Seeking Standardization in Fair Value, Risk Measures and Simulation

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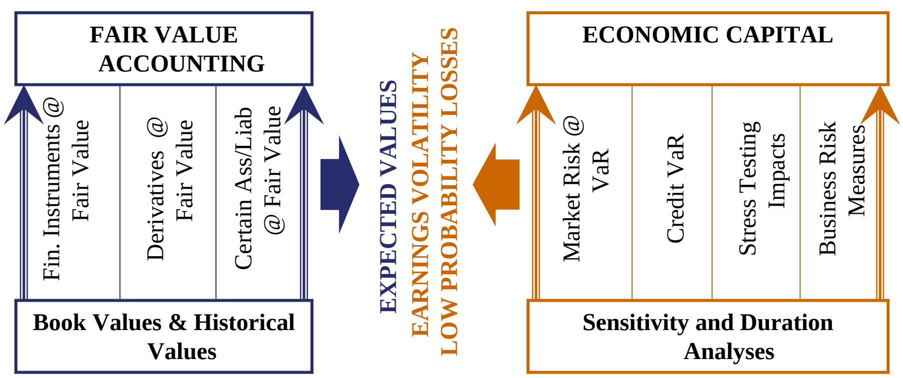
"All of life is the management of risk, not its elimination" - Walter Wriston, ex-Citicorp

Agenda

- Evolution of Accounting and Risk Measures
- Fair Value Accounting
- Disclosure of Fair Values and Risks in Financial Statements
- Conversion of Financial and Risk Reporting Standards
- Primer of Quantitative Disclosure of Market Risk
- Analysis of Tail Normality
  - S&P 500 (SPY)
  - DuPont Chemical (DD)
  - Merck (MRK)

Evolution of Accounting and Risk Measures

Accounting and Industry Standard Setters drive financial and risk reporting toward probabilistic forecast disclosures

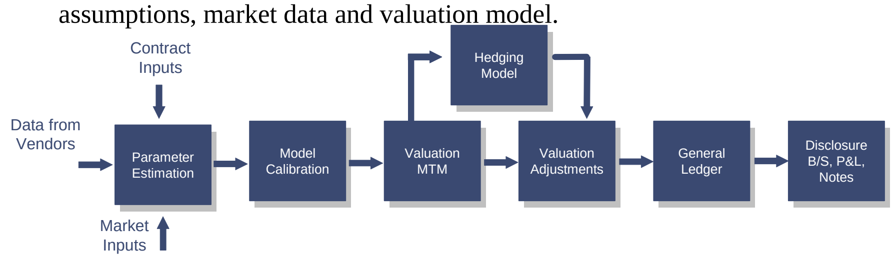


Fair Value Accounting Paradigm

- Bank of England Survey: Valuation of Exotic OTC Derivatives in 40 Financial Institutions found differences up to 60% in MTM of exotic IR and FX derivatives
- **SFAS157**: "Fair value is the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date (an exit price)."
- **FASB**: 115, 123(R), 133, FSP133-a, 138, 149, 155, 157, 159 …
  SFA Concept No. 7
- **IAS**: 21, 32, 39, … **IFRS:** 2, 7, … **CICA**: S3855, S3865, S3870…
- **ASB/EFRAG/ISDA**… SFAS157 might be useful as a methodology for determining market-based exit prices, but we question the assumption that fair value should always be equated with exit value (March 2007)
- FAIR VALUE MEASUREMENT PROJECT

Fair Value: Estimation and Disclosure

Fair Value (FV) in general is the expected value estimated with the use of assumptions, market data and valuation model.



Associated Issues

- Validity of the Inputs
- Availability of observable market data
- Vols. & corr.
- Data vendors transparency
- Manual / automatic data import

- Validity of the model
- Assumptions
- Scarce data points
- Interpolation/ extrapolation
- "One error point"

- Validity
- Assumptions
- Within limits
- Black box – vs – spreadsheet
- Misrepresentation of economic reality / behavior
- Bugs

- Subjective
- Portfolio based
- Simplifications
- General VA
- Specific VA

- Hedge accounting FAS133/IAS39/ CICA 3855/65
- VA release
- Accounting abuse

- Misstatements
- Accounting abuse
- Regulatory / GAAP compliance

Disclosure of FV in Financial Statements

Financial Statements reflect the entity's financial performance and financial position (first-moment information):

- Balance Sheet, Income Statement, Cash Flows Statement, Statement of Changes in Shareholders' Equity, Accounting Policies and Notes
- Entity is assumed to be a going concern. Information at a point in time
- Mixture of backward- and forward-looking information
- Scope of disclosure is defined by the accounting and market standards setters: FASB, IASB, CICA, FSA, SEC, …
- FV is subject to the independent price verification (IPV) and audit procedures; SOX / Bill 198 compliant.
- Potential errors in and imprecision of the FV are hidden (or not) in the Valuation Adjustments
- Risks are disclosed in "Management's Discussion and Analysis" (a single standard does not exist).

Disclosure of Risks in Financial Statements

Standard setters approach risk disclosure from different angles:

- Market and financial system stability: BIS II, Solvency II, OSFI, SEC, FSA, OCC, IOSCO, …
- Adequate and reliable information for shareholders: US GAAP, IFRS, SOX, Bill 198, …
- Integrity and soundness of risk management function: COSO, G30 Guidelines, Fisher II, Joint Forum, Industry Associations,…

Level of quantitative disclosure of risks is still debated:

PROS:

- Disclosures are informative; they predict the variability of trading revenues (P.Jorion, 2002)
- A way to show our ability to manage risk within the risk appetite boundaries (CRO of a bank)

CONS:

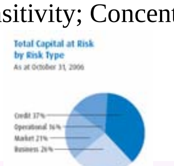
- Impossible to decode market signals from risk information (B.Schachter, 2004)
- Naïve transfer of mathematical and statistical models from the physical sciences to social systems (N.Taleb, 1997; R.Hoppe, 1999))

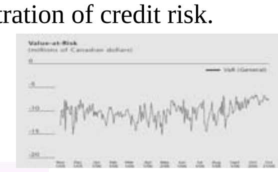
Existing Practices of Risk Disclosure

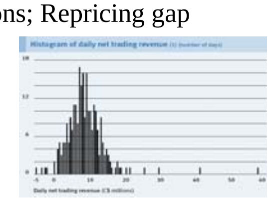
"Most of the European Banks are not transparent regarding risks in their annual reports", Bank Risk Disclosure Survey 2003, StradeaConsulting)

Management's Discussion and Analysis section of annual report provides:

- **Qualitative disclosure**: Main risk types/factors; ERM Framework; Risk Function Organizational Structure; Approaches to manage risks
- **Quantitative disclosure**: CaR/EC by risk type or SBU; VaR in trading books; IR sensitivity; Market VaR – Day/Aver./Min/Max; LLP by portfolio; Daily VaR changes; Histogram of daily net trading revenue
- **Notes to Financial Statements**: Sensitivity of certain assets/liabilities with respect to the changes in main economic assumptions; Repricing gap sensitivity; Concentration of credit risk.







Inconsistency in Measuring and Reporting FV and Risks

Accounting

- Different valuation principles: FV, Historical Cost
- Co-existence of marking-to-market and marking-to-model values
- Restrictive and prescriptive standards
- No specific requirements for internal valuation models
- Reliance on implied or observed data (vols, corr., smiles) for underlyings
- Use of valuation adjustments to capture imperfect models and data
- Regularly verified and audited FV

Risk Management

- Different simulations: MC, Historical, Parametric, Stress Testing, Scenario Analysis
- Co-existence of risk measures: VaR, CVaR, ES, Stress Tests, Risk-type specific measures
- Model Vetting: OCC, OSFI, BIS II, Solvency II
- Use of historical and risk specific data
- Different risk measures are complimentary to each other
- Back testing; Model validation

From Financial Reporting To Financial & Risk Reporting Statements

Recent developments of accounting and risk management frameworks towards reporting of the probabilistic forecasts of certain parameters of the distribution give the industry a chance of setting a common ground for International Financial and Risk Reporting Standards (IFRRS). IFRRS could include

- **First-moment statements**: Balance Sheet, Income Statement, Statement of Cash Flows, Notes, MD&A
- **Second moment/risk statements**: Quantitative disclosure of main risks and economic capital; Qualitative disclosure in risk notes
- **Statement of measurement errors**: Valuation adjustments; Tail analyses; Model risk.

Challenges in Establishing IFRRS

Critical success factor in developing IFRRS would be involvement of key stakeholders from both hemispheres in the project.

- **First Step**: Formation of a body of experts in risk management, financial engineering, accounting and industry/market regulation

Comprehensive disclosure of risks is facing many obstacles:

- High cost
- Requirement of auditability and verification
- Transparency and meaningfulness
- Single industry formats on categories of risk
- Disclosure of competitive and sensitive information
- Development and standardization coherent techniques to measure different categories of risk

Primer of Quantitative Disclosure of Risk

- Statement of Risks should disclose economic capital figures along with all main contributing risks
- Fair values of all material portfolios should be complemented by the portfolios risk measures and characteristics of tail distributions

Fair Value and 1Day Expected Shortfall @95% by Portfolio *
(As at Dec. 29, 2006)

	Fair Value		ES	For the year ended December 29			Tail
($ millions)	Assets	Liabilities	Year End	High	Average	Low	Normality
Equity	137	(19)	7	10	6	4	0.64
Foreign Exchange	45	(97)	3	5	4	1	0.43
Commodities	17	(3)	1	3	2	1	0.02
Fixed Income	1,288	(1,079)	15	22	17	9	0.21
Diversification	n.m.	n.m.	(7)	n.m.	(8)	n.m.	n.m.
Total	1,487	(1,198)	19	25	21	12	0.30

** For Illustration Purposes Only*

Analysis of Tail Distribution

"Risk Management is asking what might happen the other 1% of the time"

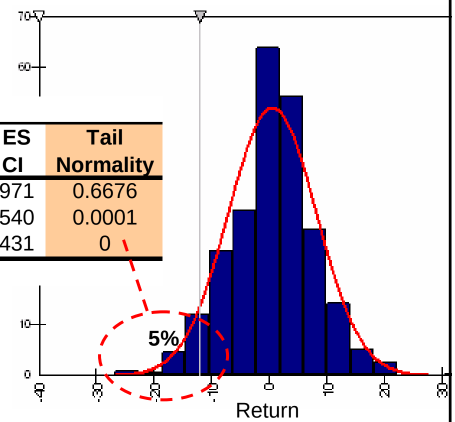
Richard Felix, Morgan Stanley

Tail statistics should describe how tail of normal distribution fits the historical tail:

(As of March 15, 2007)

	FV	1Day ES 95% CI	Tail Normality
DD	75,645	1,971	0.6676
MRK	64,785	2,540	0.0001
SPY	209,205	3,431	0

** For Illustration Purposes Only*



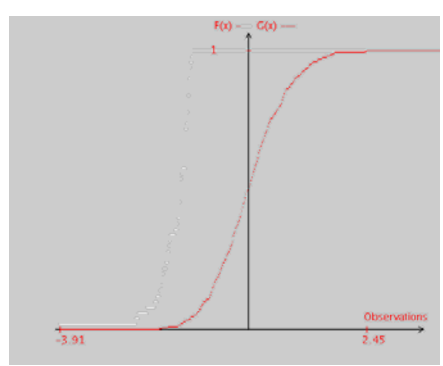
Analysis of Tail Distribution: S&P 500

50 Actual Worst Daily Returns versus 500 fitted March 26, 2003 to March 15, 2007 Adjusted (dividends and stock splits) Close to Close [SPY]

	P-value	Equal	Error-	Error+
L1	0.0000	0.0000	0.0000	0.0000
L1+	0.0000	0.0000	0.0000	0.0000
W+	0.0000	0.0000		
L1-	0.9861	0.0278	0.0000	0.1049
W-	1.0000	0.0000		
L∞	0.0000	0.0000		
Min	1.0000	0.0000		

We estimate a mean and standard deviation over the entire 1,000 daily returns. Next, we compute 10,000 pseudo-random normal deviates with the estimated mean and standard deviation and consider the lowest 500 to be our fitted 5% tail. We compare the 50 lowest actual returns (historical 5% loss tail) with the fitted 500. With SPY, an exchange traded passive portfolio of the Standard and Poor's 500, we underestimate the 5% loss tail.

Despite being an average of many stocks, we see that, as is usual, the fitted distribution underestimates the 5% loss tails. This suggests that value-at-risk and possibly the expected shortfall calculations, depending upon how they were computed, will under estimate loss exposures.



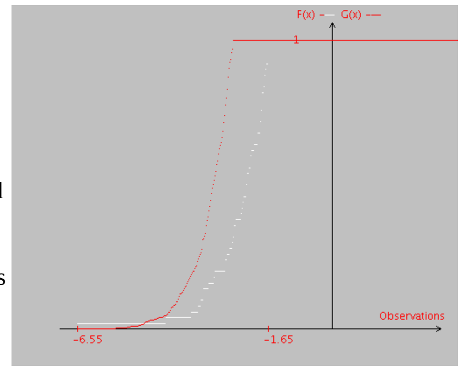
Analysis of Tail Distribution: DuPont

50 Actual Worst Daily Returns versus 500 fitted March 26, 2003 to March 15, 2007

Adjusted (dividends and stock splits) Close to Close [DD]

	P-value	Equal	Error-	Error+
L1	0.0000	0.0000	0.0000	0.0000
L1+	0.6676	0.0975	0.1017	0.0883
W+	1.0000	0.0000		
L1-	0.0000	0.0000	0.0000	0.0000
W-	0.0000	0.0000		
L∞	0.0000	0.0000		
Min	0.0000	0.0000		

With Dupont Chemical, we see that, as is unusual for a Dow Jones Thirty stock, the fitted 5% loss tail is much more pronounced than the historical loss tail. This suggests that value-at-risk and possibly expected shortfall calculations will overestimate loss exposures



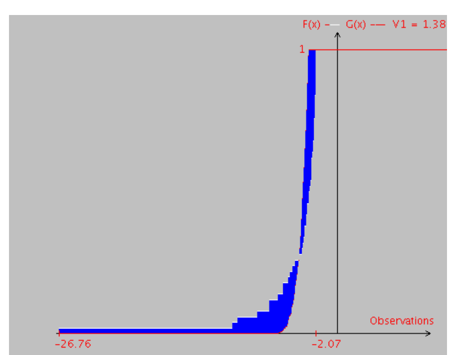
Analysis of Tail Distribution: Merck

50 Actual Worst Daily Returns versus 500 fitted March 26, 2003 to March 15, 2007

Adjusted (dividends and stock splits) Close to Close [MRK]

	P-value	Equal	Error-	Error+
L1	0.0000	0.0000	0.0000	0.0000
L1+	0.0001	0.0000	0.0000	0.0000
W+	1.0000	0.0000		
L1-	0.0000	0.0000	0.0000	0.0000
W-	0.0000	0.0000		
L∞	0.0000	0.0000		
Min	0.0000	0.0000		

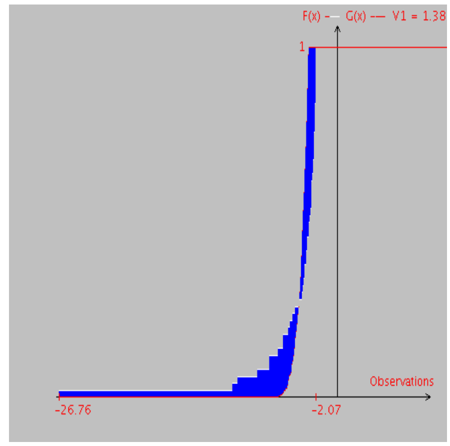
With Merck, as is usual for a Dow Jones Thirty stock, we see that the 5% loss tail is underestimated by the fitted 500 tail. This suggests that value-at-risk and possibly expected shortfall calculations, depending on how the calculations are performed, will under estimate loss exposures.



$F(x) \neq G(x)$

Analysis of Tail Distribution (L_1-norm)

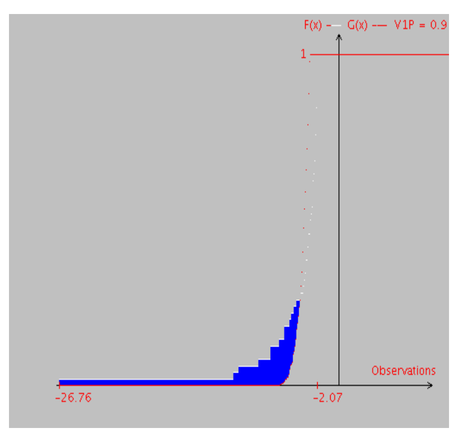
The L1-norm test statistic uses all the parameter values in its computation. It assesses the overall agreement between the two empirical distribution functions by using the area between them. Two empirical distribution functions are close in the L1-norm sense when the area between them is small. Consequently, investigators might use this test statistic with the broadest alternative hypothesis: $F(x) \neq G(x)$ We choose to use the L1-norm test statistic over L2-norm test statistic, because it is superior numerically. For instance, the difference between two consecutive observations may be a small positive number less than one. By squaring a small difference, we make it smaller still. This exacerbates significant digit and round-off problems. With the absolute value function, however, we cannot differentiate it in a neighborhood of zero. This may make estimating parameter values for other applications problematic. For example, in minimizing least squares in a regression, we take partial derivates with respect to variables and set them equal to zero and solve for parameter estimates.



$F_1(x) \neq G(x)$

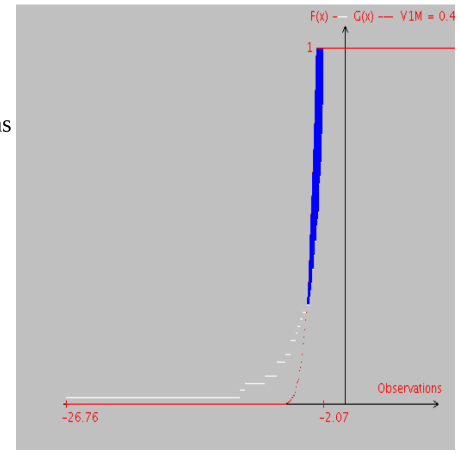
Analysis of Tail Distribution (L_1^+ -norm)

The L1+ norm test is parametric. The test statistic is the area where the first distribution function is above the second. Technically this test statistic is not a norm, since two empirical distribution functions could be distance zero apart, but not be equal when they differ where the second distribution is above the first. Nevertheless, it is a limit of a norm. We may multiply the area where the second distribution is above the first by an arbitrarily small positive number, *e>0* , and take the limit as *e->0*. Investigators might use this to test with an alternative hypothesis such as the first distribution is smaller stochastically, F(x) << G(x). To allow stakeholders to assess underlying distributional assumptions, we recommend this test statistic be reported along side value-at-risk and expected shortfall calculations in financial statements.



Analysis of Tail Distribution (L_1^- -norm)

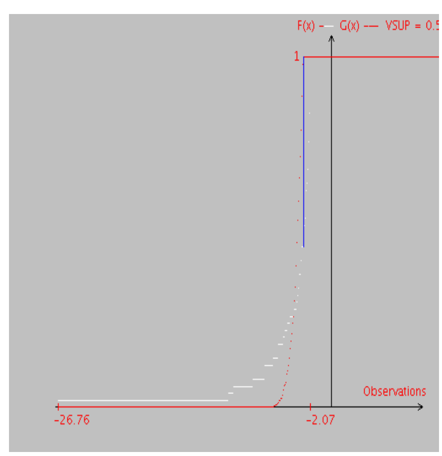
The L_1^- -norm test is parametric. The test statistic is the area where the second distribution function is above the first. Technically this test statistic is not a norm, because the two empirical distribution functions could be distance zero apart, but not be equal when they differ where the first distribution is above the second. It is a limit of a norm, however. Investigators might use this test statistic with an alternative hypothesis such as the first distribution is bigger stochastically, F(x) >> G(x)



Analysis of Tail Distribution (L_∞ -norm)

The L_∞-norm, or Kolmogorov-Smirnov, test is non-parametric, because the test statistics is not an explicit function of the parameter values, since it only uses the relative rank of the observations. The test statistic is the maximum distance between the two empirical distribution functions. It assesses with the point of worst agreement between the two empirical distribution functions. Consequently, investigators might use it to test with the broadest alternative hypothesis: $F(x) \neq G(x)$.

Min (W+, W-), W+, and W-



Analysis of Tail Distribution (cont.)

All three rank order tests are non-parametric, because these test statistics are only functions of the relative ranks and not the actual parameter values of the observations. We rank all the observations in the two samples from 1 to j = (m + n) in the two samples by using < for the real numbers. For tied observations, we use the following convention: If there are two tied observations, then we average the two integer ranks in question and assign the average to both values. Similarly if there are k ties, then we average the k ranks in question, and assign the average rank to all k observations. We let W- equal the sum of the assigned ranks to the first data set, and W+ equal the sum of the assigned ranks to the second. Investigators might use Min(W+, W-) tests with an alternative such as $F(x) \neq G(x)$, and the W+ test with an alternative hypothesis such as F(x) << G(x), stochastically.

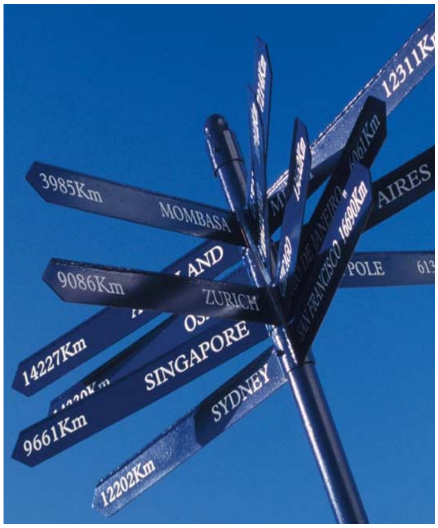
Since $\frac{j(j+1)}{2} - W- = W+$,

the p-value corresponding to W- is the complement of the p-value corresponding to W+. Investigators might use W- in a tests with an alternative hypothesis such as F(x) >> G(x), stochastically.

Analysis of Tail Distribution (cont.)

We consider a first data set of {1,4,10}and a second data set of {7,13}. We compute our p-values by exhaustively considering all ten possible arrangements of the observations in the second data set in the table.

	L1	L1+	L1-	L_∞	W+	Min	W-
{1,4}	7.5	0	7.5	1	3	3	12
{1,7}	5	0	5	0.67	4	4	11
{1,10}	3.5	0.5	3	0.5	5	5	10
{1,13}	4	2	2	0.5	6	6	9
{4,7}	4.5	1	3.5	0.67	5	5	10
{4,10}	3.5	3	0.5	0.5	6	6	9
{4,13}	3.5	3	0.5	0.5	7	7	8
{7,10}	4.5	3.5	1	0.67	7	7	8
{7,13}	5	5	0	0.67	8	7	7
{10,13}	7.5	7.5	0	1	9	6	6
Greater	0.2	0.1	0.8	0.2	0.1	0	0.8
Equal	0.2	0.1	0.2	0.4	0.1	0.3	0.1
P-value	0.3	0.15	0.9	0.4	0.15	0.15	0.85



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