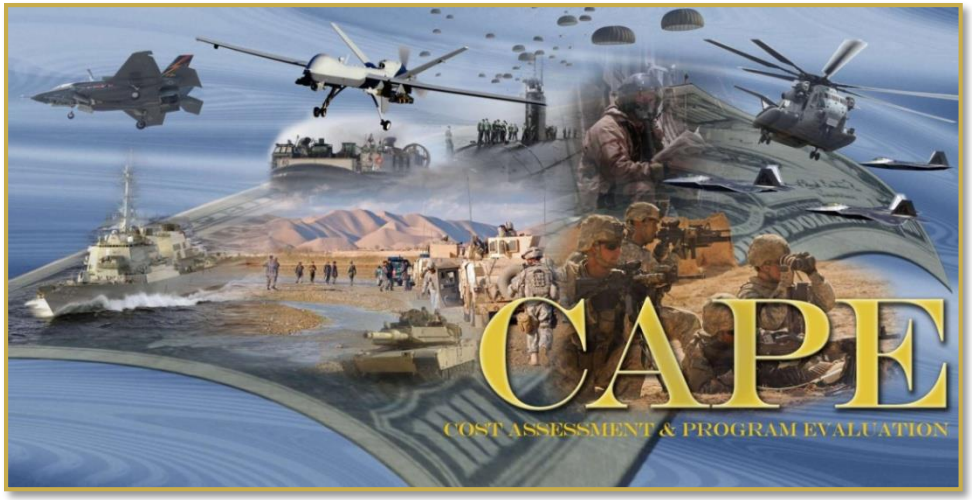
Inflation & Escalation Best Practices

OSD CAPE



October 2020

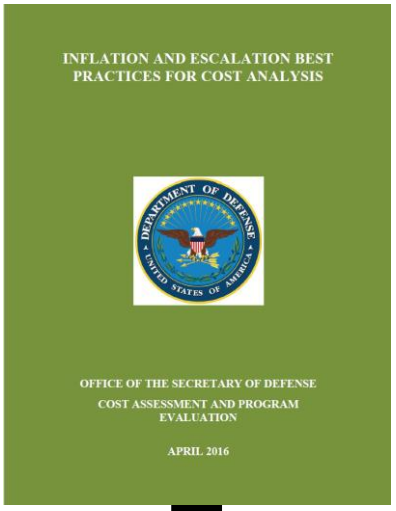
Background and Problem Statement

- Cost analysis requires proper accounting for growth in the prices of military commodities and resources, to include:
  - Economy-wide inflation
  - Commodity-specific price escalation
- Department committed to new methodology for price escalation ~2015, but still lacks consistent understanding and application in cost analysis
- Improper accounting for escalation distorts budgeting, make-buy decisions, and affordability assessments

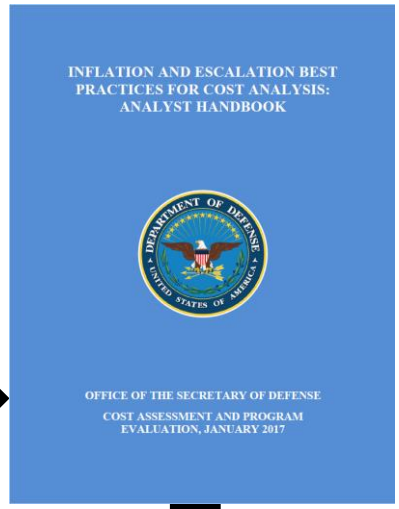
DoD cost estimates do not account for price change in a consistent manner. A shared understanding is a prerequisite for improved cost estimating practices.

Best Practices Handbook History

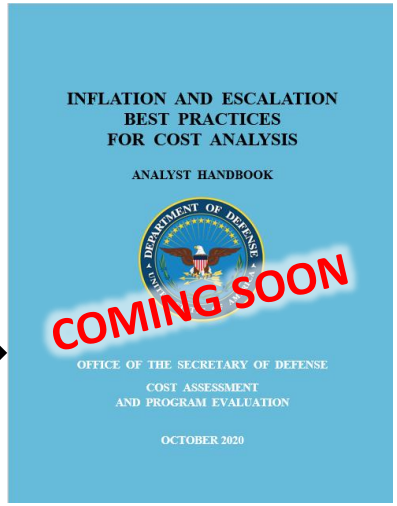
2016: Introduced escalation, real price change



2017: Expanded on escalation theory, some applications

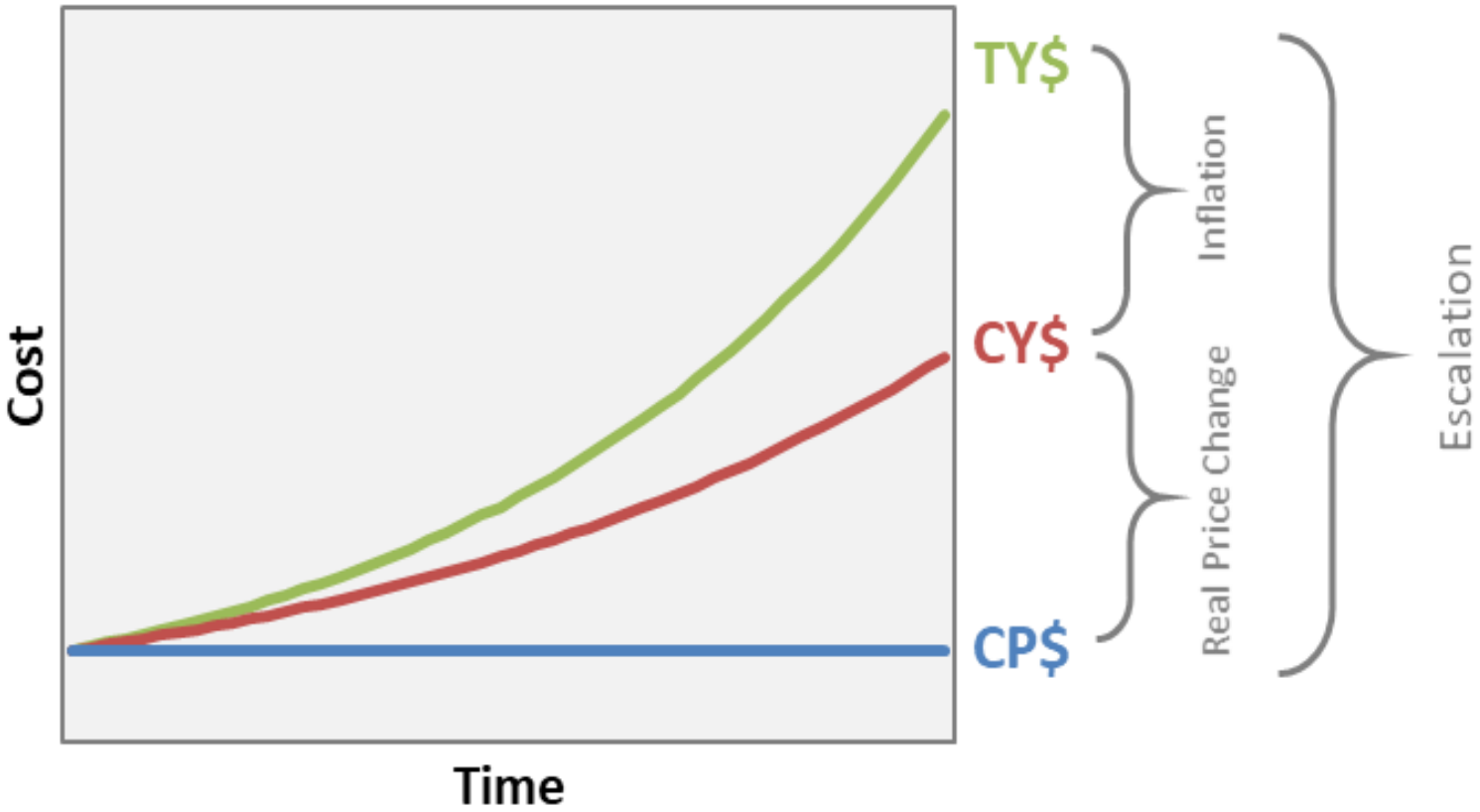


2020: Added step-by-step instructions, clarified definitions for ease of implementation



Basic Terminology Relationships

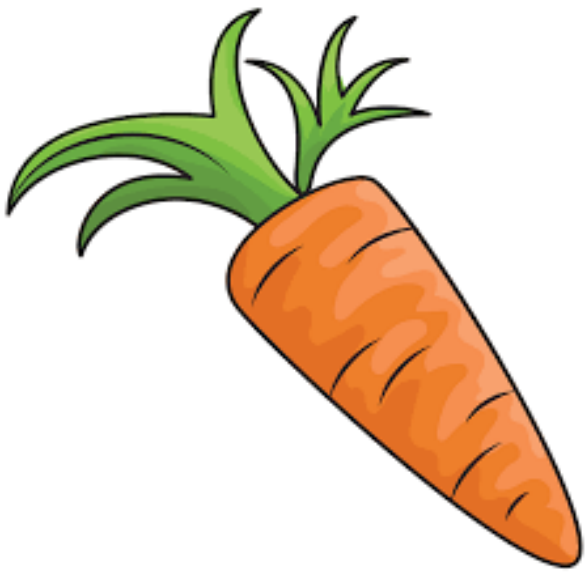
TERMINOLOGY SCHEMATIC

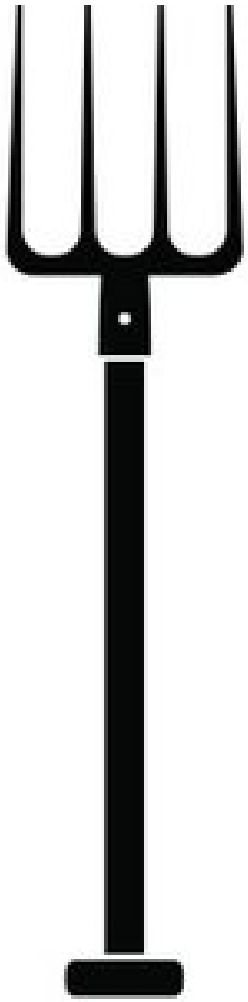


Tools of the Escalation Trade

The **PITCHFORK** Chart

The **CARROT** Chart





The **NINJA STAR** Chart

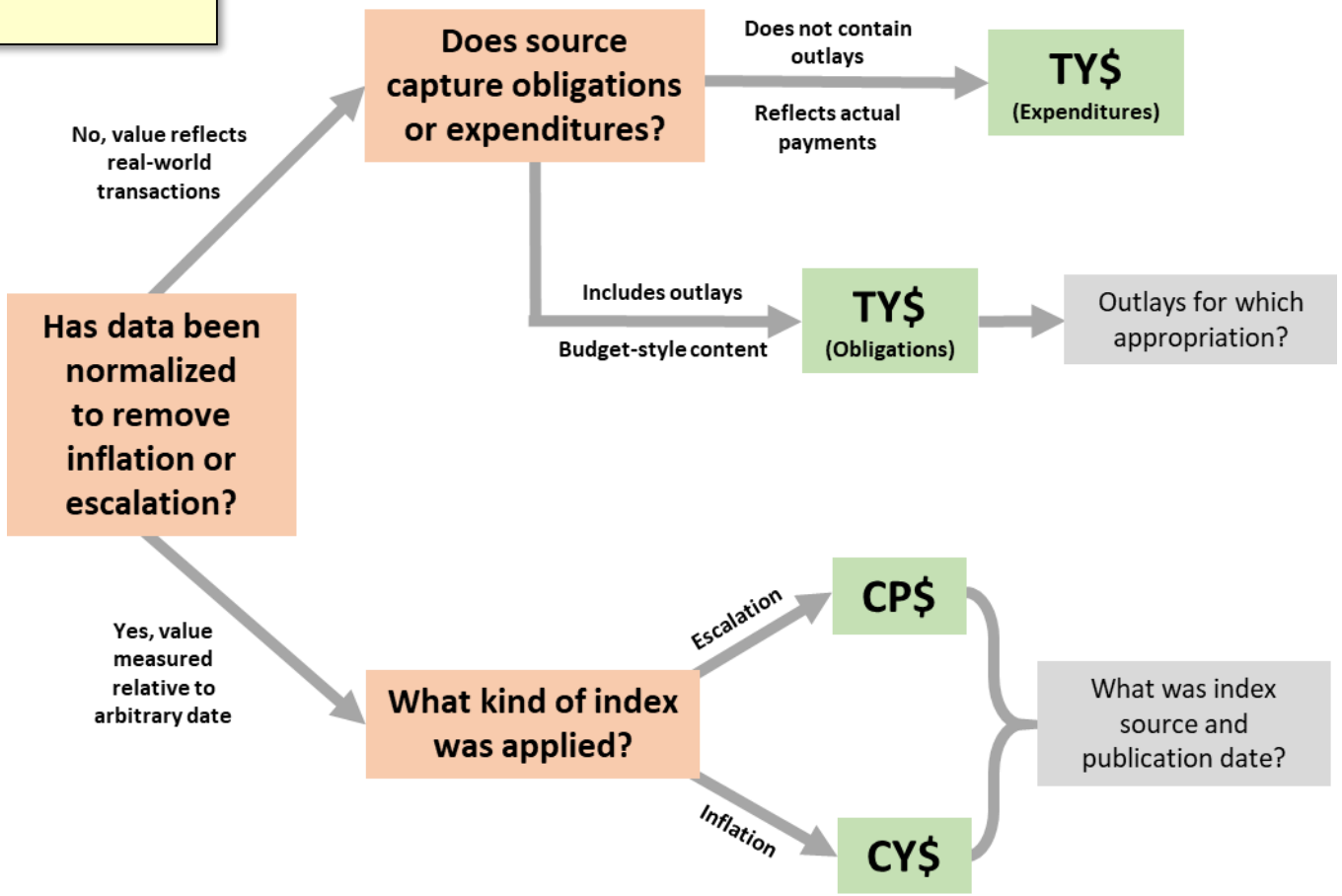
It's dangerous to go alone! Take this.

Input Diagnosis

The CARROT Chart

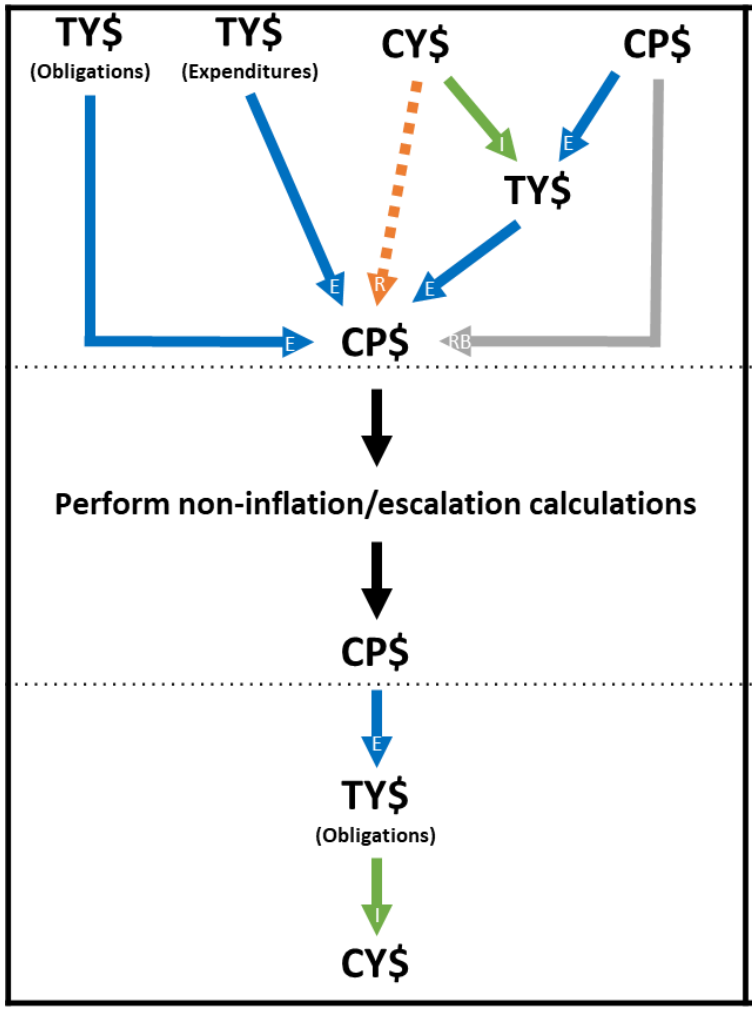
DOCUMENTATION CHECKLIST

- ☐ Value
- ☐ Transaction year
- ☐ Dollar type (TY$ obs, TY$ exp, CY$, CP$)
- ☐ Base year (if CY$ or CP$)
- ☐ Index applied (if CY$, CP$, or future TY$), including publication date



Proper Use of Dollar Types in Cost Estimates

The **PITCHFORK** Chart



Phase 1: Gather and normalize inputs.

Starting with inputs characterized according to instructions in Chapter 3, normalize inputs to CP$. Inputs already normalized to CY$ or CP$ may require an intermediate conversion to TY$ via the index with which they were originally normalized, if you wish to use a different index for your estimate.

Phase 2: Model costs.

Complete any calculations that do not require an inflation or escalation index, such as using the CP$ input in a cost estimating relationship, to create an average cost factor, to divide by number of units or usage rates, etc. The dollar type remains unchanged.

Phase 3: Report results.

Escalate all CP$ to create a TY$ estimate by year, generally including outlays for use in budget preparation and comparisons. Deflate TY$ values for each year to CY$ using appropriation-specific inflation indices for comparative analyses and cost threshold determinations.

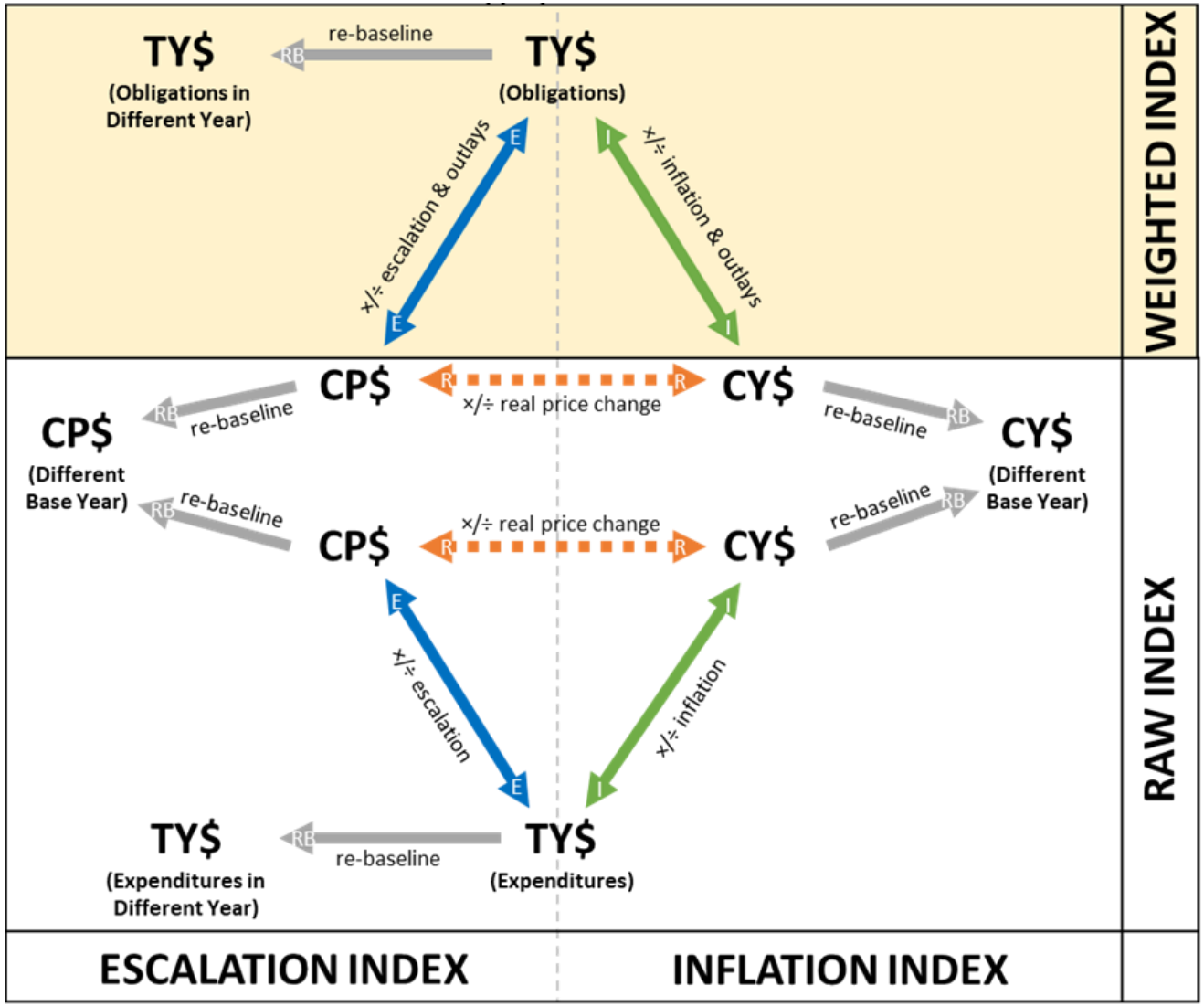
Why not report in CP$? (click here)

E	**Escalation index**	I	**Inflation index**		**No index required**
RB	**Re-baselining index**	R	**RPC index**		

See Chapter 6 for more guidance on index selection.

Index Selection based on Input & Output Types

The **NINJA STAR** Chart



Escalation index

Re-baselining index*

Inflation index

RPC index

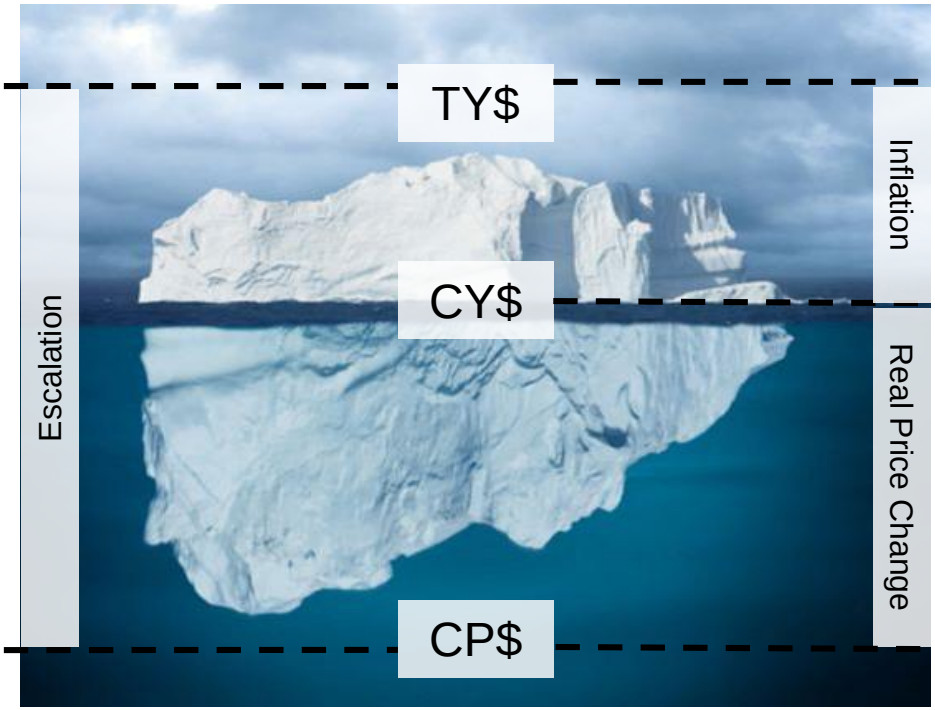
* A re-baselining index may measure either inflation or escalation; it is simply whatever index produced the input (CY$, CP$, or forecasted TY$) you are trying to convert

Index Resources

- Inflation
  - GDP Price Index
  - Almost all DoD-published raw indices are inflation-only (e.g., APA, OPA, AMMO, OMA, RDTEA); weighted indices appear different from (raw) GDP Price Index
- Escalation
  - DoD-published: MILPAY, CIVPAY, Fuel
  - Producer/Consumer Price Indices (Bureau of Labor Statistics, Global Insight, etc.)
  - Analyst-driven
- Real Price Change
  - Analyst-driven

Measuring Price Change

MILPAY, CIVPAY, and Fuel Indices



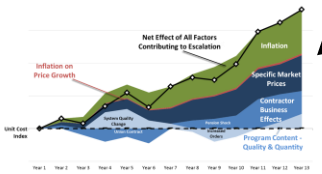
ALL OTHER DoD INDICES

(RDTE, Proc, O&M, etc.)

…so how can we capture this piece for all <u>other</u> commodities?

- Many forces cause price change over time
- DoD indices can only fully describe price change for **certain commodities**

New Framework for Analyzing Escalation



Replaces sandchart

- Escalation
  - Inflation
  - Inflation on Real Price Change
  - Real Price Change
    - Labor
      - Quantity
        - Learning curves (change hours), change workforce size
      - Quality
        - Change mix of skills, ranks, grades, productivity
      - Pricing
        - Negotiated pay rates (known MILPAY/CIVPAY salaries, FPRAs)
        - MILPAY/CIVPAY indices, FPRA outyear assumptions
    - Materials
      - Quantity
        - Change production profile/rate, change fleet mix/inventory, cost improvement curves, EOQ effects
      - Quality
        - Engineering/design changes, capability modifications, system age
      - Pricing
        - Known/negotiated price changes for GFE/CFE, price changes, WCF rate changes
        - Other matieral price changes (raw material, subsystem, etc.)

Tailored as applicable to each cost element

Blue = estimate discretely if possible; if not possible, analyze at higher level

Yellow = estimate via indices (not discrete techniques)

Best Practices – Major Points

- Capture full scope of escalation in cost estimates to the maximum extent possible
- Normalize inputs to appropriate level prior to completing calculations (see “pitchfork chart” and details in upcoming Handbook, to be formally released ~Nov 2020)
- For reporting final estimate results, bring costs up to TY$ <u>then</u> deflate to CY$
  - Contrary to past guidance to estimate in CY$ and convert to TY$ later – accounts for wide variety of inputs and normalization methods required for each
  - MUST use inflation-only index to report CY$; do not use MILPAY, CIVPAY, or Fuel, or a composite index containing them (will get mix of CP$ and CY$ instead of pure CY$)
  - If TY$ value represents obligations, use weighted index to remove outlays when converting to CY$

BACKUP

New Handbook Material (1 of 2)

- More detail on difference between obligations and expenditures, definition of outlay profiles
- Expanded definition of CP$ to differentiate between normalized data and modeling for forecasts
- Concept of “transaction year” as distinct from “base year”
- Relationship of RPC to quality and quantity changes, effects on cost models when they overlap
- Discrete modeling of RPC vs. modeling via indices
- Quick-reference flowcharts
- Concept of “re-baselining” (within-type conversions) vs. adding/removing price changes (cross-type conversions)

New Handbook Material (2 of 2)

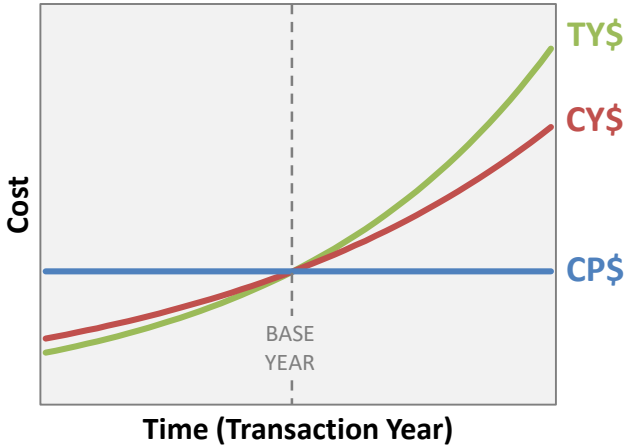
- Step-by-step instructions for basic calculations
- How to assume a midpoint for multi-year inputs, or how to manually allocate to single years
- How to make a custom index
- How to change the base year of an index
- Chapter discussing uncertainty:
  - What mistakes are avoidable and how do you avoid them?
  - What unavoidable sources of uncertainty are present under certain circumstances, and what should you do about them?

Wish List for Future Handbook Updates

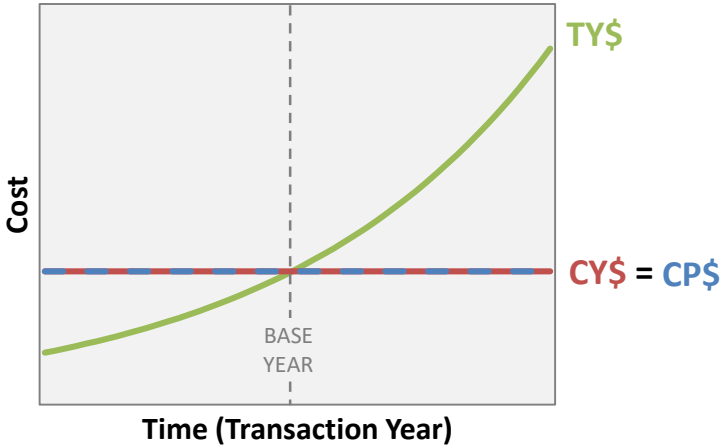
- More examples: different types of calculations, different levels of complexity
- Quiz / practice problems appendix
- More guidance on how to determine which escalation index is best for a given cost element
- List of “preferred” escalation indices
- “Pocket-sized” version of guide (~15 pages)
- More proof that real price change has significant effect on defense systems

Advanced Terminology Schematics

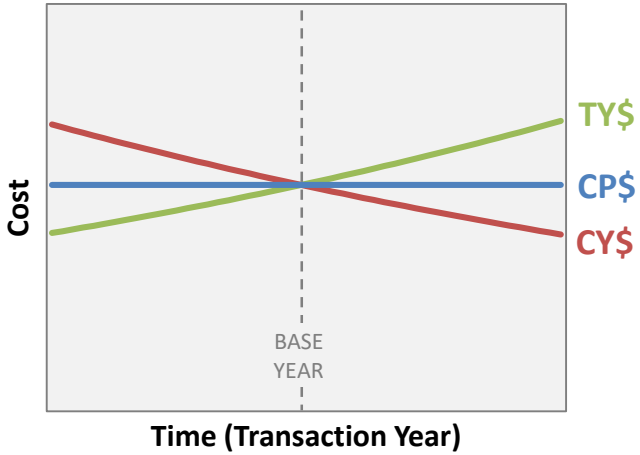
SCHEMATIC A (RPC > 1)



SCHEMATIC B (RPC = 1)



SCHEMATIC C (RPC < 1, |RPC|< Inflation)



TY$ ↔ CY$

= add or remove inflation

TY$ ↔ CP$

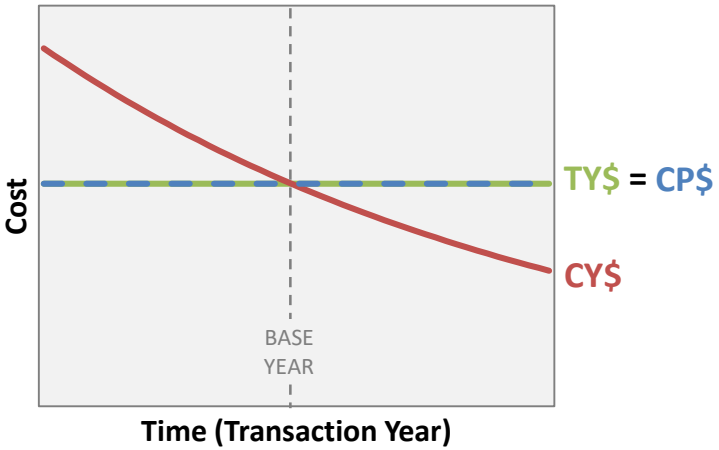
= add or remove escalation

CY$ ↔ CP$

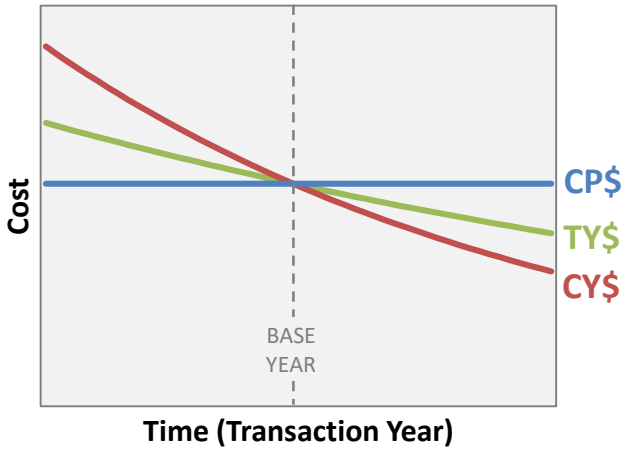
= add or remove real price change

Advanced Terminology Schematics

SCHEMATIC D (RPC = 1/Inflation)



SCHEMATIC E (RPC < 1)



TY$ ↔ CY$
= add or remove inflation

TY$ ↔ CP$
= add or remove escalation

CY$ ↔ CP$
= add or remove real price change

"Economics Textbook" Definitions

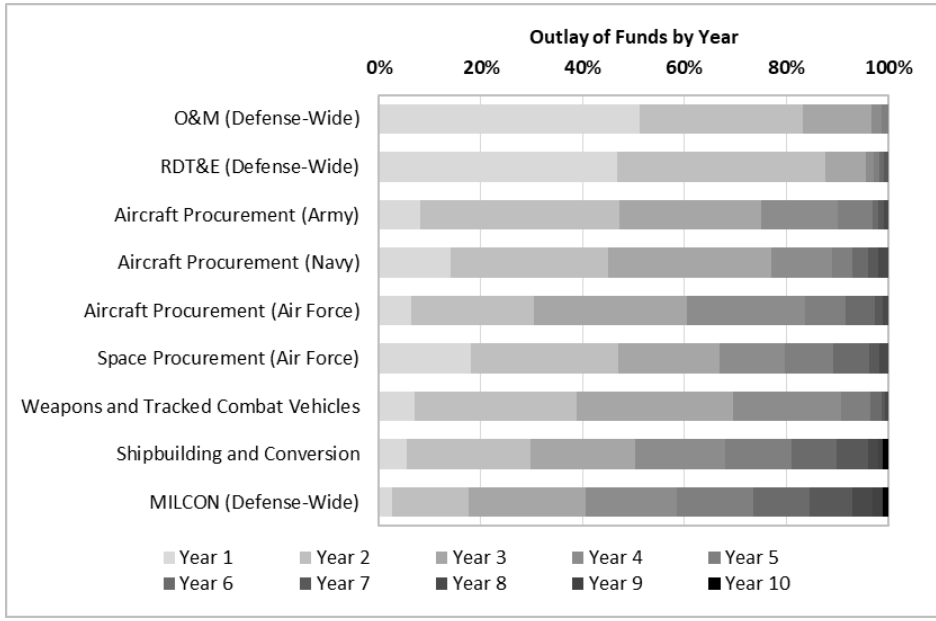
- **Inflation:** Change in general, economy-wide average price level, usually driven by a decrease in the value of the dollar
  - **Constant-Year Dollars (CY$):** Prices normalized for inflation
  - **Inflation Index:** Measures change in dollar's value over a time period

- **Escalation:** Change in price of a specific good or service (e.g., titanium, military pay), including inflation
  - **Constant Prices (CP$):** Prices normalized for escalation
  - **Specific Price Index:** Measures total change in price over a time period (including effects of both inflation & real price change)

- **Real Price Change (RPC):** Price changes due to forces other than inflation

"Cost Estimator" Definitions (1 of 2)

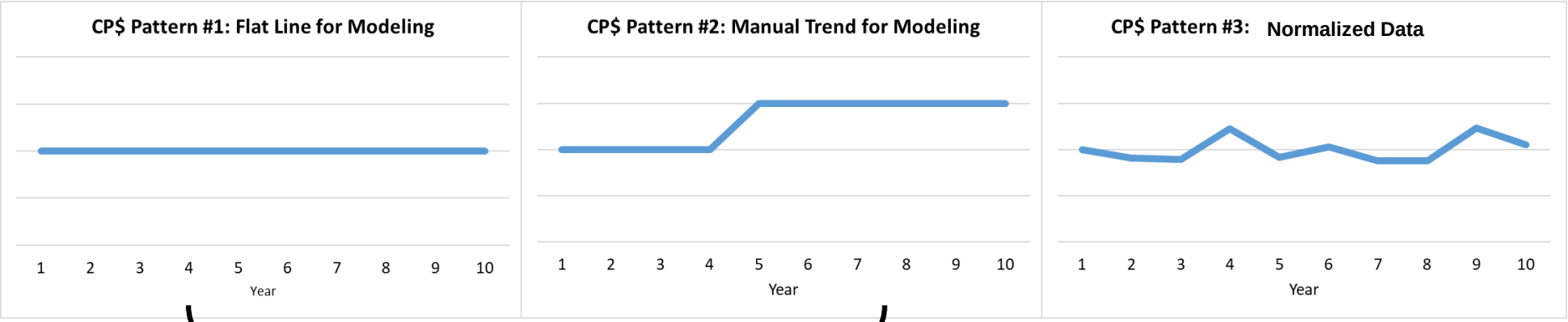
- **Then-Year Dollars (TY$):** Historical data from a primary source that has not been previously manipulated, or forecasted dollars for budgets and other external reports
  - **Obligations:** Include an outlay profile; for use in budgets
  - **Expenditures:** Do not include an outlay profile



- **Constant-Year Dollars (CY$):** TY$ that have been normalized to remove inflation relative to a base year; only used at the end of estimating process for external reports
  - **Inflation Index:** Raw index matches Comptroller's GDP index; weighted index may apply appropriation-specific outlay profile

"Cost Estimator" Definitions (2 of 2)

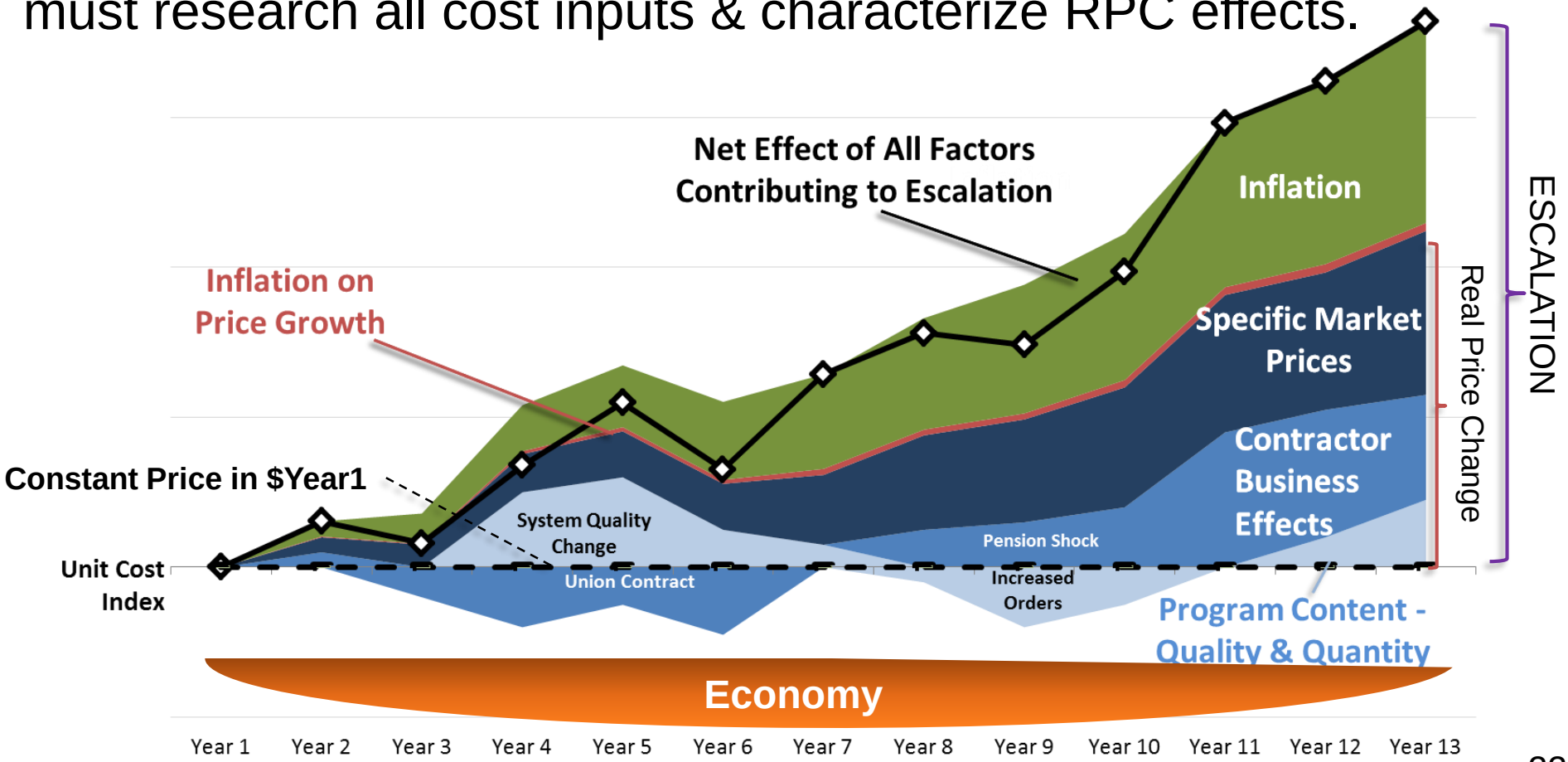
- **Constant Prices (CP$):** TY$ that have been normalized to remove escalation relative to a base year, or "flat-line" dollars used for modeling (see below)
  - **Escalation Index:** Any index whose raw form (without an outlay profile applied) does not match Comptroller's GDP index



Common practice prior to 2015 was to generate an estimate in "base year dollars" and convert to TY$ toward the end of the estimating process. That process HAS NOT CHANGED – we have merely renamed this type of dollars **CP$** to recognize that it is different from **CY$** (inflation-adjusted).

Research Cost Drivers to Decompose "Escalation"

Inflation affects all commodities in the economy. Other forces driving Real Price Change may be specific to particular program, broader commodity type, particular contractor, etc. – analysts must research all cost inputs & characterize RPC effects.



Analogy: How long is a year?

- Many ways to measure a year:

1 year	Earth Days	Mercury Years	Earth Years	Mars Years	Jupiter Years	Neptune Years
Mercury	88	**1.00**	0.24	0.13	0.02	0.00
Earth	365	4.15	**1.00**	0.53	0.08	0.01
Mars	687	7.81	1.88	**1.00**	0.16	0.01
Jupiter	4,333	49.24	11.87	6.31	**1.00**	0.07
Neptune	60,190	683.98	164.90	87.61	13.89	**1.00**

- Why do we see more comparisons in “Earth years” than in “Jupiter Years”? Want to use common points of reference when communicating with broad audience

Cost estimators should present costs normalized relative to the economy (CY$) because the economy is a widely recognized point of comparison. Costs normalized relative to specific sectors (CP$) only make sense to sector experts.

Guidance

- Realism in cost estimates is legally required
  - WSARA: "*DCAPE shall ensure…realistic estimates of cost for the acquisition programs of the Department of Defense" and further "periodically assess and update the cost indexes(sic) to ensure…sound basis and meet Department's needs for realistic cost estimation*"
  - DoD FMR (Vol 2A, Ch 1): "*DoD policy to reflect the most likely or expected full costs (including military and civilian personnel pay) for the current year, the biennial budget years, and outyear estimates for all appropriations*"…but with a small complication: "*Military and civilian personnel compensation will be fully funded in the biennial budget estimates using the rates provided by the OUSD(Comptroller).*"
- OMB Circulars clarify key constraints, rules, & definitions
  - A-11: estimates should be accurate, but trade-offs required to remain within allocated budget "topline"
  - A-94: inflation is "change in general price level" & extending inflation assumptions beyond FYDP is ok (silent on extending price assumptions)

Chain of Policy

OMB Circular A-94	
Defines Inflation	Provides Guidance
Proportionate rate of change in the general price level, as opposed to the proportionate increase in a specific price	For inflation, use the rate of increase in the GDP Price Index from the Administration's economic assumptions

OUSD(C) Inflation Policy Memo	
Distributes Rates	Provides Guidance
Pass inflation and specific price escalation rates from OMB to Services	Use inflation and specific price escalation rates for budgets

Service Implementation of Policy		
Inflation Rates	Specific Price Escalation Rates	Other Specific Price Escalation
Mandate use of inflation rates for all conversions that only add or remove inflation	Mandate use of specific price escalation rates for calculations in specified categories (pay, fuel, medical)	Allow analysts to maximize flexibility in using any index that will best forecast or normalize relevant prices

Cost Leadership Forum Decisions (Jan. 2015)

- Clarify terminology DoD-wide
- Affirm the importance of assessing price escalation assumptions in all phases of cost estimation
  - Use best information available
  - Don't rely on inflation alone to forecast prices; where possible, incorporate expected real price growth
    - Note that many service-published appropriation-level indices are essentially the GDP deflator and are not based on industry studies.
  - For constant dollar reporting (e.g., SAR): use <u>inflation</u> index
- Don't automatically extrapolate FYDP pay and fuel indices to out-years
  - Creates spurious year-to-year variation

Assessing escalation will be the standard practice, not the exception.

GDP Deflator to Inflation Guidance

FY15 Green Book

Table 5-1: DEPARTMENT OF DEFENSE AND SELECTED ECONOMY-WIDE INDICES (Continued)

(Base Year = 2015)

Fiscal Year	Gross Domestic Product[1]	Consumer Price Index (CPI-W)[2]	Dept of Defense Non-Pay	Dept of Defense Purchases[3]	Total Department of Defense
2005	83.28	79.98	80.99	83.60	81.15
2006	85.98	83.01	83.62	85.81	83.77
2007	88.31	84.84	85.92	87.75	86.00
2008	90.13	88.90	88.35	89.28	88.56
2009	91.19	88.21	88.87	90.47	89.77
2010	91.98	90.13	90.90	91.83	91.91
2011	93.78	92.84	92.99	93.50	93.75
2012	95.42	95.26	94.66	95.06	95.29
2013	96.86	96.78	96.45	96.57	96.91
2014	98.31	98.14	98.02	98.19	98.31
2015	100.00	100.00	100.00	100.00	100.00
2016	101.86	102.10	101.87	101.96	101.61
2017	103.88	104.35	103.93	104.00	103.36
2018	105.95	106.75	106.07	106.[illegible]	[illegible]
2019	108.08	109.20	108.28	108[illegible]	[illegible]

1. From OMB Historical Table 10.1 (Gross Domestic Product and Deflators Used in the Historical Tables).
2. Provided by OMB.
3. Excludes pay, fuel, and medical factors.

Year	GDP Deflator	Rate Change
2012	95.42	
2013	96.86	1.5%
2014	98.31	1.5%
2015	100.00	1.7%
2016	101.86	1.9%
2017	103.88	2.0%
2018	105.95	2.0%
2019	108.08	2.0%

Inflation Indices

February 6, 2014

Inflation Guidance - FY 2015 President's Budget

PRICE ESCALATION INDICES
(Annual Rates in Percentages)

Fiscal Year	Proc	RDT&E	Mil Con[1] FH Con	O&M (Excl Fuel and Med)	Fuel	Mil Pers[2] Non-Pay (Excl Med Accrual)	CPI-U Medical	PAY RAISE ASSUMPTIONS[4] Military	Civilian
				OUTLAYS					
2013	1.5	1.5	1.5	1.5	8.4	1.5	2.8	1.7	0.0
2014	1.5	1.5	1.5	1.5	-2.9	1.5	2.8	1.0	1.0
2015	1.7	1.7	1.7	1.7	2.2	1.7	3.7	1.0	1.0
2016	1.9	1.9	1.9	1.9	-4.3	1.9	3.8	1.0	1.0
2017	2.0	2.0	2.0	2.0	-2.0	2.0	3.9	1.0	1.0
2018	2.0	2.0	2.0	2.0	-1.4	2.0	3.9	1.5	1.5
2019	2.0	2.0	2.0	2.0	-0.9	2.0	3.9	1.8	1.8

- **BEA develops the GDP Deflator**
- **OMB disseminates to federal agencies**
- **OSD converts index to rates**
- **OSD publishes factors as inflation guidance**
- **OSD re-publishes in the Green Book**

Gray = Escalation Indices

Example: Calculating Observed RPC

This slide was designed for click-by-click animations.
If viewing this presentation as a flat file,
see next slide for fully-displayed version.

Example: Calculating Observed RPC

Given:

FY17 cost = $100
FY18 cost = $105
FY17-18 inflation = 2%

Price Escalation = Inflation * RPC

Solve for rate of RPC:

Price escalation = ($105 - $100) / $100 = 0.05 → 5%
Real Price Change = Price Escalation / Inflation
= 1.05/1.02 = 1.0294 → **2.94%**

How can I visualize these rates as dollar values?

$105 = $100 * Price Escalation
= $100 * (Inflation) * (RPC)
= $100 * (1.02) * (1.0294)
= $100 * (1 + 0.02) * (1 + 0.0294)

"FOIL" Method:
First Outer Inner Last

= $100 * (**1** + **0.02** + **0.0294** + [**0.02 * 0.0294**])

Original = **$100** Inflation = **$2** RPC = **$2.94** Inflation *on* RPC = **$0.06**

Rates are multiplicative, dollars are additive.