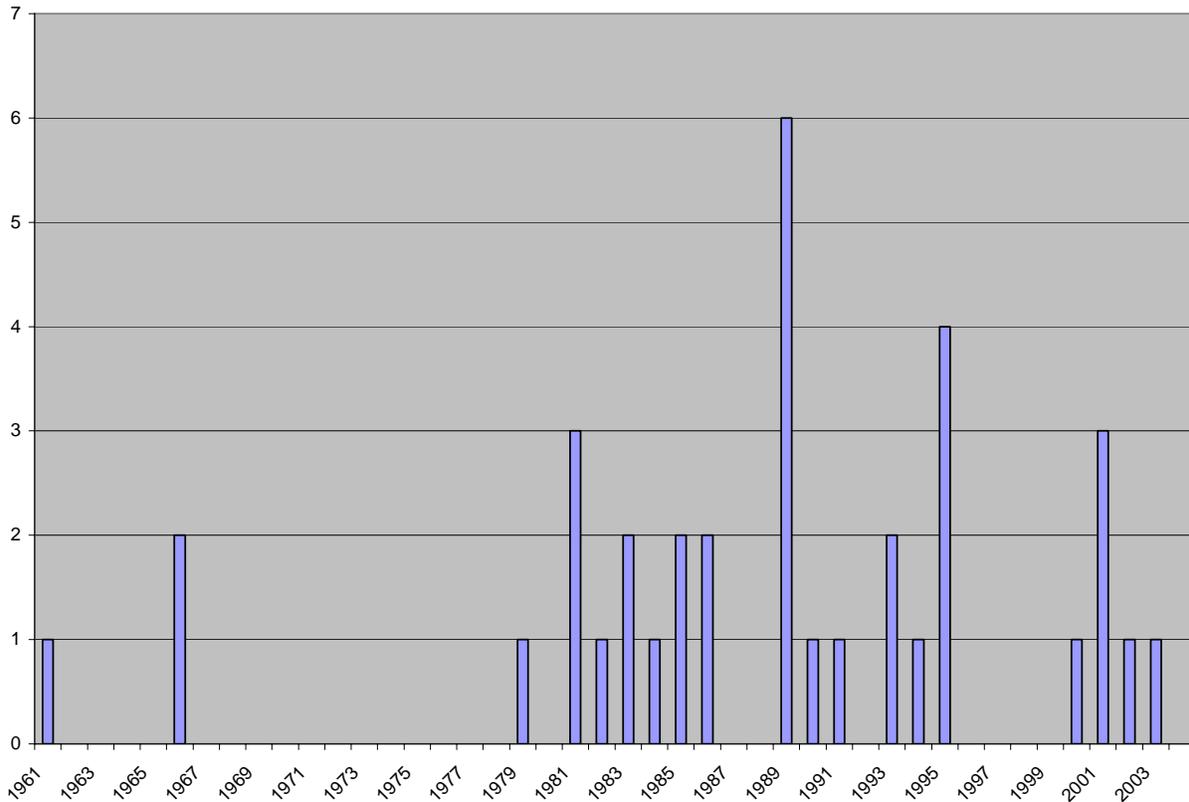
Owner Nationality	NPW	% of Total NPW	Earned Loss Ratio
Canadian	\$17,672,504,000	53%	67.34
Foreign	\$ 6,657,513,000	20%	59.78
UK	\$ 3,250,486,000	10%	60.66
US	\$ 5,825,209,000	17%	60.49

* Source: Canadian underwriter Statistical Issue 2005

The frequency of P&C insurer failures in Canada appears low in comparison to the U.S., even accounting for the difference in the number of insurers. As shown in Figure 1, since 1996 there have been only five failures, all of them occurring between 1999 and 2002. Over the twelve year period from 1992 to 2003 the Canadian industry paid out about \$100 million for insolvencies, with the cost of P&C insurance failures less than 0.1% as a share of industry

premiums. Meanwhile, the U.S. insurance industry paid out \$1.2 billion to cover bankruptcies in 2003 alone. (Harris, 2004).

Figure 1. P&C Insurer Insolvencies in Canada from 1961 – 2004*



* Source: Data adapted from information collected by PACICC

Table 2 provides a list of insolvencies since 1960, both federal and provincial. During this period, thirty-five insurers became insolvent or were liquidated;⁷ twelve of these were provincial insurers. Unlike in the U.S., in Canada receivership is almost never used and has not

⁷ In Canada, the term involuntary exit is used rather than insolvency in order to be precise. Involuntary exit is precipitated by a winding-up order issued by the appropriate supervisory authority. Insurance companies may be wound-up when they become either an insolvency risk or a liquidity risk. An insolvency risk occurs when assets become insufficient for an insurance company to meet its contractual and other financial obligations. A liquidity risk occurs when a company has sufficient assets to cover its obligations but there is a high level of risk that those assets could disappear, usually to another jurisdiction. Table 2 contains both insolvency and liquidity risks. In all cases, a winding-up order was issued. However, there was not always a liquidation associated with each winding-up order. In a few cases, it was possible to transfer the liabilities or sell off some/all of the involuntary exit.

been for well over a decade. Regulators may place a company under interim control but that is usually a measure to preserve the assets while the winding-up order is before the courts.

Similarly, Canadian regulators do not issue conservation orders. They will stage⁸ a company but

Table 2: Involuntary Exits in Canada

<u>Involuntary Exit</u>	<u>Solvency Supervisory</u>	<u>Wound-up</u>	<u>Type of Exit</u>
Abstainers Insurance Company	Ontario	1995	insolvency
Advocate General Insurance Company	Federal	1989	insolvency
Alta Surety Company	Federal	2001	insolvency
American Mutual Liability Insurance	Federal	1989	liquidity
American Reserve Insurance Company	Federal	1979	insolvency
Beothic General Insurance Company	Newfoundland	1993	insolvency
Canadian Great Lakes & Surety Company Ltd.	Ontario	1983	insolvency
Canadian Millers Mutual Insurance Company	Ontario	2001	insolvency
Canadian Universal Insurance Company	Newfoundland	1991	insolvency
Cardinal Insurance Company	Federal	1982	insolvency
Century Insurance Company of Canada (The)	Federal	1989	insolvency
Eaton Bay Insurance Company	Federal	1989	liquidity
English & American Insurance Company	Federal	1993	liquidity
Ensign Insurance Company	Federal	1961	insolvency
GISCO la Compagnie d'assurance	Quebec	2000	insolvency
Hiland Insurance Company	Newfoundland	1994	insolvency
Home Insurance Company	Federal	2003	liquidity
Ideal Mutual Insurance Company	Federal	1985	liquidity
Kansa General International Insurance Co. Ltd	Federal	1995	liquidity
Maplex General Insurance	Ontario	1995	insolvency
Markham General Insurance Company	Ontario	2002	insolvency
Menonite Mutual Hail Insurance Company	Saskatchewan	1984	insolvency
Midland Insurance Company	Federal	1986	liquidity
National Employers Mutual General Insurance Association Ltd.	Federal	1990	liquidity
North American General Insurance Company	Federal	1966	insolvency
Northern Union Insurance Company	Manitoba	1983	insolvency
Northumberland Insurance Company	Federal	1985	insolvency
Ontario General Insurance Company	Ontario	1989	insolvency
Orion Insurance Company PLC	Federal	1995	liquidity
Phoenix Assurance Company of Canada	Federal	1989	insolvency
Pitts Insurance Company	Federal	1981	insolvency
Reliance Insurance Commpany	Federal	2001	liquidity
Strathcona General Insurance Company	Federal	1981	insolvency
United General Insurance Company	Federal	1986	insolvency
Wentworth Insurance Company	Federal	1966	insolvency

⁸ All P&C companies are “staged” by OSFI, which is the process of assigning them to one of five stages, where 0 represents normal operations and stage 5 indicates that the company is not viable and insolvency is imminent.

neither the regulator nor the company are permitted to release information on its staging. They technically cannot even state that a company is stage 0 (normal operations).

Measuring Financial Strength in the P&C Insurance Industry

Differences between federal and provincial supervision exist with respect to minimum capital requirements, as demonstrated in Table 3. Other differences exist with respect to supervisory approach as well as resources dedicated to solvency surveillance. Ideally, our insolvency prediction tests would include both provincial and federal insurers; however, the data available for provincial insurers is very restricted and we are unable to include them in our analysis. As indicated previously, provincial insurers have represented two thirds of the insolvencies in Canada. This fact alone may imply that solvency monitoring at the provincial level is less effective than at the federal level.

Table 3: Minimum Capital Requirements

Regulatory Authority	Capital Requirement	Description of Risk Based Requirements
British Columbia	Risk based	MCT (100% minimum)
Alberta	Risk based	MCT (100% minimum)
Saskatchewan	Assets > liabilities	
Manitoba	\$4 million with \$1 million unimpaired	
Ontario	Risk based	MCT (150% minimum + company target)
Quebec	Risk based	MCT (100% minimum + company target)
New Brunswick	\$3 million with \$250,000 unimpaired	
PEI	\$3 million with \$750,000 unimpaired	
Newfoundland	\$3 million	
OSFI	Risk based	MCT (150% minimum + company target)

Previous studies on insolvency prediction have examined many different variables that may be related to insolvency. The types of variables used can be categorized under the following headings: capitalization, profitability, diversification, leverage, liability risk, growth, as well as control variables. Generally speaking, there is not a great deal of consistency across studies in terms of which variables are the best predictors of insolvency and how best to measure things such as profitability and leverage. In this study we use variables commonly used in other P&C insolvency prediction studies and note where our ability to use certain data is limited by what is reported from the various sources.⁹ A summary of the variables and their predicted signs appears in Table 4.¹⁰

Capitalization: A key measure of financial strength for insurers is capital. Regulations stipulate minimum capital requirements and an insurer's capitalization is an indicator of its ability to absorb unexpected shocks. Capitalization is measured as total capital divided by total assets and is expected to be negatively related to the probability of insolvency.

Leverage: Underwriting leverage is another variable closely monitored by regulators and expected to be related to solvency. A high ratio represents a high level of potential liabilities relative to capital. As in other studies, we measure underwriting leverage as NPW divided by total capital and expect a positive relationship with the risk of insolvency.

Profitability: A measure that is often found to be a predictor of insolvency is profitability (e.g., BarNiv and MacDonald, 1992; Lee and Urrutia, 1996; Pottier and Sommer, 2006). Insurers that demonstrate higher profitability are expected to have a lower risk of insolvency. To measure profitability we use return on assets, measured as net income divided by total assets.

⁹ While organizational form and group membership are commonly utilized variables in insolvency prediction, data restrictions do not allow for their inclusion in this analysis.

¹⁰ Spearman correlation coefficients are reported in the Appendix.

Liability Risk: The Canadian P&C market is dominated by auto insurance: total auto premiums written account for half of the market. Insurers that concentrate heavily in auto may have a higher probability of insolvency for two reasons. First, auto insurance is highly regulated. Theoretical and empirical research suggests that rate regulation increases volatility of underwriting results (Harrington, 2002) making it a riskier line of insurance to underwrite. Second, insurers that have a high concentration in auto are less diversified by line of business. However, for many Canadian insurance companies, a higher percentage of premiums in auto lines may be necessary for achieving economies of scale. To test for these effects, we include a variable equal to the percent of business written in auto (direct premiums written (DPW) in auto divided by total DPW) and note the expected sign is ambiguous.¹¹

Canadian Parent: As mentioned previously, many P&C insurers in Canada have foreign parents. Almost half of NPW are written by insurers that are foreign-owned. The impact of ownership on insolvency is ambiguous. Insurers that are foreign-owned may make significantly different strategic operating decisions that influence solvency as well as benefit from contributions of capital from their parent. A dummy variable is included that takes the value of 1 for Canadian-owned companies and 0 for foreign-owned companies.

Premium Growth: Whether insurers are increasing or decreasing their NPW from year to year may affect their probability of insolvency. Firms that have flat NPW or decreasing NPW may be experiencing lack of capital or may not be competitive with others in the market. In addition, premium growth may be necessary in order to achieve economies of scale, ultimately reducing the probability of financial distress. However, insurers that grow too fast may also be a concern. Companies experiencing substantial increases in NPW on a one-year basis may be

¹¹ DPW is used instead of NPW due to data restrictions in the later years of the data. As well, by-line premium data are not available for 1981-1982.

taking on substandard risks thereby increasing their probability of insolvency. The effect of growth is measured by the ratio of the one-year change in NPW relative to the prior-year's NPW which is utilized by OSFI as one of their Regulatory Early Warning Indicators. The expected sign on this variable is ambiguous.

Capital Growth: Changes in capital represent changes in an insurer's ability to absorb unexpected losses. A decrease in equity reduces an insurer's buffer available to absorb shocks increasing the probability of financial distress. This is measured by the ratio of the one-year change in capital relative to the prior-year's capital, a variable utilized by OSFI as a Regulatory Early Warning Indicator. A negative relationship is expected.¹²

Loss Ratio: Prior studies have used the loss ratio as a proxy for the quality of underwriting rigour a firm undertakes. Firms that have higher losses and higher costs associated with settling claims per dollar of premium are more likely to experience financial difficulties. A positive relationship to insolvency is expected.

Size: A number of studies find that smaller insurers are more likely to become insolvent. To measure the effect of size on the risk of insolvency we use the natural log of total assets and expect that larger insurers have a lower probability of insolvency.

Table 4. Explanatory Variables and Predicted Signs

Variable	Predicted Sign
Capitalization (Total Capital / Total Assets)	-
Underwriting Leverage (NPW / Total Capital)	+
Profitability (Net Income / Total Assets)	-
Liability Risk (Percentage of DPW written in Auto Lines)	+ / -
Canadian Parent (equal to 1 if owned by Canadian firm, 0 otherwise)	+ / -
Premium Growth (One-year rate of change in NPW)	+ / -
Capital Growth (One-year rate of change in Capital and Surplus)	-
Loss Ratio (Loss and Loss Adjustment Expenses / NPE)	+
Size (Natural Log of Total Assets)	-

¹² Although excessive increases in capital may also be a warning indicator, we expect this to be uncommon.

Data and Methodology

The data used for this study is at the individual company level. Data for the P&C industry in Canada, similar in content to the NAIC Database, was obtained from MSA Research Inc. for the years 1990 to 2004. Data for 1980 through 1988 was collected from the Report of the Superintendent of Financial Institutions.¹³ Table 5 provides a list of the insurer insolvencies used in the analysis which were compiled with the assistance of the Property and Casualty Insurance Compensation Corporation (PACICC).

Table 5: Insolvent Companies Included in Logistic Regression

<u>Company</u>	<u>Year Wound-up</u>
Advocate General Insurance Company	1989
Alta Surety Company	2001
American Mutual Liability Insurance	1989
Century Insurance Company of Canada (The)	1989
Eaton Bay Insurance Company	1989
English & American Insurance Company	1993
Ideal Mutual Insurance Company	1985
Kansa General International Insurance Co. Ltd	1995
Midland Insurance Company	1986
Northumberland Insurance Company	1985
Orion Insurance Company PLC	1995
Phoenix Assurance Company of Canada	1989
Reliance Insurance Company	2001

Consistent with recent literature in insurer insolvency (e.g., Lamm-Tennant, Starks and Stokes, 1996; Grace, Harrington and Klein, 1998; Pottier and Sommer, 2002; Pottier and Sommer, 2006), logistic regression is used for the analysis. The dependent variable in the models is equal to 1 if the insurer became insolvent in the year following the data year for that company. That is, if an insurer became insolvent in 1993, the dependent variable is 1 in 1992,

¹³ Data for 1989 was not readily available at the time of this analysis. The one insolvency from 1990 is therefore not included in the analysis, but will be included in the next draft.

but 0 in all other years of data for that firm. Given the limited number of insolvencies experienced in the Canadian P&C marketplace, this study examines the ability to predict insolvencies only in the year prior. As well, the approximate jackknife procedure was utilized to control for the bias introduced by using the same sample for estimation and prediction.¹⁴ For any given year of firm data, the firm must have positive assets, positive net premiums written, and positive capital to be included in the sample. In addition, the percent of auto written had to be greater than or equal to zero and less than or equal to one. Companies with negative loss ratios were also excluded. This leaves a sample of 4825 observations including 13 insolvencies.¹⁵

Results

Univariate Analysis

Table 6 presents the descriptive statistics for the variables included in the analysis. Means and medians are reported for solvent and insolvent firms and asterisks indicate significant differences based on t-tests and Kruskal-Wallis tests for equality of means and medians. Insolvent companies are significantly smaller than solvent companies, based on both mean and median. As well, insolvent companies have a lower return on assets. There are not significant differences in means for the other variables, however, the median capital/asset ratio is lower for insolvent firms and the median growth rate in NPW for insolvent firms is negative.

¹⁴ See Pregibon (1981) for further details.

¹⁵ Depending on the variables included in a given model, the sample size will fluctuate due to missing data.

Table 6. Selected Summary Statistics

Variable	Solvent	Insolvent	
Natural log of assets			
Mean	17.72845	16.55641	**
Median	17.72589	16.8247	**
Return on Assets			
Mean	0.029837	-0.0154268	*
Median	0.030868	-0.0263312	**
NPW/Surplus			
Mean	1.302427	1.43146	
Median	1.002942	0.0900872	*
Capital/Assets			
Mean	0.425889	0.4845166	
Median	0.3687207	0.3557469	
Loss Ratio			
Mean	67.82721	87.14927	
Median	65.5	80.1	
Percentage Auto			
Mean	0.3117579	0.2140588	
Median	0.1999733	0.09375	
Rate of Change in Capital			
Mean	0.1861622	0.0361881	
Median	0.0881526	0.0237438	
Rate of Change in NPW			
Mean	0.6166933	0.1752308	
Median	0.086914	-0.2231463	**
Canadian Parent			
Mean	0.3846154	0.3846154	
Median	0	0	
Sample Size	4825	13	

T-test comparisons for means and Kruskal-Wallis tests for medians were utilized to test for significant differences between solvent and insolvent insurers.

** significant at 5%; * significant at 10%

Logistic Models

Table 7 presents the results for the logistic regression models. Three models were run, eliminating certain variables in the model in order to incorporate more insolvencies. Model 1 includes all nine variables, resulting in only 11 insolvencies being included in the analysis. Model 2 eliminates Percentage Auto which results in one additional insolvency being added. By

Table 7. Logistic Regression Results – Predicting Insolvency

	Model 1 - All Variables	Sample Model 2 - Excluding Percentage of Auto)	Model 3 - Excluding Percentage of Auto and Rate of Change in NPW
Intercept	3.8884 (0.85)	1.7397 (0.37)	1.3141 (0.30)
Natural log of assets	-0.5156 (-2.17)**	-0.4444 (-1.84)*	-0.4024 (-1.78)*
Return on Assets	-0.8211 (-1.63)	-1.0829 (-1.96)**	-1.0517 (-2.04)**
NPW/Surplus	0.0072 (0.18)	0.0160 (0.40)	0.0118 (0.09)
Capital/Assets	-1.4632 (-0.66)	-0.3488 (-0.17)	-0.5925 (-0.32)
Loss Ratio	0.0001 (0.17)	0.0001 (0.20)	0.0001 (0.22)
Percentage Auto	0.0002 (0.00)		
Rate of Change in Capital	-0.0597 (-0.86)	-0.0035 (-0.05)	-0.0034 (-0.05)
Rate of Change in NPW	-0.0003 (-0.1)	-0.0019 (-0.75)	
Canadian Parent	0.1335 (0.26)	0.3348 (0.66)	0.1477 (0.29)
Logistic R ²	0.0594	0.0498	0.0375

t- statistics in parentheses

** significant at 5%; * significant at 10%

	Type I error rate (%)		
	Model 1	Model 2	Model 3
Type II error rate (%)			
5	90.9	83.3	84.7
10	63.6	66.7	69.2
15	45.5	50.0	53.8
20	45.5	50.0	53.8
25	36.4	41.7	46.2
30	36.4	33.3	46.2

excluding both Percentage Auto and Rate of Change in NPW, model 3 is run using a total of 13 insolvent firms.

The signs for Capital/Assets, NPW/Surplus, Rate of Change in Capital, and Loss Ratio are all as predicted, but not significant. For the Rate of Change in NPW the expected sign was ambiguous, and the results indicate a negative relationship, yet it is also insignificant. The Canadian Parent variable had a positive sign, suggesting that Canadian-owned firms are at higher risk for insolvency, but again the variable is not significant. The two variables that are significant are size (in all three models) and return on assets (in models 2 and 3). Although the sample of insolvent insurers is small, the evidence indicates that smaller insurers and insurers with lower profitability have a higher probability of insolvency. These results are consistent with expectations. The fact that most of the variables are not significant may be due in large part to the small number of insolvent insurers.

Classification error rates are presented at the bottom of Table 7. Type I error rates are calculated for different Type II error rates. The type I error rate is the percentage of insurers that subsequently became insolvent that are incorrectly predicted to remain solvent. The Type II error rate is the percentage of solvent firms that are incorrectly predicted to become insolvent. For any given Type II error rate, a lower Type I error rate indicates a better model.

The ability of the model to correctly classify insurers is not very good. Misclassification rates are high for all three models, with Model 1 performing marginally better than the other two. These results are similar to those of Pottier and Sommer (2006) based on using individual company data and not incorporating group data, which they find to significantly improve classification results.

Conclusion and Future Work

This paper presents a preliminary analysis of insolvency prediction in the Canadian P&C insurance market. Given the small number of insolvencies and the limitations on the data available, the ability of the model to predict insolvencies is not very good. Future work will attempt to improve the model in the following ways: 1) incorporate more insolvencies by including provincial insurers; 2) incorporate additional variables including organizational form and group membership; 3) incorporate another level of analysis by including group data.

The small number of insolvencies over the past 25 years provides some evidence of the efficacy of solvency monitoring by the OSFI. In comparison to the U.S. where solvency is monitored at the state level, Canada's experience may provide relevant input to the discussion regarding the advantages and disadvantages of a single federal regulator.

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