Risk Adjusted Inflation Indices

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Presented at the 2014 ICEAA
Professional Development and Training Workshop
June, 2014

Introduction

- It is often observed that Office of the Secretary of Defense (OSD) inflation rates are different than prime contractor specific inflation rates seen in:
  - Forward Pricing Rate Agreements/Proposals (FPRAs/FPRPs)
  - Commodity group composite rates (e.g. Global Insight indices).
- Yet, it is a standard practice in many cost estimating organizations to use OSD inflation rates for escalating future-year costs in estimates without giving consideration to a range of different possible inflation rates
- This can result in cost estimates that underestimate the effects of inflation
  - Especially for programs that have many years of procurement and/or operations & support (where the compounding effects of inflation are significant)
- This presentation proposes an approach to create risk adjusted inflation indices based on defined risk distributions, thus giving consideration to a range of different inflation rate possibilities
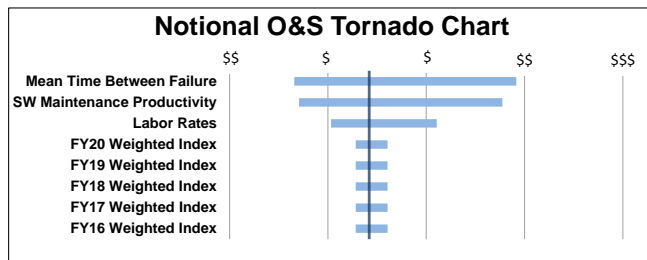
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- Before sharing the proposed approach, I'd like to share a different approach I've seen previously...

Discreet Distributions on Weighted Indices

- One approach that has been used to model uncertainty on future-year inflation is to define discreet distributions on the weighted indices for each individual year, for example:
  - FY20 Weighted Index = distribution(parameter1, parameter2,…)
  - FY19 Weighted Index = distribution(parameter1, parameter2,…)
  - FY18 Weighted Index = distribution(parameter1, parameter2,…)
  - FY17 Weighted Index = distribution(parameter1, parameter2,…)
  - FY16 Weighted Index = distribution(parameter1, parameter2,…)
  - Where the most likely value is usually the OSD weighted index for that year
- This approach has limitations…

Discreet Distributions on Weighted Indices (cont.)

- This approach has limitations:
  - The cumulative effect of the uncertainty around all the weighted indices cannot be easily compared to the other cost risk drivers
    - I.e., "If FY16-20 Inflation were combined, where would it rank on the Tornado Chart?"
    - Often results in a tornado chart that resembles:

Notional O&S Tornado Chart

	$$	$	$	$$	$$$
Mean Time Between Failure					
SW Maintenance Productivity					
Labor Rates					
FY20 Weighted Index					
FY19 Weighted Index					
FY18 Weighted Index					
FY17 Weighted Index					
FY16 Weighted Index					

  - Also, using discreet distributions on the weighted indices does not influence the compounding effect of each year's inflation rate on the following years
    - I.e., the results of the risk simulation for FY16 do not affect FY17, FY18, and so on

- On to the proposed approach…

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Building Weighted Indices 101

- Let's review how weighted indices are built up
- Example OSD inflation table:

Fiscal Year	Inflation Rate %	Raw Index	Outlay Phasing						Total	Weighted Index
			YEAR1	YEAR2	YEAR3	YEAR4	YEAR5	YEAR6		
2004	2.00%	1.000	57.4%	32.7%	4.6%	2.4%	1.2%	1.7%	100.0%	1.017
2005	2.80%	1.028	58.6%	32.2%	4.3%	2.2%	1.1%	1.6%	100.0%	1.045
2006	3.10%	1.060	61.0%	29.8%	4.3%	2.2%	1.1%	1.6%	100.0%	1.074
2007	2.70%	1.088	57.5%				1%	1.6%	100.0%	1.102
2008	2.40%	1.115	53.6%				6%	0.0%	100.0%	1.124
2009	1.50%	1.131	48.6%				7%	0.0%	100.0%	1.139
2010	0.80%	1.140	53.4%				6%	0.0%	100.0%	1.154
2011	2.00%	1.163	31.4%				5%	0.0%	100.0%	1.181
2012	1.80%	1.184							100.0%	1.204
2013	2.10%	1.209							100.0%	1.228
2014	1.90%	1.232							100.0%	1.251
2015	1.90%	1.255	31.4%	60.4%	4.6%	2.1%	1.5%	0.0%	100.0%	1.275
2016	1.90%	1.279	31.4%	60.4%	4.6%	2.1%	1.5%	0.0%	100.0%	1.299
2017	1.90%	1.304	31.4%	60.4%	4.6%	2.1%	1.5%	0.0%	100.0%	1.324
2018	1.90%	1.328	31.4%	60.4%	4.6%	2.1%	1.5%	0.0%	100.0%	1.349
2019	1.90%	1.354	31.4%	60.4%	4.6%	2.1%	1.5%	0.0%	100.0%	1.374
2020	1.90%	1.379	31.4%	60.4%	4.6%	2.1%	1.5%	0.0%	100.0%	1.401

$$\text{Weighted Index} = \cfrac{1}{\displaystyle\sum_{i=1}^{n}(O_i / I_i)}$$

I = Raw Index   O = Outlay Phasing %
n = number of years in outlay profile

- Here, the weighted index for 2004 is generated using the ratio method
- Also, note that OSD future-year inflation rate %'s are all the same
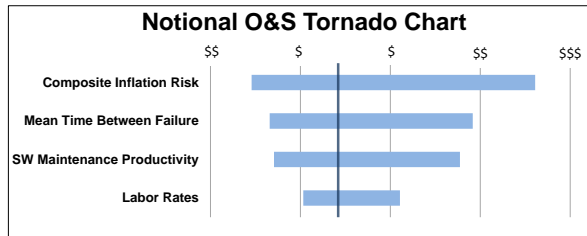 - I.e. from FY15 and onward, every year is 1.9%

Proposed Approach

- The proposed approach is for future-year escalation only
  - Prior year escalation rates are actuals (i.e. can't change the past)
- The proposed approach is to:
  - Define a single distribution for all the future-year inflation rates of that appropriation type
  - Then, assign the output of the risk simulation on that distribution to each year's inflation rate %
  - For example:
    - Composite Inflation Risk = distribution(parameter1, parameter2,…)

Fiscal Year	Inflation Rate %	Raw Index	Outlay Phasing						Total	Weighted Index
			YEAR1	YEAR2	YEAR3	YEAR4	YEAR5	YEAR6		
2015	Each Year's Inflation % is set to the output of the risk simulation	1.255	31.4%	60.4%	4.6%	2.1%	1.5%	0.0%	100%	1.275
2016		1.279	31.4%	60.4%	4.6%	2.1%	1.5%	0.0%	100%	1.299
2017		1.304	31.4%	60.4%	4.6%	2.1%	1.5%	0.0%	100%	1.324
2018		1.328	31.4%	60.4%	4.6%	2.1%	1.5%	0.0%	100%	1.349
2019		1.354	31.4%	60.4%	4.6%	2.1%	1.5%	0.0%	100%	1.374
2020		1.379	31.4%	60.4%	4.6%	2.1%	1.5%	0.0%	100%	1.401

These weighted indices are now risk adjusted

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Proposed Approach

- This approach produces a tornado chart where the cumulative effect of the uncertainty around all the weighted indices can be compared to the other cost risk drivers:

Notional O&S Tornado Chart

	$$	$	$	$$	$$$
Composite Inflation Risk					
Mean Time Between Failure					
SW Maintenance Productivity					
Labor Rates					

- Also, modeling uncertainty with this approach influences the compounding effect of each year's rate on the following years
  - I.e., the FY15 raw index, affects FY16, which affects FY17 and so on

Don't Forget..

- As with any cost risk analysis, make sure to assign correlation between each distribution

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Acknowledgments

- Thank you to the following individuals for their inputs to this presentation:
    - Jake Mender of the Naval Center for Cost Analysis
    - Tim Lawless and Lisa Pfeiffer of the Naval Sea Systems Command Cost Engineering and Industrial Analysis Division (NAVSEA 05C)