A Model for Understanding the Relationship Between Transaction Costs and Acquisition Cost Breaches

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Cost Growth in DoD

- Controlling cost growth for major defense acquisition programs (MDAPs) has been problematic in the Department of Defense (DoD) for many years.

- A 2007 RAND study of 46 weapons system programs in DoD found an average of almost 50% cost growth from Milestone B (program initiation) (Obaid Younossi et. al 2007, xvi).

- According to the GAO, active MDAPs in FY 2011 collectively experienced a cost growth of $74.4B (GAO 2011, 2).
Transaction Costs

• Transaction costs are the costs associated with source selection, periodic competition and renegotiation, contract negotiation and management, performance measuring and monitoring and dispute resolutions.

• Although they are not often captured in the accounting records, the time and effort associated with these three types of transactions represent real costs to the organization.
Cost Breaches

• A cost breach is considered to occur when cost expenditures exceed the approved baseline cost estimate for an MDAP—also known as the acquisition program baseline (APB).

• If an MDAP has been officially rebaselined cost breaches are measured relative to the current baseline.
### Types of Cost Breaches

<table>
<thead>
<tr>
<th></th>
<th>APB Breach (RDT&amp;E, Procurement, MILCON, O&amp;M)</th>
<th>Nunn-McCurdy “Significant” Breach (PACU &amp; APUC)</th>
<th>Nunn-McCurdy “Critical” Breach</th>
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</thead>
<tbody>
<tr>
<td><strong>Current Baseline</strong></td>
<td>+10%</td>
<td>+15%</td>
<td>+25%</td>
</tr>
<tr>
<td><strong>Original Baseline</strong></td>
<td>N/A</td>
<td>+30%</td>
<td>+50%</td>
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Relationships

• A 2006 RAND study established that MDAP SE/PM costs vary between programs depending on the program type (Stem, Boito, and Younossi, 2006)

• Angelis et al. (2008) suggested using the SE/PM cost as a proxy for transaction costs to examine the relationship between transaction costs and cost overruns.

• Biggs (2013) showed that as the EAC SE/PM cost ratio rises there is a statistically significant corresponding increase in the probability of a cost threshold breach occurring.
SE/PM ratio

\[
\text{SE / PM Cost Ratio} = \frac{\text{SE / PM Costs}}{\text{Total Cost}}
\]
Interactions

- "MATURITY"
- TRANSACTION COSTS
- SE/PM COST RATIO
- RISK & COMPLEXITY
- COST OVERRUNS
- CONTRACT TYPE
- \( P_{\text{Pr}}(\text{APB,N-M BREACHES}) \)
- OBSERVED
- NOT OBSERVED
Data Sources

• Selected acquisition reports (SAR)
  – Cost threshold breaches
  – Program maturity (time since program initiation at Milestone B)
• Cost and software data reporting system (CSDR)
  – SE and PM costs
  – Type of contract
• A total of 32 MDAPs representing Air Force, Army, Navy, and Joint programs since 1988.
Possible Relationships

• Relationship between transaction costs (using the SE/PM cost ratio as a proxy) and the likelihood of cost breaches experienced by a program
  – Survival model looks at the hazard of cost breaches over program maturity time
  – Focus on Nunn-McCurdy breaches
Cox-Relative Hazard

\[ h_j(t) = h_0(t)\exp(x_j \beta_x) \]

The hazard a particular subject \( j \) faces at time \( t \) is a function of the baseline hazard modified proportionally by the vector of regression coefficients \( \beta_x \).
Cumulative Risk of APB Breach
Cumulative Risk of Nunn-McCurdy Breach
Significant Results

• APB breaches
  – A one percentage point increase in estimated SEPM at completion increases the risk of breach by 3-5%
  – The estimated impact is reduced in the model with to date SEPM, where it is about 2% when we do not control for contract type
  – Cost-plus programs are two to three times more likely to experience a cost breach
Significant Results

• Nunn-McCurdy breaches
  – In the model where we do not control for contract type, breaches are about 4% more likely per one percentage point increase in SEPM estimate at completion
Conclusion

• It seems reasonable to assume that higher SEPM ratios can be associated with more complex and risky programs.

• Our results suggest that the SEPM ratio is a promising measure of the likelihood that such programs will experience a cost breach.

• Program managers and others interested in controlling cost growth in DoD programs should consider using the SEPM ratio as an early indicator of the risk of a cost breach.