

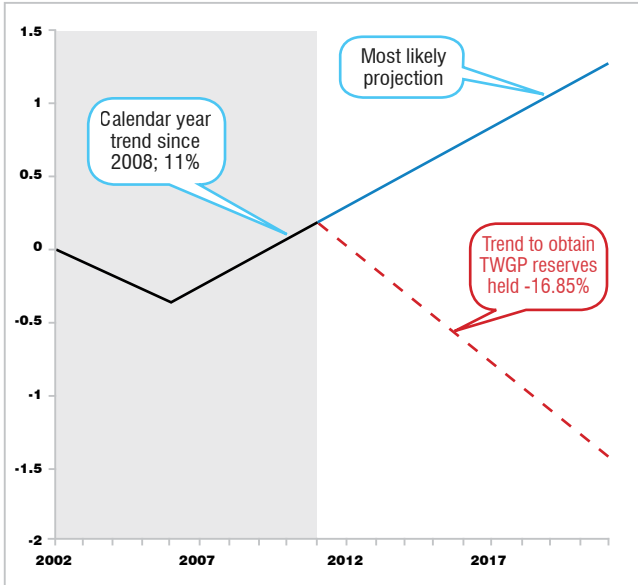
# DID POOR METHODOLOGY SINK TOWER GROUP?



ARE YOU NEXT?



# TOWER GROUP: A FAILURE IN PROGRESS SINCE 2007



- A new calendar year trend that emerged in 2006 was steadily eroding their financial position and culminated in the failure of Tower Group in 2013 when under-reserving was finally noticed.
- What took experts and stakeholders so long to see the problem?
- Statistical models which describe calendar year trends in the data clearly demonstrate Tower Group was sinking way back in 2009!
- Commonly used methodologies do not measure calendar year trends.
- Using the right modeling tools in 2007 could have saved Tower Group. By 2011 (see the timeline on next page), it was far too late.

## IS YOUR COMPANY THE NEXT TOWER GROUP?

Insureware's modeling tools, applied to Schedule P 2011 data, show losses have been growing at a rate of 11% per calendar year **above** earned premium since 2006.

To obtain the same Mean Ultimates as posted by Tower Group in 2011 by total and accident year, we have to use a calendar year trend of -16.85% (yes, **negative**). The forecast table with Tower Group Ultimates Held (inset) is shown below.

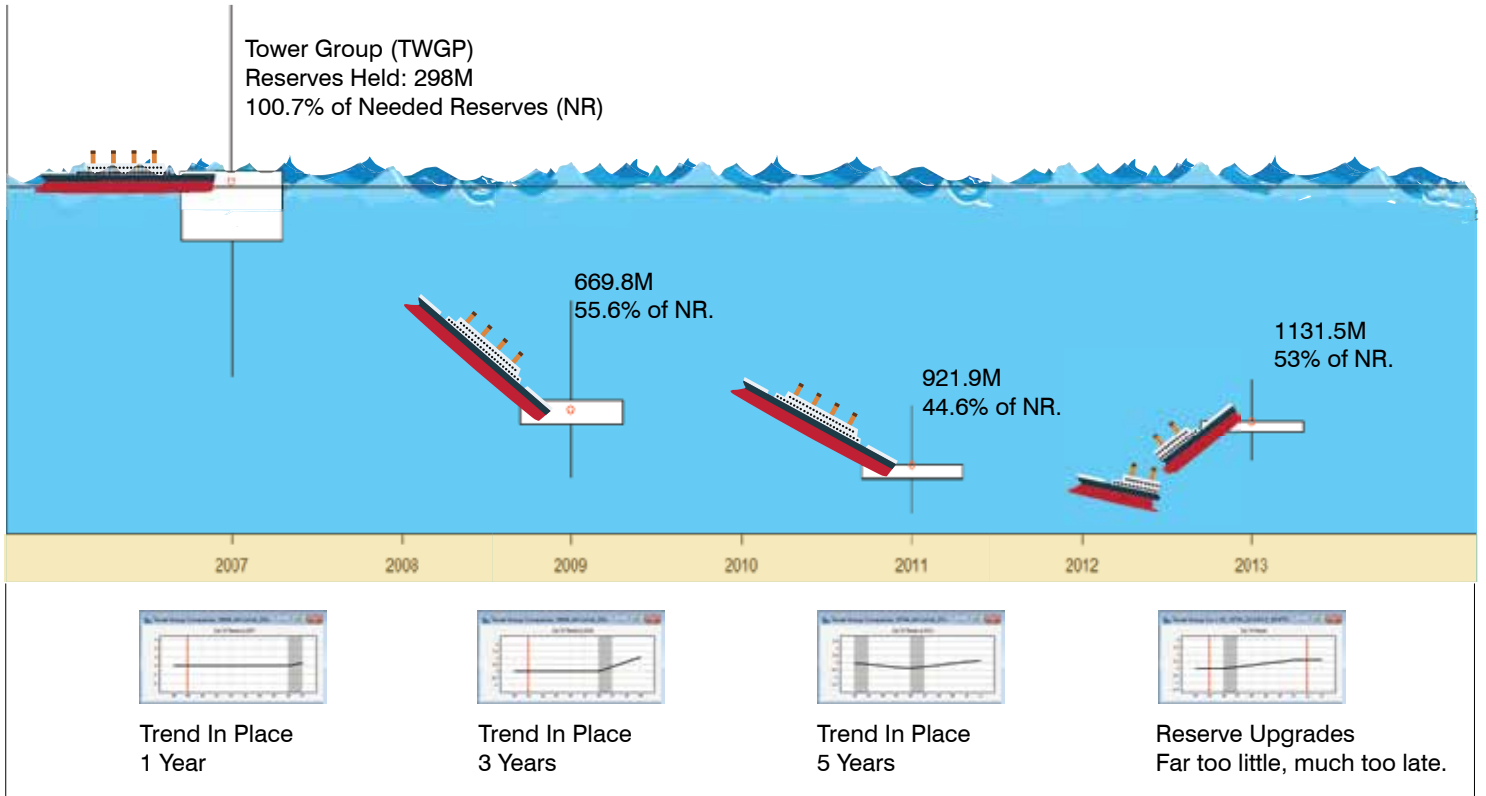
Tower Group Companies_18794_All Comb_2011:PL(I)_EP:PTF[Good-1]:Reserve Forecast Table																																					
Actual Values & Mean Forecast																																					
	Cal. Per. Total	0	1	2	3	4	5	6	7	8	25	Ultimate																									
2004	103,911	49,725	28,182	18,392	13,302	14,338	7,644	-974	<table border="1"> <thead> <tr> <th>Accident Period</th> <th>Ultimates Held</th> <th>ELR(%)</th> </tr> </thead> <tbody> <tr><td>2004</td><td>139,323</td><td>50.6</td></tr> <tr><td>2005</td><td>173,568</td><td>49.1</td></tr> <tr><td>2006</td><td>229,368</td><td>46.5</td></tr> <tr><td>2007</td><td>366,618</td><td>52.4</td></tr> <tr><td>2008</td><td>465,232</td><td>54.1</td></tr> <tr><td>2009</td><td>566,722</td><td>57.7</td></tr> <tr><td>2010</td><td>535,394</td><td>59.9</td></tr> <tr><td>2011</td><td>696,984</td><td>61.8</td></tr> </tbody> </table>	Accident Period	Ultimates Held	ELR(%)	2004	139,323	50.6	2005	173,568	49.1	2006	229,368	46.5	2007	366,618	52.4	2008	465,232	54.1	2009	566,722	57.7	2010	535,394	59.9	2011	696,984	61.8	141,272
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2005	112,194	49,518	38,942	19,431	26,140	21,041	1,763	8,669		176,492																											
2006	135,327	59,475	50,083	37,107	32,325	9,817	17,547	10,086		370,727																											
2007	221,653	115,284	89,880	56,719	25,047	34,904	22,087	12,099	464,409																												
2008	324,522	143,386	121,849	38,678	67,792	41,909	22,944	12,570	547,420																												
2009	427,253	181,575	108,336	95,660	72,304	40,476	22,162	12,143	553,700																												
2010	393,802	209,186	140,943	78,973	55,656	31,159	17,062	9,350	689,895																												
2011	694,364	319,844	152,849	84,246	59,382	33,249	18,208	9,978																													
	Total Paid		2012	2013	2014	2015	2016	2017	1 Unit = \$1,000			Total Ultimate																									
Cal. Per.	2,526,865		388,046	226,348	137,902	76,276	41,802	22,925	12,581	6,909	0	3,448,096																									

1 Unit = \$1,000; Forecast Scenario: -16.85% future calendar year trend

The observed losses (blue) are in the upper part of the triangle above. Projected mean losses (black) form the lower section of the triangle.

Observed losses are increasing (note in particular, region highlighted in blue). In contrast, the projected losses (highlighted green for example), are decreasing! We used a calendar trend of -16.85% and matched Tower Group's Ultimates by Accident Year almost perfectly. Does that make sense when the past trend was +11%?

# TIMELINE OF TOWER GROUP'S DECLINE



## ICRFS™ TECHNOLOGY MITIGATES MODEL RISK

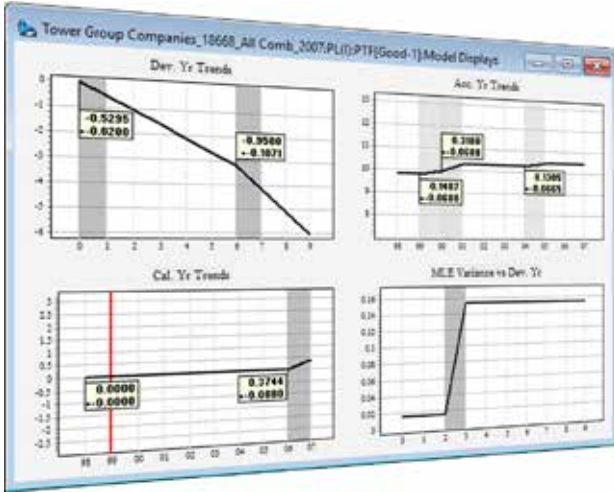


USE CRITICAL INSIGHTS TO MAKE INFORMED DECISIONS REGARDING CAPITAL MANAGEMENT.

EXTRACT DATA TRENDS SCIENTIFICALLY AND BE PREPARED FOR ANY CONDITIONS.



# ICRFS™ SOUNDS A WARNING ON SCHEDULE P 2007 DATA



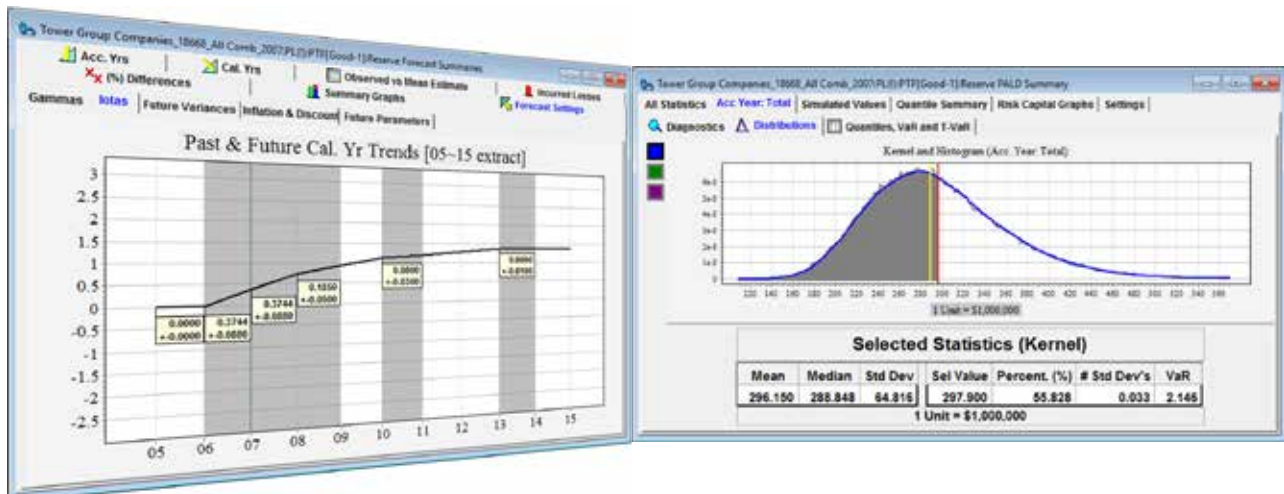
- Tower Group sported a policy of rapid expansion with premium increasing by 50% per year.
- A Probabilistic Trend Family (PTF) model (left) reveals a dramatic calendar year trend of 37.44% emerging between 2006 and 2007. Some of this increase may be due to acquisition, however this is the first sign of impending catastrophe.
- Action in 2007 may have averted disaster.
- By 2009, the emerging calendar year trend has continued for three years.
- By 2011, it is too late. The change in trend, still unnoticed, has long since reached breaking point.

## ICRFS™ TECHNOLOGY COULD HAVE SAVED TOWER GROUP!

Insureware's Probabilistic Trend Family (PTF) modeling framework is used to distinguish the trends in each time dimension (development, accident, and calendar) along with the volatility. Changes in trends are modeled explicitly and full control over future assumptions is provided.

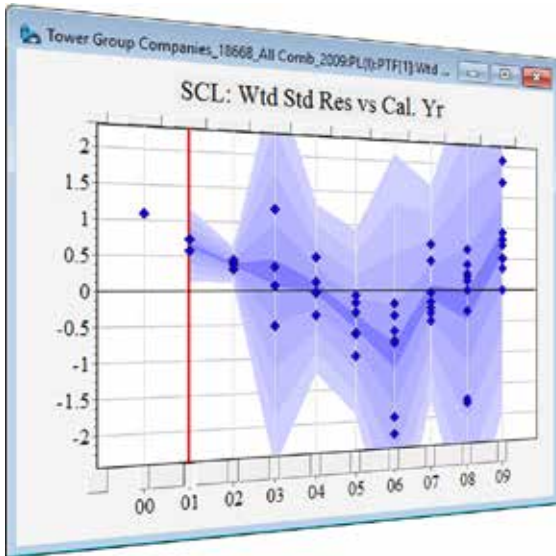
ICRFS™ with Schedule P contains Paid Losses, Case Reserve Estimates, Incurred Losses, and Ultimates Held (amongst other loss development arrays).

An analyst aware of the new trend in 2006~2007 and making the assumption that the trend would return to a normal level after a few years, would have regarded the 2007 reserves as adequate. However... if the trend were to continue for longer, then there would be trouble.



The 2007 Reserves Held were consistent with the data up to then, but the distribution of the total reserve (right) highlights the considerable risk element in assuming all would be well. Knowledge of the calendar trend change in 2007, and the associated risk levels with the business written, ought to have influenced decisions regarding future premiums, reinsurance, and risk appetite.

# KEY FEATURES OF TOWER GROUP'S DATA WERE OVERLOOKED



Commonly used actuarial methods such as the Mack method cannot measure calendar year trends.

- A diagnostic model for detecting calendar year trends in the PTF modeling framework, applied to the 2009 Schedule P data (left), demonstrates the clear calendar year trend change in 2006.
- Methods which smooth across accident years to maintain consistent loss ratios, like Bornhuetter-Ferguson, will only exacerbate the effect of not perceiving the calendar year trend change(s).
- Reserve increases in 2013 were needed more than four years earlier.

## STANDARD ACTUARIAL METHODS SUPPORT TOWER GROUP'S RESERVES

Acc. Yr	Premium	Paid To	Mean		Loss Ratios (%)		
			Outstanding	Ultimate	A Priori	Mean	SD
2002	175,262	101,348	2,209	103,567	59.01	59.067	0.000
2003	289,531	168,851	3,633	172,484	59.45	59.574	0.298
2004	275,146	135,726	4,285	140,910	50.64	50.886	0.778
2005	353,795	165,504	11,097	176,801	49.06	49.916	0.829
2006	493,306	206,354	23,871	230,225	46.50	46.670	0.928
2007	700,159	321,834	45,561	387,395	52.36	52.473	1.195
2008	860,332	371,706	102,248	473,963	54.08	55.090	1.411
2009	982,642	385,671	198,306	583,877	57.67	59.419	1.923
2010	894,285	350,129	227,362	577,491	59.87	64.576	2.584
2011	1,127,743	319,844	440,792	760,638	61.80	67.448	3.229
Total	6,162,201	2,526,860	1,059,364	3,686,229	58.292	58.292	0.991

The A Priori loss ratios (highlighted: blue) are based on Tower Group's estimates of mean Ultimates.

The Loss ratios (highlighted: green) on the left are based on the Mack method applied to the Incurred data (Schedule P 2011).

The loss ratios center (highlighted: green) are based on the PTF model with an assumed future calendar year trend of -16.85%. Note the proximity of the estimates of the Mack method loss ratios and PTF loss ratios with the -16.85% future calendar year trend to Tower Group loss ratios.

Loss ratios (right, highlighted: red) are based on the scenario where the 11% trend continues. This is a more accurate reflection of reality.

From the stability of Tower Group's loss ratios, it appears that a method like Bornhuetter-Ferguson was used to maintain consistency between accident years.

This combination of a blind method (eg: Mack) with wishful thinking (Bornhuetter-Ferguson) led to disaster. Although the data contained the information needed to avert catastrophe, adherence to standard actuarial methods obscured this information until too late.

## ICRFS™: The world's best long-tail liability risk management system

ICRFS™ is a high-powered analytical and data management system and the only actuarial software which treats insurance data arriving in calendar time as an essential feature of its modeling solutions. Designed with the P&C actuary and senior executives in mind, results are delivered in seconds.

The software is:

- small-footprint,
- intuitive and graphic,
- very fast, and
- rapidly implemented enterprise wide!

Insureware's new versatile technology, ICRFS™ Importer, accelerates the implementation process even further! ICRFS™ Importer builds a bridge between a database holding a mass of transaction records and an analytic engine which can analyse triangle data.



### ICRFS™ Importer

#### Access information instantly

- Connect large repositories of unit record data with ICRFS™
- Extract all database variables
- Create triangles at any granularity for analysis
- Convert claims table data into loss development triangles
- Aggregate:
  - Across all values of a variable
  - By particular values
  - Across multiple categories and values

### Relational databases

#### Access information instantly

- Small footprint
- Fast to implement enterprise wide solution
- Data organized according to your requirements
- Models and forecast scenarios saved in databases
- Simple to navigate
- Easy to monitor, manage, and update



Significant gains to an Insurance organization can be achieved by creating one or more ICRFS™ databases. These databases serve as a repository for all aspects of the company's long tail liability risks. All the information in the database including data, models, and results, are right at your fingertips.

### Modeling Frameworks

The identified models in the Probabilistic Trend Family (PTF) and Multiple Probabilistic Trend Family (MPTF) modeling frameworks describe the trends in the three directions (development, accident, and calendar) along with the volatility around the trends. They provide complete loss distributions by accident period, calendar period, and total.



## Modeling multiple long tail liability lines

### Get the complete perspective

- Introduction to probabilistic modeling frameworks
- Common drivers and measuring trends
- Correlations and their impact
- Long-tail liability risk profiles
- One composite model for the whole company
- Aggregate distributions for accident year, calendar year, and totals
- Quantiles (percentiles), V@Rs, and T-V@Rs
- Economic Balance Sheet and Solvency II metrics
- Real life case studies!



## Pricing: Segments, Layers and Reinsurance

- Introduction to probabilistic modeling frameworks
- Pricing future underwriting years including for the aggregate of multiple LOBs
- Pricing segments
- Assessing optimal outward reinsurance
- Layers and High Severity/Low Frequency
- Adverse Development Cover
- Real life case studies!



## Understanding correlations and common drivers

- Purpose of correlation measures
- Correlations are model dependent
- Common accident year and calendar year drivers versus correlations
- Impact of accident year drivers on pricing
- Real life case studies!



## Solvency II – one year and ultimate year risk horizons for long-tail liabilities

- Economic Balance Sheet
- Solvency II Capital Requirement
- Technical Provisions
- Market Value Margins
- IFRS 4 Phase II
- Fungibility and Ring Fencing
- Consistency of metrics on updating
- One year ahead metrics



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