# Addressing Economic Volatility (or Not) in Project Risk Analysis

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#### Experience:

- Owner Validation Estimating, LLC since 2005 (www.validest.com)
- Recently launched ValidRisk cloud-based risk software (www.validrisk.com)
- Prior: Various Mining, Battelle Institute, Fluor, Kodak, IPA Inc.
- Industries: benchmarking, process, power, mining, infrastructure, etc.
- Focus: Estimating, Risk Quantification, Project Controls
- Other:
  - Very active in AACE<sup>®</sup> International (primarily Technical products)
  - Lead author AACE "Total Cost Management Framework" (2006)
  - Author "Project Risk Quantification" (2016)
  - BS Mining Engineering (Penn State) and MBA (Indiana Univ. of PA)



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- "Project Risk Quantification"
  - www.decisions-books.com/PRQEvent or Kindle version via Amazon.com
  - Escalation is covered in chapters 4 and 13
- AACE Recommended Practices
  - 58R-10: Escalation Principles and Methods Using Indices
  - 68R-11: Escalation Estimating Using Indices and Monte Carlo Simulation





- **Economic Volatility and Escalation:** X
  - Define escalation and review escalation history
- Scalation Risk Analysis Challenges:
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- Quantifying Escalation as a Risk:
  - Review recommended practices for probabilistically analyzing escalation
- Conclusions







## **Escalation and Economic Volatility**

- Escalation = changes in price levels driven by the market. Varies by item and locale. It includes inflation.
- Inflation = changes in purchasing power of money.
   Varies by monetary regime.
- Economic volatility
  - Escalation is highly volatile in line with respective market
  - Inflation is usually more gradual but with broad impact



- Escalation driven by prevailing economic conditions in the macro and micro-economy such as:
  - Industry and regional market conditions (demand, labor shortages, contractor margins, etc.)
  - Industry productivity and technology (yes, it addresses prevailing trends in productivity)
  - Underlying monetary conditions reflected in inflation
- Varies for different cost items, regions and strategy (unlike inflation which tends to be more broad based)
- Differs for <u>each tier of supply</u> because price includes successive markups from the smallest subcontractor up to the owner



#### In hot markets, escalation leaves inflation in the dust

- 2004-2012 "Supercycle"
- Chart compares the:
  - 1. US Consumer Price Index (CPI)
  - 2. Chem Eng Plant Cost Index (CEPCI)
  - 3. IHS Markit Downstream index (DCCI)
- These respectively represent:
  - 1. Inflation
  - 2. Escalation to a Contractor (first tier)
  - 3. Escalation to an Owner (ultimate market)
- To the owner, escalation = 3X inflation during this period
  - Are we entering such a period now?



Figure 4.8 of PRQ text



### The Goodyear Rule; Escalation can be local

- "...BHP CEO Chip Goodyear said each major resources project approved in W. Australia adds 10% to the cost of every other project in the state".
  - Freed, Jamie, "Cost of BHP nickel project leaps to \$2.8b", Sydney Morning Herald, December 1, 2006.
- This is a realistic representation of how capital investment in a local market drives price escalation (inflation has nothing to do with this)
- Most dramatic when projects are executed simultaneously in a region with limited skilled labor and infrastructure
  - Quebec would be a classic example, as was W. Australia for mining and gas
- Mega-projects compete against themselves, because they are combinations of a number of small projects done together in same place and time
- Therefore, factoring in local "capital demand" must be a part of escalation estimating best practice

**Escalation is a sleeping tiger; it bites the complacent** 



### **Escalation spoils the revenue party**

Hot markets mean increasing sales prices and revenues,

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- resulting in owners "chasing revenue" by launching projects simultaneously,
- they then get burnt because capex escalation follows thus, negating the promised NPV,
- while locking high cost assets into the balance sheet (which are often written down).

Metals and oil learned this lesson from 2012 price collapse and are currently displaying remarkable "capital discipline"





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- Many finance departments view escalation as a synonym for inflation (unfortunately, many regulators do as well)
- Finance argues that the discount rate used in NPV calcs is correlated with inflation, therefore escalation (which they conflate with inflation) is largely irrelevant
  - In a volatile capex market this is a hugely <u>false assumption</u>
- Finance also takes a long view in NPV models, which forgets that escalation is a short term/front-end risk that locks in a high price asset that later returns are unlikely to cover.
  - The worst case for capex in NPV sensitivity analyses is often hugely understated



#### Nobody is accountable for escalation; Hakuna Matata

- Few treat escalation as a risk; most estimate it deterministically a nominal point value in the project budget
- But in volatile economies, escalation can become the largest cost
  - About 30% of my billings during the 2004-2012 supercycle were for helping owners understand why their project costs were blowing out left and right
- Most label it "unknown-unknown", write down the asset, and try to forget
  - It was welcomed by many project managers because ALL bad cost outcomes could be blamed on escalation. Nobody was held accountable\*
    - \*that is not quite true; virtually EVERY major mining company CEO was canned in 2012





**Escalation is sometimes buried in control base or contingency** 

- When allocated to control accounts, escalation fattens the budget and can result in over-reported early progress
- For some, escalation is buried in contingency risk analysis
  - Most risk registers include escalation items (e.g., "price may increase")
  - Not too bad for small projects with mid-point of spend 1-2 years out
  - Fail to recognize that delays drive escalation
    - In volatile times, escalation is the Grim Reaper of delays (along with interest)
- Both approaches lead to loss of visibility of what is driving cost



#### There are no price indices for the prices of bid services

- Producer Price Indices (PPI) and equivalents don't measure the price of services that are bid
  - i.e., engineering, construction, fabricated items, modules
- Bid prices include supplier's contingency, margin and mark-ups; they may increase these dramatically in a hot (and to them risky) market
  - The higher up you are on the food chain (owners) the more this successive accumulation of markups will hit you
- Some escalation is the result of receiving fewer bids
  - In normal markets, one gets several viable low bids, but in hot markets one may only get a single bid, and that one is a courtesy bid that would never be considered normally



- First of all, every contract with an extended duration should include an escalation clause
  - It is unfair to transfer escalation risk to contractors
- However, these clauses often refer to indices that do not track the prices a contractor may have to pay lower tier subcontractors and others
  - Contractors beware!



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#### References

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- Chapter 13 of "Project Risk Quantification"

#### Follow these steps:

- 1. Start with a base escalation model that applies indices against a cash flow
- 2. Incorporate indices based on econometric modeling (from the economic experts)
- **3.** Adjust economist's indices to address the prices for bid services (capex adjustment)
- 4. Quantify escalation probabilistically
- 5. Integrate the escalation and contingency models (i.e., "universal capex risk")



- Start with a base cost estimate in current dollars, summarize the costs in accounts with unique price trends
  Contingency is in current dollars and must also be acceleted
  - Contingency is in current dollars and must also be escalated
- Develop an incurred (not expended) cash flow by period
- Obtain price indices from economists; i.e., measures of price levels, usually normalized (e.g., 2000 = 1.00)
- Adjust the indices
- Stimate each cost by period using index ratios



### **Adjust indices for capital demand**

- As stated, published indices do not cover services that are bid
  - Apply a "capital demand factor" adjustment
- Economists provide forecasts of capital spending by industry by region
- Capex factor is derived as follows:
  - Given:
    - underlying index increases by 8% (1.08)
    - capex in the relevant EPC market increases by 20% that year (1.20),
    - capex exponent (based on market supply/demand category) is 0.4,
  - Then, the bid price increase =  $1.08 \times 1.20^{0.4} = 1.08 \times 1.08 = 1.17$ 
    - Adjusted result is 17% increase versus 8% base
- Capex price increase tends to lag product demand by a year or so
  - but also do not decrease when sales decrease ("sticky prices")



- The capex adjustment has been shown to be realistic
- Comparison of adjusted CEPCI vs. market-based benchmark (IHS Markit DCCI)





## Make a probabilistic escalation model

### Implement Monte-Carlo simulation

- Apply distributions to these uncertain escalation variables:
  - Contingency (distribution from a QRA model)
  - Schedule durations (distribution from a QRA model)
  - Price Indices (cyclical; book explains heuristic)
  - Cash flow pattern (early/late; book explains heuristic)
- Establish correlations; run the MCS
- Output will be escalation distribution AND total capex distribution including cost/schedule contingency risk!



### Pay attention to the economist's words

- While economists rarely predict sharp turns (models tend to "regress to the mean"), they provide probabilistic range information in scenario analyses
- Example: "...on average, they [economists] expect the downturn to end in October....but "economists also see nearly a one-in-six chance that the U.S. will fall into a depression" (Wall Street Journal, March 10, 2009)
- Pay attention to their words about the <u>range as opposed to the</u> <u>consensus view</u>; reflect this in your price index distribution





### **Good Escalation Method = Good Data**

- Istorical cost data must be normalized for escalation
- Use the same methods but with past actual adjusted indices instead of future forecast indices
- If you use 1 or 2 rather than 3 on this chart your historical data quality and value will decline quickly





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### **Take-Aways**

- Second Second
- There are no published price indices for bid services: one must adjust
  - Bid prices correlate with capital spending trends
- Stimate escalation probabilistically using Monte-Carlo simulation
  - Study the economist's scenario discussions...ranges, not most likely
  - Input cost/schedule distributions from QRA into escalation model
  - Provides a "universal" capex distribution for NPV modeling
- Use adjusted indices for normalization of historical data too
- Study the recommended practices:
  - 58R-10: Escalation Principles and Methods Using Indices
  - 68R-11: Escalation Estimating Using Indices and Monte Carlo Simulation
  - Project Risk Quantification, Chapter 13 (sources shown prior)





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