

Eco Risk Markets LLC helps companies lower the cost and reduce the risk of managing their fuel, commodity, interest rate, and foreign exchange expenditures

EnergyRisk

Scenario analysis and stress testing
as tools to manage market risk

September 29, 2010

eco+risk
markets



Definitions

- “Stress” – a pre-specified movement in selected risk factors
- “Scenario” – a set of stresses applied to a derivative portfolio

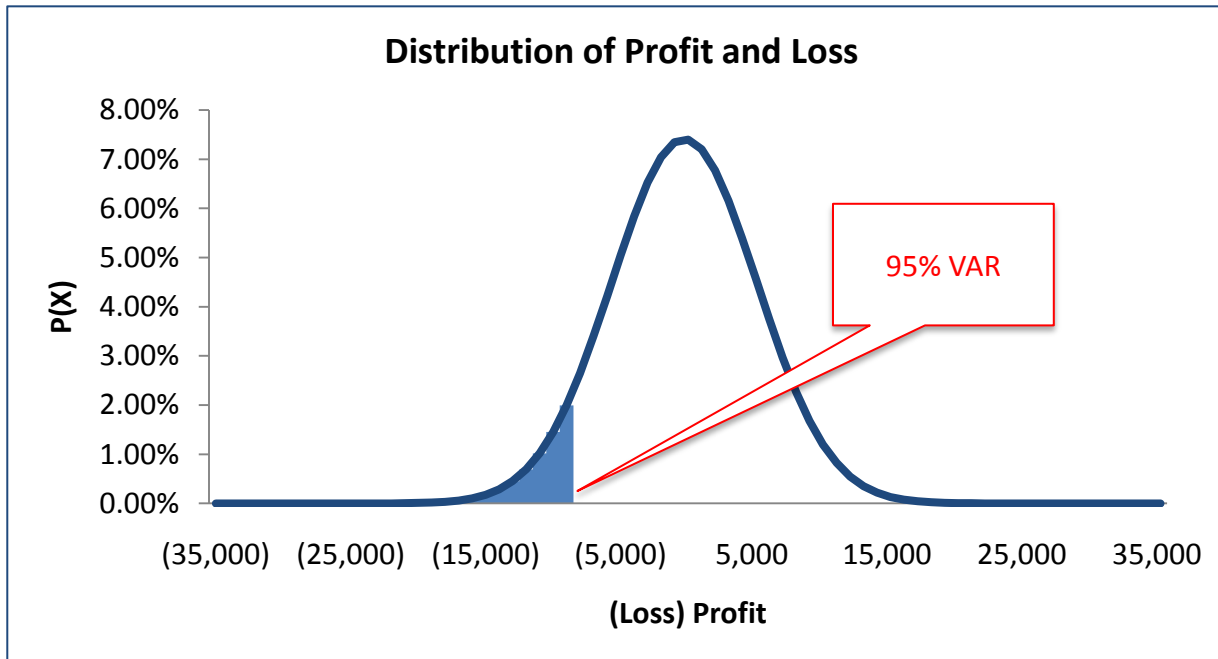
Characteristics

- Determines the magnitude of a loss without respect to likelihood
- Starts with economic or business insights, not statistical inference
- Equivalent to a one-draw simulation
- Supplement to “normal market” risk analysis

Supplement to other risk metrics

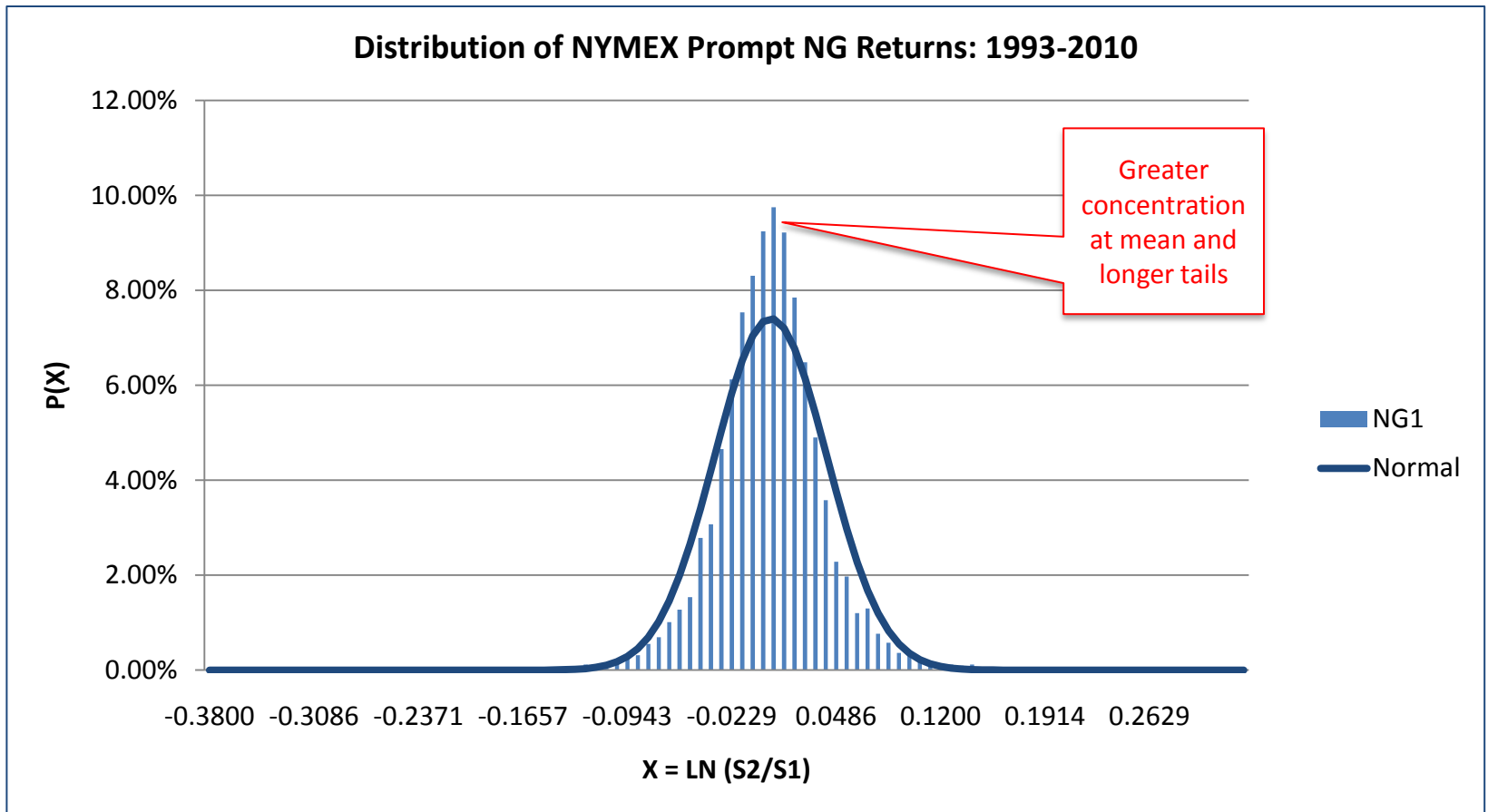
- Value-at-Risk
- Credit metrics
- Liquidity measures

Typical example: VAR assumes “normal” market conditions, but...



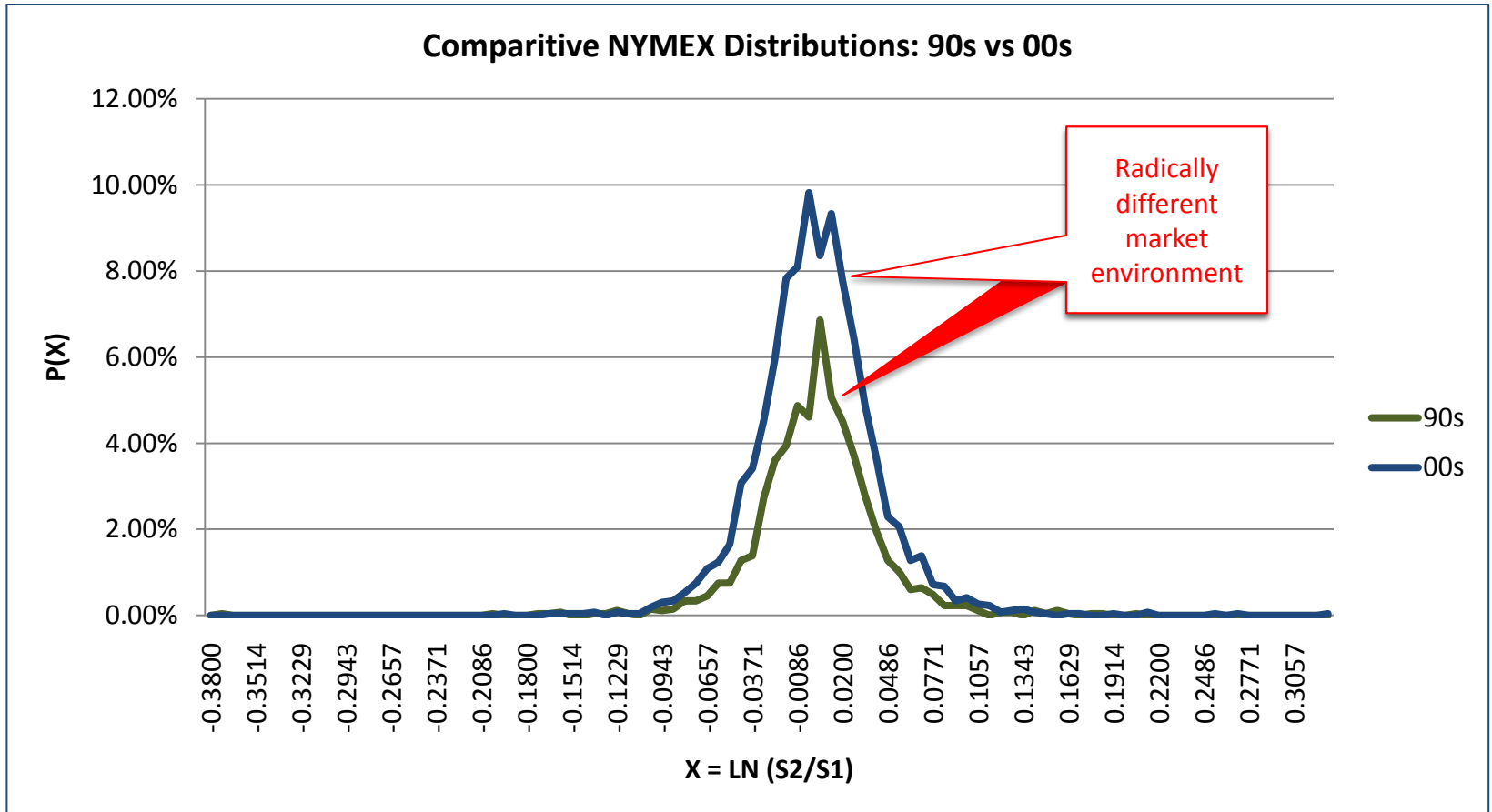
Supplement to other risk metrics (continued)

...Markets are not normal...



Supplement to other risk metrics (continued)

...Nor do they maintain conditions over long periods of time...



Supplement to other risk metrics (continued)

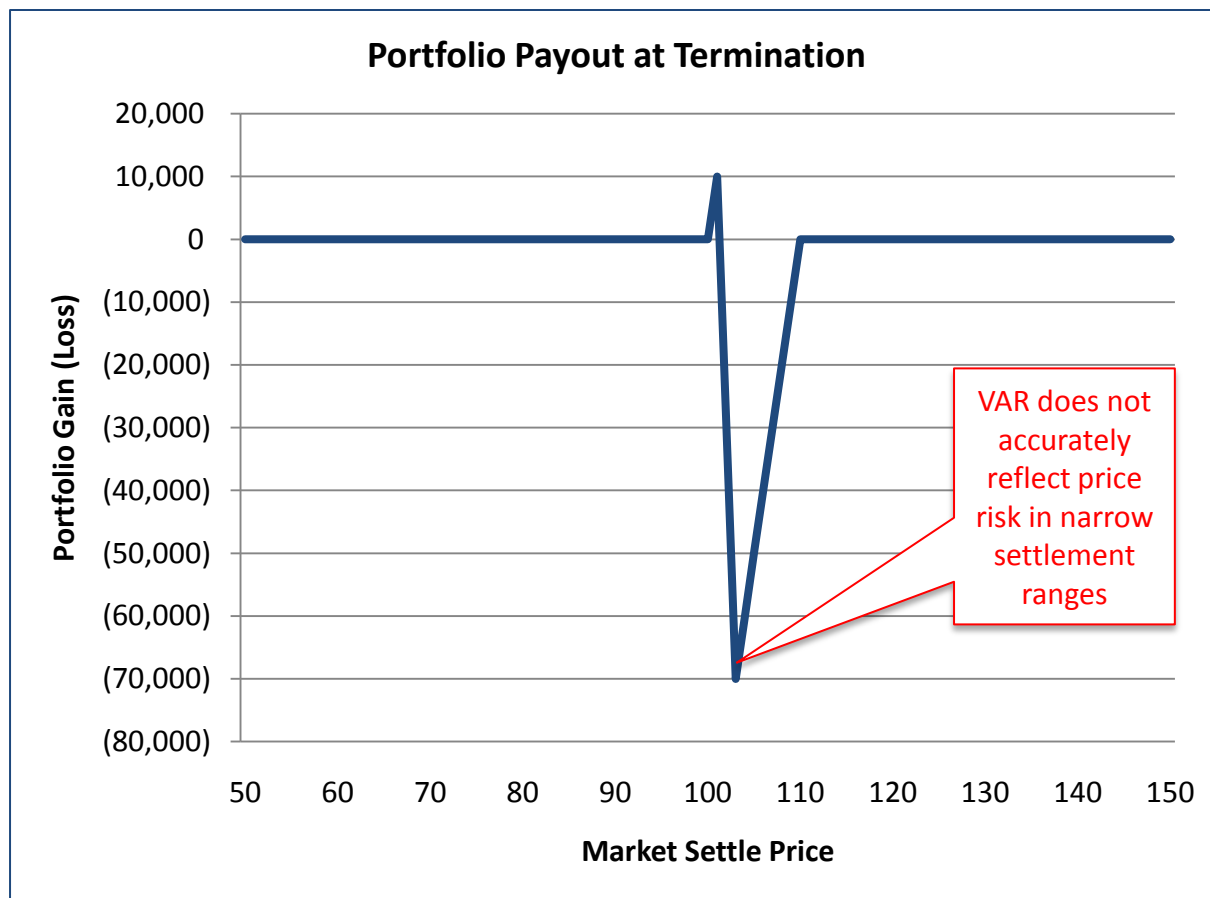
...nor are portfolios are not always linear.

Portfolio:

- Buy 10k 100/103 call spreads
- Sell 50k 101/102 call spreads

Result:

- Nothing under 100
- Narrow gain at 101
- Massive loss at 102
- Nothing over 110



Enterprise risk concerns

- Apply to all business risks
 - Financial control: on balance sheet and off balance sheet risks
 - Trading control: positions limits, stop-loss limits, P&L

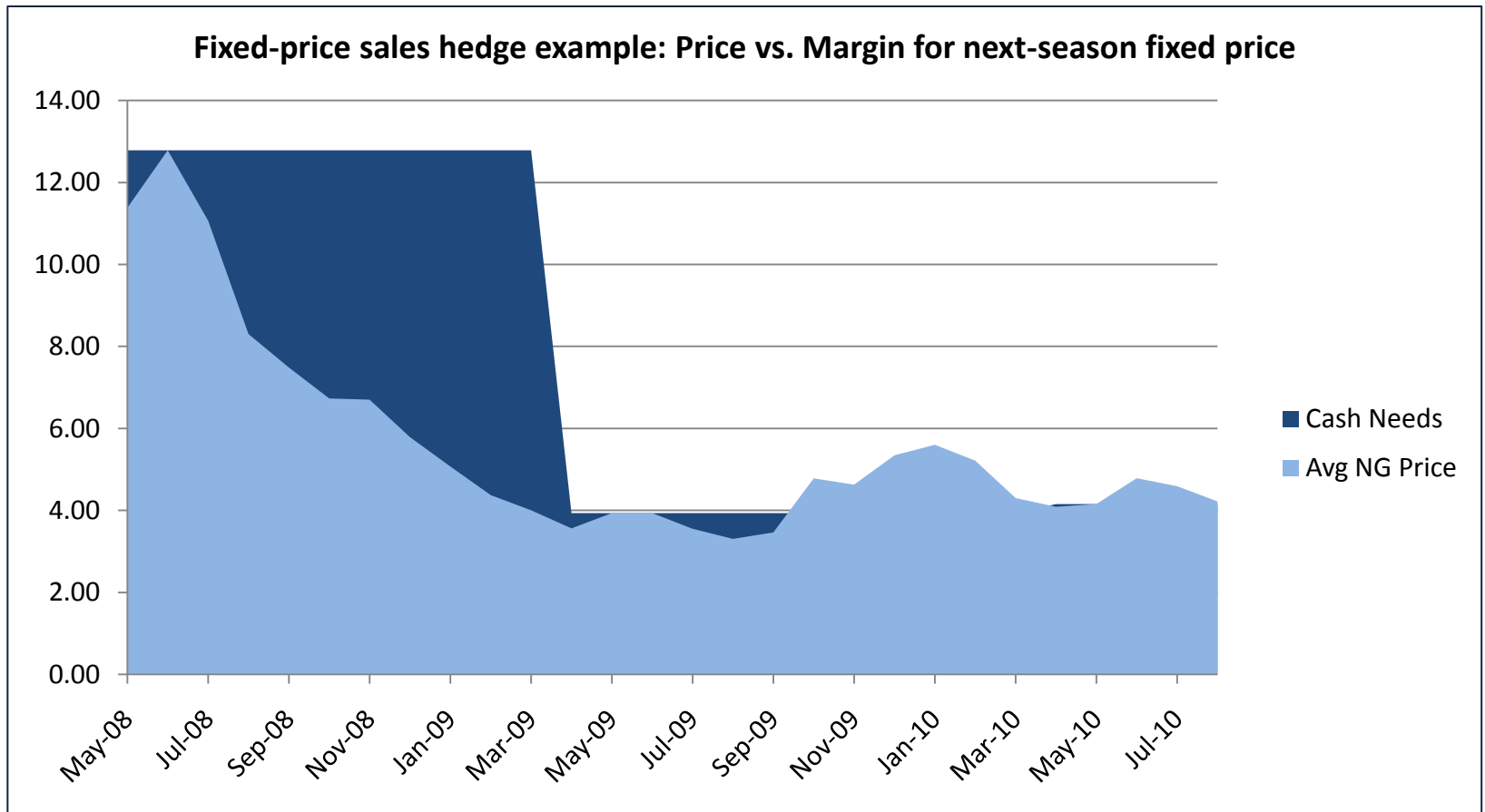
- Report widely and consistently
 - Trading: traders, desk leads, risk control, trading compliance
 - Finance and accounting: treasurer, cash managers, controller
 - Management: CEO, CFO, strategy groups

- Link results to decision-making process

- Don't leave the data stranded

Enterprise risk concerns, continued

- Always tie market stresses to collateral!



Integrated credit and market risks

- CVAR is a helpful measure, but its results are less robust than traditional VAR
 - Inputs are opaque
 - Traditional methodologies have been criticized
 - Hard to lay off the risk

- Integrated credit risk scenarios: credit, market, and collateral
 - Show: collection versus disbursement scenarios
 - Goal: determine contractual updates to provide security in default situations
 - Remember offsets: netting, asset liens, production rights, etc.

- Test ***your*** credit as well – what happens if you can't transact?

Off-balance sheet risks

- Contingent liquidity requirements
- Embedded derivatives (e.g. NPNS exemptions)
- Correcting tenor assumptions based on off-balance sheet exposures

Market impacts on firm liquidity

- Senior Supervisor's Report (2008) stressed the role of liquidity management:
 - Identification must be supported by discussion and action
 - Stale valuation and correlation assumptions must be challenged
 - Contingent liquidity risks must be identified and managed
 - Information must be uniformly available and understood across business units

Past scenario analysis failures

- Price shocks too small
- Price shocks tenors too short
- Scenarios did not validate portfolio validation claims
- Senior management did not pay sufficient attention to “falling sky” scenarios
- Cash-to-futures basis risk ignored
- Proxy assumptions in newly-developed markets
- Over-reliance on credit rating agency assumptions
- Inability to transact at actual stresses

Tail risk analyses

- Conditional VAR
 - Expected losses conditional on VAR being exceeded
 - Problem – what does the tail look like?

- Extreme value theory
 - Establishing distributional characteristics for extreme events
 - Attempts to solve the problem “what does the tail look like?”

Dynamic stress testing

- Assumption – market stresses are long-lasting and compounding
- Create scenarios with compounded stresses over long periods

Day	Static Scenario	Dynamic Scenario		
		Mid-point	Bid	Ask
1	100.0	100.0	99.00	101.00
2	97.5	97.5	95.55	99.45
3	95.0	90.0	85.50	94.50
4	92.5	85.0	83.30	86.70
5	90.0	90.0	89.10	90.90

Tenor	5 days	5 days
Net Change	10%	10%
Max Bid/Ask	0	5%

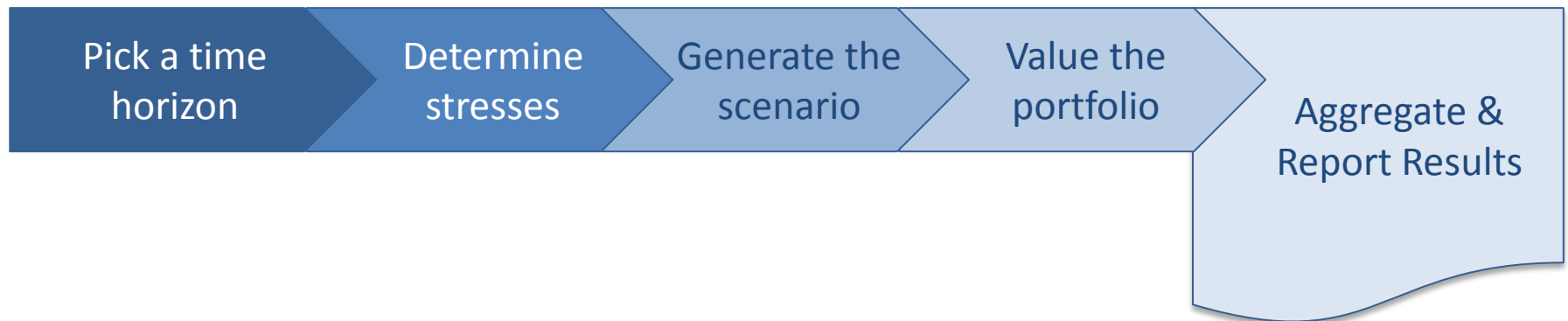
Construction: old standards

- Standard stresses from the Derivative Policy Group (1995)
 - Parallel yield curve shift +/- 100 bps
 - Yield curve twist +/- 25 bps
 - Equity index +/- 10%
 - Currency +/- 6%
 - Volatility +/- 20%

- Replication scenarios
 - Prior market observations: price shifts, curve shapes, stress length
 - New wrinkles: what if past corrective measures don't occur in the future?

Construction: a balanced approach

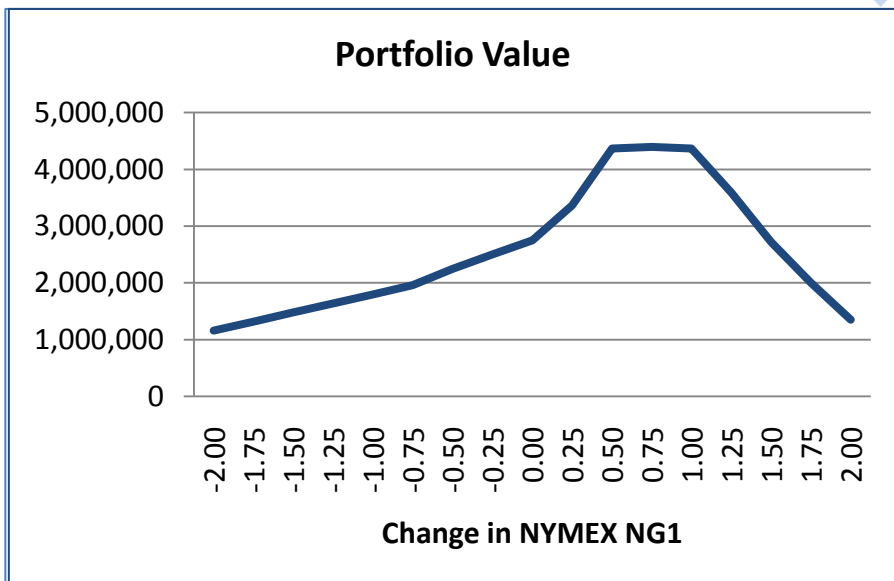
- Basic approaches
 - Typical market moves (e.g. Derivative Policy Group, 1995)
 - Historical scenarios (e.g. Henry Hub Force Majeure, 2005)
 - Hypothetical future scenarios (e.g. mandated end of coal-fired generation)
 - Portfolio vulnerabilities (e.g. call-spread in prior example)
- Basic steps



Construction: suggestions

- Accept simplifying assumptions
- Go beyond observed data
- Create multiple stresses
- Update “standard” stresses

- Examine impact to both value and position
- Make sure correlations do not violate positive definite requirements



Scenario Analysis: Delta and Portfolio Sensitivities to NG Change				
NYMEX Adder	Delta	Difference	Portfolio	Difference
-1	199,523	199,523	\$2,631,298	\$2,631,298
-0.5	150,462	150,462	\$2,898,046	\$2,898,046
0	0		\$0	
0.5	(85,464)	(85,464)	\$3,288,976	\$3,288,976
1	(298,804)	(298,804)	\$3,332,232	\$3,332,232

Defining risks

- Standard portfolio risks – price, interest rates, time, etc.
- Non-standard portfolio risks – Correlation , volatility, credit, collateral, pin risk
- Achieve management buy-in through participation in risk definitions
- All defined risks should tie back to a strategic or economic concern
- Risks should be able to be integrated into financial statements

Frequency and distribution

- Standard scenarios – daily
- Strategic scenarios – at least as often as the risk management committee meets
- Extreme scenarios – as market movements dictate
- Keep it manageable!

Case study and questions