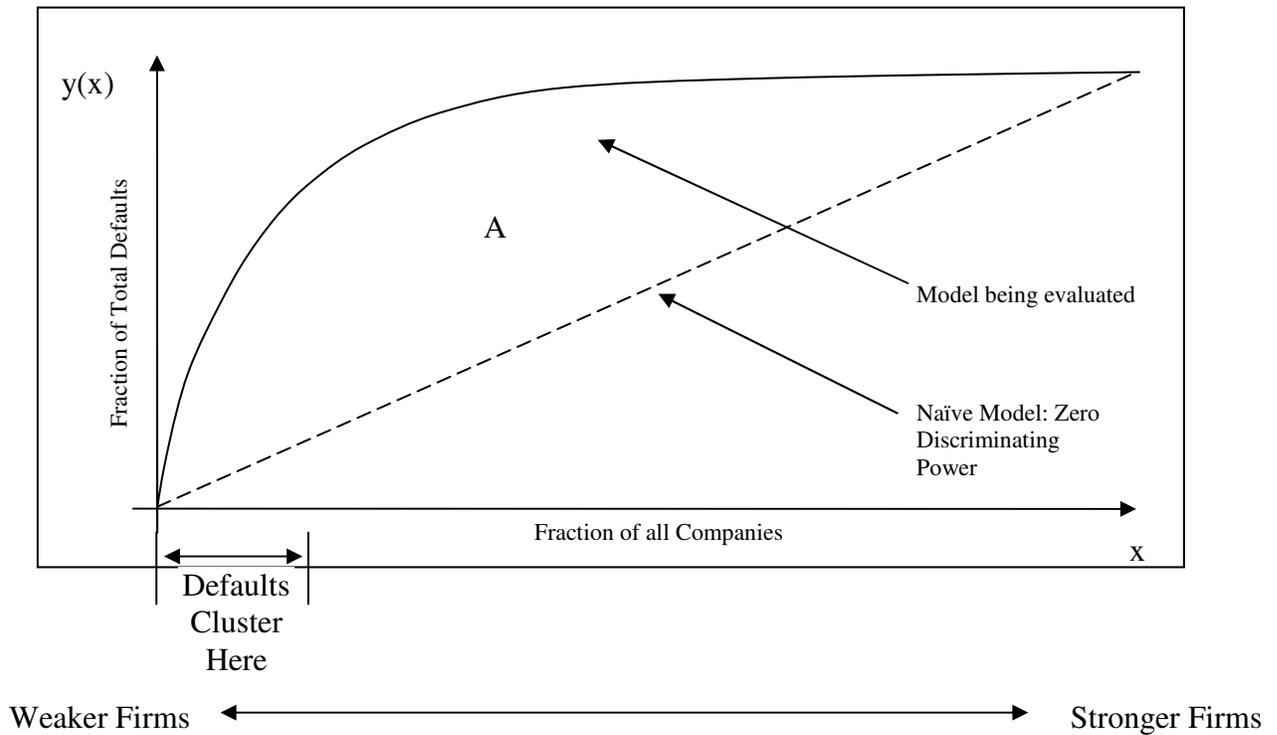# www.FirstKnow.It Cumulative Accuracy Profile (CAP) – Gini Coefficient [©]

Introduction

Rigorous back testing of credit models is essential and is a key element of the new Basel II capital accords. The Basel II proposals indicate a minimum back testing period of one year, preferably three years. Gini Curves – often called Cumulative Accuracy Profiles (CAP's), and Gini Coefficients, are expected to be a key element of this process.

Gini Coefficients are widely used to measure the degree of concentration, or inequality, of a variable in a distribution of its elements. In the case of credit analysis, it is measuring the ability of a predictive measure to discriminate between defaulting and non-defaulting companies. A further advantage of the Gini analysis is to enable different credit evaluation techniques, either quantitative or based on qualitative rating grades, to be compared in their ability to predict default.

Essentially, the Gini analysis takes a specific date and orders the companies in the analysis in order of descending default probability (ratings) predictions. Assuming a 12 month default probability, the analysis then maps the predictions against actual defaults during the subsequent 12 month period. If the predictions are accurate, the companies with the highest predicted default probability should be mapped against a large number of defaults and correspondingly few surviving companies. If the predictions have no informational content, defaults should be mapped randomly throughout the chart, with equal numbers mapped against companies with low default probability as against companies with high default probability. This gives the well known Gini Curve (Chart 1):

y(x)

Fraction of Total Defaults

A

Model being evaluated

Naïve Model: Zero Discriminating Power

Fraction of all Companies

x

Defaults Cluster Here

Weaker Firms ⟷ Stronger Firms

The more predictive the model, the more the defaults cluster to the left of the chart into the weakest firm category. Thus a naïve model has companies dispersed equally throughout the chart, the weakest 5% of companies correspond to 5% of defaults, the weakest 30% corresponds to 30% of defaults, producing the diagonal line of the Naïve Model. A perfectly predictive model would have all the defaults in the weakest category as follows (Chart 2):
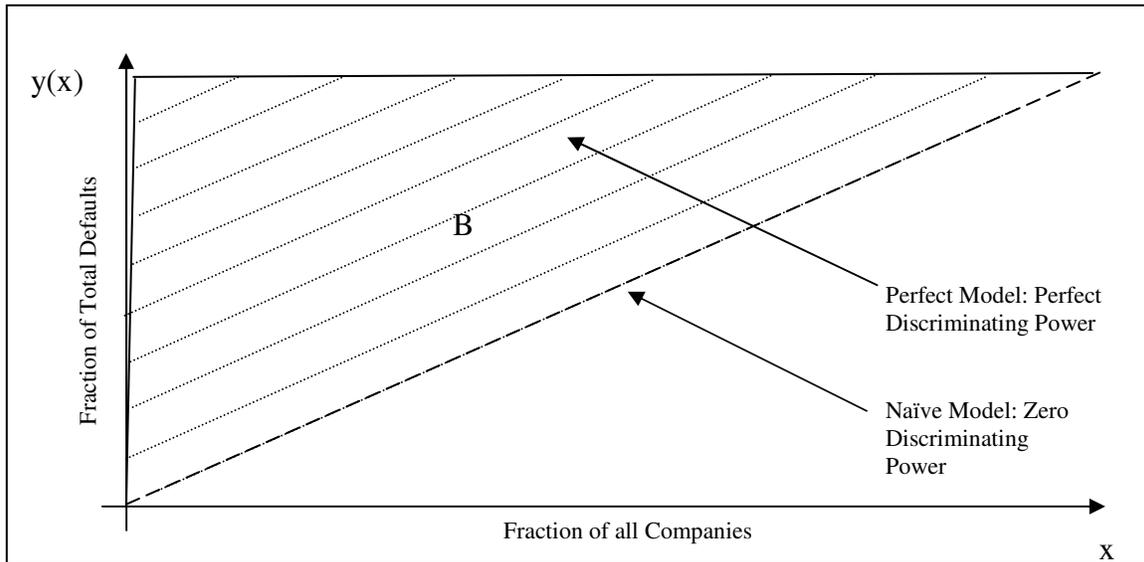
The ratio of area A in Chart 1 to area B in Chart 2 – the Gini Coefficient - is a measure of predictive accuracy. This ranges from zero (zero predictive power) to 1 (or 100%) for a perfectly predictive system.

Typical Values

Acceptable credit evaluation systems are expected to have a Gini Coefficient in excess of 50%. Moody's ratings are cited by Oderna, Dacorogna & Jung as being in the 70%-80% range[1]. In an analysis, the same authors found the Gini Coefficient for quoted companies in the MoodysKMV® service to be 87%. In their benchmarking of a Bundesbank private firm model[2] (ie/ on non-quoted companies), Blochwitz, Liebig & Nyberg identified a Gini Coefficient of 59.7% for the KMV Private Firm Model and 68% for the Bundesbank expert system. They found common financial ratios gave much lower Gini Coefficients in the order of 38%-48% for ratios such as ROE, Equity Ratio and Capital Recovery Ratio.

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[1] Credit Risk Models. Do they Deliver Their Promises? A Quantitative Assessment. Oderna, Dacorogna & Jung. Economic Notes 2002.
® MoodysKMV and KMV are trademarks of MIS Quality Management Corp.
[2] Benchmarking Deutsche Bundesbank's Default Risk Model, the KMV Private Firm Model and Common Ratios for German Corporations. Blochwitz, Liebig & Nyberg. November 2000

Economic Background

The last three years really have been wretched from a credit perspective. The following chart shows the number and value of international credit defaults identified by S&P since 1980.

Annual Defaults
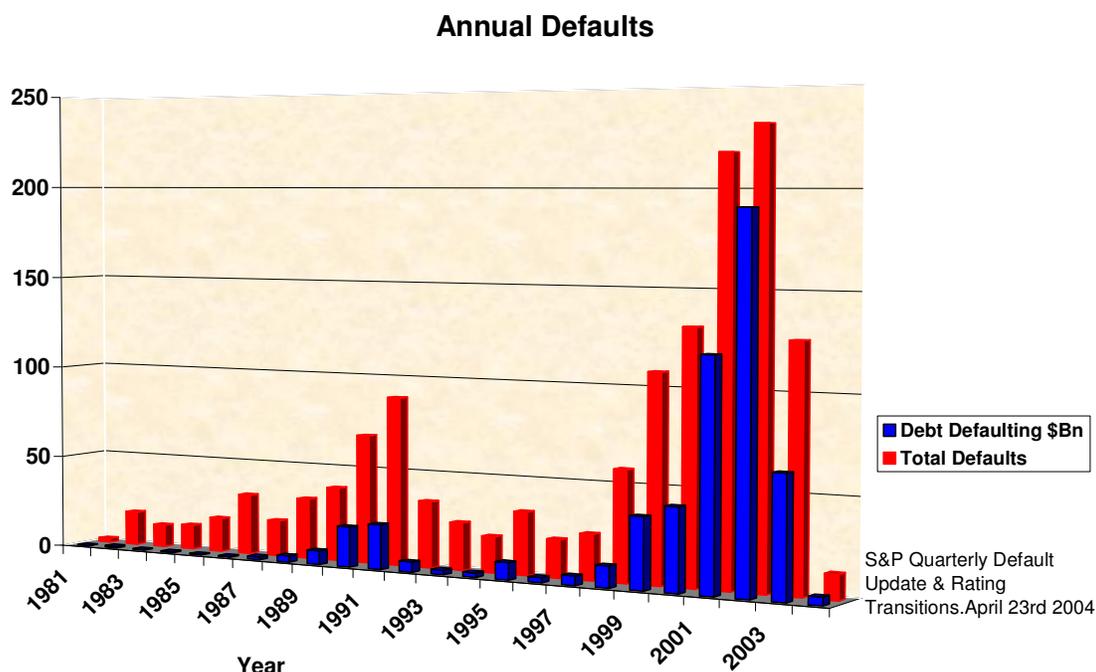
Whereas the early '90s recession saw numbers of defaults peak at 89 involving 3 investment grade companies and $23 bn, the latest downturn peaked in 2002, involving 232 defaulting companies 17 of which were investment grade and $ 191 bn. There were 815 defaults during the 1999/2003 period compared to 231 between 1989 and 1994. The poor credit environment has been further deteriorated by the corrosive effects of several major instances of corporate fraud and financial misrepresentation.

In a broader context, the analysis period has been marked by immense political and social uncertainty. Following the 1999/2001 economic slowdown and dotcom crash, the 9/11 outrage was a huge political and psychological blow, exacerbating the uncertain credit outlook. The subsequent Afghan and Iraq wars followed. The second half of 2002 was marked by immense uncertainty as the US and its allies squared up against former allies in "Old Europe" and against Russia over the campaign against Saddam Hussein. These political uncertainties caused great concern in the financial markets, with the S&P500 declining 31% between March and October 2002 and average implied asset volatility peaking at 26.9% in December 2002 compared to just 18.8% in the post-Iraq-war period in mid 2003.

The last three years can therefore be characterized as one of the weakest economic and credit environments of the post- World War II period.

US Coverage

The Gini analysis is produced on a quarterly basis for the www.FirstKnow.It data for three successive years commencing 6th June 2001. The analysis takes the one year default probability and performs the Gini analysis on companies defaulting during the subsequent 12 months. Over the three year time horizon, there were 33 defaults among the 850 US companies comprising the US coverage, as follows:

Table (1)   **US Defaults: June 2001 - June 2004**

June 2001/2002		June 2002/2003		June 2003/2004	
Company	**Default**	**Company**	**Default**	**Company**	**Default**
Safety Kleen	9-Jun-00	Worldcom	21-Jul-02	Mirant	15-Jul-03
Genesis Health Ventures	22-Jun-00	US Airways	11-Aug-02	Loral Space & Communications	15-Jul-03
Owens Corning	5-Oct-00	Consolidated Freightways	2-Sep-02	Northwestern	14-Sep-03
USG	25-Jun-01	Eott Energy Partners	9-Oct-02	Solutia	17-Dec-03
Federal Mogul	8-Oct-01	Oakwood Homes	15-Nov-02	Footstar	3-Mar-04
Bethlehem Steel	15-Oct-01	UAL	16-Dec-02	Healthsouth	8-Jun-04
Chiquita Brands International	29-Nov-01	Magellan Health Services	11-Mar-03		
Hayes Lemmerz International	5-Dec-01	Spiegel	17-Mar-03		
Kmart	22-Jan-02	Fleming Companies	1-Apr-03		
PhyCor	31-Jan-02	Weirton Steel	19-May-03		
Kaiser Aluminum	13-Feb-02	Penn Traffic	30-May-03		
National Steel	7-Mar-02	Westpoint Stevens	1-Jun-03		
Covanta Energy	1-Apr-02				
Exide	16-Apr-02				
Williams Communications	23-Apr-02				
Total Defaults	**15**	**Total Defaults**	**12**	**Total Defaults**	**6**

Despite this challenging backdrop, the www.FirstKnow.It US model has performed excellently, consistently producing Gini Coefficients of about 90% for the Historical Volatility Analysis and well in excess of this for the Implied Volatility Analysis, as shown in Tables (2) and (3):

Table (2)	**Gini Coefficient: US Historical Volatility Analysis %**				
Year Starting	**March**	**June**	**September**	**December**	**Mean**
2001		92.08	87.80	86.99	88.96
2002	91.99	90.45	90.69	92.65	91.45
2003	92.02	92.31	86.73 *		90.35
Mean	**92.01**	**91.61**	**88.41**	**89.82**	**90.46**

Table (3)	**Gini Coefficient: US Implied Volatility Analysis %**				
Year Starting	**March**	**June**	**September**	**December**	**Mean**
2001			91.92	95.16	93.54
2002	95.15	92.91	92.57	94.18	93.70
2003	94.57	94.25	91.36 *		93.39
Mean	**94.86**	**93.58**	**91.95**	**94.67**	**93.54**

* 9 months to 9th June 2004: 4 defaults

Analysis for US companies based on Historical Volatility commenced on 5th June 2001. The Gini analysis is produced on a quarterly basis mapping one year default probabilities to defaults during the subsequent 12 months from 6th June 2001 to 6th September 2003. This is repeated for the Implied Volatility Analysis, starting 6th September 2001 from when the Implied Volatility data became available.
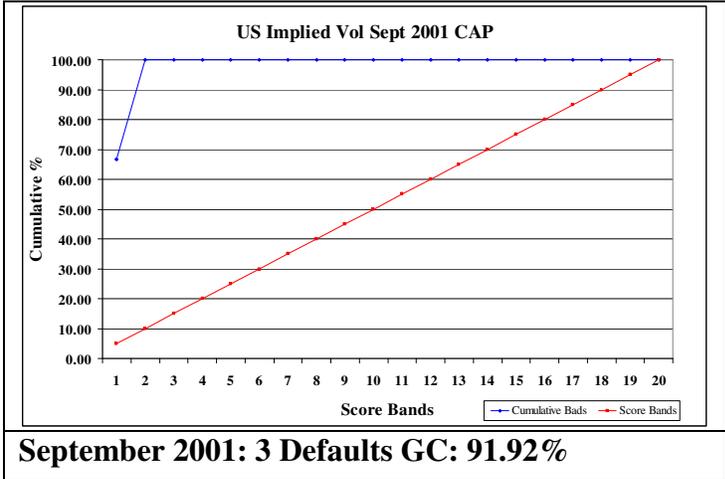
The results are excellent, substantially outperforming alternative systems. The Historical Volatility Analysis has a mean Gini Coefficient of 90.46%. The minimum full year value of 86.99% occurs in the year commencing December 2001 whilst the highest value of 92.31% occurs in the year commencing June 2003. The Implied Volatility Analysis outperforms the Historical Volatility analysis, with a mean Gini Coefficient of 93.54%. The lowest full year value of 91.36% occurs in September 2002 whilst the highest coefficient of 95.16% is achieved in December 2001. Interestingly, the strongest result from the Implied Volatility Analysis occurs in the same quarter as the weakest result from the Historical Volatility Analysis, highlighting the importance of using both approaches in evaluating risks.

This analysis indicates the model has an exceptionally strong ability to discriminate between good and bad credit risks on the one year time horizon.

As well as producing very high Gini Coefficients, the model also provides very stable results over the 9/10 quarters indicating a consistent ability to discriminate default risks.
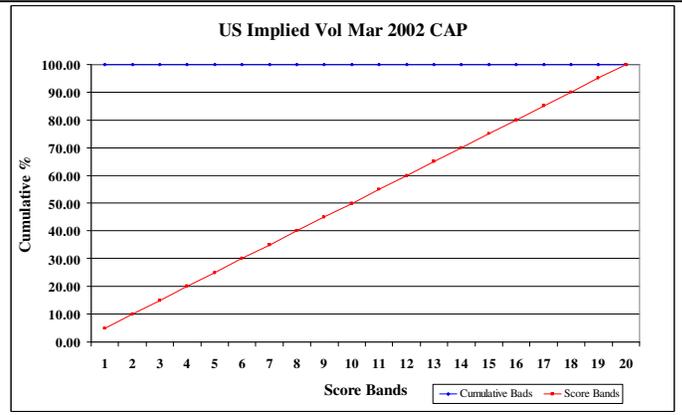
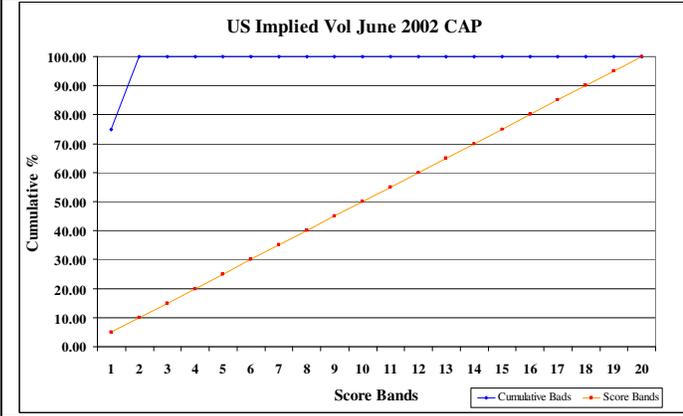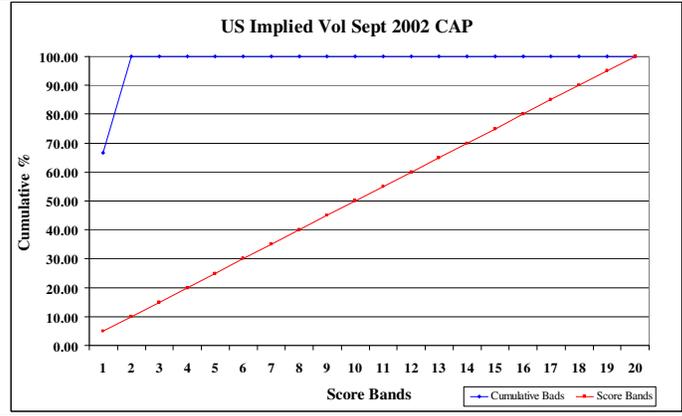Gini Charts are as follows:

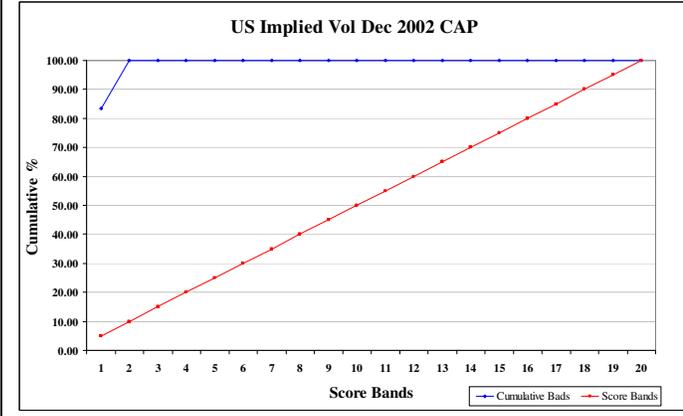**US Implied Volatility Analysis**

September 2001: 3 Defaults GC: 91.92%

US Implied Vol Dec 2001 CAP
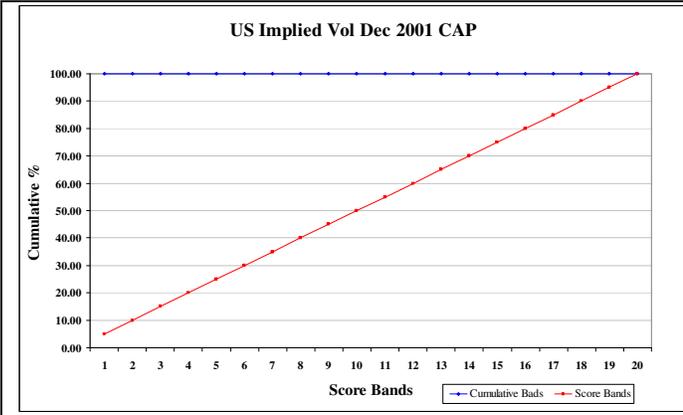
December 2001: 2 Defaults GC: 95.16%

US Implied Vol Mar 2002 CAP

March 2002: 2 Defaults GC: 95.15%

US Implied Vol June 2002 CAP

June 2002: 4 Defaults GC: 92.91%

US Implied Vol Sept 2002 CAP

September 2002: 6 Defaults GC: 92.57%

US Implied Vol Dec 2002 CAP

December 2002: 6 Defaults GC: 94.18%

US Implied Vol March 2003 CAP
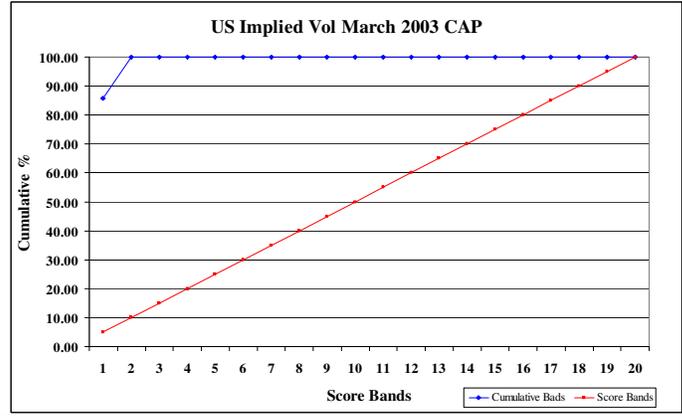
March 2003: 7 Defaults GC: 94.57%

US Implied Vol June 2003 CAP
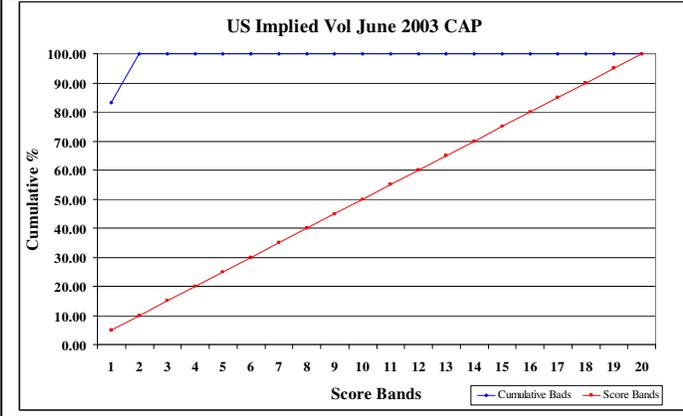
June 2003: 6 Defaults CG: 94.25%

US Implied Vol Sept 2003 CAP
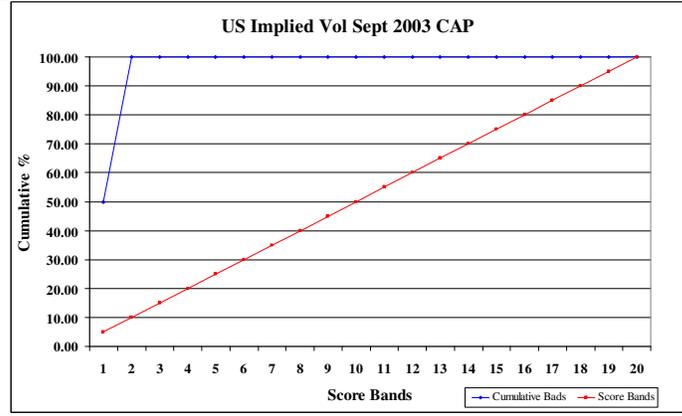
Sept 2003: 4 Defaults (9 Months) GC: 91.36%

US Historical Volatility

US Historical Vol June 2001 CAP

June 2002: 12 Defaults GC: 92.08%

US Historical Vol Sept 2001 CAP
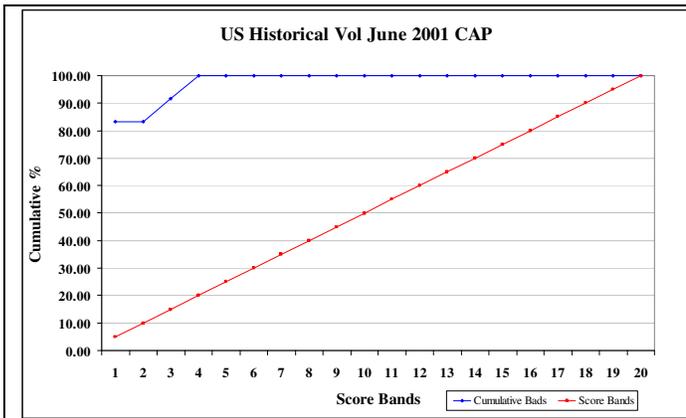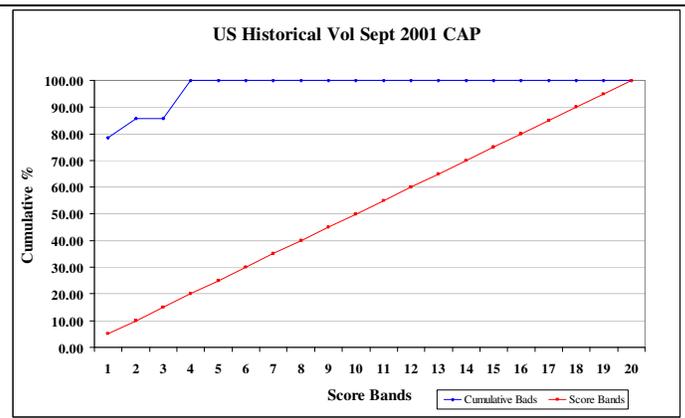
September 2001: 14 Defaults GC: 87.80%

US Historical Vol Dec 2001 CAP
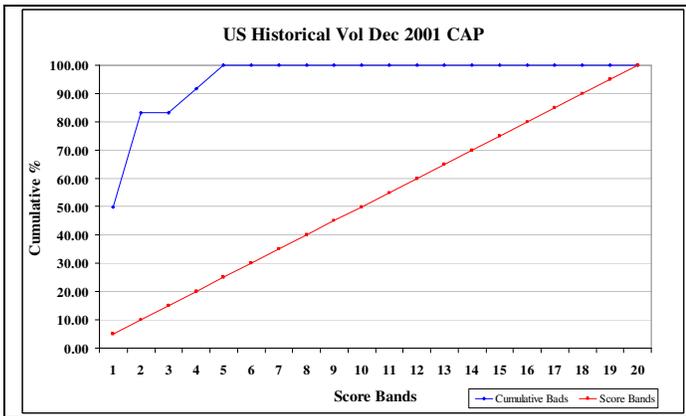
December 2001: 12 Defaults GC: 86.99%

US Historical Vol March 2002 CAP
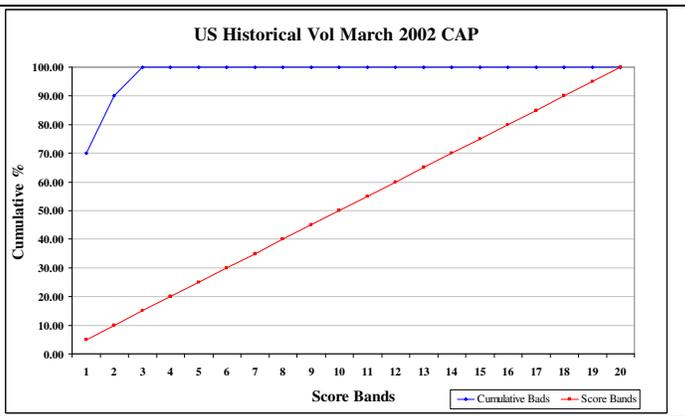
March 2002: 10 Defaults GC: 91.99%

US Historical Vol June 2002 CAP

June 2002: 12 Defaults GC: 90.45%

US Historical Vol Sept 2002 CAP
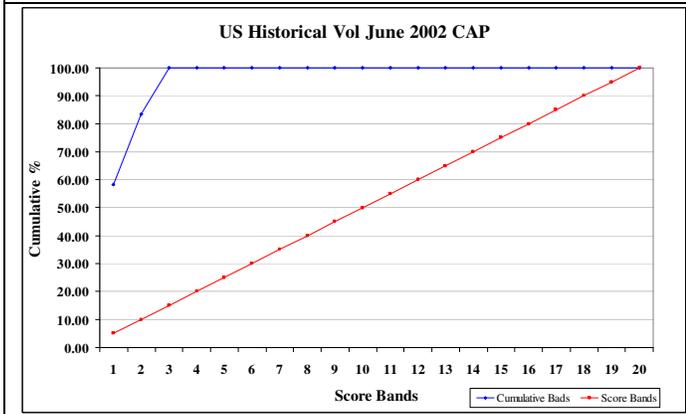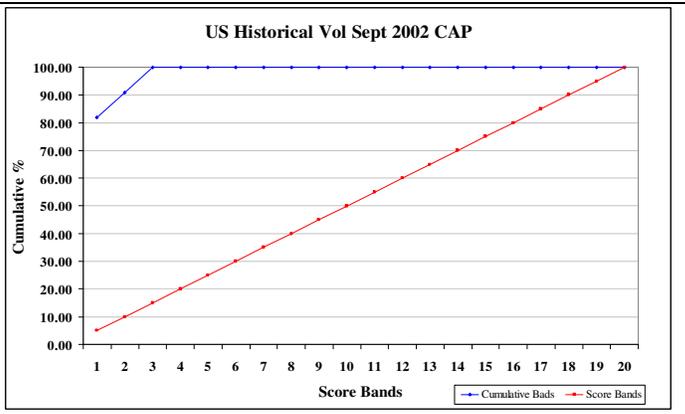
September 2002: 11 Defaults GC: 90.69%

US Historical Vol Dec 2002 CAP
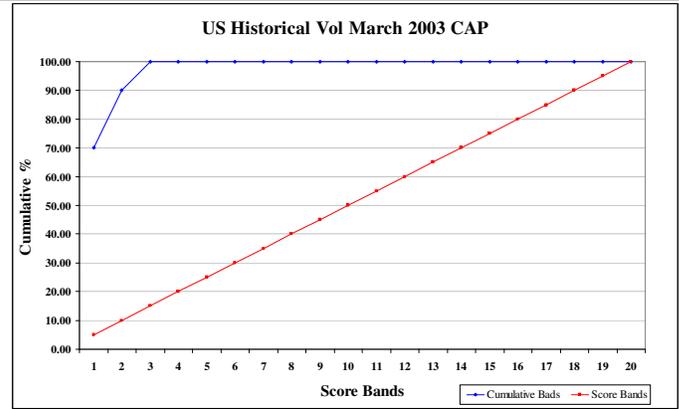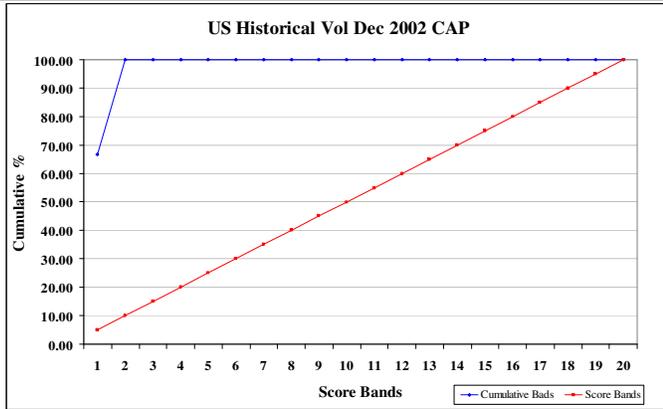
December 2002: 9 Defaults GC: 92.65%

US Historical Vol March 2003 CAP

March 2003: 10 Defaults GC: 92.02%

US Historical Vol June 2003 CAP
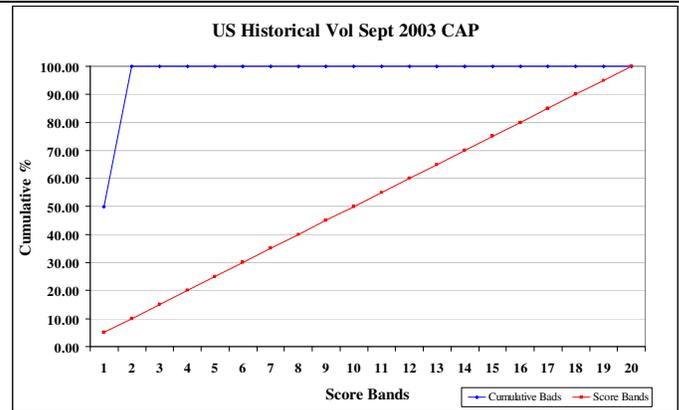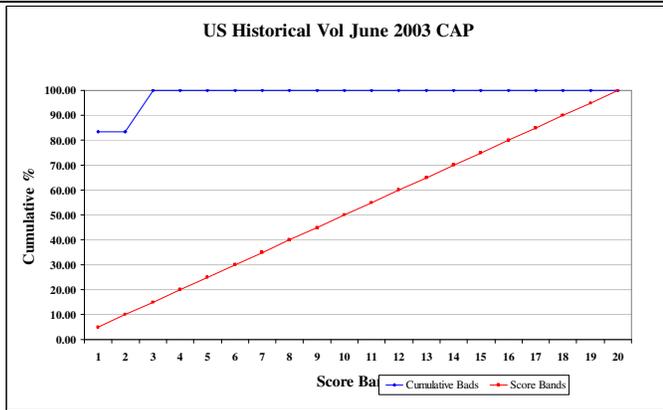
June 2003: 6 Defaults GC: 92.31%

US Historical Vol Sept 2003 CAP

Sept 2003: 4 Defaults (9 Months) GC: 86.73%

Implied Minimum Acceptable Credit Level

In reviewing the default history, it is interesting to consider whether there is a minimum acceptable credit level (MAC level) which will in effect eliminate the overwhelming number of defaults.

16 of the defaulters were on the implied volatility with all but 3 rated D

The other 3 were rated:

Company/Implied Volatility Based Rating previous June		
2001 Defaults	**2002 Defaults**	**2003 Defaults**
Kmart: B	Fleming Co's: CCC+	Footstar: C
Covanta Energy: N/A	Penn Traffic: N/A	

A MAC level of B- would have approved just Kmart   (1/16: 6.3% of defaults)
C+ just Fleming Co's and Kmart,   (2/16: 12.5% of defaults)
C- just Footstar, Fleming Co's and Kmart   (3/16: 18.8% of defaults

All but 5 of the 33 companies defaulting in the historical volatility analysis were rated D on the www.FirstKnow.it 1 year rating in the preceding June

The other 5 were rated:

Company/Historical Vol Based Rating previous June		
2001 Defaults	**2002 Defaults**	**2003 Defaults**
Kmart: B	Fleming Co's: CC	Footstar: CC-
Covanta Energy: CCC	Penn Traffic: C+	

A MAC level of CCC+ would have approved just Kmart,   (1/33: 3.3% of defaults)
CC+ just Covanta and Kmart,   (2/33: 6.6% of defaults)
C+ just Footstar, Covanta and Kmart   (3/33: 9.9% of defaults)

A MAC level of C+ on the historical and implied volatility analysis would statistically eliminate about 90% of defaults. Currently there are 39 (4.5%) of the 850 companies on the system which fall into this category in the historical volatility analysis and 21 (3.3%) of 630 companies in the implied volatility analysis. This leaves in excess of 95% of companies exceeding the MAC level.

Conclusion US Analysis

In both its Implied Volatility and its Historical Volatility forms, the www.FirstKnow.It model has provided an excellent indicator of one-year probability of default over the three year time period of this analysis. The average Gini Coefficients of 90.46% for the Historical Volatility form of the model and 93.54% for the Implied Volatility form substantially exceed the typical maximum aspiration of 50%-80% for credit models. The results of the analysis indicate that models also comfortably outperform Moody's and even exceed the Gini Coefficient of 87% for MoodysKMV cited by Oderna, Dacorogna & Jung, particularly for the Implied Volatility Analysis. The consistency of performance of the models during this highly unstable period has also been outstanding.