

ERM, Cycles and Risk Capital Models

Paul J. Kneuer, FCAS
Scott I. Rosenthal, FCAS
CARE Research Corner

HOLBORN[®]

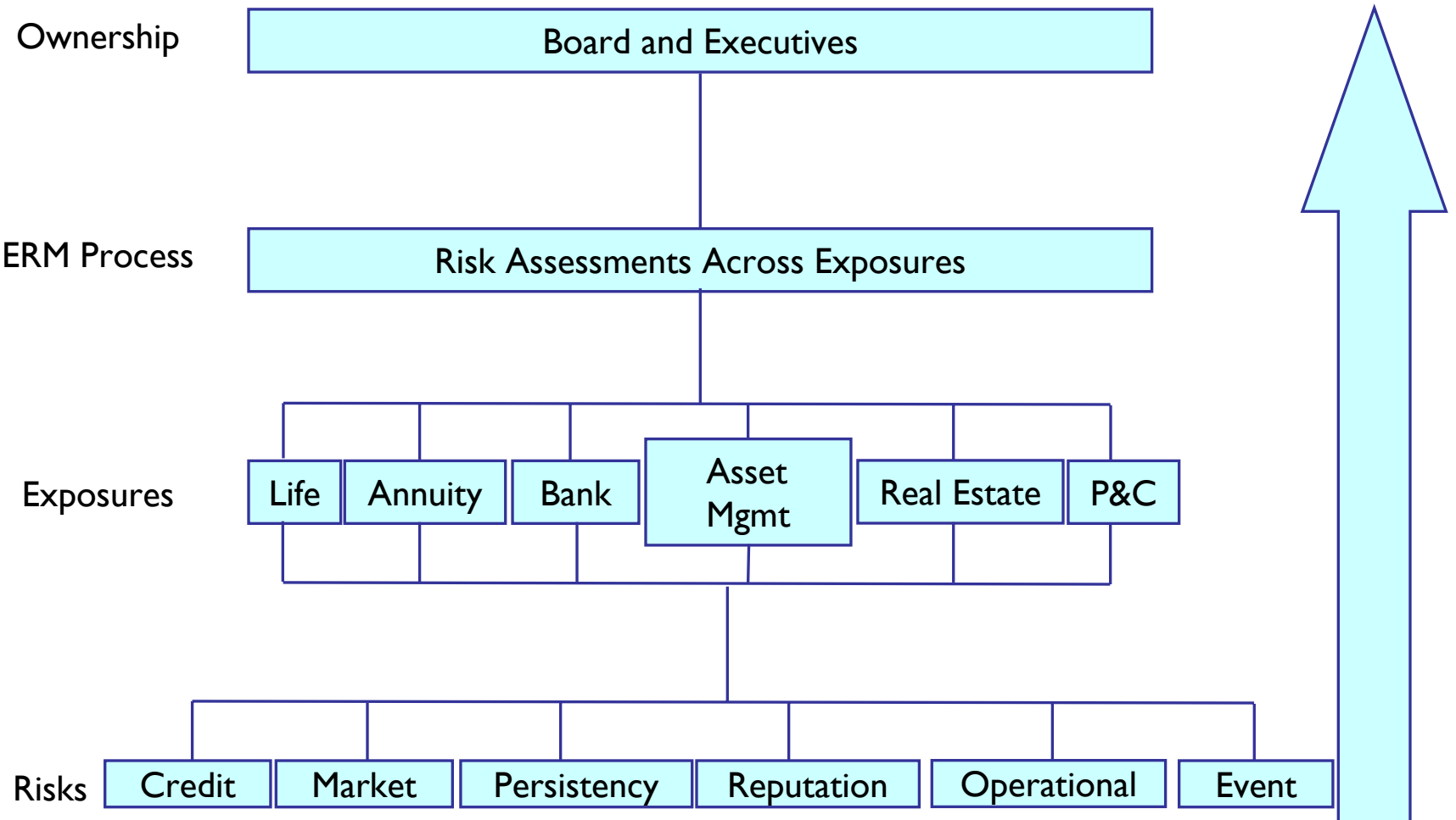
May 18th, 2009

Observations

- What ERM looks like
- ERM: how did we get here?
 - *Some ideas that look similar, but aren't*
- The crisis: what were the problems?
 - *Some ideas that look different, but aren't*
- P&C context
- Some thoughts on going forward

What ERM Looks Like

Take Cross-Silo Views



What ERM Looks Like

Recent Sample from a Global Institution

I-in-250 Year Risks as % of Capital	Current Year end	Prior Year end	Peak Daily Values:	
			Highest	Lowest
Interest rate risk	17.0%	8.5%	21.7%	5.8%
Equity price risk	8.8%	3.5%	14.0%	3.7%
Foreign exchange risk	1.9%	0.9%	2.8%	0.9%
Commodity risk	2.3%	1.1%	2.8%	0.7%
Diversification benefit	-8.1%	-4.4%	-14.0%	-2.7%
Percent of Capital Exposed	21.9%	9.5%	27.4%	8.5%

Notes:

Percent of latest year-end capital

For consistency with insurance reporting, daily figures restated as I-in-250 year exceedence levels

Original results are simulations by reporting company, based on historical price volatility

Implied risk of ruin is 0.06% per year

What ERM Looks Like

VAR is Counted in Dollars

I-in-250 Year Exceedence Amounts	Current	Prior	Peak Daily Values:	
	Year end	Year end	Highest	Lowest
Interest rate risk	\$ 3,817	\$ 1,909	\$ 4,891	\$ 1,312
Equity price risk	1,988	795	3,141	835
Foreign exchange risk	437	199	636	199
Commodity risk	517	239	636	159
Diversification benefit	(1,829)	(994)	(3,141)	(596)
Value at Risk	\$ 4,931	\$ 2,147	\$ 6,164	\$ 1,909

Notes:
 \$ Millions
 Year end capital was \$22,490 Million
 To convert from daily to 250-year results, assumed Pareto with $q = 1.25$, daily "random walk".

What ERM Looks Like

Banks Use a Daily Timeframe

I-in-100 Daily Value at Risk	Current	Prior	Peak Daily Values:	
	Year end	Year end	Highest	Lowest
Interest rate risk	\$ 96	\$ 48	\$ 123	\$ 33
Equity price risk	50	20	79	21
Foreign exchange risk	11	5	16	5
Commodity risk	13	6	16	4
Diversification benefit	(46)	(25)	(79)	(15)
Value at Risk	\$ 124	\$ 54	\$ 155	\$ 48

\$ Millions

Source:
Lehman Brothers Holdings, inc. 2007 10-K
MD&A, page 71: "Risk Management"

What ERM Looks Like

Use of Risk Capital to Make Business Decisions

- Calculate VAR, RBC or BCAR, etc. contributions from individual operations
- Compute marginal risk capital and marginal profit by operation
- Rank operations on Profit/Risk Capital
- “Grow the winners.”

ERM: How Did We Get Here?

Some Ideas that Look Similar, But Aren't

- Basel Accords
- COSO
- VAR

ERM: How Did We Get Here?

Some Ideas that Look Similar, But Aren't

- Basel Accords – Internal measurements
- COSO – Public company governance of risk
- VAR – Business unit roll ups

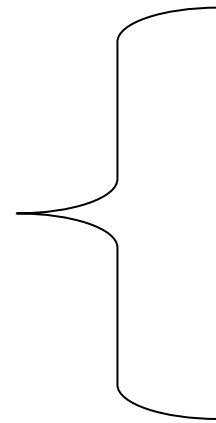
The Crisis: What Were the Problems?

Some Ideas that Look Different, But Aren't

- Model specification risk
- Non-independence
- Market “Bubbles”
- “Black Swans”

The Crisis: What Were the Problems? *Some Ideas that Look Different, But Aren't*

- Model specification risk —
- Non-independence —
- Market “Bubbles” —
- “Black Swans” —



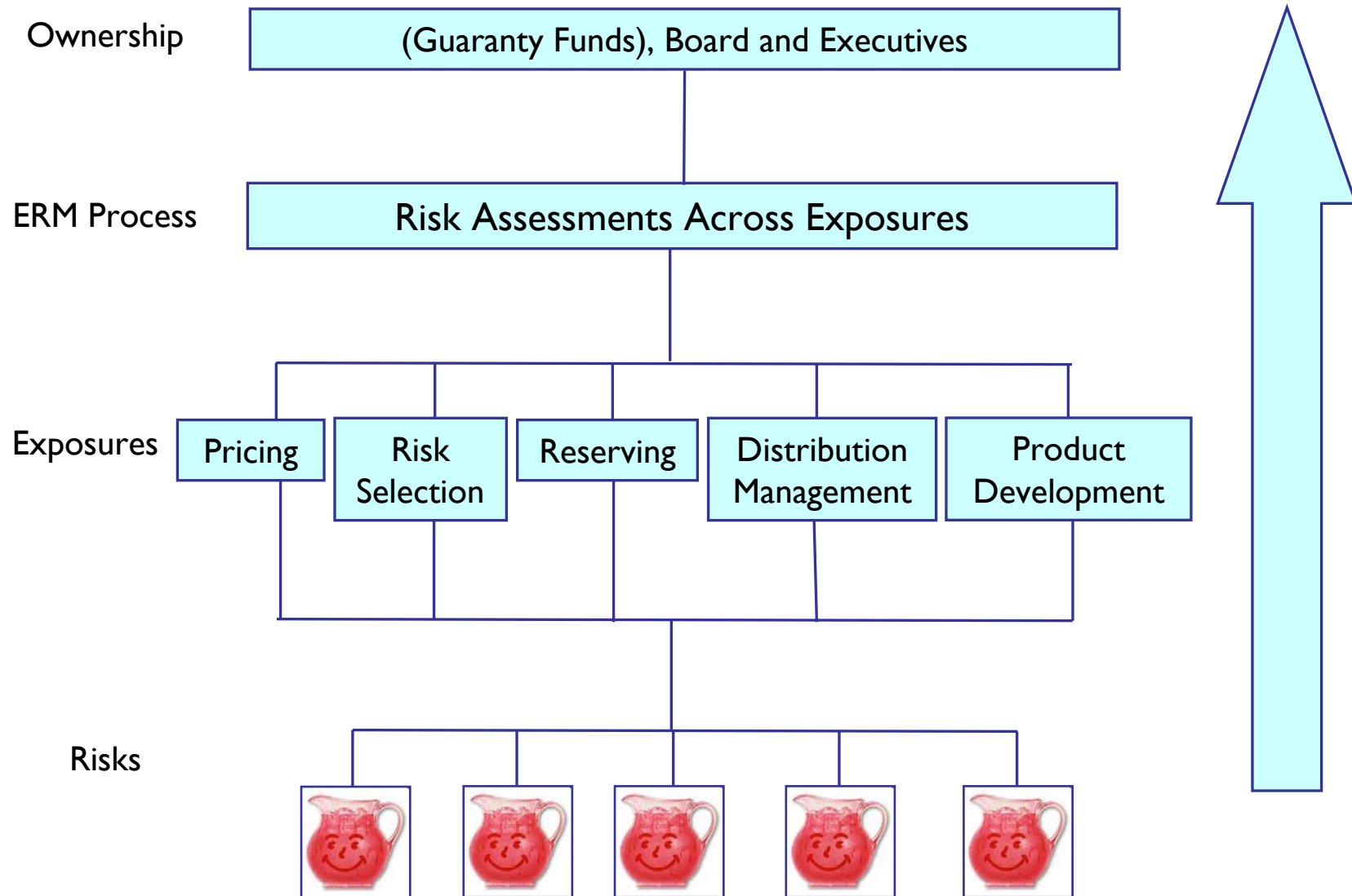
Since not i.i.d.,
aggregate result isn't
anything like a
normal.

“Extremistan”

P&C Context

- “Driving through the back window” ($f'' = -f$)
- Industry and company both have reaction lags
- Under-reserving forces bad pricing, risk selection, distribution management and planning
- The cycle killed off more P&C companies than Cats, credit, operational failures and ALM combined

Silos That Matter in P&C



Silos That *Really* Matter in P&C

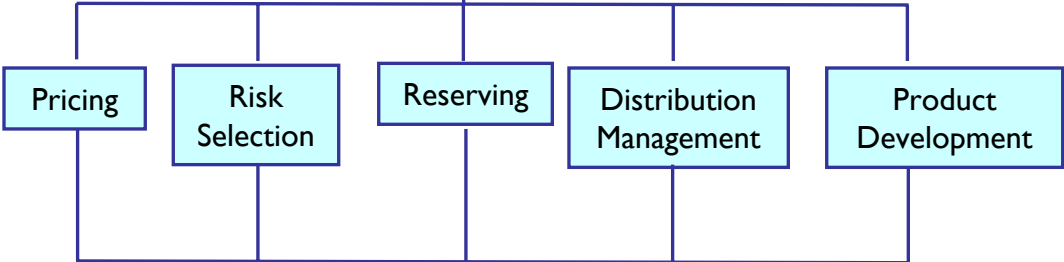
Ownership

(Guaranty Funds), Board and Executives

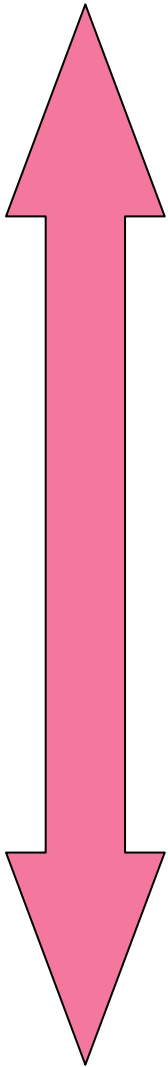
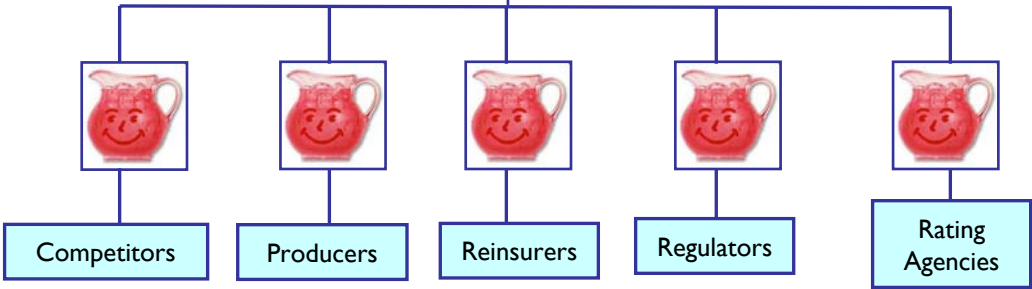
ERM Process

Risk Assessments Across Exposures

Exposures



Risks



Looking Forward

Risk capital models:

- Understate the risk of ruin, but do give a floor measure
- Are objective
- Can provide a relative measure inside a company

But:

- Need to reflect a wider view of risk: Cycles or bubbles

Charges for Cycles in Risk Capital Models

If $f'' = -f$, cycle response is a sine function. Risk level is:

$$R(t) = I + a \cdot \cos\left(\frac{2\pi}{b} \cdot t + c\right)$$

$a = \text{amplitude (observed, guessed)}$

$b = \text{period (guessed)}$

$c = \text{time since last trough (observed)}$

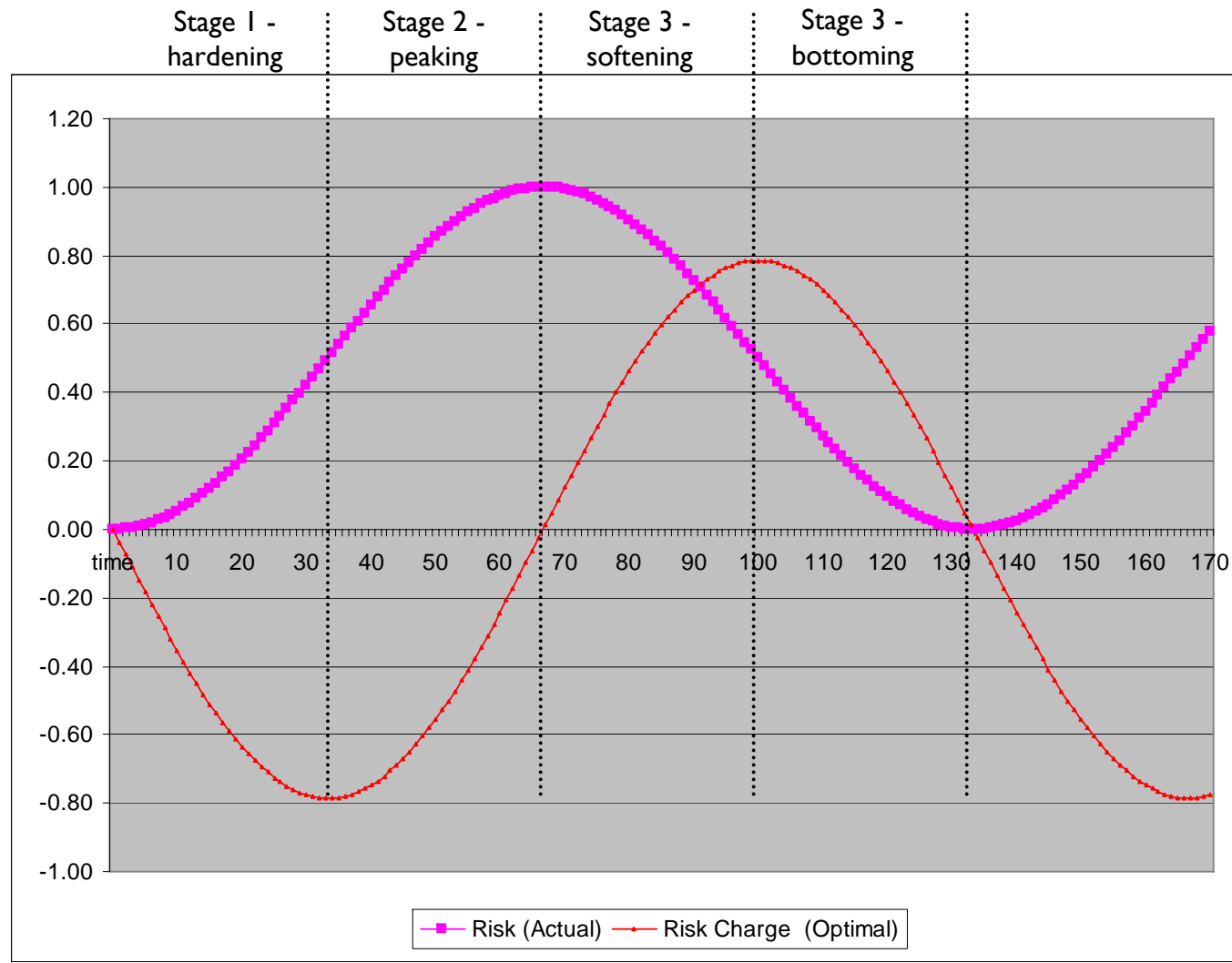
Risk of managing in the cycle is that you don't know how long the period of the cycle is. When is the next trough?

$$\text{Risk Charge} = dR/db = a \sin\left(\frac{2\pi}{b} \cdot t + c\right) \cdot \frac{2\pi}{b^2}$$

Risk charge for cycles should reflect both estimate of the amplitude (a), but even more on how long you think the period is (b).

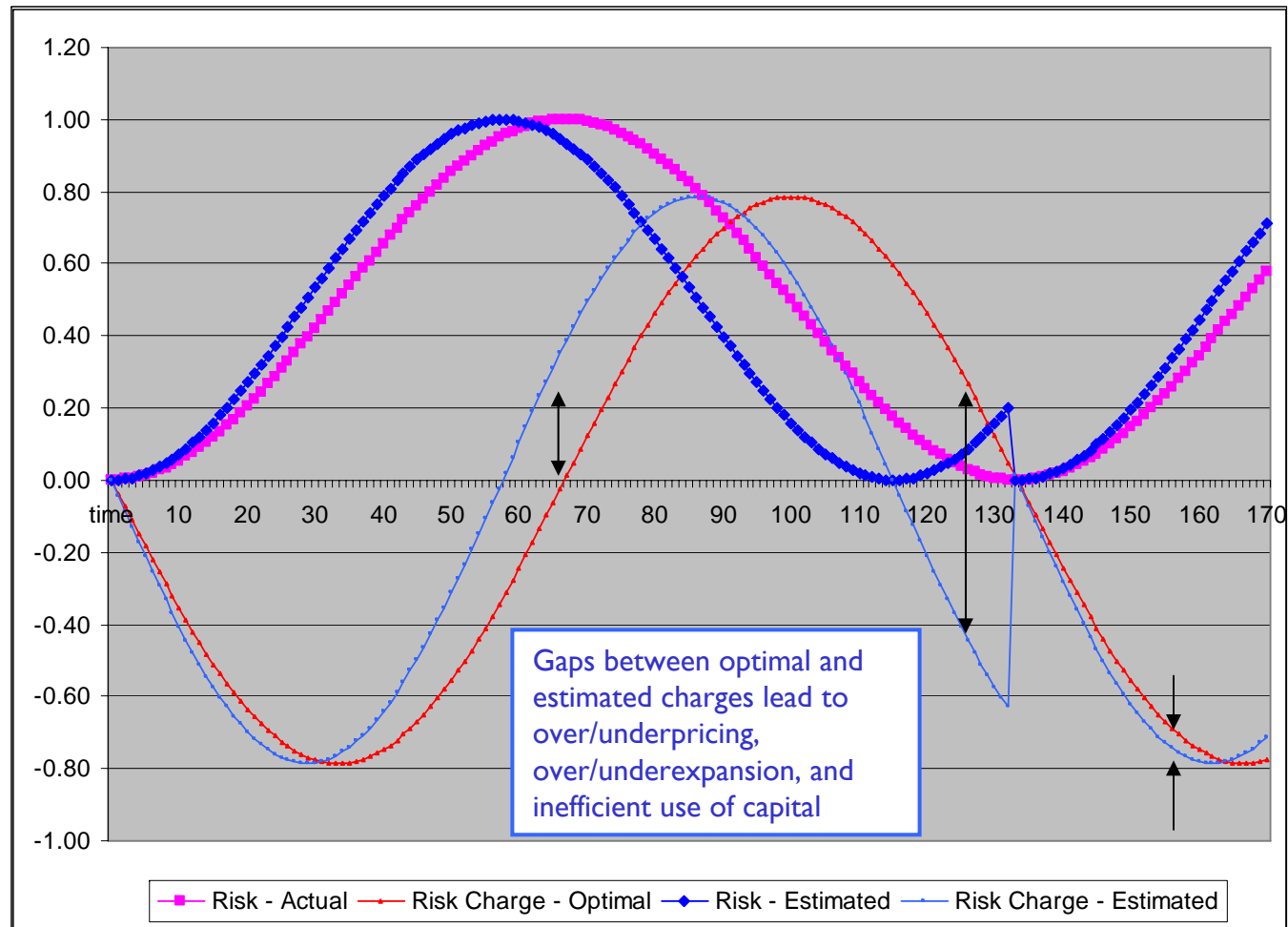
Charges for Cycles in Risk Capital Models

Cycle Stage and Cycle Risk are $\frac{1}{4}$ cycle out of Phase



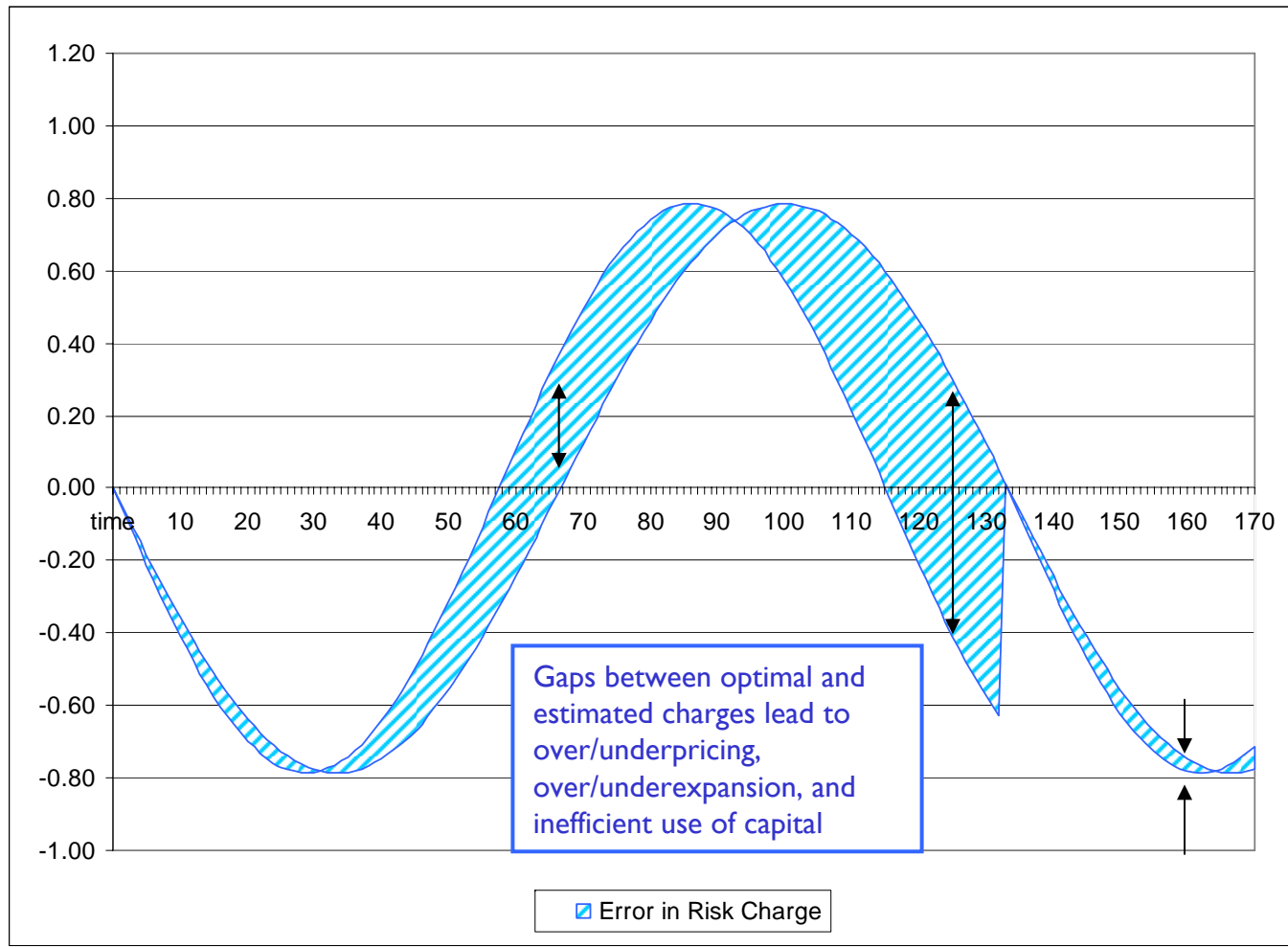
Charges for Cycles in Risk Capital Models

Actual view of the cycle is imperfect. Example I: “cycle bottom is ‘overdue’”



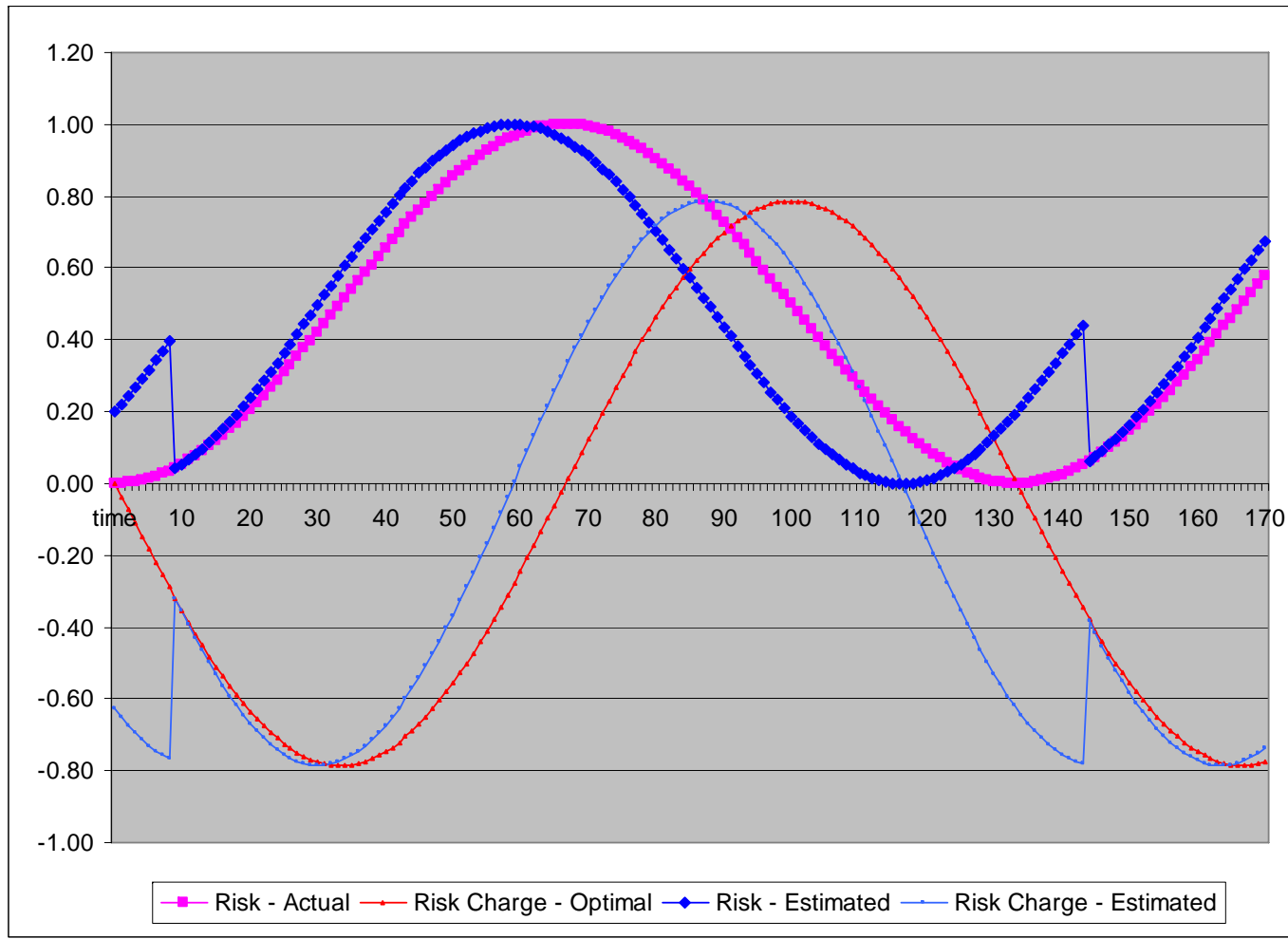
Charges for Cycles in Risk Capital Models

Actual view of the cycle is imperfect. Example I: “cycle bottom is ‘overdue’”



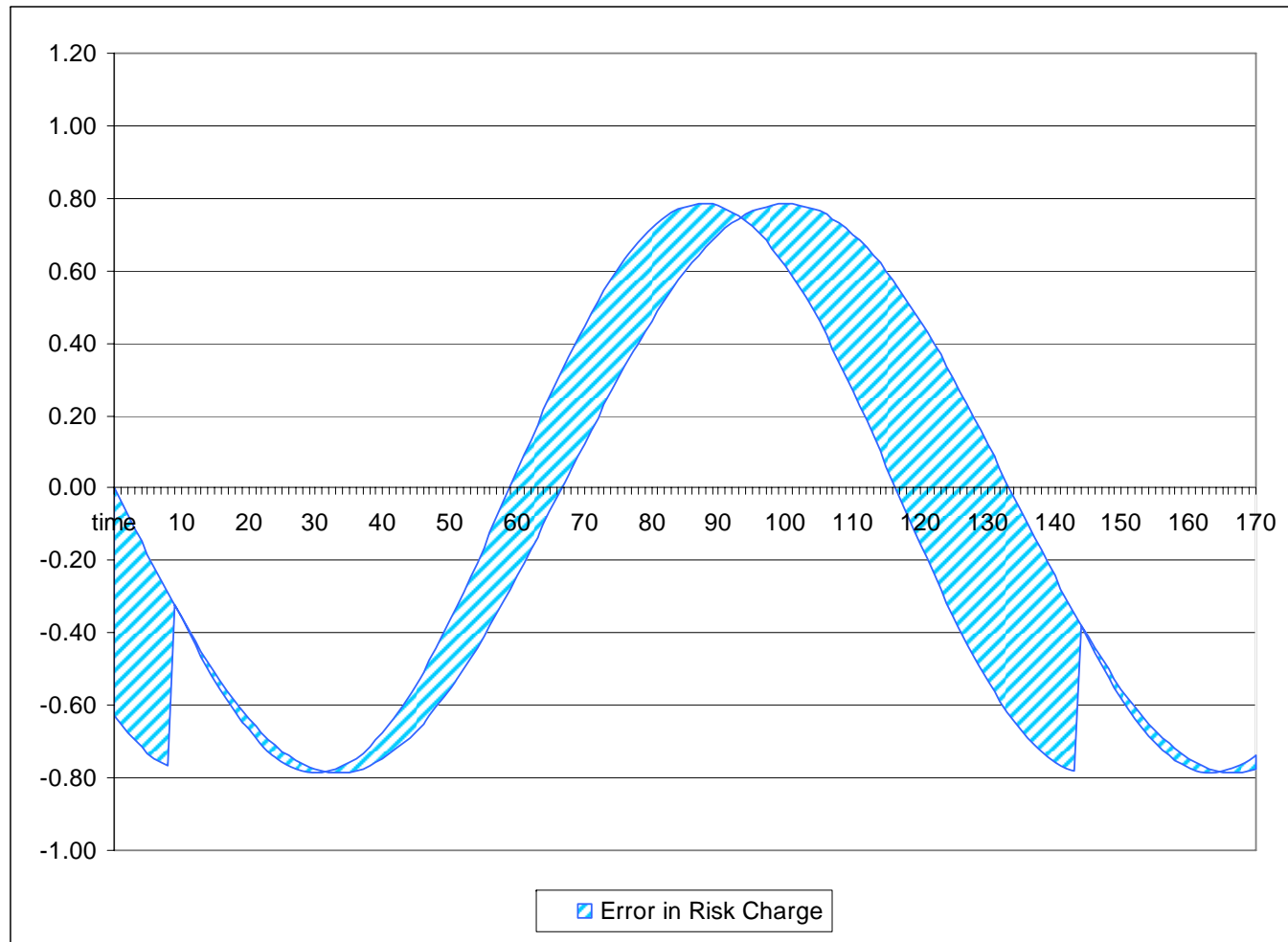
Charges for Cycles in Risk Capital Models

Actual view of the cycle is imperfect. Example 2: Delay in identifying trough



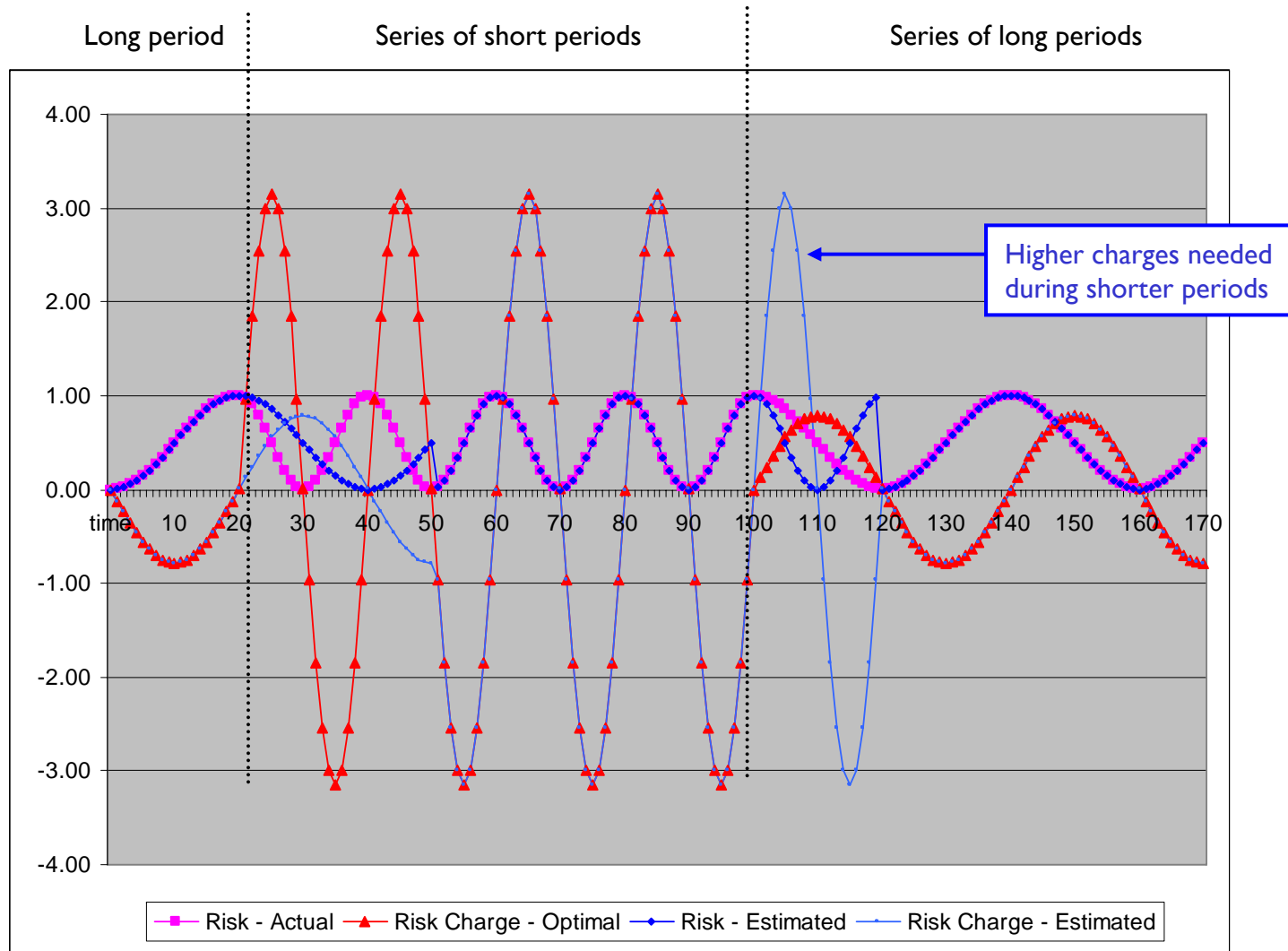
Charges for Cycles in Risk Capital Models

Actual view of the cycle is imperfect. Example 2: Delay in identifying trough



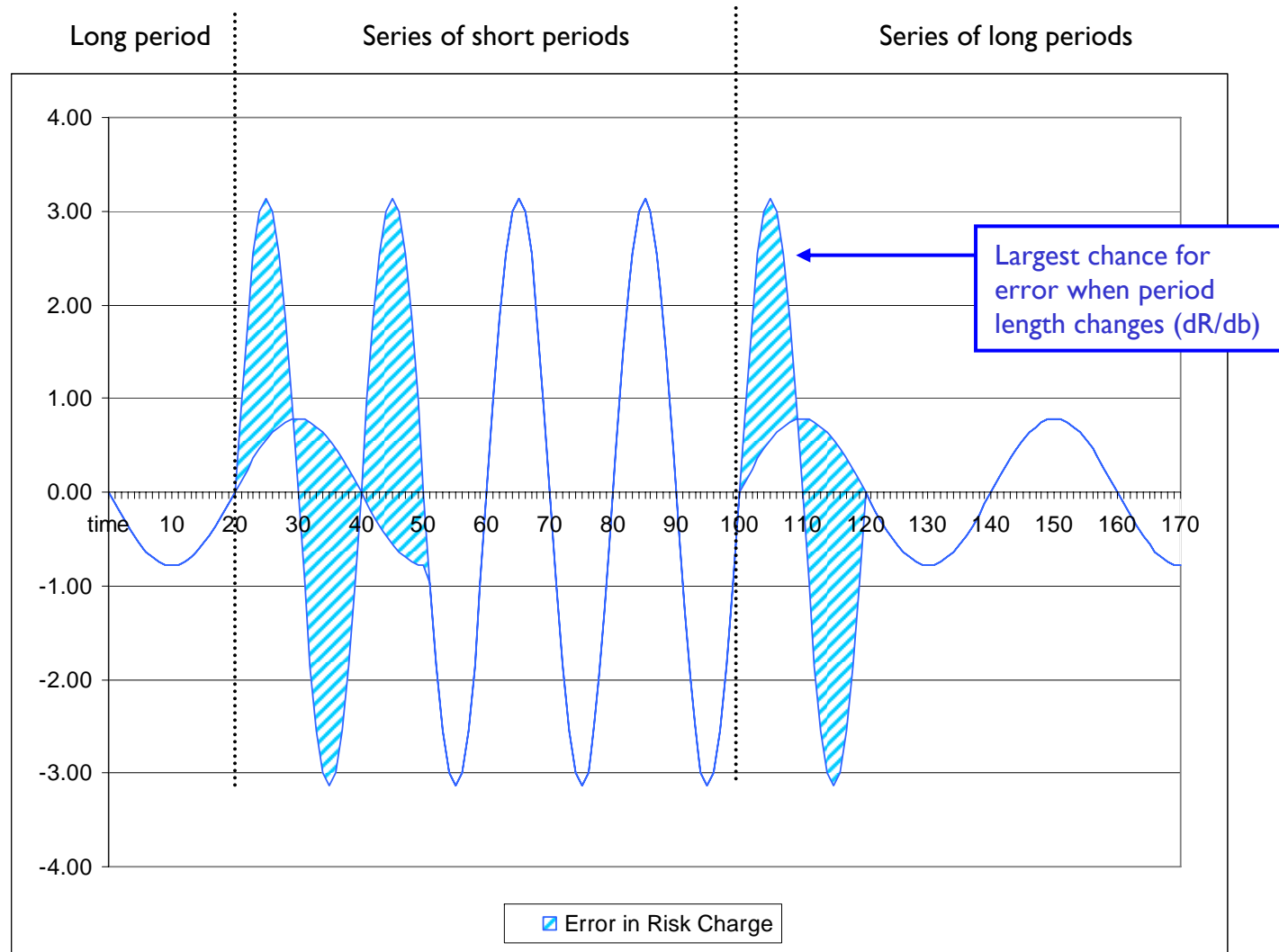
Charges for Cycles in Risk Capital Models

Actual view of the cycle is imperfect. Example 3: Over-/under-estimate cycle period



Charges for Cycles in Risk Capital Models

Actual view of the cycle is imperfect. Example 3: Over-/under-estimate cycle period



For Comments or Questions:

Paul Kneuer
Scott Rosenthal

www.holborn.com

212-797-2285

SOA/CAS call paper:

<http://www.soa.org/library/essays/rm-essay-2008.pdf>

Holborn Whitepaper:

<http://www.holborn.com/holborn/newsCreditTroublesandtheReinsuranceMarket.html>