

INFLATION AND ESCALATION BEST PRACTICES FOR COST ANALYSIS



OFFICE OF THE SECRETARY OF DEFENSE
COST ASSESSMENT AND PROGRAM
EVALUATION

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1. Background

Reliable cost analysis is critical to defense management. The rates at which the prices of defense goods are expected to change are often important determinants of system cost. Well-researched forecasts of price growth help the Department to make sound acquisition trade-offs and adequately budget for weapon systems.¹

Section 2334(a)(3) of Title 10, United States Code, requires the Director, Cost Assessment and Program Evaluation (DCAPE) to “periodically assess and update the cost indexes used by the Department to ensure that such indexes have a sound basis and meet the Department’s needs for realistic cost estimation.” DCAPE has published this guide to help analysts meet these objectives. Developed in collaboration with cost estimators and economists in OSD and the Military Departments, it provides best practices for incorporating price change into cost analysis. It includes:

- Standard terminology to distinguish between inflation and escalation
- Minimum standards for documenting and labeling indices used in an analysis
- Use of realistic escalation rates to estimate investment and sustainment costs
- Selection of long-term assumptions about fuel prices and other rates to maximize the realism and stability of the estimate
- Selection of indices for converting then year estimates to a base year

Cost estimates should demonstrate understanding of price growth concepts and use accurate, relevant data. Therefore, the cost community should foster the data and methods necessary to measure escalation affecting weapons systems, and encourage analysts to assess all escalation rates bearing on their analyses.

This guide will be supplemented by an in-depth handbook to help analysts implement the best practices.

2. Standard Terminology

Cost estimates should distinguish between inflation and changes in specific prices by adopting the following terms. An expanded glossary, including examples, appears in the Appendix.

- a. “Inflation” refers to growth in the general, economy-wide, average price level and reflects a decrease in the value of the dollar.
- b. A change in a specific price, or in the prices of a particular set of goods and services, is not inflation. Inflation is only one component of a price change. The term “escalation” may be used for price changes below the level of the economy as a whole. Equivalent

¹ DoD Instruction 5000.73, “Cost Analysis Guidance and Procedures,” states, “It is DoD policy... that analysis be conducted to provide accurate information and realistic estimates of cost for DoD acquisition programs.”

terms include “price escalation,” “specific price change,” “specific price escalation,” or simply, “price change.” Examples of escalation include military and civilian pay raises, changes in contractor wrap rates, and changes in the unit cost of a particular weapon system. Escalation does not refer to price changes attributable solely to the mix of items being measured or significant changes in quality. Escalation can be positive or negative.

- c. “Constant year (CY) dollars,” also called “constant dollars,” have been normalized for inflation, not escalation, using an economy-wide index such as the Gross Domestic Product Implicit Price Deflator (GDP Deflator). Constant year dollars measure what goods and services economy-wide would have cost in a base year by adjusting for the decrease in the value of the dollar. This term will not be used to refer to costs normalized for specific price change.
- d. “Real price change” (RPC) is price change measured in constant year dollars. Positive real price change indicates that the item has become more expensive relative to other goods and services in the economy, while negative real price change indicates that the item has become less expensive relative to other goods and services in the economy.
- e. The term “constant price” (CP) may be used to refer to costs normalized with an escalation index. A constant price indicates what a narrowly defined basket of goods would have cost in a base year. Examples of constant prices include contractor labor rates divided by a labor rate index, aircraft unit costs divided by an aircraft index, and fuel costs divided by a fuel price index. Constant prices exclude both inflation and real price change.

Table 1 provides examples of correct and incorrect usage of the terms “inflation” and “escalation.”

Table 1 Examples of Correct and Incorrect Terminology

What Happened	Examples of Correct Terminology	Examples of Incorrect Terminology
The price of medical procedures increased 3%	<ul style="list-style-type: none"> • Medical escalation • Escalation • Price change • Specific price change 	<ul style="list-style-type: none"> • Inflation • Medical Inflation
The general price level in the U.S. increased 1.7%	<ul style="list-style-type: none"> • Inflation • General price inflation 	<ul style="list-style-type: none"> • Escalation • Specific price change
Government civilian pay increased 1.5%, a smaller percentage in previous years	<ul style="list-style-type: none"> • Pay raise • Escalation • Wage growth 	<ul style="list-style-type: none"> • Inflation • Pay inflation • Deescalation
The unit cost index for aircraft changed as a result of major capability improvements	<ul style="list-style-type: none"> • Unit cost increase 	<ul style="list-style-type: none"> • Escalation • Price change • Inflation

3. Documentation and Labeling

- a. Cost estimates must document the inflation and escalation rates used to estimate each component of the program. Documentation must be accessible to decision makers, other

users of the estimate, and subsequent analysts. Citations of published indices must include the chosen index, base year, source(s), and date. References to analyst-developed indices must include a descriptive title, base year, source data, and date.

- b. Estimates expressed in a base year using an escalation index, or a composite of inflation and escalation, must be labeled “constant price” to distinguish them from inflation-adjusted estimates. The Appendix discusses options for labeling both constant year dollars and constant prices.
- c. Ambiguous labels, such as “fiscal year dollars” and “base year dollars,” will be annotated to indicate the index used.

4. Use of Realistic Escalation Rates to Estimate Then Year (TY) Dollar Costs

- a. Cost estimates will incorporate the escalation rates that best forecast funding requirements for the system being estimated, taking specific markets into account.
- b. Cost analysts (and the organizations publishing estimates) are responsible for determining which escalation assumptions are appropriate and where they are applicable, for conducting analyses necessary to forecast escalation affecting system costs, and for developing the rationale for their approach. Analysts should not rely exclusively on DoD-published indices to measure escalation, as the indices for Research, Development, Testing, and Evaluation (RDT&E) and Procurement reflect inflation and generalized expenditure rates. They are not developed based on DoD’s pricing experience or industry trends.² Although escalation in a given program may match the DoD index, this conclusion should be supported with analysis. Professional market forecasts, cost estimating models, government-published price indices, contractors’ forward pricing rate agreements, contractual economic adjustments, historical quality-adjusted unit costs, and historical wrap rates are among the preferred data and tools to measure and predict escalation.

Example. The unit cost of a vehicle system is \$20M in 2015 and the analyst is estimating what its cost will be in 2025. A military service’s published procurement index is growing at an annual average rate of 2%. If this index is an accurate measure of system escalation, in 2025 DoD would pay \$24.4M ($=\$20M \cdot 1.02^{10}$) per unit. Based on a combination of market forecasts and contractor rate trends, however, the analyst estimates that unit costs will grow 3% per year. The system-relevant escalation rate implies that DoD would instead pay \$26.9M ($=\$20M \cdot 1.03^{10}$) in 2025. Thus, the correct approach yielded an estimate 10.2 percent higher than would be expected based on the published index.

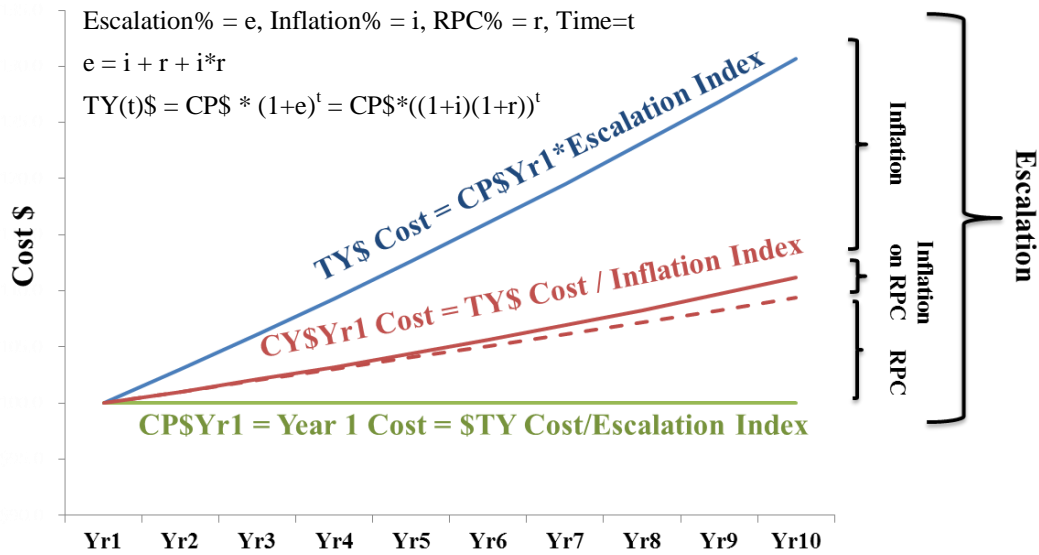
² DoD and service indices for RDT&E, Procurement, Military Construction and Family Housing, and Operations and Maintenance typically track the GDP Price Index forecast developed each year by the Office of Management and Budget. Thus, the raw indices for these appropriations are the same. Weighted indices differ because they include appropriation-specific outlay profiles. Changes in military pay, civilian pay, fuel, and medical costs are types of escalation; indices for these costs, and composite indices including them, are escalation, not inflation, indices.

- c. Long-term forecasts. Long-term assumptions about inflation and escalation of fuel prices, military pay raises, civilian pay raises, and other prices will be chosen to maximize the realism and stability of the cost estimate. The OSD (Comptroller) annual President's Budget Inflation Guidance typically addresses DoD's Future Years Defense Program (FYDP) only. There is no requirement to extrapolate price growth assumptions for the FYDP into out years beyond the scope of the guidance. This practice causes year-to-year changes in cost estimates based solely on FYDP values; estimates of programs with large sustainment costs, normally incurred over many decades, can be particularly unstable. The same principle applies to years beyond other government or commercial forecasts: out year assumptions should be chosen to maximize the realism and stability of the estimate.
 - i. OSD (CAPE) will oversee an advisory group charged with recommending post-FYDP price escalation rates to use in cost analysis. Advisory group participants include representatives from OSD (Comptroller), OSD (AT&L), and the Military Departments, including organizations responsible for publishing services' index tables. These recommendations may include, but are not limited to, inflation, fuel prices, military and civilian labor costs, and medical costs. The scope of the advisory group's recommendations will depend annually on direction from DCAPE, expected by October 1 of each year.
 - ii. The advisory group will convene no later than the first week in November each year. Components will identify participants by mid-October. The group will develop and circulate recommendations to coincide with the release of OSD (Comptroller) annual President's Budget Inflation Guidance, during December-February.
 - iii. Recommendations will be based on analysis of published public and private forecasts. To avoid excess volatility in the annual post-FYDP rate recommendations, the advisory group will only recommend a change in the rates previously used if the analysis indicates a significant shift in long-term forecasts. The size of change in the forecast necessary to trigger an update to the post-FYDP rate guidance will be agreed upon by members of the advisory group under the direction of DCAPE.

5. Converting Then Year Dollar Estimates to a Base Year

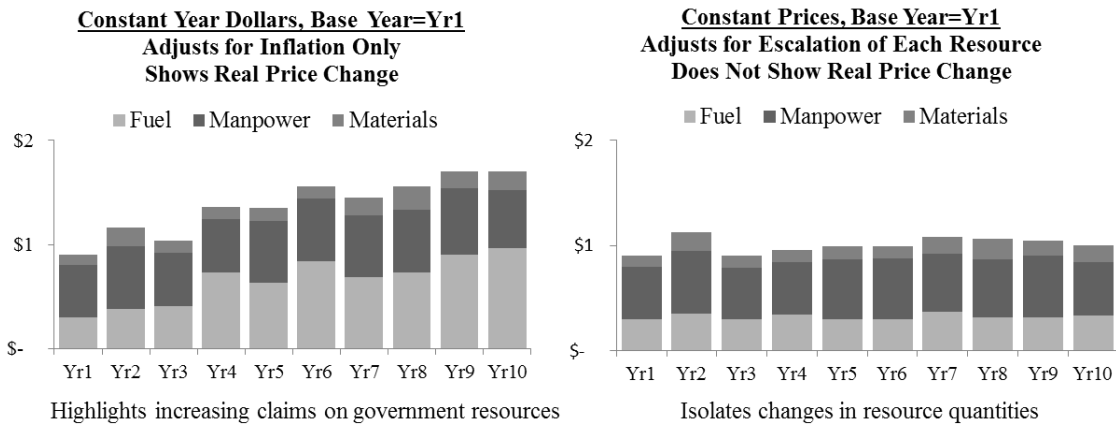
- a. Figure 1 presents the graphical and algebraic relationships between then year dollars, constant year dollars, and constant prices. The relationships have been simplified by assuming that inflation and escalation rates are the same each year. The increase in constant year dollar costs relative to the base year (here, year 1) is real price change (RPC). The gap between RPC and the remaining escalation is inflation plus an interaction term, interpreted as inflation on RPC.

Figure 1. Converting Then Year Dollars to a Base Year



- b. Constant dollar and constant price figures convey distinct information and have different uses in cost estimation. Constant year dollars eliminate the distortion³ caused by the reduced value of the dollar over time but preserve real price change. Real price change signals increasing or decreasing claims against budgetary resources. In contrast, constant prices help measure changes in quantity or capability underlying a then year dollar cost.

Figure 2. Comparison of Constant Year Dollars and Constant Prices (Hypothetical Data)



Example. Figure 2 uses hypothetical data to illustrate the difference between constant year dollars and constant prices. Constant prices are calculated by normalizing the cost of each resource with a price index, e.g., fuel costs are normalized using a fuel price index and manpower costs normalized using a manpower price index. The constant price chart has a flat profile. The constant year

³ If the dollar can be viewed as a measuring stick for expressing the cost of all items, inflation “lengthens” the measuring stick. Constant year dollars remove the distortion caused by this change in the measuring stick.

dollar chart shows that due to increases in the real price of fuel, the program is becoming more expensive to support. This information may affect decisions about the program, e.g., whether to seek fuel-efficient alternatives.

- c. Cost estimates to support decision making should be presented in then year dollars or constant year dollars, not constant prices. Thus, when it is necessary to present a cost estimate in terms of a base year, the conversion from then year dollars to constant year dollars should be made with an inflation index, not an escalation index. This principle applies to both investment and sustainment costs. Lifecycle costs should be converted to a base year using (raw or weighted) inflation indices for all appropriations and phases of the program.
- d. Constant prices indicate what a given product, service, or capability would cost in a base year. Potential applications include normalization of historical unit costs, buying power analysis, cost estimating relationships, and learning curves.

Example. An analyst is estimating the 2015 cost of a new aircraft system based on analogy to a similar system last procured in 1990 at a unit cost of \$30M. The analyst determines that unit costs would have escalated at 2.8% annually between 1990 and 2015, while inflation grew at 2%. Thus, the inflation index value for 1990, base year 2015, is .609 and the escalation index is .501. Converting the 1990 unit cost to 2015 constant dollars yields \$49.2M ($=\$30M/.609$). The constant price is \$59.8M ($=\$30M/.501$). The constant year dollar figure is incorrect because it only adjusts for inflation and neglects real price change during the past 25 years. The constant price figure is a more accurate measure of what the system would cost today.

APPENDIX: GLOSSARY

Base Year. A 12-month period used as a reference against which to measure price change. Both constant year dollars and constant prices are expressed in terms of a base year.

Constant Price. A dollar value that has been adjusted to remove escalation. Constant price values are labeled CP\$Year or CPYear, where Year is the base year (e.g., CP\$12 if the base year is 2012).

Example. Suppose the nominal price of a gallon of fuel was \$3.50 in 2015 and that the fuel index value for 2015, index base year 2008, was 1.250. In 2015, the CP\$08 price of fuel would be \$2.80 ($=\$3.50/1.250$).

Constant Year Dollar. A dollar value that has been adjusted to remove inflation so that its purchasing power is the same as that of a base year; also called a “constant dollar.” A cost in constant year dollars does not remove all price change, only that due to decreased purchasing power of the dollar. Constant year dollars are labeled CY\$Year, where Year is the base year. Many variations exist, including “Constant Year Dollars, Base Year = Year”.

Example. Suppose the price of a gallon of fuel was \$2.80 in 2008 and \$3.50 in 2015, and that the inflation index value for 2015, index base year 2008, is 1.149. The 2015 price expressed in CY\$08 is \$3.05 ($=\$3.50/1.149$).

Escalation. The change in the price of a specific good or service, or a specific basket of goods and services, over time. Escalation reflects not only inflation, but also the change in the real price of a good or service. In percentage terms,

$$\text{Escalation \%} = \text{Inflation \%} + \text{Real Price Change\%} + \text{Inflation\%} * \text{Real Price Change\%}$$

Example: Suppose inflation is 2% per year and real price change is 1%. Overall price growth, or escalation, is 3.02% ($=.02 + .01 + .02*.01$). The final term represents inflation on real price change.

Escalation Index. An index used to measure change in the price of specific good or service, or basket of goods and services, relative to a base year. Producer Price Indices for particular industries and the Employment Cost Index, both developed by the Bureau of Labor Statistics, are examples.

Inflation. A sustained rise in the general price level, or the proportionate rate of increase in the general price level per unit of time. The general price level is an economy-wide average. A sustained decrease in the general price level is called deflation.

Inflation Index. An index used to measure the percentage change in the general price level relative to a base year. The Gross Domestic Product (GDP) Price Index and the similar GDP Implicit Price Deflator, published by the Bureau of Economic Analysis (BEA), capture the year-to-year change in the price level encompassing all goods and services produced in the U.S.

Real Price Change. The change in price of a good or service net of inflation, i.e., price change measured in constant year dollars. Real price change can be positive or negative, and indicates that the product has become more (or less) expensive relative to other goods and services in the economy. Causes of real price change include market shifts, changes in the supplies of system-unique materials, contractors’ and government’s costs of doing business, economies or diseconomies of scale (i.e., rate effects), technological change, and learning.

Example. Suppose the price of labor was \$50.00 in 2008 and \$60.00 in 2014, and that the inflation index value for 2014 (index base year 2008) is 1.150. The 2014 price of labor expressed in CY\$08 would be \$52.17 ($=\$60.00/1.150$). Real price change is the difference in prices measured in CY\$08, and is equal to \$2.17 ($=\$52.17-\50.00) or 4.3% ($\$2.17/\50.00). This suggests increased demand or decreased supply of labor.

Then Year (TY) Dollars. The dollars necessary to fund Total Obligation Authority (TOA) and Budget Authority (BA), taking into account the time-phasing of funds expended each year after they are appropriated. The cost of a system in then year dollars reflects escalation up to and during the year of the appropriation; and throughout the period during which dollars are expended from the Treasury. Then year dollars are converted to constant year dollars using a weighted inflation index and to a constant price using a weighted escalation index.

Inflation example. The spendout rate for system X is expected to be 60% in year 1 and 40% in year 2. The raw inflation index with base year 2015 is forecasted to be 1.35 in 2030 and 1.38 in year 2031. The weighted inflation index applicable to system X is 1.362 ($=1/ (.6/1.35 + .4/1.38)$). This is the amount of funding that would be required to buy the system using dollars appropriated in 2030, to cover inflation expected during the spendout period. If the TY\$30 cost of the system is \$1M, the CY\$15 cost in 2030 is \$0.73M ($=\$1M/1.362$).

Escalation example. Suppose the raw price index for system X is expected to be 1.28 in 2030 and 1.29 in 2031. The weighted index is 1.284 ($=1/ (.6/1.28 + .4/1.29)$). If the TY30 cost of the system is \$1M, the CP\$15 cost in 2030 is \$0.84M ($=\$1M/1.184$).