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New Approaches to Defense Inflation and Discounting

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Department of Defense (DoD) cost analysts must have correct information to generate operations and maintenance (O&M) estimates to support effective decisionmaking. Uniquely positioned under the 2009 Weapon Systems Acquisition Reform Act (WSARA) to improve and support DoD cost analysis, the Office of Cost Assessment and Program Evaluation (CAPE) within the Office of the Secretary of Defense asked RAND to assess O&M costs associated with several ground vehicles. The RAND researchers perceived a related question that also needed to be addressed: How well are current inflation indices and discount rates serving DoD weapon-system program management today?

Inflation indices and discount rates are necessary tools in DoD’s acquisition process, as the final selection of a system is partially based on potential increases in sustainment costs (inflation) and the present value of future costs (discounting). This study assesses the accuracy of the inflation indices and the benefits of the policy guiding discounting and offers recommendations that may assist CAPE in supporting the work of weapon-system program cost analysts.

**Inflation Indices Do Not Reflect All Sustainment Realities**

Cost estimators rely on inflation indices to normalize data from disparate time periods. Inflation indices built for DoD use very broad categories that include O&M as well as manpower, procurement, and research and development. This study investigates inflation rates for parts for the Abrams tank, the Bradley armored personnel carrier (APC), the Stryker armored fighting vehicle, and the high-mobility multipurpose wheeled vehicle (HMMWV), using the Army’s operations and support (O&S) cost system, the Operating and Support Management Information System (OSMIS), parts records, and other sources. For brevity this document presents results for two of these programs, the Abrams and Bradley. Different methods are used to generate inflation rates over the 2001–2010 time period, including the Marshall-Edgeworth inflation index, in which National Item Identification Numbers (NIINs) are weighted by the frequency with which parts are purchased, for those parts purchased in every year, over the entire period of interest. Another method is the geometric-mean index, in which a base-year
price share is created for each item in the period of interest. For both approaches, the indices we present include NIINs that are demanded in every year of the 10-year period. If an analyst picked a shorter period of interest, it is likely that more parts would be captured every year in the data, as some parts have an inconsistent demand history. The economists who designed the revised Consumer Price Index (CPI) in 1998 used the geometric-mean approach because it allows for the natural substitution of goods. However, this approach may lead to chronic underestimation of parts costs for programs if substitutions for less-expensive parts cannot be made as prices rise.

Figure S.1 compares the results of using the two indices to estimate inflation for the Bradley APC, using the Army Master Data File (AMDF) price, which considers primarily reparable parts, including track, sights/scopes, circuit cards, transmissions, and engines.

The figure illustrates the cumulative effect of building several years of inflation upon one another to show overall price changes. The estimates using the Marshall-Edgeworth (or “basket of goods”) index are higher than those using the geometric-mean approach, as anticipated. The “basket of goods” approach is preferred for parts inflation, as DoD has limited ability to substitute parts. Figure S.1 also shows that the growth rates vary widely from year to year.

The Bradley inflation rates estimated using the Marshall-Edgeworth method are different from those outlined in the official Army O&M budget inflation in the Naval Center for Cost Analysis (NCCA) 2012 version of the inflation calculator and the published DoD National Defense Budget Estimates (Green Book) inflation index.

**Figure S.1**
Inflation of Bradley APC, Calculated with Marshall-Edgeworth and Geometric-Mean Inflation Indices

![Price level vs. Year](image_url)
The estimates made using the geometric-mean index are close to the official inflation prediction.

The desire to capture more parts than are reflected in the 10-year indices and to show changes in parts as a result of obsolescence and modifications results from the expectation that parts used in every year of a shorter period of time might capture more variation of interest. Estimators may want to use information provided in the FEDLOG data system, which indicates when parts have been modified or upgraded.1 The inflation picture changes when a constant basket of goods is observed over a shorter period of time, as shown in Figure S.2. The larger set of NIINs needed in a 5-year period results in a different view of inflation than that calculated with the 10-year indices. The 10-year-indices data are the same as those used in Figure S.1, but they have been rebaselined to 2006 for comparison with the 5-year data.

Inflation for more-recent parts shows a different pattern from that reflected in the 10-year index. The cumulative difference between the estimates from 2006 to 2010 is 3.5 percent. This result suggests that cost analysts should consider trends in recent parts usage on similar systems to improve future cost estimates.

The AMDF price is the cost of buying new parts from the industrial base (which includes working-capital fund cost recovery charges or surcharges), but program management offices are often interested in estimating the cost of purchasing a mix

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1 Parts regularly become obsolete because of advances in technology, changes in supplier availability, and modifications to platforms over time. While this analysis did not focus on which parts are interchangeable, that information is available in the FEDLOG section on interchangeable and substitutable (I&S) parts.
of new and depot-repaired parts. For this purpose, inflation can be calculated with the Marshall-Edgeworth index, using the exchange price, also known in the Army’s Operating and Support Management Information System (OSMIS) as the cost to the consumer. Figure S.3 contrasts inflation of the Bradley APC for the AMDF price and the exchange price, or cost to the consumer.

The exchange price shows much lower inflation than the AMDF price. In addition, the program experiences high variability in cost because of the variance in repaired-part prices.

The Defense Logistics Agency and the Army Materiel Command manage parts with a working-capital fund and add a surcharge to parts each year to cover costs; the surcharge is included in the indices presented here. It varies by up to 20 percentage points based on the overhead costs and sales (using lot average cost) forecast for a given year. Surcharge variation does play a role in parts costs inflation or deflation over time, and these price changes are very real for system operators. A major change in surcharges can significantly impact program and unit operations.

DoD Discounting Practices Do Not Deliver Least-Cost Decisions

Discounting is the process of taking into account the time value of money. Earlier expenditures carry more weight, and for DoD this means that acquisition costs are emphasized over sustainment costs. Discounting in the private sector typically balances near-term investment against future profits.

Figure S.3
Bradley APC Inflation, Calculated with the Exchange Price and AMDF Price
Government decisionmaking can also benefit from discounting. Government investments that impact the private economy are balanced against future societal costs and benefits. The discount rate in this case is the opportunity cost of private capital, which was set at 7 percent in 1992. For internal government investments, the discount rate is the Treasury’s borrowing rate, which varies by the length of the obligation and currently has a “real” (no inflation component) value of 1.1 percent for a 10-year project. This rate reflects the market’s preference for current consumption and the perception of the uncertainty in repayment due to risk of default. Inflation expectations also influence the market’s rate setting, but inflation is excluded from the real rate. When DoD decisions impact total federal borrowing, it makes sense to discount, but this is not always the case.

Choices made using discounted cash flows are not always the least expensive for DoD. For example, the cost to modify a DoD system to save $2 million a year for 10 years could not equal $19 million given current discounting guidance. The opportunity to net an overall savings of $1 million is forgone, even though there is no compensating interest savings to DoD. And the Treasury would save on interest expense only if the decision impacted the DoD top-line budget, which is unlikely in day-to-day investment decisions. Normal financial programming activities result in funds released by one action being consumed by another.

Consider the choice among companies providing logistics support to a weapon system. One firm could have a higher bid, but if its costs were biased to the later years of the contract, its discounted cost could be less. Using discounted cash flow to select that firm would incur a greater real-dollar expense and would diminish the funds available for other activities.

Today’s real 10-year rate is 1.1 percent, but as recently as 2007 it was 2.8 percent. Different discount rates will order alternative cash flows differently, impacting decisions. Likewise, discount rates during the execution of a program can be different, which would also impact a decision. To guard against selecting an incorrect alternative when discounting is used, the discount rate should be varied to determine the sensitivity of the choice to future market behavior.

When a significant program is canceled or retired early, or even extended past its originally planned lifespan, changes to the DoD top-line program can result. Cost estimators must provide decisionmakers with information on the range of costs and the range of risks to enable them to take into account the larger context for investment decisions. Discounted costs have often been portrayed as the clear line where investment decisions must be made. From a practical standpoint, however, lower discount rates place more weight on future costs, while higher discount rates place less weight

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2 See NYU Stern, undated.
on the future. We conclude that reality is more subtle than a single discount rate and a sensitivity analysis is needed, because a range of reasonable courses of action exists for many DoD investment decisions.

**Recommendations**

We present the following recommendations for CAPE to consider when evaluating the inflation and discounting policies that impact the long-term affordability of DoD programs.

- **Revisit O&M costs annually with a 5-year moving-average inflation.** The cost of repairing parts differs over time, sometimes dramatically, and DoD O&M estimating strategies should be reviewed to reflect changing repair and other costs. This analysis shows that two weapon systems, while both ground systems, experience inflation differently. Guidelines on how to develop individual system indices, posted online by CAPE or published in a handbook, could help the DoD acquisition community make more-accurate decisions for today’s systems, as well as for future purchases. For future systems, variants that are most similar to the system should be selected. The uncertainty in using a variant to estimate a future system is indicated by the percentage of total NIINs they have in common.

- **Show variation in working-capital surcharges.** The role of supply chain surcharges in parts costs should be highlighted in cost estimates and used to inform program financial analysis, as those surcharges have varied by up to 20 percentage points over the past two decades.

- **Expand analysis of investments to ensure consideration of least-cost outcomes.** Discounting at the Treasury rates can result in more-costly programs. Further analysis is indicated to allow decisionmakers the opportunity to make strategic decisions about investment, as follows:

  1. Discount the constant-dollar alternatives, using the appropriate Treasury rate from OMB Circular A-94, Appendix C.
  2. Refer to the Table of Past Years Discount Rates in OMB Circular A-94 to develop a range of recent discount rates to use in sensitivity analyses.
  3. Compare the undiscounted constant-dollar costs of the alternatives. This is the typical treatment of the cash-based federal budget (Kohyama, 2006).
  4. Where these analyses point to a preference for different alternatives, the decisionmaker will be informed about the economic and cost impacts of a decision.