



In the USA the National Association of Insurance Companies (NAIC) and in the UK the Department of Trade and Industry (DTI) (to a lesser extent) make schedule P data available to the public, for a fee. I believe it should be incumbent on APRA to adopt the American model of collating schedule P loss development data (triangulations) and other relevant data on a yearly basis, for each line of business, for each company, making it readily available to anyone for a fee. This way APRA, rating agencies, brokers and any other organization can conduct their own independent assessment of the adequacy of a company's provisions as set out in the balance sheet.

It is therefore of concern that the proposed reforms will not result in the best possible framework for monitoring the general insurance and reinsurance industry.

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## Table of Contents

<b>Summary</b>	.....	<b>2</b>
<b>Section 1:</b>	<b>A wave of insolvencies and major loss reserve (provisions) upgrades around the world. ....</b>	<b>4</b>
<b>Section 2:</b>	<b>Outstanding claim liabilities and financial accounts .....</b>	<b>5</b>
<b>Section 3:</b>	<b>The float, positive cash-flow and superimposed inflation .....</b>	<b>6</b>
<b>Section 4:</b>	<b>What did the companies that went to the wall (including HIH) have in common? .....</b>	<b>7</b>
<b>Section 5:</b>	<b>Could these losses have been avoided or mitigated? .....</b>	<b>8</b>
<b>Section 6:</b>	<b>Life Insurance (LI), General Insurance (GI), process variability, common reserving methods and their deficiencies .....</b>	<b>9</b>
<b>Section 7:</b>	<b>When did HIH's problems start and would it have made any material difference if the company's failure had been detected in the middle of last year? .....</b>	<b>10</b>
<b>Section 8:</b>	<b>Was there any warning of HIH's impending failure in freely available reports in the public domain? .....</b>	<b>11</b>
<b>Section 9:</b>	<b>Estimates of HIH's liabilities provided by the liquidator compared to estimates shown in the accounts for year ending June 30, 2000. ....</b>	<b>13</b>
<b>Section 10:</b>	<b>Was the failure caused by any impropriety or breaches of corporate law? .....</b>	<b>15</b>
<b>Section 11:</b>	<b>The Risk Management Revolution .....</b>	<b>15</b>
<b>Section 12:</b>	<b>APRA's proposed reforms for the General Insurance industry are vastly inadequate. ....</b>	<b>15</b>
<b>Conclusions</b>	.....	<b>17</b>

## Summary

Section 1 contains a list of reported large reserve increases and failures experienced by various insurers around the world writing long-tail liabilities in the last few years.

Section 2 provides a brief explanation of basic accounting principles for general insurance companies. The relationship between outstanding claims liabilities for long-tail business lines, the inherent variability of these liabilities, and the provision made for them in the financial accounts is explained.

Section 3 describes why general insurance companies can be cash flow positive for many years but as a result of undetected superimposed inflation in their experience (along with high skewness and variability) they suddenly run out of cash.

Section 4 contains a discussion of likely reasons for the problems experienced by the insurers listed in Section 1. These reasons include unrecognised superimposed inflationary trends, skewness and variability of the long-tail liabilities. Deficiencies in the methods used to evaluate risks mean that trends are often recognised too late.

Section 5 explains how early recognition of problems using appropriate probabilistic models can mitigate the losses incurred.

Section 6 first describes some major differences between **Life Insurance (LI)** and **General Insurance (GI)** and discusses why deterministic techniques (eg averages) that work well in LI are not necessarily appropriate for GI. We then go on to discuss common (standard) reserving techniques and their shortcomings:

- i. Failure to adequately identify trends in the paid losses.
- ii. Failure to allow for uncertainty in model parameters of a probabilistic model.
- iii. Failure to adequately allow for process variability.

In Section 7 we explain that the failure of HIH was not just an event that occurred in the last year. In fact, its 'true' financial position in respect of its long-tail liabilities was probably little different twelve months ago or even earlier. Arguably its problems commenced when it started writing long-tail liabilities.

The **HIH Winterthur Offering Memorandum dated 13 July 1998** is considered in Section 8. In particular, the Memorandum contains significant warning signs as to HIH's financial health for the informed reader. Yet the public offer was over-subscribed! **I first examined the Memorandum in 1998 at the request of a stockbroker. My advice was not to buy.**

In Section 9 we provide a likely explanation for the substantial difference in the estimates of losses (liabilities) given by the liquidator and those shown in the HIH accounts for year-end June 30<sup>th</sup>, 2000.

**I believe that the substantial differences between the two sets of estimates is more likely to be due to the differences in loss reserving methodologies than any other factor.**

Section 10 explains that ultimately the failure of HIH is likely to be more to do with technical matters than with any corporate impropriety. It is likely that the greater part of the loss could not have been arrested by anyone in the last several years. A major paradigm shift in techniques for assessing long-tail liability risk and reporting them is required.

The revolution in the way the banking and investment sectors assess risk is discussed in Section 11. The concept of Value-at-Risk (VaR) has been developed in response to failures of major financial entities. VaR is an easily understood method for calculating and controlling market risk.

The inadequacy of APRA's proposed reforms for the general insurance industry is considered in Section 12. APRA has recognised the need for statistical quantities when examining solvency and capital requirements. However, APRA has not gone far enough. The statistical quantities specified by APRA do not include VaR and in any case will not provide sufficient information to enable a thorough assessment of the financial condition of an insurer in relation to its long-tail liabilities. I believe APRA should adopt the American and UK model of collating loss development data on a yearly basis, for each line of business, for each company, making it readily available to anyone for a fee. In this way, APRA, rating agencies, brokers and any other organization can conduct their own independent assessment of the adequacy of a company's provisions as set out in the balance sheet.

**Section 1: A wave of insolvencies and major loss reserve (provisions) upgrades around the world.**

Much of the media coverage of the failure of HIH has concentrated on the role of directors, auditors, regulators and the size of the shortfall, which has been estimated as \$2.7 billion (median) and \$4 billion (75<sup>th</sup> percentile) by the provisional liquidator, Mr Tony McGrath. See Section 9 for current estimates and comparisons with those shown in the HIH accounts June 30<sup>th</sup>, 2000.

There has been little comment on the HIH failure in a worldwide context. In fact, whilst HIH may be Australia's largest corporate collapse, in the global general insurance and reinsurance industry it ranks as the failure of a relatively small player.

In recent times, there have been a number of reports of insurers strengthening reserves or experiencing difficulties. The following are excerpts from various insurance trade publications.

- June 1999: "Cologne Life Re increases reserves by US\$275m".
- December 1999: "Frontier increases reserves by US\$136m in third quarter following a US\$155M increase at the end of 1998".
- January 2000: "The series of reserve additions made by Frontier in recent years deters potential suitors. Frontier makes a deal with Clarendon for Clarendon to pay claims if Frontier is unable to do so".
- October 2000: "Fremont General, one of the biggest workers compensation insurers in the US, increases loss reserves (provisions) for past-year workers compensation policies by US\$450m in the second quarter of 2000".
- December 4, 2000: "State insurance regulators in California decided to appoint a special deputy examiner to oversee Fremont's California operations because of 'unfavourable trends and significant deterioration in the statutory surpluses'".
- December 4, 2000: "Equitas Ltd, set up to runoff Lloyd's pre-1993 long-tail liabilities, was likely to further strengthen reserves for asbestos claims at year-end because of higher-than-expected losses".
- December 18, 2000: "Reliance Group has to provide for huge loss reserve increases during 2000, ends the year unable to make debt repayments on time and delisted by the New York Stock Exchange".

- May 2001: “The Workers Compensation Insurance Rating Bureau has estimated that in 2000 California’s workers compensation insurers had “**US\$7bn less in reserves than it needed to pay claims.**” The failures of California workers compensation insurers, HIH America Compensation and Liability Insurance and Great States Insurance are noted as part of a “wave of insolvencies”.
- June 2001: Independent Insurance collapses. PwC appointed provisional liquidator Sunday 17<sup>th</sup>.  
 “There are some allegations that the company failed to record case estimates on reported claims.”  
 “..a letter was not disclosed (by Chairman) from actuaries Watson Wyatt relating to Independent’s financial health. The letter, addressed to the directors on May 25, raised concerns over unquantifiable losses and threatened to withdraw its positive position on the adequacy of reserves.”  
 “As the investigation continues into the company, the role of analysts and rating agencies in raising the awareness of its true financial condition will be examined.”  
 “Shareholder groups are planning to bring civil actions against KPMG, Independent Insurance’s auditors, Watson Wyatt, the company’s actuaries, the Financial Services Authority and the Department of Trade and Industry.”
- August 6, 2001 “CNA posted a \$1.76 billion second-quarter loss Aug. 2 as it took a massive \$2.1 billion charge, principally to beef up reserves and largely related to asbestos and environmental claims”.
- August 13, 2001 "CNA recently announced a substantial charge principally related to loss-reserve strengthening for both core loss reserves and asbestos and environmental reserves.."

The following is another interesting example of a major loss reserve deficiency. NRG, the reinsurance arm of ING, bought Victory Re in the late eighties. NRG conducted due diligence before signing the deal. A year or two after purchase, it was found that Victory Re had a loss reserve deficiency in excess of US\$500m (Victory Re had exposure to the London Market excess of loss spiral). NRG is now defunct.

## **Section 2: Outstanding claim liabilities and financial accounts**

Prediction of outstanding claim liabilities is a major issue in any assessment of the financial condition of an insurer writing long-tail lines, whether performed by company management or by the supervisory authorities. Since solvency is a probabilistic concept, its assessment necessarily includes (should include!) the quantification of loss reserve **variability** or **uncertainty**. **Total uncertainty** is the combination of **process variability** and **parameter uncertainty**. This is explained in Section 6 using a simple example involving coin tossing.

For a 'long-tail' line of business there are delays between the time period for which insurance protection is afforded (the risk period) under the policy, and the actual claim payments. Accordingly, the insurer may take many years to discharge its obligations assumed under the policy.

An insurer's outstanding claim liabilities at a given date are the amounts that it is liable to pay, after that date, for claims that arose on or before that date.

In order to understand the necessity for the estimation of outstanding claim liabilities, it is helpful to have a conceptual understanding of the basic accounting principles applicable to general insurance (GI) companies. GI companies use the accrual basis of accounting, which recognises revenue when it is earned, not when it is received. Costs are likewise recognised as expenses in the same period as the revenues giving rise to these costs. This results in a particular kind of financial statement that better matches costs with corresponding revenues.

At the end of an accounting year the insurer sets aside a **provision** (equivalently a **loss reserve**) in the accounts to provide for the outstanding claim liabilities. The total of the outstanding claim liabilities is uncertain or variable. It has a probability distribution, and it is incumbent on the insurer to compute or estimate the distribution, using past experience and any other relevant information. It is of paramount importance to understand that what will actually be paid out is a single outcome from a probabilistic process, just like the number of heads,  $X$ , observed in 100 tosses of a coin is a single outcome from a probabilistic process.

**How the insurer arrives at a provision is critical, as the actual financial provision in the accounts has a direct impact on shareholders' equity (and therefore solvency) and also on underwriting profit. The reliability and usefulness of both the balance sheet and underwriting statement are dependent on the accuracy and probabilistic interpretation of the provision and incurred losses shown in the insurer's accounts. Management must recognise and accept variability (uncertainty) and should not only be concerned with the final figures, which it reports in company accounts.**

### **Section 3: The float, positive cash-flow and superimposed inflation**

A long-tail liability is characterized by a delay between the risk year in which the insurance cover is afforded and the year in which the claim is paid. Unlike most other businesses, a company writing long-tail liabilities is **necessarily cash flow positive** in the early years of operation and is likely to remain so for some time. According to Warren Buffett, the 'float' is money the company holds but does not own. It arises because premiums are pre-paid and it takes a long time, sometimes up to twenty years, to pay for the losses. Even without generating much 'float', prior risk year losses can be covered with new business (current year) premiums.

The principal reason that Dr Alan Greenspan and Ian MacFarlane focus on maintaining a low level of economic inflation is due to its geometric (exponential) effect on prices.

*“The arithmetic makes it plain that inflation is a far more devastating tax than anything that has been enacted by our legislature. The inflation tax has a fantastic ability to simply consume capital” (Warren Buffett).*

Inflation consumes capital because of its geometric effect. Even the rate of the rate of the rate...of growth is also exponential.

In long-tail liabilities, there is another type of inflation called ‘superimposed’ or ‘social’ inflation. This sits on top of economic inflation. Dr Alan Greenspan and Ian MacFarlane have very limited influence on this kind of inflation. It is principally driven by the social environment in the year in which the payment is made.

A company that starts writing long-tail liabilities can be under-reserved for many years and still have a significant positive cash flow, even more so if it enjoys a high investment return. In some ways the ‘float’ is an inducement for the company to under-price. However, if it continues to under-reserve each year, and does not recognise the superimposed inflation in its own experience, it reaches a point where the paid losses explode, leading to a negative cash flow.

Superimposed inflation also manifests itself in the current and prior risk years. This is a fundamental property of all long-tail liability lines. **It is tantamount to saying that the future has an impact on the past risk years.** Consider this real life example. In a recent report (December 4, 2000) “Equitas Ltd, set up to runoff Lloyd’s pre-1993 long-tail liabilities, was likely to further strengthen reserves for asbestos claims at year-end because of higher-than-expected losses”. The reason for this is almost certainly that the current (calendar year 2000) social environment impacts on the 1993 and prior (risk) years paid losses development. The Californian Worker’s Compensation example cited in the next section is also illustrative of this effect.

#### **Section 4: What did the companies that went to the wall (including HIH) have in common?**

HIH regarded itself as an expert in workers’ compensation insurance and other long-tail lines and had expanded its business in these areas in recent years via purchases of HIH America, FAI in Australia and the Cotesworth Group in the UK.

It is likely that the companies that went to the wall (including HIH) experienced, inter alia, high superimposed inflation and variability in long-tail liabilities.

Often the under-provisioning and under-pricing may not be recognised until it is too late. In respect of the prior risk years, the proverbial horse has already bolted. Recognition is often delayed because the company does not have the right tools to assess the changing trends, skewness and variability in its own experience. This problem would typically be amplified if the company were *growing* in the long-tail liability lines of business, as its already positive cash flow may be augmented.

**It is important to appreciate that future superimposed inflation will also manifest itself in HIH's 2000 and prior risk years paid losses development. The future will impact the past risk years.**

In the **HIH annual report** for the year ending 30<sup>th</sup> June 2000 an inflation rate of 3.8% is used to calculate the outstanding claims liabilities. However, from my knowledge of the global industry, this assumed inflation is highly unlikely to be an accurate reflection of HIH's own experience. The following real life cases highlight the potential for understatement of inflation.

A large writer of Workers' Compensation in California (a client of a client of mine) experienced claims inflation estimated to be 23% per annum in the years 1987 to 1990, and 10% per annum in the years 1990 to 1999. Indeed, due to this high inflation rate along the calendar years, the company paid more money in 1998 than it did in 1997 in respect of claims originating (incurred) in 1978 (20 years delay!). This is an example of the effect mentioned above. The superimposed inflation here is in excess of the decay in the paid losses, and consequently the resultant trend in the delay direction is positive for risk year 1978. HIH also wrote Worker's Compensation in California through HIH America.

In a line of Workers' Compensation business written by GIO of NSW, the mean trend in **superimposed** (on top of economic) inflation in the years 1981-1986 was in excess of 8%.

In 1995 I delivered an Inaugural Professorial Address at the University of Melbourne on the predictability of outstanding claims for long-tail lines of business. As part of the address I drew attention to the adverse inflationary trend (in excess of 32% per annum) in the NSW CTP experience which had been present for some time and which should have led to an increase in reserves and premiums at a time when insurers were reducing premiums. This part of the address was based on a report prepared for the Motor Accident Authority of NSW and a separate report for the then CEO of AMP General Insurance. While no NSW CTP insurer failed, substantial losses were incurred.

#### **Section 5: Could these losses have been avoided or mitigated?**

In most cases, I believe the answer to be 'yes'. Let's see why.

Sound statistical tools can detect shifts in trends soon after they take effect.

The large writer of Workers' Compensation in California discussed in the previous section has experienced a high, but stable, trend of about 10% since 1990. This means that four years ago, say, a sound probabilistic model would have predicted a similar distribution of reserves to that predicted today, even though we now have four years more of claim data.

In respect of NSW CTP discussed in Section 4, losses were mitigated as a result of detection of the unusual high inflationary trends based on reports written for the then CEO of AMP General, and the General Manager of the Motor Accident Authority.

Had the high inflation rate been detected earlier these losses would have been less.

## **Section 6: Life Insurance (LI), General Insurance (GI), process variability, common reserving methods and their deficiencies**

It is of paramount importance to recognize and understand that there are major differences between General Insurance (GI) and Life Insurance (LI). The sum assured in a GI policy is typically subject to much more variability than in an LI policy. LI is a different kind of business, more part of the savings and personal finance world. Deterministic models (eg averages) often work well in LI, but they can fail miserably in GI. This is because of the importance of **process variability** (explained below) in GI. For long tail liabilities it is very rare that you can diversify **process variability**, as you do in LI.

High process variability usually produces **high positive skewness**. High positive skewness means that it is more likely that a paid loss is less than the mean, but when it is larger than the mean it can be extremely large. These “unlikely” large losses can lead to insolvency.

Commonly used reserving and pricing techniques are not based on sound statistical methodology. As a result, their predictions are unreliable. In addition, they are deterministic methods so they give no indication of the uncertainty in the future. Frederick Cripe, Chairperson of the (US) Casualty Actuarial Society's Research Policy and Management Committee (<http://casact.org/pubs/actrev/may01/latest.htm>) has said on this subject "actuaries ... act in ways that are incongruent with what they know to be true."

Moreover, common reserving methods do not facilitate the identification of payment/calendar year (or inflationary) trends in the claims data. Indeed, using the common standard techniques can lead to systematic under reserving for long-tail lines for at least three reasons:

1. **They do not capture (explicitly) or quantify the trends in the data including superimposed inflation and stability thereof. Assumptions about future (superimposed) inflationary trends are usually based on judgement, not on trends in the historical experience.**
2. They do not account for the uncertainty in the risk parameters, including future superimposed and economic inflation.
3. They do not account adequately for process variability. This can lead to substantial under estimation of reserves.

Any one of these problems might lead to serious under-reserving.

It is important to be clear about the meaning of the term **prudential margin**, referred to in the **HIH Winterthur Offering Memorandum dated 13 July 1998** discussed in Section 8 below. A better term than prudential margin is **security margin**. The

security margin should be based on two components, viz., **risk parameter uncertainty** and **process (stochastic) variability**. **Total uncertainty** is the combination of parameter uncertainty and process variability. Process variability is the effect of chance and is a function of the system (process). It is not reducible through either study or measurement. There are numerous portfolios that I have studied where process variability is the major component in the **total uncertainty**.

To clarify these definitions, I give a simple illustration of these fundamental concepts.

When you toss a symmetric (unbiased) coin 100 times, the central estimate of the number of heads obtained is exactly 50 – there is no uncertainty about the central estimate. However, we cannot predict the actual number of heads,  $X$ , due to the inherent randomness (process variability) of the coin. Now, think of  $X$  as the loss reserve. If you “reserve” 50 heads, there is (approximately) a 50% chance that your reserve will be too low, due to the process variability. So you need a **security margin** based only on the process variability. For a 97.5% confidence level, say, you would ‘reserve’ 60 heads. The security margin is 10 (= 60-50). Equivalently, if you “reserve” 50, the VaR at 97.5% is 10. Suppose now the coin is mutilated in some way and you have no idea of the probability of a head. You conduct a preliminary experiment by tossing the coin 10 times. Based on the outcome of this experiment, it just happens that you observe five heads. You now have an estimate of 0.5 of the probability of obtaining a head. There is uncertainty (parameter risk) associated with this estimate as you are not certain that the probability of obtaining a head is exactly 0.5. The central estimate of the number of heads in a subsequent experiment of 100 tosses is 50 (in this case). The central estimate of 50 is now subject to (risk parameter) uncertainty. The total number of heads that will be observed is now subject to a total uncertainty that includes both (risk) parameter uncertainty and process variability. The security margin (for same confidence level of 97.5%) is larger (than 10) now!

Reinsurance is the ceding of risk (variance). **Reinsurance does not remove the need for a security (prudential) margin.**

For additional support for the use of probabilistic methods in reserving, please visit the **Casualty Actuarial Society** (USA) web page <http://casact.org/pubs/actrev/may01/latest.htm> where you will find a review by a CAS Chairperson on a paper that I co-authored entitled ‘**Best Estimates for Reserves**’.

**Section 7: When did HIH’s problems start and would it have made any material difference if the company’s failure had been detected in the middle of last year?**

Solvency is fundamentally a probabilistic concept, especially for an insurance company that writes long-tail liabilities. If HIH had established adequate reserves so that each risk year was fully funded (provisions sufficient to meet liabilities), there would be no problem now. Thus, it is likely that the problems started the first year that HIH wrote long-tail lines of business.

In the media the emphasis has largely been on events in the last few years, or even the last six months. One press report suggested that HIH’s financial position deteriorated

by between \$3.6bn and \$5.9bn in the eight months since auditors and directors signed off HIH's last public accounts.

This is unlikely to be true. The difference between the **true** financial position of HIH today and that of twelve months ago in respect of its long-tail liabilities would be marginal. What has changed is the **perceived** financial position presumably as a result of the way the loss reserves are being recalculated. **The difference is more likely to be due to the differences in loss reserve methodologies applied by the liquidator and those applied to obtain the figures shown in the accounts, than any other factor. See Section 9.**

It is also likely, as a result of the down turn in the stock market, that HIH's 'float' would have deteriorated since March 2000.

HIH's transfer of its long-tail liabilities portfolio to other insurance companies does not necessarily eliminate the problem of under-provisioning and under-pricing for the prior risk years. If the company did not transfer its prior risk years, it is still assuming the risks (liabilities) of those years (see Section 9), and moreover any **future superimposed inflation will also manifest itself in the current and all prior risk years**. See Section 4.

**Section 8: Was there any warning of HIH's impending failure in freely available reports in the public domain?**

There certainly was – in the **HIH Winterthur Offering Memorandum** dated **13 July 1998**. I first examined the Memorandum in 1998 at the request of a stockbroker. My advice was not to buy. **The Memorandum is based on accounts as at year-end 31 December 1997!**

Robert Kiyosaki, of "Rich Dad, Poor Dad" fame, teaches that the key to financial success is financial literacy. Kiyosaki maintains that in order to run a business successfully, it is essential to be able to understand financial statements. The financial statement of an insurance (reinsurance) company is not as easy to interpret as a financial statement of a bricks-and-mortar company, especially if the insurance company is writing risks subject to high variability, such as long-tail liabilities. The largest number (and the one most subject to variability) in the balance sheet of such an insurer is often the provision for outstanding long-tail liabilities. *The derivation and the interpretation of this single number is the key to assessing the financial health of the company.*

The Memorandum states that:

1. *"HIH believes taking into account the views of external auditors and actuaries, that adequate provision has been made for losses incurred as at 31 December 1997"* (page 11 and page 48).

2. *“The establishment of appropriate provisions is an inherently uncertain process, and there can be no assurance that the ultimate losses will not materially exceed the Company's provisions and have a material adverse effect on the Company's results of operations and financial condition”* (page 11)
3. *“HIH does not currently maintain prudential margins over the actuarially determined central estimates. However, the claims reserving process is underpinned by an actuarial review of future long-tail claims liabilities and historical data”* (page 48).
4. *“The decline in the adequacy of claims provisions in recent years has been due to the larger than expected adverse development of certain long-tail portfolios, including the workers’ compensation and liability portfolio.....The Company incurred underwriting losses in 1997..... Such losses are continuing and although specific measures have been taken in respect of these classes to reduce ongoing losses, a significant strengthening of reserves may be required”* (page 50).

In striking contrast to the first statement, the fourth statement admits that reserves have been inadequate in the past due to the larger than expected adverse development and may have to be significantly strengthened in the future. **If the reserves have to be strengthened significantly in the future then shareholder’s equity will be significantly diminished in the future.** I am amazed that the public offering was oversubscribed! If ‘significant strengthening’ means a 20% increase, for example, then the company’s gross reserves would increase by almost \$400m! The second statement makes it clear that under-provisioning could *“have a material adverse effect on the Company's results of operations and financial condition”*.

The above information is sufficient to raise a loud alarm bell, but actually there is more pertinent information available, especially if you understand the statistical technicalities involved in assessing long-tail liabilities.

It is unclear whether the “actuarially determined central estimate” represents the mean or the median of the loss reserve distribution, or some other statistic. It should be the estimate of the mean, but this is unclear. In any case, it seems that the central estimate is likely to be biased downwards because (even with everything else being right) the inflation rate assumption used to calculate the outstanding claims liability is 5% per annum. Where does this assumption come from? I doubt very much that it has anything to do with the company’s actual experience. Perhaps this is the reason that statement 4 mentions *“larger than expected adverse development”*. It strongly suggests undetected superimposed inflation. Based on my knowledge of similar lines of business, an assumed inflation rate of 5% is relatively low. See Section 4 for a discussion of (superimposed) inflation rates experienced by other companies, including Workers’ Compensation in California. HIH also wrote Workers’ Compensation in California. In the **HIH annual report** for the year ending 30<sup>th</sup> June 2000 an even lower inflation rate of 3.8% per annum is quoted.

Statement 3 shows that no prudential margin was included in the actuarial central estimate and also suggests that the use of an “actuarial review of future long-tail

liabilities and historical data” is sufficient to make a prudential margin unnecessary, that is, the central estimate is precise enough for the mean.

There are two issues here. Firstly, process variability is ignored, perhaps as a result of not appreciating that the total of the paid losses is a single outcome from a random process, and it is not the mean. This misunderstanding may also be found in Clause 12 of Actuarial Professional Standards 300 (PS300). Secondly, it suggests that an “actuarial review...” removes the uncertainty in the central estimate of the mean. Even if the latter were true then not including a security margin represents the antithesis of the fundamental statistical principle of insurance. It is well known that if you charge the (true) mean cost, it is statistically certain that you will eventually go bankrupt due to the process variability. But in practice, you don’t even know the mean cost precisely, so you need to allow for that uncertainty too (the risk parameter uncertainty). Recall from Section 6 that the total uncertainty is the combination of risk parameter uncertainty and process variability. It is also a rule of thumb that the higher the process variability, the higher is the risk parameter uncertainty and the higher is the mean!

To recap, it needs to be understood that the total outstanding claim liability is a single outcome (realization) of a **random** process. This total liability is what is known in statistics as a random variable. It is not the central estimate. The central estimate is usually the estimate of the mean of the **distribution** of the loss reserve. Even if the mean is known exactly, the distribution of the loss reserve can have a large variance due to the process variability. See Section 6.

Statement 4 mentions “... *specific measures have been taken in respect of these classes to reduce ongoing losses*”. In respect of the current and prior years, it is not possible to control losses, as the proverbial horse has already bolted. In fact, as mentioned earlier, future superimposed inflation will affect the current and prior risk years’ paid losses development. The company may be able to have some control on losses only in respect of future underwriting years by changing mix of risks or simply ceasing to write that line of business. The only time I have seen a company control its losses in respect of the current and prior years is when it is liquidated!

Finally, note that based on the Consolidated Profit and Loss Statement (page 6), HIH incurred an **underwriting loss** for year end 31 December 1997 and year end 31 December 1996. The operating profits were due to the generation of the ‘float’ (investment income).

**Section 9: Estimates of HIH’s liabilities provided by the liquidator compared to estimates shown in the accounts for year ending June 30, 2000.**

The provisional liquidator has provided estimates of HIH’s loss of \$2.7Bn (median) and \$4Bn (75th percentile), based on an “actuarial review”.

**Why are these estimates very different (much higher) than those shown in the accounts for year-end June 30<sup>th</sup>, 2000?**

Here is a plausible explanation that could be easily tested.

Turning to the bottom of page 47 of the **HIH Winterthur Offering Memorandum dated 13 July 1998**, there is a brief description of the loss reserving projection method that is applied to obtain reserve estimates. This method is commonly termed by Australian actuaries the **Payment per Claim Incurred (PPCI)** method. The paid losses development array is first transformed to PPCI data, by creating averages based on estimates of the number of claims ultimately incurred for each risk year. For each delay period a weighted average of the PPCI data is selected, and then inflated using an inflation assumption for the future. In the **Memorandum** there is no mention of how inflation is determined from the actual historical experience, so the 5% future inflation assumption is likely to be based on "judgement". In the accounts for year-end June 30<sup>th</sup>, 2000, the future inflation assumption is 3.8%.

Suppose, now, the paid losses (PPCI) experience is trending upwards at 10% per annum since 1990, as in **Worker's Compensation in California** for one of my clients' clients that writes a large exposure. See Section 4.

Suppose, moreover, that the 10% per annum inflationary trend is not recognized. At the end of each year, an average of the **more recent PPCI experience** is recalculated and projected forward at 3.8 % per annum, say, using the inflation assumption in the accounts for year-end June 30<sup>th</sup>, 2000. Since the recent PPCI experience is escalating at 10% per annum, the average, as it is recalculated at the end of each year, of the more recent experience, is likely to increase. Accordingly, loss reserves will be strengthened at the end of each year, but never enough, as 3.8% per annum is assumed going forward when the experience is escalating at 10% per annum going forward. This is likely to be the reason for statement 4 in Section 8 (taken from the **Memorandum**).

My understanding is that the liquidator's estimates originate from KPMG London. In the UK, a more traditional favoured method for reserving is based on link ratios or development factors. These link ratio methods, when applied to produce loss reserve projections, under certain circumstances, incorporate implicitly (but probably not accurately) inflation rate(s) going forward that reflect some of the inflation rates in the experience.

**Therefore one could reasonably conclude that the substantial differences in loss reserve estimates are more likely to be due to differences in loss reserving methodologies, than any other factor.**

Both sets of figures (accounts and liquidator) were probably derived using deterministic techniques that are flawed.

The liquidator has provided a median loss of \$2.7Bn and a 75<sup>th</sup> percentile of \$4Bn based on an "actuarial review". It may be that the amount of \$4Bn could even be an underestimate of the mean given the weaknesses of the standard techniques (see Section 6).

Based on common (standard) techniques it is not possible to obtain scientific estimates of statistical quantities such as the median, mean and percentiles. Often individual judgement is used. Assumptions about the future claims processes should

be based on a probabilistic model that explains the past experience of the company. Only by developing such a valid probabilistic model can reasonable estimates be obtained for the long-tail liabilities at various levels of probability.

**Section 10: Was the failure caused by any impropriety or breaches of corporate law?**

Having regard to the previous discussion it is likely that the failure of HIH has little to do with impropriety or breaches of corporate law, as with other companies that have gone to the wall for the same reasons. It is likely that the greater part of the loss could not have been arrested by anyone in the last several years, just like Equitas Ltd (mentioned in Sections 1 and 3) cannot arrest its “higher-than-expected losses” for 1993 and prior risk years! The proverbial horse had already bolted.

From a probabilistic perspective HIH Winterthur may have been technically insolvent on December 31, 1997, especially if the inflationary trends in its own experiences exceeded those assumed in the loss reserve projections.

Many other insurance and reinsurance companies have experienced major upgrades in reserves or have failed for the same reasons as HIH. What is required is a paradigm shift in the way risks associated with long-tail liabilities are evaluated and the way the single outstanding claims liability figure in the balance sheet is reported and interpreted.

**Section 11: The Risk Management Revolution**

Orange County, Barings, Metallgesellschaft, Schowa Shell, Daiwa... some of the world’s largest financial entities have lost billions of dollars in financial markets. In most cases, senior management poorly monitored the exposure to market risks. These failures have triggered a revolution in both the theory and practice of risk management in the banking and investment sectors. The world’s leading banks and financial firms are turning to Value-at-Risk (VaR), an easy-to-understand method for calculating and controlling market risks.

It is surprising that the banking and investment sectors are now more advanced than the insurance sector when it comes to assessing market risks, particularly since it could be argued that assessing long-tail liability risks is an especially pressing issue requiring sound statistical and financial tools.

**Section 12: APRA’s proposed reforms for the General Insurance industry are vastly inadequate.**

What is needed in the general insurance and reinsurance markets is a revolution - a paradigm shift - in assessing long-tail liability risks that parallels the revolution that is taking place in assessing market risks. However, this revolution has to go much further, as VaR is grossly inadequate as a single measure of risk for long-tail liabilities.

Accordingly there should be concern that APRA has decided to fast-track proposed reforms that are inadequate.

In its proposed reforms APRA has recognized the need for reserves and risk-based capital requirements to be based on a number of statistical quantities, including estimates of the mean, standard deviation and 75<sup>th</sup> percentile. However, it is surprising that there is no requirement for VaR to be calculated. More importantly, these statistical quantities arise naturally only from properly constructed probabilistic models.

In themselves, these statistical quantities do not provide sufficient information to assess the financial condition of the company. It is incumbent on APRA to require that insurance companies provide a great deal more information regarding their long-tail liability risks. Any assumptions about future trends, uncertainty in those trends and process variability should be qualified in relation to the trends and process variability found in the historical experience.

In the US the National Association of Insurance Companies (NAIC) and in the UK the Department of Trade and Industry (DTI) (to a lesser extent) make schedule P data available to the public, for a fee.

*“The NAIC uses Schedule P for three of the Insurance Regulatory Information System (“IRIS”) tests, and investment analysts use the Schedule to measure the adequacy of a carrier’s held reserves. Schedule P data are used to determine the reserving risk and the written premium risk charges in the risk-based capital formula, which account for most of an insurance company’s capital requirements. Actuaries and accountants need a thorough understanding of this Schedule, both to complete it for their own company or client and to evaluate the performance of peer companies”.* Taken from Sholom Feldblum CAS Forum (1998).

I believe APRA should adopt the American model of collating schedule P loss development data (triangulations) and other relevant data on a yearly basis, for each line of business, for each company, and making it readily available to anyone for a fee. This way APRA, rating agencies, brokers and any other organization can conduct their own independent assessment of the adequacy of a company’s provisions as set out in the balance sheet.

## **Conclusions**

The failure of HIH is part of a global wave of insurance companies going to the wall as a result of exposure to long-tail liabilities. It is highly likely that if the true financial position of HIH had been accurately assessed, its problems would have been detected many years ago. There were even warning signs in the 1998 Memorandum offering HIH shares to the public. The Memorandum is based on accounts as at year-end 31 December 1997.

There is a litany of companies worldwide writing long-tail liabilities that have made major reserve upgrades in recent years, some of which have failed. Inability to detect high inflationary trends and process variability has almost certainly played a significant role in this.

Compelling arguments have been provided for a scenario that includes positive cash flows and non-recognition of inflationary trends that have a “fantastic ability to simply consume capital”. In respect of HIH it has been argued that the differences between the liquidator’s estimates and those shown in the accounts for year-end June 30<sup>th</sup> 2000 are more likely to be due to differences in loss reserving methodologies than any other factor.

In the banking and investment sectors, poor risk management resulting in large-scale losses and failures led to a revolution in how market risks are assessed. The concept of Value-at-Risk (VaR) was subsequently widely adopted.

There now needs to be a revolution in how general insurance and reinsurance companies assess and report long-tail liability risks.

APRA has decided to fast-track general insurance reforms that are vastly inadequate. The proposed reforms are only a very small step in the right direction. Statistical quantities such as the estimated mean, standard deviation and 75<sup>th</sup> percentile of the liabilities are important, but it is surprising that there is no requirement for VaR to be calculated. More importantly, these statistical quantities in themselves do not provide sufficient information to assess the financial condition of the company.

In the US the National Association of Insurance Companies (NAIC) and in the UK the Department of Trade and Industry (DTI) (to a lesser extent) make schedule P data available to the public, for a fee. I believe APRA should adopt the American model of collating schedule P loss development data (triangulations) and other relevant data on a yearly basis, for each line of business, for each company, and making it readily available to anyone for a fee. This way APRA, rating agencies, brokers and any other organization can conduct their own independent assessment of the adequacy of a company’s provisions as set out in the balance sheet.

It is therefore of concern that the proposed reforms will not result in the best possible framework for monitoring the general insurance and reinsurance industry.