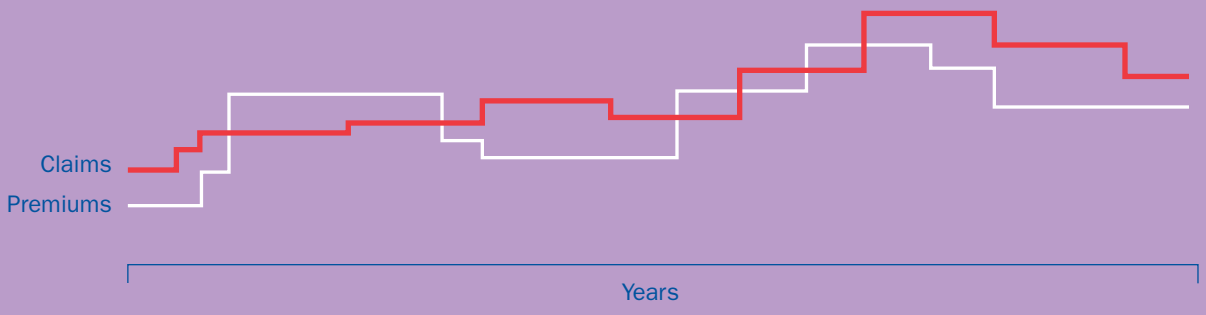
PACICC

Property and Casualty Insurance Compensation Corporation
Société d'indemnisation en matière d'assurances IARD

Why insurers fail

Inadequately pricing the promise of insurance



By

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PACICC's mission and principles

Mission statement

The mission of the Property and Casualty Insurance Compensation Corporation is to protect eligible policyholders from undue financial loss in the event that a member insurer becomes insolvent. We work to minimize the costs of insurer insolvencies and seek to maintain a high level of consumer and business confidence in Canada's property and casualty insurance industry through the financial protection we provide to policyholders.

Principles

- *In the unlikely event that an insurance company becomes insolvent, policyholders should be protected from undue financial loss through prompt payment of covered claims.*
- *Financial preparedness is fundamental to PACICC's successful management support of insurance company liquidations, requiring both adequate financial capacity and prudently managed compensation funds.*
- *Good corporate governance, well-informed stakeholders and cost-effective delivery of member services are foundations for success.*
- *Frequent and open consultations with members, regulators, liquidators and other stakeholders will strengthen PACICC's performance.*
- *In-depth P&C insurance industry knowledge – based on applied research and analysis – is essential for effective monitoring of insolvency risk.*

“For every promise, there is a price to pay”

JOHN ROHNX AMERICAN ENTREPRENEUR, AUTHOR AND MOTIVATIONAL SPEAKER

Executive summary

Insurance is a promise to pay claims in the future in exchange for premiums today. Confidence in the industry rests upon the foundation that these claims will be paid. Over the past 30 years, inadequate pricing and reserving has been the leading cause of failure for Canada's insurers. What can we learn from the experience of 14 Canadian insurers that failed due to price inadequacy and deficient loss reserves?

The leading cause of failure

Since 1979, 32 insurers have been involuntarily wound-up by Canada's solvency regulators. Several (11 companies) were financially sound yet were closed because their foreign parent became insolvent. But most became insolvent (21 companies). Two-thirds of the insolvent Canadian insurers over the past 30 years failed due to inadequate pricing, deficient loss reserves or rapid growth (14 of the 21 companies).

Insolvency arises when insufficient assets and capital are in place to cover the claims liabilities incurred. A few insurance companies have failed over the last 30 years because of shocks to their capital or reinsurance arrangements (3 companies). One company failed because it was overwhelmed by claims from a catastrophic event. A few companies failed due to alleged fraud (3 companies). But two-thirds of the Canadian insurance failures over the past 30 years were due to some form of price or reserve inadequacy (14 companies).

PACICC is Canada's national guarantee fund that protects insurance consumers from undue financial loss in the event that a member insurer fails. More than 75 percent of the claims paid by PACICC since it was founded were the result of insurers that failed due to price or reserving inadequacy.

This is the third report in PACICC's ongoing research into why insurers fail. Our objective in this report is to focus on lessons learned from insurance failures due to severe price or reserving problems. We have identified five factors that have contributed to severe price or reserve inadequacy:

Insurance pricing is difficult

Claims, the largest cost for insurers, are unknown when the customer is accepted. Pricing is determined and agreed to before costs are known. Actuarial analysis is used to anticipate the expected frequency and severity of future claims but actual costs are not known when prices are set. Some have described this as an inverted production cycle, noting that insurance is quite different from the other financial industries and most businesses where input costs are largely known when prices are set.

Pricing under duress

Troubled companies frequently assume additional risks when struggling to survive. Distressed insurers sometimes enter into new markets where the risks are unfamiliar, and/or they temporarily offer aggressive pricing to attract customers and additional revenue. While there may be examples where "gambling the company" proved successful, often these approaches cause the situation to deteriorate rapidly.

De-linking the relationship between claims costs and pricing increases insolvency risk

Anything that systemically disrupts the link between pricing and expected claims costs increases the risk of insolvency. Experience in Canada and the United States indicates that stricter forms of rate regulation can weaken or even disrupt the price/claim link. Specifically, these stricter forms of rate regulation can reduce the capacity of insurers to make rate changes consistent with changes in underlying claims patterns. As a result, an insurer may be forced to draw down its capital to support claims, possibly impairing its solvency strength in the process.

Data deficiency and poor information management

Most Canadian insurers that have failed due to price and reserve inadequacy had poor information management systems. The specific deficiencies varied, yet consistently failed to provide meaningful and timely information about claims costs needed to properly manage solvency risks.

Pricing is difficult in new markets

North American data show that almost one quarter of new insurance companies fail within their first five years of operation and 70 percent of failed insurers were less than ten years old. Setting adequate prices is a challenge for inexperienced insurers, including new companies and established companies that enter into new markets.

Overall, our detailed case review of the Canadian insolvency experience and supplementary analysis of the United States experience relating to inadequate pricing has identified a number of relevant general observations:

Governance and operational risk

- In many cases strategic decisions to enter new or unrelated lines lacked appropriate underwriting expertise and loss experience data.
- Prior to the wind-up of a company, management in many cases undertook strategies that could be described as "gambling for survival."
- Inadequate information and reporting processes and systems were found in 71 percent of involuntary exits linked to inadequate pricing.

Costs of insolvency

- Inadequate pricing is the leading cause of failure among insurance companies.
- Insolvent insurers that underwrote rate-regulated products were more expensive in liquidation than other insolvent insurers.

Monitoring and supervision

- When industry growth in claims costs exceeds growth in capital, the probability of insolvency increases.
- Managerial experience in new entrants is an important determinant in the survival capacity of an institution.
- Companies writing in new lines of business, outside their area of expertise, are at greater risk.
- Price controls in a rate-regulated system that de-links the price/claim cost relationship are a risk factor for insolvency.

Introduction

The insurance industry is built on policyholder confidence that insurance contracts will be fulfilled and eligible claims paid. This is the "promise" that insurers make to policyholders in exchange for premiums. For consumers, the purchase of insurance is a key component of how they manage their financial risk and consumer confidence in the industry is therefore closely linked to confidence in the solvency of their financial institutions. The credit crisis that began in 2008 clearly demonstrated that eroding confidence can rapidly and adversely impact a well-functioning financial industry. Insurer insolvency exposes claimants and policyholders to the risk of unexpected financial loss and the potential for considerable personal and economic cost.

There is a body of literature that examines the causes of insolvency among property and casualty (P&C) insurance companies. Consistently across both time and jurisdiction this literature has found inadequate pricing (deficient loss reserves) to be the leading cause of insolvency. Inadequate pricing, in some contexts called mispricing, is defined as:

> ***the consistent and broad failure to manage pricing risk such that the going concern assumption for the institution is at risk of being violated.***[1]

Inadequate pricing leads to an insufficiency of resources earned (either through premiums or investment) to establish appropriate loss reserves. A loss reserve is the amount established as the estimated cost of a claim. Deficient loss reserves may be the result of either past or present inadequate pricing of the product due to improper or inaccurate estimation. Alternatively, deficient loss reserves may occur because of future inadequate pricing, (for example, when the product that was priced was ultimately not the correct product. This may occur in long-tail lines, when retroactive change in the statutory or legal environment was not originally priced for).

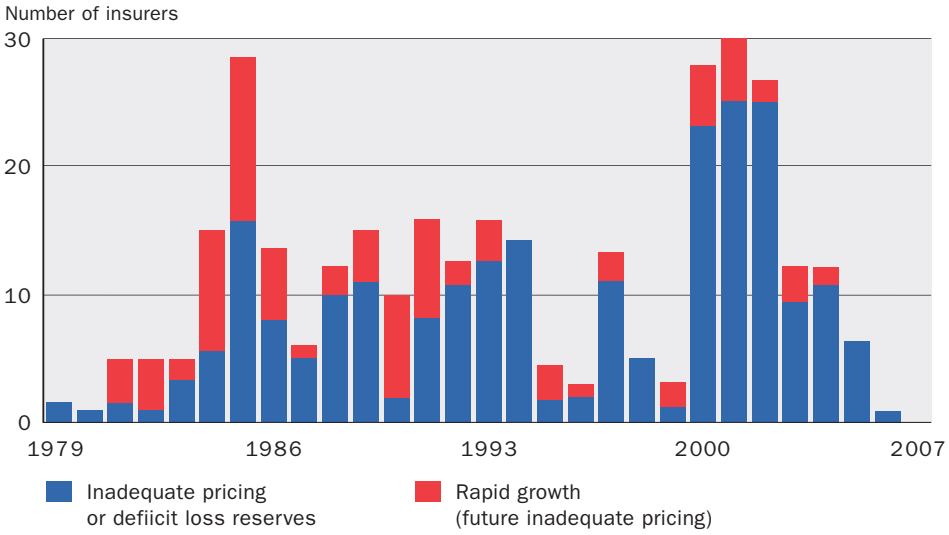
From a solvency perspective, inadequate pricing and deficient loss reserves are therefore effectively similar concepts, only approaching the problem from different angles. Rapid growth (defined as greater than twice the industry level of growth), encouraged by underpricing relative to the competition is a special case of inadequate pricing and deficient loss reserves.

According to data from A.M. Best and PACICC, in the United States and Canada since 1979 a total of 314 P&C insurers have involuntarily exited the market because of inadequate pricing. Since 2000, 115 P&C insurers from both countries, or half of all insurers that failed in that period, became insolvent due to inadequate pricing.

[1] This definition is not meant to include short-term decisions to under-price a product for strategic gain when there is sufficient capital to support such a strategy.

To the best of our knowledge, there is no body of literature that examines the sources of inadequate pricing in insurance insolvencies. However, given the enormous cost of such insolvencies, including the dislocation of policyholders and $25.3 billion USD in guarantee fund assessments since 1979 (inflation adjusted to 2008 and equalling $32.3 billion CDN), an improved understanding of the dynamics of inadequate pricing in insurance would be beneficial for guarantee funds, solvency supervisors and policymakers.

Figure 1 – Involuntary exit from inadeqate pricing
(Canada and U.S.)

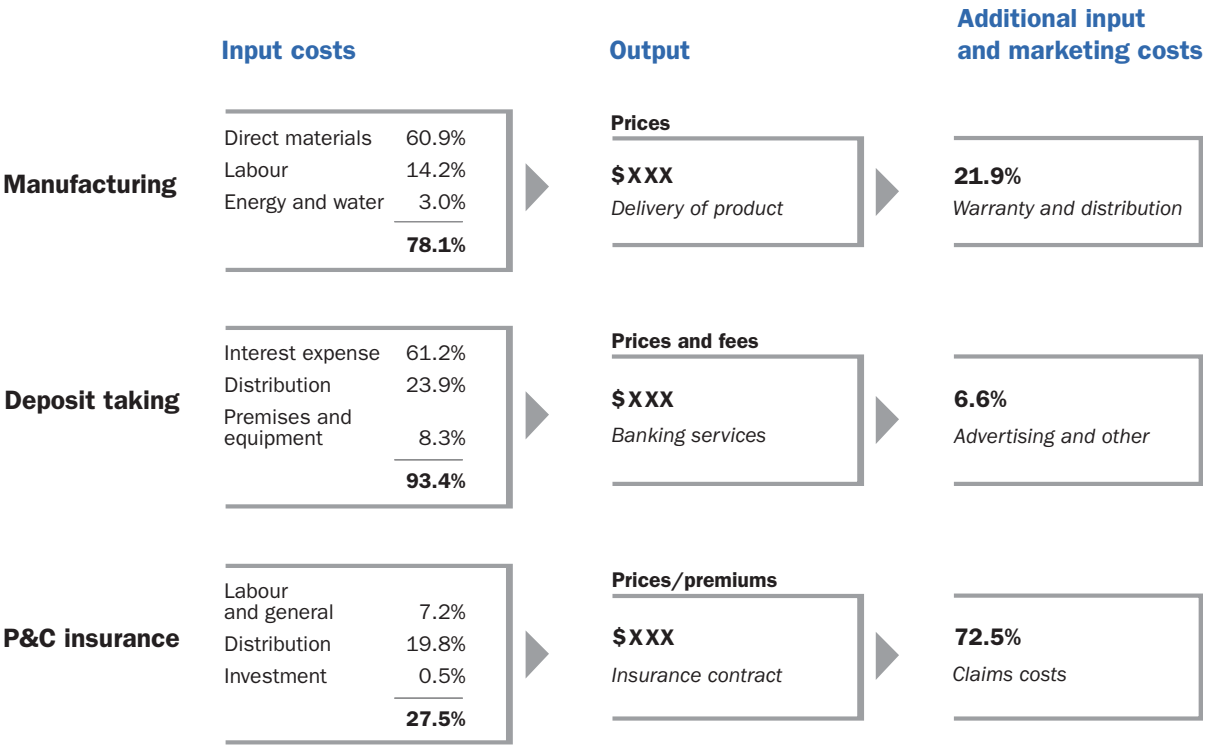


Source: Data from PACICC, A.M. Best

A historical overview of insurance underwriting

Inadequate pricing is a recurring cause of property and casualty insurer insolvency due to the industry's inverted production process. In contrast to most other goods and services where input costs are largely known beforehand and are used to set prices, insurer output prices (insurance premiums) are established before most of the input costs (insurance claims) are known. At the beginning of the contract, policyholders pay a known insurance premium in exchange for a promise of compensation should some uncertain future event involving a loss occur.

Figure 2: Industry production cycles



Source: Manufacturing (Statistics Canada Cansim database). Deposit taking (OSFI website). P&C insurance (MSA Researcher).

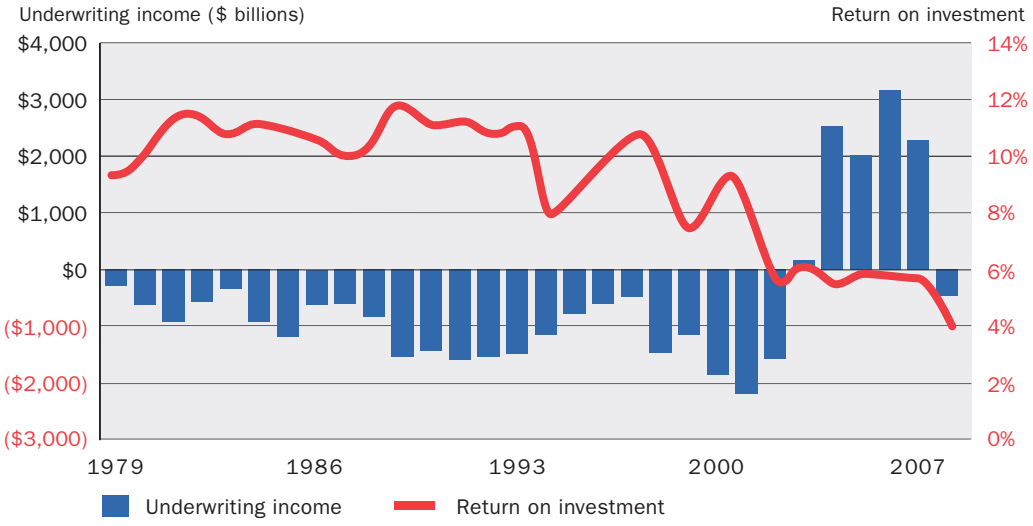
As can be seen from Figure 2, the production cycle of the P&C industry is indeed inverted.[2] Nearly three quarters of the costs of the product are incurred after the contract is delivered, in some long-tail lines perhaps not materializing for a decade or more. Importantly, largely as a result of this inverted production process, illiquidity rarely precedes the insolvency of a P&C insurance company (Plantin & Rochet, 2007). This is in contrast to most other industries which typically experience liquidity constraints before insolvency. Because P&C insurers receive the premium before the costs are incurred, under-reserving may not result in a liquidity challenge prior to technical insolvency.[3]

[2] Comparing the production processes of different industries presents challenges as, for example, core input costs in one may be an inconsequential or post-production cost in another. For example, distribution is a core business process of financial services but not of manufacturing (automakers notwithstanding).

[3] It should be noted that insurance actuaries do estimate claims costs and factor this into the pricing of insurance contracts. The fact that most insurance companies operate successfully speaks to their actuarial skill and success. However, the large uncertainties prevalent in this process and the after-the-fact occurrence of claims have historically continued to present risks to solvency, particularly when combined with inadequate risk management and governance.

Historically, P&C insurance companies have consistently earned an underwriting loss on their product. Between 1979 and 2007 the Canadian P&C insurance industry generally charged policyholders a premium level (after adjusting for inflation) that was a cumulative $22.8 billion less than was necessary to pay claims and underwriting expenses. Insurance companies invested the premiums to earn sufficient investment income to compensate for the underwriting loss.

Figure 3 – Policy subsidization by investments
(Canada)



Source: PACICC, with data from IBC

While the incorporation of investment income into the pricing model has long been part of standard practice, with the advent of sustained underwriting losses in the late 1970s, the incidence of involuntary exit grew. For example, during the period of 1960 to 1978, only three insurers failed – or one every six years. Only one of these failures was due to inadequate pricing. During the 1979 to 2008 period, 32 insurers failed, slightly greater than one company per year. Highlighting this, during the 1980s, a period of interest rate volatility and rising claims costs (particularly in liability lines), seven Canadian P&C insurers failed as a result of inadequate pricing and reserving.

During this period, the industry generally relied on strong investment performance for success. However, this model also increases an institution's risk profile as the company is subject to risk from two sets of parameters instead of one: investments and underwriting. Success is dependent upon the ability of management to estimate these parameters. From a solvency perspective, an insurer operating such that premiums fund the underwriting risks is subject to risk primarily from underwriting parameters.[4]

In a low interest rate environment, such as that experienced since the early to mid-1990s, those insurers who place a greater reliance on investment income for financial health generate increased exposure to insolvency risk in the event of unexpected claims trends or developments in financial

[4] Underwriting parameters include reserve estimation, appropriate risk selections, etc. The insurer is still subject to investment and/or asset risk but this should not be an inadequate pricing risk.

[5] Further, because a low interest rate environment reduces investment income from "safer" investments such as government bonds, some insurers relying on investment income may pursue higher-risk investments.

markets.[5] Reflecting this, inadequate pricing and rapid growth were the primary cause of involuntary exit for 80 percent of all Canadian P&C failures since the mid-1990s – a period of low and stable interest rates. During the period between the mid-1970s to the early 1990s, interest rates and inflation were both higher. These same sources of involuntary exit only represented 44 percent of all involuntary exits in Canada.

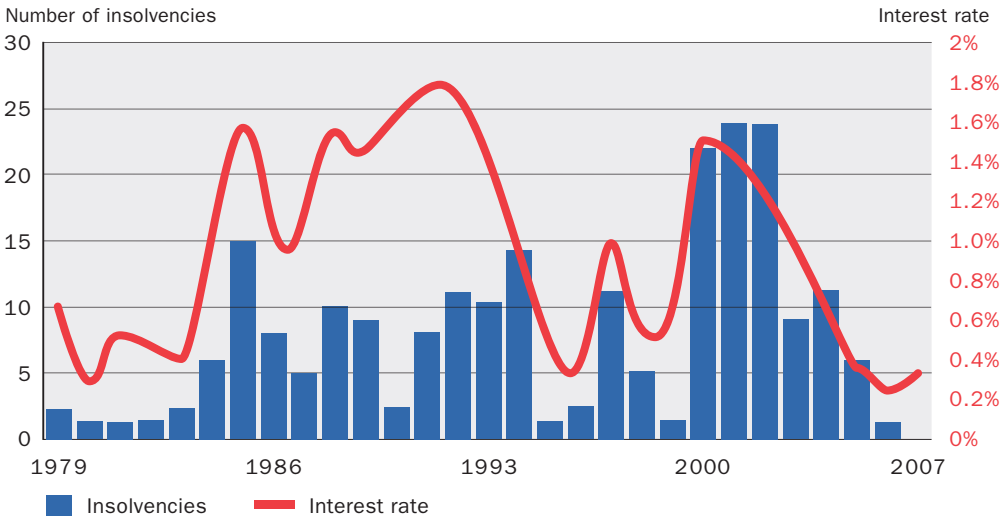
Table 1: Comparing inflation and interest rates

	1975 to 1991	1992 to 2006	
Consumer Price Index	7.25	1.85	3.9x
90-day Treasury Bill	10.33	4.30	2.4x

Source: PACICC, with data from Statistics Canada

Prior to 1990, the correlation coefficient between return on investment and underwriting results was -80.9 percent. The magnitude and sign of the coefficient indicate that as investment income increased, underwriting profitability decreased. This correlation, while still strong, has weakened by a third since the 1990s. In the past decade, Canadian P&C insurers have adapted to the new interest rate environment by exerting underwriting discipline and aligning underwriting costs with premiums.

Figure 4 – Interest rate volatility* and involuntary exits from inadequate pricing
(United States)



** Standard deviation of US Treasury yields*

Source: PACICC, with data from A.M. Best and U.S. Federal Reserve

Insurance companies with sufficient capital and risk management supporting the strategy, may also temporarily underprice a product for strategic or competitive reasons (for example, to gain market share). However, A.M. Best (2002) noted that the sustained period of high interest rates in the late 1970s and early 1980s encouraged many insurers in the United States P&C industry to adopt an underwriting strategy reliant on investment income. Insurers in the United States also invest a higher proportion of their assets in stock markets than Canadian-based insurers and increases in the stock market also supported such underwriting.

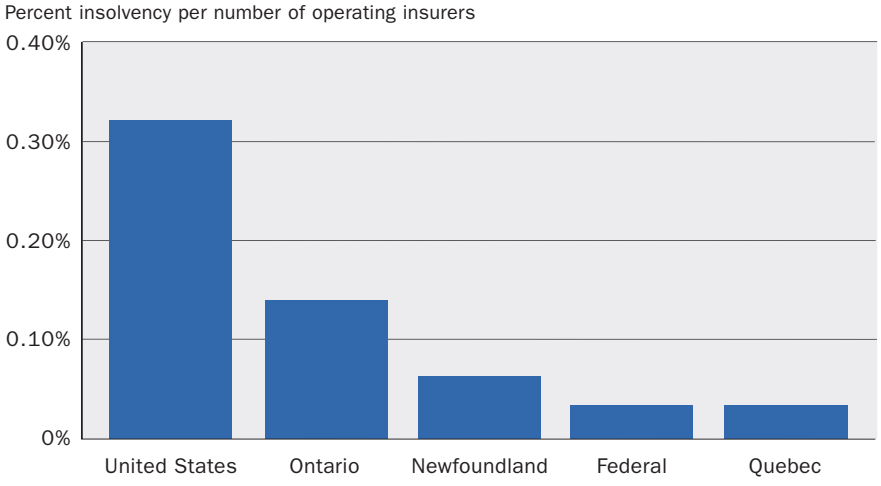
As a consequence, in the United States, the relationship between interest rates and the proportion of financial impairment as a result of inadequate pricing has also been historically strong.

Insolvency experience by jurisdiction

Individual insurers are supervised for solvency purposes by the jurisdiction in which they are incorporated. Companies incorporated under the federal *Insurance Companies Act* are regulated by the Office of the Superintendent of Financial Institutions. Insurers incorporated under the various provincial statutes are regulated by provincial superintendents. In 2007, there were 154 provincially regulated insurance companies (for solvency purposes) and 192 federally regulated insurance companies writing $9.5 billion and $30 billion in premiums, respectively.

Frequency on the basis of supervised institutions shows Ontario to have the highest frequency of P&C insurance company insolvency as a result of inadequate pricing in Canada. In Ontario, the majority (80 percent) of companies that involuntarily exited the market as a result of inadequate pricing were primarily writers of automobile insurance (compared to 55 percent of insurers who were primary writers of Ontario auto insurance).[6]

Figure 5 – P&C insolvency frequency by supervisory jurisdiction (failures from inadequate pricing 1990 to 2007)



Source: PACICC

Among federal insurers, the frequency of involuntary exit has been declining since the reform of the federal supervisory system and establishment of OSFI in 1987. Supervisory resources dedicated to enhancing accounting and actuarial reliance (for example peer review) have further supported reduced frequency. Since 1990, only one federally supervised insurer (which was in run-off) has failed as a result of inadequate pricing or deficient loss reserves. No federally supervised going concern insurers have failed as a result of inadequate pricing in nearly two decades.

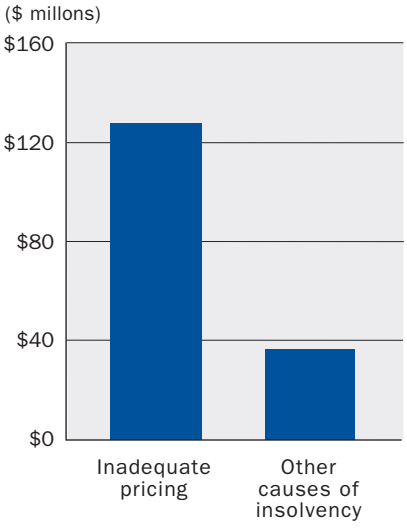
The average frequency of involuntary exits linked to inadequate pricing (0.10 percent) for Canada is approximately one-third of that for the United States. Among involuntary exits linked to inadequate pricing in the United States, a majority (58 percent) were domiciled in rate-regulated jurisdictions. By comparison, the average number of states with prior approval or state-prescribed pricing between 1990 and 2007 was 19, or 35.3 percent of jurisdictions.

[6] A primary writer of auto insurance is defined as an insurer with two-thirds or more of its premiums written in the Ontario automobile insurance product.

Inadequate pricing: the Canadian experience

Since PACICC was established in 1989, ten insurance companies have failed as a result of inadequate pricing in Canada, representing 71 percent of all P&C insurance failures in the past 20 years.[7] These insolvencies directly affected 193,000 policyholders and cost the industry (after accounting for inflation) $128 million.

Figure 6 – PACICC claims payments by cause of insolvency



Source: PACICC, inflation-adjusted to 2008

The pricing of an insurance contract is an inherently challenging process. Insurers are setting a price on an unknown future risk – the payment of future claims. Policyholders enter into short-term contracts – typically a year in length – by paying premiums in exchange for financial protection from losses due to the occurrence of unforeseen future events, accidents, natural disasters or legal liability. As with all predictive exercises, there is significant uncertainty in the estimation of both individual and aggregate insurance losses. Therefore, a major challenge for all P&C insurers is the estimation of the size and timing of future cash outflows necessary to pay claims as they are incurred.

This challenge with estimating future losses manifests through both the underwriting and reserving processes. Underwriting or risk selection is the assessment and acceptance of risk in exchange for a premium whereas reserving involves the estimation of the future costs and claims-related payouts. Both underwriting and reserving are important factors in the determination of the premium to charge for a risk.

Inadequate pricing and deficient loss reserves are two sides of the same coin and manifest through higher than expected/estimated loss resulting in adverse loss development. From a detailed case-by-case review of 35 failed Canadian P&C insurers, there is a range of scenarios that led to the inadequacy of pricing and deficient loss reserves (Dibra and Leadbetter, 2008). However, in broad terms they can be grouped into four primary types of scenarios:

- strategic decision-making/governance
- underwriting/risk selection
- under-reserving, and
- new entrant.

In general, two or more of these characteristics can be observed in every involuntary exit identified as having failed from inadequate pricing.

[7] Insurers identified as having a proximate cause of failure being current deficient loss reserves or rapid growth (future deficient loss reserves). If liquidity risks (where solvent Canadian insurers were wound-up due to the failure of a foreign parent) are excluded, then 71 percent of failures were related to inadequate pricing.

Strategic decision-making and governance

For the majority of the insolvencies in Canada (61 percent), the cause of involuntary exit can ultimately be traced to a strategic risk or operational decision by the company. If branch insurers are excluded, this proportion increases to 84 percent.[8]

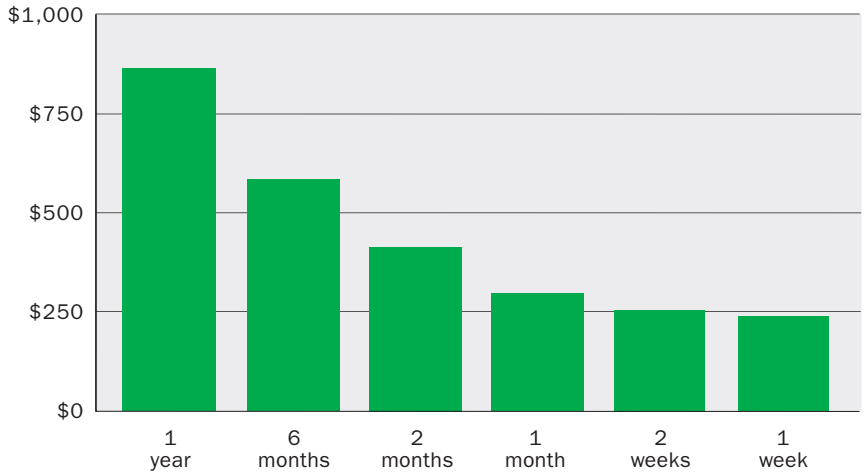
Internal controls and financial reporting are an important aspect for the accountability and operational effectiveness of an insurance company. Internal controls and processes may break down for a number of reasons, but company solvency risk is further increased when they are purposefully circumvented. Alleged fraud was involved in three (9 percent) of the identified involuntary exits in the entire period covered in the study (1979 to 2008). It was also identified as a contributing factor to other insolvencies. Most of these failed companies were newly licensed and operating for less than three years.

In the Canadian insolvency experience since 1979, of the fourteen involuntary exits resulting from inadequate pricing, five management teams were relatively inexperienced either in a new line of business or had limited direct insurance underwriting experience. Seven others demonstrated operational weakness.[9]

Upon becoming financially stressed, in the sample of insolvent Canadian insurers (excluding branches), 60 percent could be identified as exhibiting a "spiral of decline" as outlined by Kanter (2003). For example, behaviours such as repeated changes in strategic direction and entering and exiting new lines of business in rapid succession occurred in several distressed insurers. In the Canadian insolvency experience since 1979, of the 14 involuntary exits resulting from inadequate pricing, 10 exhibited managerial and/or strategic behaviour consistent with "gambling for survival" or a "spiral of decline." Figure 7 provides an example of one such insurer's pricing activity as it sought to attract premium in its final year of operation in its "gamble for survival."

Figure 7 – Markham General Insurance Company

Average annual auto insurance premium by period leading up to winding-up



Source: PACICC, with data from liquidations

[8] Historically, branch insurers are wound-up because of the failure of a foreign parent rather than due to exposure to the Canadian underwriting environment. Excluding branches puts the focus on insurers that failed as a result of Canadian underwriting conditions.

[9] Operational weakness is defined as a weak internal control system which provided limited capacity for accountability or performance measurement. Adequate performance measurement allows managers to evaluate skills, systems and take timely and effective action to correct problems.

Underwriting and risk selection

The second set of experience involves challenges in risk selection and underwriting. An insurer would consistently under-price the product, in some cases to maintain or gain market share in a period of rising claims costs. Typically, this was accompanied by weak or loosened risk selection which in some cases led to the selection of risks either outside the company's prior experience or higher than planned for.

In several cases where this occurred, the strategy was supported by insufficient capital and the management was expecting to ride out the rough time in the belief that the insurance cycle would turn around before it got to the point of insolvency. Typically, when the situation became more critical (that is, it became difficult to pay claims), these insurers would start to grow even more rapidly, selling policies in order to generate revenue to pay current claims. This scenario was more typical of small regional insurers.

Reserving

The final set of experience involved reserving challenges. In these cases, more common among liability writers, an insurer would price the product more aggressively than the rest of the market and claims reserves were also set comparatively low. As the actual claims costs were incurred, these insurers had not set aside adequate reserves for the liability and had insufficient capital to absorb the losses. This occurred more with insurers exposed to the U.S. market, particularly asbestos and other significant liability risks.

Of course, risk selection and reserving are generally not independent of each other. However, for the purposes of this review, we define reserving as the estimation of claims liabilities and risk selection as follows: the underwriting of policies that conform to the corporate strategic plan and underwriting guidelines. Deficient loss reserves are therefore defined as a mis-estimation of liabilities and inappropriate risk selection or a deviation from or lack of underwriting guideline leading to the assumption of risks outside the plan or experience of the company.

New entrants

The involuntary exit of a new entrant linked to inadequate pricing is a special case of the previous factors. During the period between 1985 and 2005, nearly a third of all new entrants into P&C insurance in Canada were wound-up. Among failed new entrants that were in business less than ten years, 57 percent were wound-up as a result of inadequate pricing (most of the rest were related to fraud).

A new entrant may be a new company or a new entrant into a line of business. In four cases, an insurer entered a line of business and did not have sufficient knowledge or data to properly estimate the expected losses. Two were new players in the industry with limited underwriting experience. In two other cases, a relatively small insurer expanded aggressively into new lines of business (one into auto insurance and the other into commercial lines) in which it had limited

experience. In one case, the insurer was already experiencing financial distress and exhibited signs of "gambling for survival" by its entry into the new line of business. The second company had no prior financial stress but misjudged the claims experience. Both insurers had decades of experience in the insurance industry.

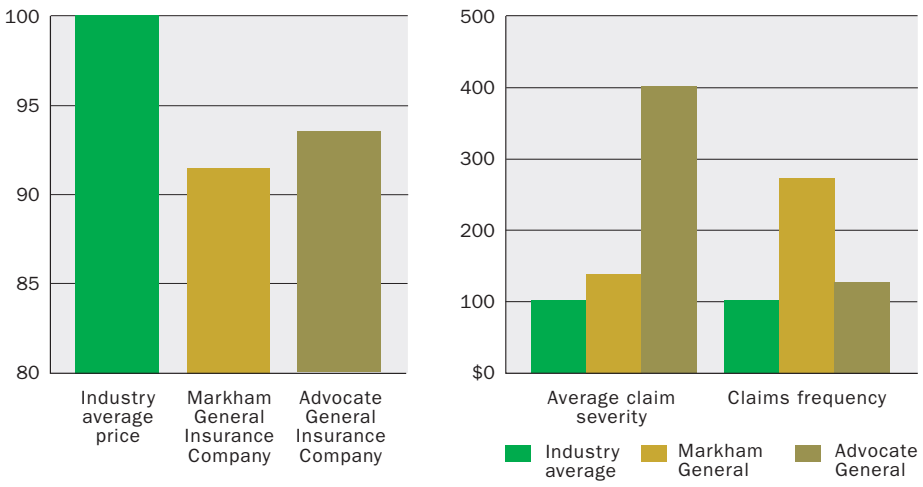
Among many new entrants, management appeared overly optimistic about the profitability of the market, and believed their corporate business model would deliver lower costs than found elsewhere in the industry. As a result they under-priced the product to gain business. In an industry where the primary consideration for consumers is price (particularly in the key automobile insurance segment), a strategy for growth is to underprice competitors. While taking losses for market share is not uncommon, in cases where it led to insolvency, under-pricing was often much more aggressive than elsewhere and not supported by knowledge of the market or appropriate risk management. Typically, this occurred in conjunction with limited capital being put into the endeavour, quickly leading to its depletion and to the eventual wind-up of the insurers.

The lessons from the Canadian experience therefore suggest that the risk of inadequate pricing of insurance is significantly higher for new entrants into a line of business, or into an unrelated line of business for experienced insurers.

Aggressive pricing practices

The common theme underlying each set of experiences is an aggressive pricing or underestimation of risk related to the insurance product relative to the market. In fact, most involuntary exits involve more than one factor. Exits as a result of deficient loss reserves typically had a higher concentration of business in higher-risk policies.

Figure 8 – Pricing and claims experience: auto insurance policies



Source: PACICC, with data from liquidations and General Insurance Statistical Agency (AU90)

This pricing and underestimation of risk is illustrated below with two examples of failed Canadian insurance companies. In general, each experience represents a different miscalculation that led to the mis-estimation of the claims experience. Advocate General underestimated the severity (and subsequently established insufficient reserves) of its claims experience. In contrast, Markham General loosened its risk selection process in order to grow rapidly, building a book of business with higher-risk policyholders that were much more likely to make a claim.

Analysis of corporate characteristics: inadequate pricing

The previous section identified various factors related to involuntary exit and inadequate pricing in the Canadian historical experience. Given the existence of statistical data plans and extensive actuarial research on pricing models, the question exists, for example in risk selection, as to why an insurer would make such a catastrophic mistake. This section attempts to provide some insight to this question of "why."

A few potential mechanisms can be identified that could result in a systemic and catastrophic mis-pricing of insurance policies so as to result in the ultimate failure of the company (more than one of which may have played a role in the outlined historical scenarios). The following sources of mis-pricing are discussed:

- firm size and data deficiency
- managerial experience
- rate regulation.

Firm size and data deficiency

The insurance industry devotes considerable actuarial resources to developing pricing tools and techniques for insurance risks. Similarly regulators and rating agencies have devoted considerable resources to monitoring the pricing and reserving of insurance. At its most basic, however, insurance pricing is typically based on historical loss trends. Actuarial judgement and other techniques, including modeling for catastrophic risks may supplement the base model. Despite these resources within the industry, in the Canadian insolvency experience since 1979, of the 14 involuntary exits resulting from inadequate pricing, 10 failures (71 percent) exhibited data or information systems-related challenges and deficiencies. These deficiencies took a variety of forms but typically made it difficult for the insurer to conduct analysis or extract meaningful claims cost information.

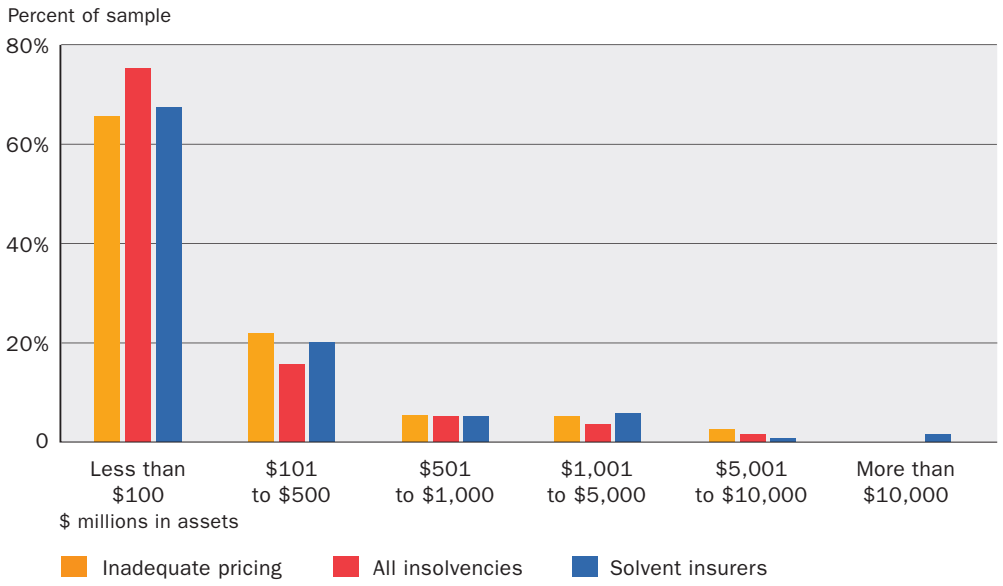
The need to measure risk and develop expectations on future claims costs means that insurance pricing is heavily reliant on statistical loss data for its pricing models. An insufficient loss history for a particular risk can lead to mispricing and possibly insolvency. A very simple illustrative example of how the use of an inappropriate or insufficiently representative dataset could result in mispricing is found in Exhibit I.

While the simulation in Exhibit I represents an extreme example for demonstration purposes, it does highlight that inappropriate data can lead to financial distress.

For the standard lines of business such as automobile and property (fire) insurance, there is a breadth and depth of loss history on which to base pricing. In the United States, there are several statistical agencies (Insurance Services Office, etc.) that provide data and actuarial services to insurance companies for their underwriting. In Canada, the General Insurance Statistical Agency (GISA) provides statistical data on auto insurance and Ontario general liability. Further, the Insurance Information Division of the Insurance Bureau of Canada (the contracted data agency for GISA) provides statistical data on personal property for subscribers and regularly holds data quality sessions for insurers. Similarly, the Casualty Actuarial Society regularly holds seminars on pricing.

Limited loss experience and data may be an issue in the pricing of certain risks. Policies with exposure to natural catastrophes would be an example. In nearly five decades of experience, only one Canadian insurer has failed from natural catastrophe risks. However, as the A.M. Best data separates such sources of involuntary exit from the inadequate pricing sample, they would therefore offer limited explanatory power for involuntary exits due inadequate pricing.

Figure 9 – Size distributions of insurers



Source: Data from A.M. Best

Using data from the United States, the size distribution of companies failing from inadequate pricing (Figure 9) is not substantially different from the industry distribution, suggesting that insufficiency of data may not be a systemic risk. However, insurers failing from other causes do tend to be smaller in size.

An analysis of the Canadian experience finds that the primary source of data deficiency for most involuntary exits was the inadequacy of the insurer's own information management systems, rather than a lack of data. But in a few cases, particularly in commercial lines, the lack of loss data was a factor.

Managerial experience

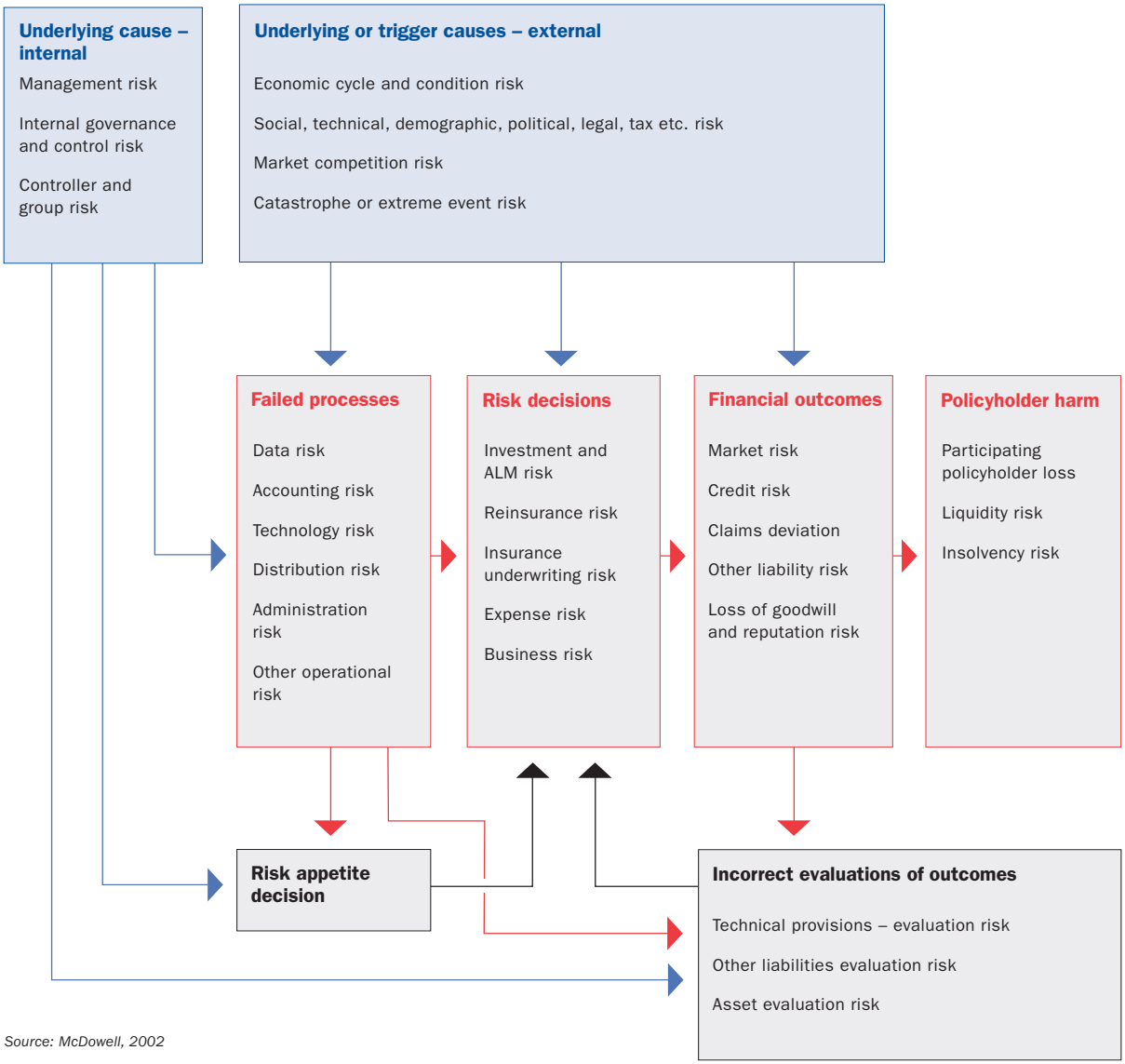
Management plays a central and critical role in the governance and operational management of the risks faced by an insurance company. Management determines the risks to be underwritten but also how they are underwritten. Managerial experience may either amplify or mitigate risks. For example, managers with greater experience may be able to draw on their experience and recognize whether the pricing model is consistent with industry practice and trends.

Those with less experience may be less likely to recognize those patterns or inadvertently make other higher-risk operational choices. The risk map framework in Figure 10 illustrates the linkages where the quality and experience of management can affect the business processes, risk tolerance and pricing of an insurance company.

Considerable research effort has been devoted to the study of effective managers (see, for example, Goleman, 1998; Collins, 2001). In financially stressed or distressed institutions, the reaction of management can be important for the success of the institution's turnaround (Kanter, 2003). Managerial activities, such as focusing on self-protection, building barriers to information and creating harmful incentives can lead to a cycle of decline (Kanter, 2003).

Among the 35 Canadian P&C insurance insolvencies since 1960, 46 percent exhibited weaknesses in their operational management relating to their oversight of internal controls or other business process-related issues. In one-fifth of these, inexperience in a new line of business could be identified as a factor. In addition, three of these experienced fraud by senior management.

Figure 10 – Insurer risk map



Source: McDowell, 2002

Rate regulation

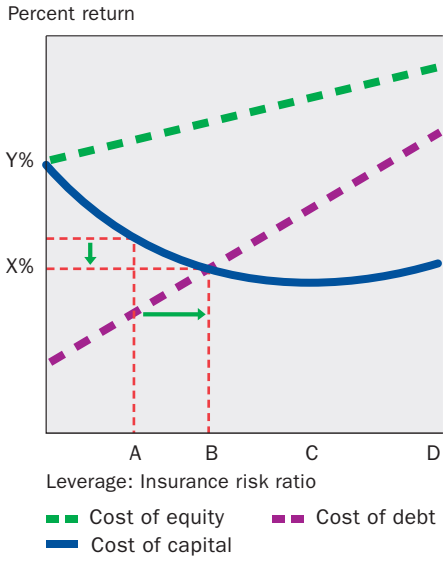
Active price regulation in Canada is a relatively recent phenomenon that until 2003 was restricted to the province of Ontario. At that time, a hard insurance market, with historically low profitability and subsequent premium increases for consumers, at that time spurred a political reaction toward adopting price regulation in Alberta and Atlantic Canada.

In the United States and Europe, rate regulation has had a longer and different history. American experience with auto insurance regulation differs from Canada due to a different legal and constitutional framework. In the United States, the *McCarran-Ferguson Act* of 1945 exempts any insurance company that is subject to other state regulations from federal anti-trust laws. To take advantage of this exemption, all states established state regulation of insurance by 1951, primarily for solvency purposes. According to data from Harrington (2002) and the Insurance Information Institute, stricter forms of rate regulation were in place in up to 37 states during 1970s, as few as 25 in the mid-1980s, up to 32 in the late 1990s. Following recent reforms in a number of states, strict price regulation (prior approval and state prescribed) was applied in only 12 states in 2007.

In Europe, the *Third Council Insurance Directives* introduced the 'freedom of service' principle and completed the establishment of a single European insurance market. This resulted in the removal of strict price regulation in most European countries after 1992. Currently, European supervisory authorities generally have only limited means of interfering with the premium setting by insurance companies. Outside of Europe and North America, the regulation of insurance prices is relatively common in both Southeast Asia and Latin America.

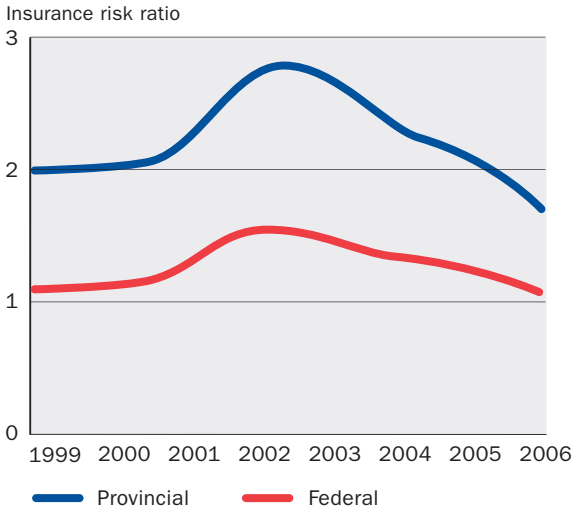
Rate regulation may have two mutually supporting transmission mechanisms related to insolvency. First, standard finance theory indicates that price controls generate incentives to reduce exposure (capital commitments) by owners of firms by increasing leverage. Firms that have capital that is subject to regulatory constraints (for example, on rate of return), will in general deploy less capital (see Figure 11A). In Canada, leverage rates between provincially-supervised insurers are higher than those for federally-supervised insurers (see Figure 11B).

Figure 11A – Rate regulation and cost of capital theory



Source: Based on Stephen Ross (2005). "Capital Structure and the Cost of Capital" Journal of Applied Finance

Figure 11B – Leverage by type of incorporation



Source: PACICC, with data from MSA Research and IBC. Insurance risk ratio = NPW/equity

While federal insurers are also subject to rate regulation in their automobile insurance business, the federal supervisory authority has noted in its annual reports the solvency-related risk that rate regulation may pose to insurers in a deteriorating underwriting environment. Federal insurers are expected to take this and others risks into account when setting their company MCT target at some point above the supervisory minimum. Provincial insurers do not typically, on a systemic basis, have similar supervisory oversight to mitigate the incentive effects.

Second, in addition to the incentive effects, stricter forms of rate regulation may reduce the ability of insurers to make rate changes consistent with changes in underlying claims patterns. As a result, an insurer is forced to draw down its capital to support claims. The example found in Exhibit II, which is based on actual claim trends during the period 1999 to 2002 in Canada, illustrates the principle.

Stricter forms of rate regulation may therefore de-link changes in the price of insurance from changes in the cost of insurance claims. Evidence of such de-linking can be found within the Canadian automobile insurance data. Statistical correlations in Canada between average earned premiums and average claims incurred (or alternatively claims incurred per earned vehicle) have generally been close to unity during the 1986 to 2001 period for most jurisdictions.[10] The exception is Ontario following the introduction of a prior-approval form of rate regulation in late 1989.

Figure 12 – Relationship between average price and average claim* (all provinces 1986 to 2007)

** We use average claims because it is more intuitive than other measures. Alternative measures such as average claims cost per earned vehicle yield similar results (an R-squared of 0.846 rather than 0.9033).*

[10] The period 1986 to 2001 roughly represents two full insurance cycles in Canada. The use of an entire cycle allows for the average long-term systemic effect, after accounting for periods of price softening and hardening.

Table 2: Correlation coefficient between average premiums and average claims costs for private passenger automobile insurance

	Ontario	Alberta	Atlantic Canada
1986 to 1989	0.99	0.63	0.99
1986 to 2001	0.61	0.95	0.95
2002 to 2007	0.60	0.09	076

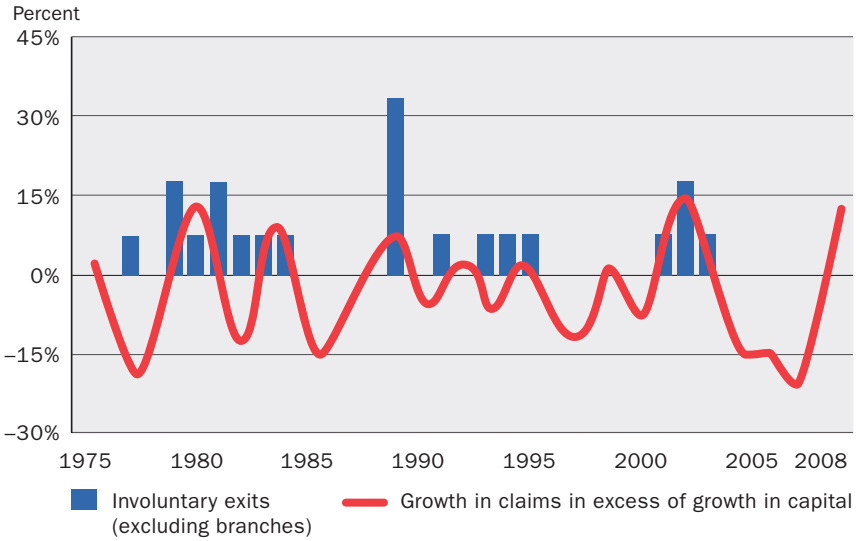
Source: IBC Insurance Information Division, Private Passenger Automobile Economic Trends Exhibit
(Shading indicates a period that included rate regulation)

From Figure 12 and Table 2, there is evidence a de-linking of the relationship between changes in claims costs and those of prices under rate regulation.

For Alberta and Atlantic Canada, the price freezes during 2002 and subsequent introduction of rate regulation in 2003 led to a similar de-linking of average prices and average claims costs. Our access to data from the United States is limited to the period of 2002 to 2004, a period in which automobile claims costs per exposure were falling. Nevertheless, a similar trend can be found in auto insurance there. Non-rate regulated states had a higher correlation between prices and claims costs (73 percent) than states with stricter forms of rate regulation (53 percent).

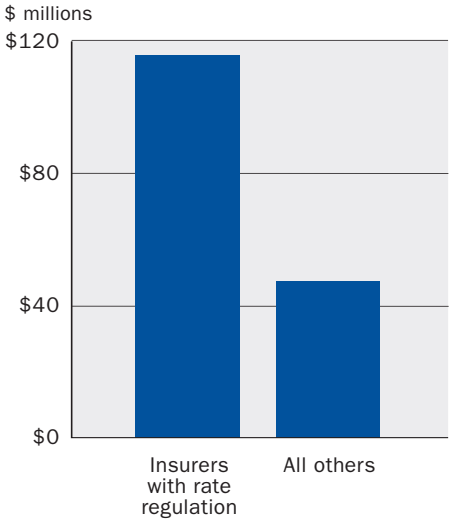
Figure 12 illustrates the greater dispersion in the average price/claim relationship associated with rate-regulated as compared to non-rate regulated.[11] In general, there is evidence that stricter forms of rate regulation can de-link changes in the price of insurance from changes in the cost of insurance claims. Subdividing the Canadian data for 1986 to 2007 into periods of soft markets and hard markets, the correlations between average price and average claims during a soft market (where prices are declining) in rate-regulated jurisdictions is 96 percent. This suggests that the detrimental effect of rate regulation on the relationship between claims and prices exists primarily when claims costs and prices are moving upward.

Figure 13 – Capital and involuntary exit



Source: PACICC with data from MSA Research

PACICC claims payments (1989 to 2008)



Source: PACICC, inflation-adjusted to 2008

[11] Note: while the vertical and horizontal axes show different dollar amounts, they have the same range (9000 on the y-axis and 600 on the x-axis) so that the differentials are the same and the spreads comparable.

Rate regulation is not in itself a direct cause of inadequate pricing. Rather, rate regulation can adversely affect an insurer's ability to respond to changes in claims trends. Risk increases if claims costs increase at a rate faster than can be accommodated under the rate regime, requiring an insurer to draw down its capital. Insurers with less capital and/or greater rate inadequacy are therefore less likely to achieve rate adequacy before the onset of financial distress. In the industry, historically the risk of insolvency increases when claims costs exceed capital growth (Figure 13).

Put simply, price controls that de-link prices from claims costs for an already stressed insurer can have a detrimental effect on the company's solvency.

In the Canadian insolvency experience since 1989, when rate regulation was introduced in Ontario, of the 10 involuntary exits resulting from inadequate pricing, five were writers of rate-regulated Ontario automobile insurance. These five rate-regulated insurers that failed as a result of inadequate pricing generated $115 million in claims costs for the guarantee fund system, or 90 percent of the total claims incurred from failed insurers as a result of inadequate pricing. These claims costs also accounted for 71.1 percent of the total financial obligations incurred by PACICC since 1989.

Statistical analysis of U.S. P&C insurance insolvencies

The purpose of this statistical analysis is to supplement the case study analysis of the Canadian insolvency experience and reinforce or further gain insight into the risk factors associated with insolvency and inadequate pricing. The Canadian data sample of insolvency is small, making statistical inference challenging. We have therefore utilized the broader set of data from the United States to further assess the issue of severe pricing inadequacy. The overall purpose of this statistical analysis was not to create another predictive model of insolvency, nor necessarily to compare different methods against each other, and thus differs from most previous work. The primary goal is to establish whether a tangible relationship exists between specific risk factors for mispricing and insolvency.

Literature review

Insolvency prediction and the various sources of mispricing in the P&C insurance industry are all topics that have been subject to extensive research.[12] While insolvency may be incorporated into some pricing models, there is rarely a linkage between the causes of mispricing and insolvency.

On insolvency prediction, multiple methods have been applied to better identify at-risk institutions. For example, Brockett, Cooper, Golden, Pitatong (1994) used neural networks and Beaver, McNicols, Rhie (2005) employed a hazard model. However, the logit/probit approach is by far the most popular whether it is used strictly on its own as in Cummins, Grace, Philips (1999), Pottier, Sommer (2002), Sharpe, Stadnik (2007) or used in a modified manner as in Cummins, Harrington, Klein (1995) and Chen, Wong (2004). BarNiv and McDonald (1992) tested a variety of methods in insolvency prediction and favoured probit/logit for its superior ability to examine predictive differences over different time periods and regions.

Typical for most research in insolvency prediction is a period of three-to-five years projected two-to-three years into the future to predict insolvency. IRIS (Insurance Regulatory Information System) and FAST (Financial Analysis and Surveillance Tracking) ratios, or equivalents when using non-U.S. data, in combination with other factors such as the type of company (mutual/stock, size, etc.) are standard measures used to predict insolvency. Grace, Harrington, Klein (1998) found that risk-based capital (RBC) ratios are of little predictive value on their own but add to the predictive power of IRIS and FAST ratios. Pottier and Sommer (1997) conducted similar analysis using private sector RBC ratios and concluded that these ratios are not useful for the prediction of insolvency.

A.M. Best (2004), Dibra and Leadbetter (2007) and McDonnell (2002) aggregated the results of individual case reviews of national sets of failed institutions in the United States, Canada and the United Kingdom. Each of these studies found that inadequate pricing and deficient loss reserves were the leading cause of failure in each jurisdiction. While none of these studies explored inadequate pricing further, each study identified governance and internal controls as being important factors in the failure of institutions.

[12] Mispricing is defined as a consistent and company-wide failure to manage pricing risk such that the going concern assumption for the institution is at risk of being violated. It is not meant to include short-term decisions to under-price a product for strategic gain where there is sufficient capital to support such a strategy.

The literature on pricing or ratemaking and reserving within the actuarial community is far too extensive and diverse to summarize here. Jones and Ussif (2008) provide a brief overview of rate making methods. Similarly Derrig (1991) and Cummins (1990) provide historical overviews of the development of insurance pricing models in the United States. In general, the models are based on the going-concern assumption with a risk of default.

Typically, the literature is focused on the process of ratemaking rather than characteristics of insurers who may experience challenges in pricing the insurance product. However, the firm survival literature does highlight an empirical regularity that survival is highly dependent on firm size and age (Thompson, 2005 & Dunne *et al*, 1988). Cummins and Phillips (2005) estimated that the size factor in P&C insurance was much smaller than other risk factors.

With regard to the effect of managerial quality and experience on survivability, a number of studies in non-financial sectors, notably Thompson (2005), Mitchell (1991), Carroll *et al*. (1996), and Klepper and Simons (2000) have found that the prior experience of management is an important factor in firm survival rates. For example, several studies have found that experienced firms that diversify into businesses outside of their experience also have a higher risk of involuntary exit.

Similarly, studies on insurer insolvency have found that quality of management was an important component of insurer insolvency (McDonnell, 2002, A.M. Best 2004). For example, A.M. Best's 2004 Insolvency Report states that "*…all primary causes of financial impairments in this study were related to some form of mismanagement*."

Since the establishment of the *McCarran-Ferguson Act* of 1945 in the United States, there has been a historical recognition that rate regulation was necessary for solvency purposes (Doherty & Garven, 1986). In Canada, rate regulation has always been a market conduct tool to address insurance affordability issues rather than a solvency-related regulatory tool. Due to the extent of rate regulation in the United States, the constraints it imposes have long been a part of the ratemaking processes.

In addition, there is an extensive empirical literature on the market dynamics of prior approval rate regulation. This literature suggests that the effect on rates from prior-approval regulation, relative to claims costs, varies over time (Harrington, 1987; Tennyson, 1997, & Cummins *et al*, 2001). In general, strict price regulation has been found to limit competition, reduce availability of coverage and increase volatility in insurance premiums (Tennyson, 1991; Harrington, 2002 & Leadbetter *et al*, 2008).

Overall, this literature has noted that stricter forms of rate regulation tend to temporarily compress the premiums collected per dollar of loss experience. In the long run, stricter forms of rate regulation have not been found to result in overall lower prices (Cummins *et al*, 2001 & Harrington, 2001). To date, however, this literature has not explicitly considered the implications of price controls on the involuntary exit of insurance companies.

In summary, therefore, the literature on firm survival and insurer insolvency identifies the following:

- no single financial indicator, or set of indicators, has been identified as a robust measure for predicting financial distress
- firm size is a factor in financial distress
- managerial experience and governance are important factors in firm survival
- price controls increase the volatility of insurance premiums and may temporarily compress prices relative to loss experience.

Methodology and data

Data from the A.M. Best and Highline Data databases from the period 1996 to 2006 were used. A.M. Best provided the balance sheet and income statement data which was supplemented with data from Highline on by-state premiums. The method of analysis was a logit regression model in the following form:

$$\text{Failure}_{j,t} = ß_0 + ß_1\ \text{RegulationIndex}_{j,t} + ß_2\ \text{Size}_{j,t} + ß_3\ \text{YearsIncorporated}_{j,t} + ß_4\ \text{Mutual}_{j,t} + ßn\ \text{Other}_{n,j,t} + \varepsilon_{j,t}$$

The variable $\text{Size}_{j,t}$ – the natural logarithm of total assets – was included following the method of Sharpe & Stadnik (2007) using that measure as a size proxy. As size is closely correlated with scale of underwriting data, particularly in personal lines, we used the size variable as a proxy to test the capacity to internally generate sufficient loss experience data. As size can also be associated with other scalable factors, it may be an imperfect proxy. However, we note that with respect to direct financial solvency linkages, other financial indicators such as investment returns are not variable by size of institution in either the Canadian or U.S. data.[13] Alternative measures such as the dummy variable approach of Cummins *et al* (1995) were also tested with similar results. However, using size as a proxy may be imperfect – the variable may also be influenced by other size-sensitive factors relevant to solvency such as business diversification, access to financial markets and better capacity to attract human capital.

As managerial experience is generally unobservable, we use age of the firm as a proxy for experience. While this is an imperfect proxy, it is consistent with the results of Dibra & Leadbetter (2007), Thompson, (2005) and Dunne *et al*, (1988) which indicate that likelihood of survival is higher with older companies and that the age of a firm may be linked to the quality of management. Similarly, it is expected that in a conservative and mature industry like P&C insurance, start-ups and newer companies would have difficulty attracting experienced managers from larger and more established players. Therefore, the variable, $\text{YearsIncorporated}_{j,t}$ represents the age of the company.

[13] For example, in 2007 only one of the largest 10 Canadian insurers had a return on investment greater than the industry average and six had returns worse than the industry average. Three quarters of all insurers recorded an ROI within 25 basis points of the industry average. Similarly in the U.S., only one of the 10 largest insurers had an ROI greater than the industry average. The correlation coefficient between size and ROI is 0.08 and 0.009 for Canada and the U.S., respectively. This similarity of returns among insurers is likely due to the high proportion of assets invested in government bonds.

Following Cummins, Harrington, Klein (1995) we include $Mutual_{j,t}$ as a binary dummy to indicate if the company was a mutual company, thus accounting for any differences that mutual companies may have from other companies.

Table 3: Descriptive statistics for solvent and failed insurers (1996 to 2006)

		Failed insurers		
	Solvent insurers	**Inadequate pricing-related failures**	**Failures other than inadequate pricing**	**All failed insurers**
Number of insurers	2,648	88	101	189
Percentage of mutual insurers	16.3%	12.5%	12.9%	12.7%
Age of institutions (years)				
Average	38	40	31	35
Median	24	21	17	19
Size of institutions (assets, $millions)				
Average	$311	$114	$29	$69
Maximum	$100,413	$7,846	$2,062	$7,846

Source: PACICC, with data from A.M. Best

The variable $RegulationIndex_{j,t}$ was defined as the proportion of auto insurance premiums subject to rate regulation. States requiring state-prescribed rates or prior approval for rate changes were considered to be regulated. An index for the amount of rate-regulated business was determined by summing the product of the proportion of auto premiums written to total premiums in each state by a binary variable representing whether or not the state was regulated. On occasion there were irregularities in the data (for example, companies in run-off had a negative premium value resulting in a negative index value) which were adjusted to either one or zero, depending on which case was more appropriate.

In some cases, premium data by state and line of business were unavailable. To correct for this, estimates were made of state-by-state auto coverage by taking the proportion of auto premiums to total premiums and applying the proportion to the total premiums written in each state. While such estimation loses some accuracy, the majority of the companies to which this method was applied were regionally focused and operated in few lines of business, thus limiting any distortion effects.

Other variables were also included to control for additional risk factors. A variety of profitability, liquidity and solvency indicators were used, similar to the approach used by Cummins *et al* (1999), Poittier & Somner (2006) and Sharpe & Stadnik (2007). While a number of indicators were considered and tested, the variables outlined in Exhibit III were identified as being representative of the literature.

The correlation matrix identified few significant correlations (defined as greater than 0.20) among the various indicators. The variable YearsIncorporated was negatively correlated with the Mutual variable (–0.435) suggesting that in the sample, as a company gets older, it is less likely to be a mutual. Size was modestly correlated with overall liquidity (0.337), suggesting that larger insurers had better access to sources of liquidity. Not surprisingly, nearly all the IRIS ratio variables relating to the failure of a specific IRIS test were correlated in some manner with each other and strongly correlated with the total number of IRIS test failures.

In addition to the primary specification, two others were tested using sub-samples of insolvent insurers. The sample of insolvent insurers was split into those identified by A.M. Best as having inadequate pricing as a cause of failure, and those that had other causes of failure. The secondary specifications utilized the same set of independent variables but the dependent variable was replaced with a dummy variable isolating companies that failed due to inadequate pricing or other reasons. These secondary specifications were conducted to identify whether there were relationships distinct to failures from inadequate pricing that did not exist for other failures.

Discussion of results

Overall, the regression results were consistent with those of the prior literature. As can be seen from the table in Exhibit III, the variable for size was significant and had a coefficient of the expected sign, indicating that larger companies are less likely to fail, confirming the results of Cummins, Harrington, Klein (1995); Cummins, Grace, Philips (1999); Pottier & Sommer (2002) and Sharpe & Stadnik (2007). In the secondary specifications, the size variable was also significant, although the much smaller coefficient suggests that in practice the importance of size is less material for predicting insolvency as a result of inadequate pricing. This result does provide some support for the hypothesis that smaller insurers do have some disadvantage in access to underwriting data, but the weakness of the result may be due to the availability of industry data sources through statistical agents.

The age of the insurance company was found to be statistically significant for insolvencies related to causes other than inadequate pricing, but only weakly significant for insolvencies caused by inadequate pricing. As the age distribution of insolvencies caused by inadequate pricing is similar to that of the population of solvent insurers, this is not surprising. In contrast to studies in other industries, the positive coefficient in the inadequate price-related failure model is opposite the expected sign. The sign of the age variable is of the expected sign for other types of insolvencies, suggesting that overall as companies develop more experience in the market they are less likely to become insolvent. As insurer age may be a poor proxy for managerial experience, the development of an appropriate dataset and further exploration of the relationship between managerial quality and insolvency could be a useful area for future study.

An insurer's exposure to rate regulation is a significant explanatory variable and the coefficient is of the expected sign if price controls are likely to increase the risk of insolvency. In the secondary specifications, the coefficient and significance of rate regulation increases for failures resulting from inadequate pricing, but is not significant for other types of failures.

Indicators of profitability and liquidity showed mixed results in terms of significance. However, with the exception of ROA, virtually all profitability and liquidity indicators were not found to be important explanatory variables for insolvency. This is consistent with the literature (Cummins *et al*, 1995; Cummins *et al*, 1999; Sharpe & Stadnik, 2007). The relatively strong negative coefficient of the ROA variable reinforces the results of Sharpe & Stadnik (2007) and conventional wisdom that profitability is a strong indicator of financial health. The ROA variable is robust with or without the other measures in the specification.

A number of solvency-related indicator variables were found to be significant. A.M. Best's capital test measure is significant but the low coefficient suggests weak explanatory power. Other risk-based capital measures tested (RBC-related scores) were not found to be significant. The insurance risk ratio – a measure of leverage – is significant but the coefficient suggests that it offers limited explanatory power. This is consistent with Cummins, Grace, Philips (1999) and to a lesser extent Pottier & Sommer (2002) which respectively found risk-based capital ratios to be not significant, or only weakly so. In the discussion of explanatory power of risk-based capital measures, it may be important to consider that they are designed and calibrated to protect assets in liquidation. As a result, the risk factor that they measure may be collectability of assets rather than the solvency of the institution in itself. More research in this area may be required.

The dummy variable for mutual companies was not found to be statistically significant in the supplementary specifications, but was in the general model. This suggests that being a mutual organization is a poor predictor of a type of insolvency, but it does indicate a lower overall risk of insolvency. This is consistent with Cummins, Grace, Philips (1999) and Cummins, Harrington, Klein (1995).

Link to characteristics of Canadian involuntary exits

In general the statistical analysis of the U.S. data confirmed the results of the smaller Canadian sample of involuntary exits.

The Canadian experience identified three potential sources of systemic and catastrophic mispricing of insurance policies that could result in the ultimate failure of the company:

- firm size and data deficiency
- managerial experience
- rate regulation.

In the analysis, firm size is statistically significant although the size of the coefficient suggests that it might not be a strong factor in contributing to involuntary exit. The results for managerial experience, proxied by age of the institution in the statistical analysis, was inconclusive. It was not significant in the full sample and only marginally so in the sample of involuntary exits linked to inadequate pricing, and with the wrong sign. Institutional age is likely a poor proxy for managerial experience and quality. An improved dataset would likely provide more insight.

Our statistical analysis of the experience of the United States, with its longer history of rate regulation, found this factor was significant in explaining involuntary exits linked to inadequate pricing, but not for other types of involuntary exit. This suggests that price controls have a detrimental effect on the solvency of weaker insurers.

Summary

We reviewed the circumstances for all Canadian insurance companies that involuntarily exited the market during the past thirty years, and further conducted a statistical analysis using data from the U.S. P&C insurance industry. The analysis presented in this report offers a number of lessons and observations concerning the solvency implications of severe price and reserving inadequacy. Many of these observations will not be surprising to experienced observers. Nevertheless, they are recurring themes for involuntary exits extending over several insurance cycles and thus bear repeating.

For solvency supervisors and insurance guarantee funds, understanding and being reminded of the factors related to insurer insolvency can help mitigate or reduce the overall impact of such occurrences for policyholders.

Overall, our detailed case review of the Canadian insolvency experience and supplementary analysis of the U.S. experience relating to inadequate pricing reveals the following general observations:

Governance and operational risk

- In many cases strategic decisions to enter new or unrelated business lines lacked appropriate underwriting expertise and loss experience data.
- Prior to the wind-up of a company, management in many cases undertook strategies that could be described as "gambling for survival."
- Inadequate information and reporting processes and systems were found in 71 percent of Canadian involuntary exits linked to inadequate pricing.

Costs of insolvency

- Inadequate pricing is the leading cause of failure among insurance companies.
- Insolvent insurers that underwrote rate-regulated products were more expensive in liquidation than other insolvent insurers.

Monitoring and supervision

- When industry growth in claims costs exceeds growth in capital, the probability of insolvency increases.
- Managerial experience in new entrants is an important determinant in the survival capacity of an institution.
- Companies writing in new lines of business, outside their area of expertise, are at greater risk of insolvency.
- Price controls in a rate-regulated system that de-link the price/claim cost relationship increase the risk of insolvency.

Exhibit I: Data deficiency simulation

In this exercise, a population of auto insurance policies sample was randomly generated to simulate the market. The insurer (ABC Insurance Company) is assumed to be a new company entering the market with access to market data that is not representative of the risks it is underwriting. The insurer bases its pricing policy on the data and assumptions set out below.

Base data

Average industry loss claim:	$3,461
Loss ratio:	74%
Combined ratio:	100%

Assumptions

- Claims distribution is based on Ontario auto size of loss reports AU50 for 2002.
- Premiums are set to cover claims costs.
- Insurer only has data on good risks but is exposed to the entire population.
- The effect of investments is ignored.

ABC Insurance Company	Full data	Partial data
Expected price per policy	$1,184	$393
Expected premium	$70,080	$23,285
Expected claims costs	$51,911	$17,248
Actual claims costs	$51,911	$51,911
Loss ratio	74.1%	222.9%
Premium surplus (or deficiency)	$0	($28,626)

The simulation illustrates how incorrect expectations on claims costs can result in a too low level of price per policy (and overall expected premium) necessary in order to pay the actual claims costs.

Exhibit II: Price control simulation

In this exercise, the insurer (ABC Insurance Company) is assumed to be facing growing claims costs and restrictions on its ability to adjust premiums.

Note, that this rather simple example ignores the effect of increased liabilities from the worsening environment and only includes the income statement effect. Increasing liabilities would accelerate the company toward technical insolvency.

Assumptions

- Premiums only permitted to grow at the level of inflation or less.
- Claims growth based on actual claim trends during the period 1999 to 2002 for Ontario auto.
- For simplicity, expenses are confined to claims incurred.

ABC Insurance Company

Capital available	$4 million
Earned premium	$8 million
Claims incurred	$7.68 million
Initial insurance risk ratio	2.00 (Leverage below regulatory threshold of 3)
Initial loss ratio	96% (Positive underwriting experience)

	Period 1	**Period 2**	**Period 3**	
Permitted earned premium increase	0.9%	3%	3%	inflation
Claims cost increase	15.8%	14.5%	8.2%	
Insurance risk ratio	2.5	6.3	n/a	
Loss ratio	110%	122%	129%	
Capital ($millions)	$3.18	$1.31	–$1.14	(technically insolvent)

Exhibit III: Statistical results

Risk variables utilized

Return on assets	a profitability test
Return on equity	a profitability test
Combined ratio	an underwriting profitability test
BCAR	A.M. Best's capital adequacy measure
Overall liquidity	admitted assets/(total liabilities less conditional reserves)
Operating cash flow	measures revenue generated from underwriting and related investments
Ceded reinsurance to equity	measure of dependence on reinsurance for solvency
Business retention	proportion of premium written retained by the insurer
Insurance risk ratio	net retained premiums to capital. A measure of exposure to pricing errors on current book of business.
IRIS ratios	dummy variables = 1 if test is failed
IRIS 1	gross premium to surplus (leverage)
IRIS 3	change in net writings (a growth measure)
IRIS 7	percentage increase or decrease in capital held
IRIS 11	two-year reserve development relative to capital
Number of Iris failures	number tests failed (0 to 12)

Table 5: Summary of results

Independent variables	1 General model	2 Inadequate pricing	3 Failures caused by other sources
ROA	**–1.237** **(0.000)**	**–0.152** **(0.094)**	**–0.708** **(0.015)**
Size	**–0.138** **(0.000)**	**–0.067** **(0.019)**	**–0.209** **(0.000)**
BCAR	**–0.009** **(0.000)**	**–0.009** **(0.001)**	**–0.008** **(0.002)**
Years incorporated	0.000 (0.715)	**0.002** **(0.090)**	**–0.003** **(0.034)**
Mutual	**–0.191** **(0.082)**	–0.222 (0.138)	–0.139 (0.357)
Rate regulation	**0.124** **(0.054)**	**0.171** **(0.013)**	0.000 (0.987)
Combined ratio	0.000 (0.336)	0.000 (0.416)	0.000 (0.990)
ROE	**–0.002** **(0.037)**	**–0.002** **(0.021)**	0.000 (0.723)
Overall liquidity	**0.000** **(0.037)**	0.000 (0.179)	**0.001** **(0.002)**
Operating cash flow	**0.000** **(0.000)**	**0.000** **(0.001)**	**0.000** **(0.012)**
Ceded reinsurance to equity	**0.001** **(0.000)**	**0.002** **(0.000)**	**0.001** **(0.000)**
Business retention	0.001 (0.107)	**0.001** **(0.024)**	0.000 (0.790)
Insurance risk ratio	**0.001** **(0.003)**	**0.002** **(0.000)**	**0.000** **(0.062)**
IRIS ratios			
IRIS 1	**–1.093** **(0.000)**	**–1.119** **(0.000)**	**–1.000** **(0.000)**
IRIS 3	–0.063 (0.617)	–0.079 (0.500)	–0.053 (0.442)
IRIS 7	**–1.090** **(0.000)**	**–0.782** **(0.020)**	**–1.245** **(0.000)**
IRIS 11	0.185 (0.125)	**0.602** **(0.000)**	–0.225 (0.165)
Number of IRIS tests failed	**0.328** **(0.000)**	**0.207** **(0.000)**	**0.418** **(0.000)**
Nagelkerke R^2	0.164	0.127	0.142
Hosmer-Lemeshow	0.501	0.518	0.030

Coefficients reported with p-values in parentheses. ***Bold*** *values are significant at the 10% level of confidence.*

The pseudo R^2 is low but in the range of previous studies. The Hosmer and Lemeshow Goodness-of-Fit Test with a p-value of greater than 0.05 indicates that the general and inadequate pricing models have an adequate fit.

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