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*Cancellations and Delays in
Completion of Department
of Defense A-76 Cost
Comparisons*

Edward G. Keating

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National Defense Research Institute

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D O C U M E N T E D B R I E F I N G

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*Cancellations and Delays in
Completion of Department
of Defense A-76 Cost
Comparisons*

Edward G. Keating

*Prepared for the
Office of the Secretary of Defense*

National Defense Research Institute

PREFACE

The Department of Defense (DoD) is considering expanding its use of contractors (outsourcing). This documented briefing examines the recent history of A-76 public/private cost comparisons in the DoD using data covering fiscal years 1978–1994. A-76 refers to the Office of Management and Budget (OMB) Circular A-76, which describes the process of competition for work between government employees and contractors. A fuller understanding of this history may provide insights as to how future outsourcing endeavors might progress as well as suggest possible policy changes to improve future outcomes. The hope is that outsourcing might reduce infrastructure costs and/or increase military effectiveness.

This research is part of a project entitled "Options for Managing Future Budget Constraints" undertaken for the Deputy to the Under Secretary (Policy) for Policy Support in the Office of the Under Secretary of Defense for Policy. The research was conducted within the International Security and Defense Policy Center of RAND's National Defense Research Institute (NDRI), a federally funded research and development center sponsored by the Office of the Secretary of Defense, the Joint Staff, and the defense agencies.

The work should be of interest to individuals involved in A-76 cost comparisons inside and outside the Department of Defense as well as policymakers interested in improving the comparison process.

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SUMMARY

As the Department of Defense considers expanding its use of contractors, we attempted to glean lessons and insights from the recent DoD history of government/contractor cost comparisons.

Previous studies, e.g., Savas (1992), Marcus (1993), Uttley (1993), Tighe et al. (1996), argue there is significant potential for savings and other improvements from competition and outsourcing. However, we find that since 1978 there have been approximately five A-76 cost comparisons canceled for every eight completed.¹ Further, those completed have typically taken about two years (and often considerably longer) to complete. If the DoD is to fully benefit from competition, it would be beneficial to understand and reduce cancellations and delays in A-76 cost comparisons.

Outsourcing in the DoD has taken a variety of approaches. For example, new missions, such as maintaining a new weapon system, can be assigned to contractors directly without a government/contractor cost comparison. Also, there is a process called "direct conversion" whereby functions employing ten or fewer civilians can be turned over to contractors without a government/contractor cost comparison. However, this briefing focuses exclusively on the subset of attempted and completed outsourcing actions that has involved government/contractor cost comparisons that occurred between FY 1978 and FY 1994.

Government/contractor cost comparisons follow the process described in Office of Management and Budget Circular A-76. A cost comparison is announced, a work statement describing the performance required is drafted, and a decision is reached as to whether a contractor or government employee "Most Efficient Organization" (MEO) is the cheapest approach.

BACKGROUND ON DOD COST COMPARISONS

When a function at an installation is selected for cost comparison, a record is set up in a data file called the Commercial Activity Management Information System (CAMIS). We obtained a copy of the DoD's CAMIS

¹"A-76" refers to the Office of Management and Budget Circular that describes the process of competition for work between government employees and outside contractors.

data for FY 1978–1994. There were cost comparisons in the DoD prior to 1978 and there have been cost comparisons since 1994, but our data do not cover them. The number of cost comparisons undertaken DoD-wide dropped sharply in the 1990s, down from a peak of activity in the late 1970s and early 1980s.

Cost comparison cancellation has been a major problem. Whereas the DoD completed 2268 cost comparisons between FY 1978 and FY 1994, another 1418 were canceled.

PATTERNS OF COST COMPARISON CANCELLATION

Controlling for other factors, cost comparisons evaluating large numbers of government-employed civilians were disproportionately prone to cancellation. Indeed, five of the six largest cost comparisons (in terms of the number of government-employed civilian slots evaluated) attempted in the DoD between FY 1978 and FY 1994 were ultimately canceled. If a study is canceled, the status quo (generally provision of work by government employees) continues.

The Marine Corps, the Defense Logistics Agency, and, especially, the Defense Mapping Agency have had problems with cost comparison cancellations. Education and Training and Manufacturing cost comparisons have also been vulnerable to cancellation.

Some cost comparison cancellations may have emanated from the policy first promulgated in the FY 1991 Appropriations Act of canceling single function cost comparisons after two years if they have not yet reached bid opening. This policy applied to cost comparisons in progress at the time as well as those started since FY 1991. Perhaps reflecting the influence of this policy, cost comparisons started in the late 1980s were particularly prone to cancellation.

HISTORICAL DURATION OF COST COMPARISONS

We looked at the elapsed calendar days between the announcement of a cost comparison and the date of an initial decision as to who should provide the service. The median cost comparison completion took 664 days to the initial decision; the mean was 810 days. Over 10 percent of completed cost comparisons took at least four years to the initial decision.

We undertook regression estimation in an attempt to find correlates with completed cost comparison duration. The Marine Corps' and the Army's

cost comparisons have been slower than the other services', controlling for other factors. Completion speed also varied by the type of function evaluated.

ACKNOWLEDGMENTS

The author appreciates the project leadership of David Chu and Ellen Pint on this research. Marc Elliott of RAND and Samuel Kleinman of the Center for Naval Analyses (CNA) provided thoughtful reviews. Carol Ellis, Susan Gates, Phyllis Gilmore, Susan Hosek, Kathy Mills, Nancy Moore, Jeanne Nazimek, Al Robbert, Irene Sanchez, Regina Sandberg, Mark Wang, and Stephanie Williamson provided key assistance. Frank Camm and Chris Hanks were co-authors on related research that helped shape this study; see Keating, Camm, and Hanks (1997). Jeanne Heller edited this document. Jan Hanley, Rachel Louie, and Sue Polich provided computer assistance. Susan Adler provided library assistance. This research was briefed to Dr. David L. McNicol, Deputy Director (Resource Analysis), Office of the Secretary of Defense, Director (Program Analysis and Evaluation) and his staff on September 10, 1996 and to Mr. Frederick L. Frostic, Deputy Assistant Secretary (Requirements and Plans), Office of the Secretary of Defense, Assistant Secretary of Defense (Strategy & Requirements) and his staff on September 11, 1996. Of course, any remaining errors are the author's responsibility.

Cancellations and Delays in Completion of DoD A-76 Cost Comparisons

This briefing presents DoD-wide data on A-76 cost comparisons attempted between Fiscal Year (FY) 1978 and FY 1994 (the last year for which DoD-wide data are available). A-76 refers to the Office of Management and Budget Circular A-76 that prescribes a specific process for competition between government employees and contractors for workload. We use the term "cost comparison" in this briefing as a shorthand for such A-76 endeavors.

This analysis of past cost comparisons may suggest what may occur if the DoD chooses to expand such cost comparisons in the future. Further, pointing out some past challenges may suggest areas for possible policy changes. Obviously, the DoD wishes that its outsourcing efforts result in maximum possible cost savings and/or military effectiveness.

It is important to note, however, that the DoD can and has outsourced work through processes other than the A-76 procedure we analyze here. For example, new missions, such as maintaining a new weapon system, can be assigned to contractors directly without a government contractor cost comparison. Also, in a process called "direct conversion," functions employing ten or fewer civilians can be turned over to contractors without a government/contractor cost comparison. Hence, this briefing analyzes a subset, albeit an important one, of attempted and completed outsourcing actions in the DoD.

Outline

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- •Background on DoD Cost Comparisons
 - Patterns of Cost Comparison Cancellation
 - Background on Completed Cost Comparisons
 - Historical Duration of Cost Comparisons
 - Concluding Observations

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We will first provide some background data on cost comparisons attempted in the DoD between fiscal years 1978 and 1994.

We Obtained the DoD CAMIS Data

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- Information on A-76 Cost Comparisons DoD-wide**
- Covers 2268 completed, 1418 canceled, 91 in-progress cost comparisons from FY 1978 to FY 1994**

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Cost comparison data are recorded in a system called the Commercial Activity Management Information System (CAMIS). A CAMIS record is set up every time a function is nominated for A-76 cost comparison. A record is then kept of these nominated cost comparisons, e.g., the function and installation involved, the dates of various milestones, and, ultimately, the outcome (completion or cancellation) of the cost comparison.

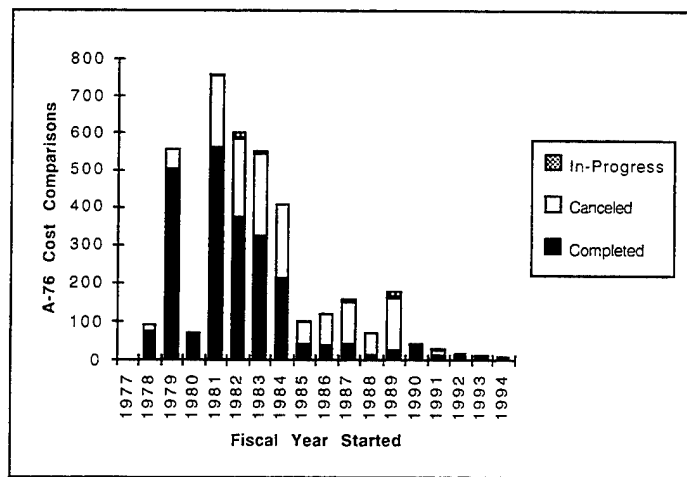
As noted, DoD can and has used other avenues to outsource work. For example, when 10 or fewer civilian positions are evaluated, a direct conversion can be used where the choice is only among contractors.

The data analyzed in this report, however, cover only A-76 public/private cost comparisons.

Further, the DoD outsourced positions prior to FY 1978. For example, a large installation support contract was started at Vance Air Force Base in the early 1960s. See Shishko, Paulson, and Perry (1977). Similarly, Los Angeles Air Force Base has used contracting extensively since a number of maintenance and other service contracts were put in place prior to the installation officially becoming an Air Force Station in April 1964. Our data, however, extend back only to FY 1978. Also, there have been cost comparisons since 1994; they are not considered here either.

The Number of Cost Comparisons Started and Completed Sharply Declined in the mid-1980s

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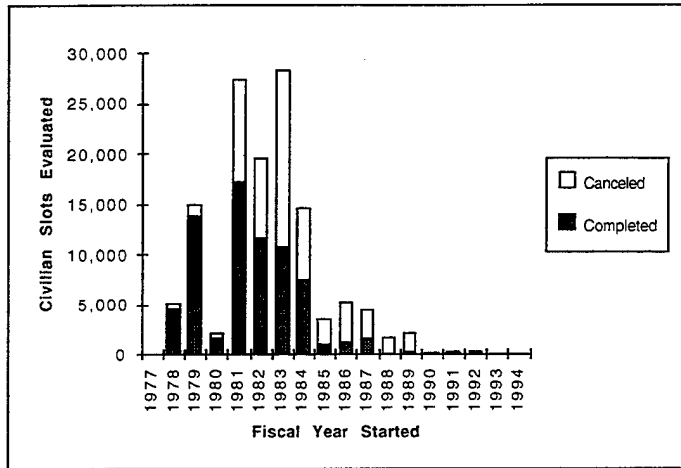
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This figure plots the number of completed, canceled, and in-progress cost comparisons by year started, as of FY 1994, the last year for which such data are available DoD-wide. We see a sharp diminution in the number of cost comparisons started from FY 1985 forward, with very few comparisons started DoD-wide in the 1990s. Further, the figure shows the rate of cancellation was greater for those cost comparisons started in the late 1980s rather than in the early 1980s. Hence, between the reduction in the number of comparisons started and the increase in the comparison cancellation rate, there was a sharp drop in the number of completed comparisons.

In total, this figure covers 2268 completed, 1418 canceled (or roughly an 8 to 5 ratio of completed-to-canceled comparisons), and 91 cost comparisons in progress as of FY 1994. Some of the in-progress designations seem somewhat suspect, though. For example, there are 15 cost comparisons announced in FY 1982 still officially recorded as in progress.

Government-Employed Civilian Slot Evaluation Peaked in the Early 1980s

NDRI



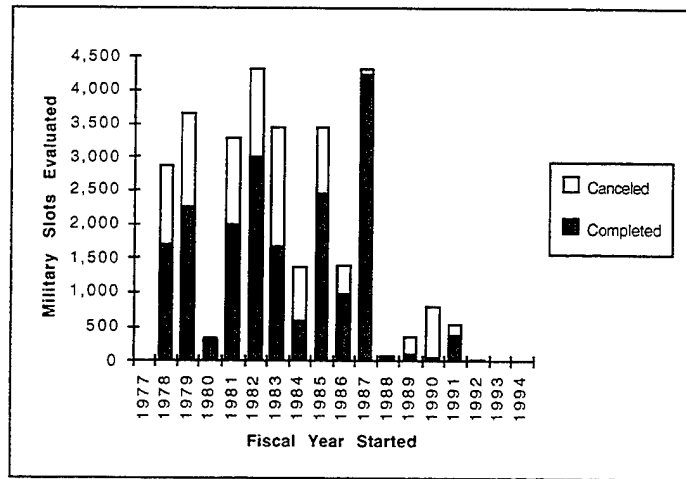
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This figure shows the number of government-employed civilian slots evaluated by starting fiscal year. In aggregate, 70,897 civilian slots were evaluated in completed cost comparisons; another 59,374 were evaluated in cost comparisons that were ultimately canceled.

On page 4, we noted there was roughly an 8 to 5 ratio of completed to canceled cost comparisons. On the basis of civilian slots evaluated, however, the completed/canceled ratio is closer to 6 to 5. This result presages an upcoming finding that cost comparisons that evaluated large numbers of government-employed civilians were disproportionately prone to cancellation.

FY 1987 Had the Most Military Slots Successfully Evaluated

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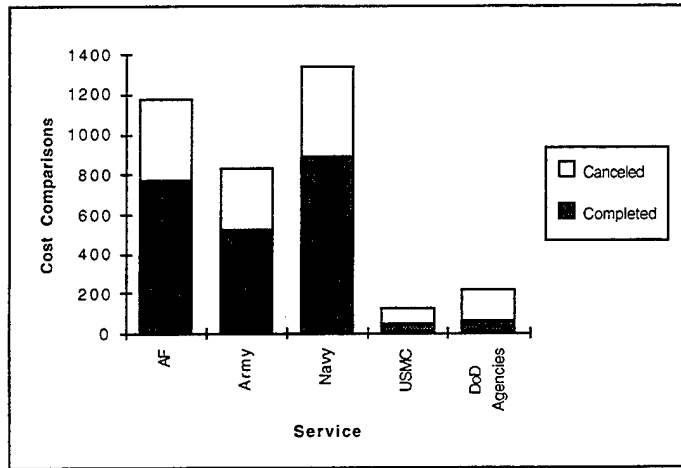
Evaluation of military slots in A-76 cost comparisons peaked somewhat later than evaluation of civilian slots.

Closely mirroring page 4's results, there was roughly an 8 to 5 ratio of military slots in completed A-76 cost comparisons to military slots in canceled cost comparisons.

In addition to the slots in this figure, many military slots were evaluated in direct conversions. See Keating, Camm, and Hanks (1997).

The Navy and Air Force Have Started and Completed the Most Cost Comparisons

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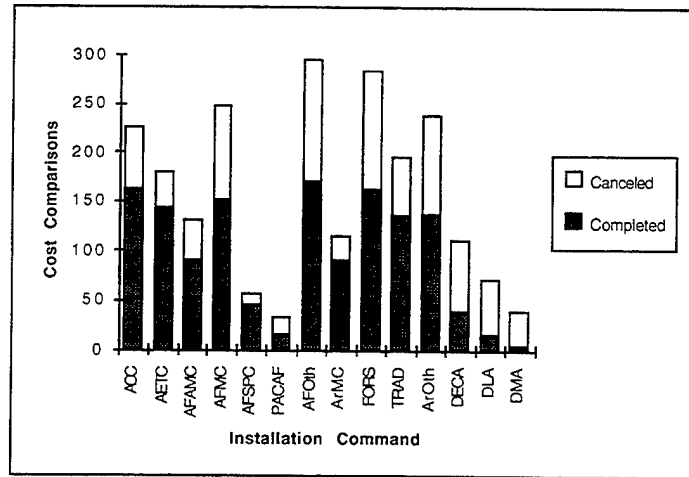


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This figure plots the number of completed and canceled cost comparisons by service. The Navy has started (1337) and completed (883) the most cost comparisons. The Air Force's totals (1192 started, 767 completed) are close behind the Navy's.

Command Installations Have Different Cost Comparison Histories

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This figure reprises page 7's data, but breaks the Air Force and Army into constituent command installations and the defense agencies into the three DoD agencies that have undertaken cost comparisons. The number of comparisons started and completed varies considerably across the commands.

Defining the acronyms: ACC is Air Combat Command, AETC is Air Education and Training Command, AFAMC is Air Force Air Mobility Command, AFMC is Air Force Materiel Command, AFSPC is Air Force Space Command, PACAF is Pacific Air Forces, AFOth is other Air Force commands (e.g., Special Operations Command), ArMC is Army Materiel Command, FORS is Forces Command, TRAD is Training and Doctrine Command, ArOth is other Army commands (e.g., United States Army Pacific), DeCA is Defense Commissary Agency, DLA is Defense Logistics Agency, and DMA is Defense Mapping Agency. For the Army and Air Force, the installations are identified with their current commands. It is possible the installations were actually associated with different commands (for example, the now-extinct Strategic Air Command) when the cost comparison was undertaken.

Outline

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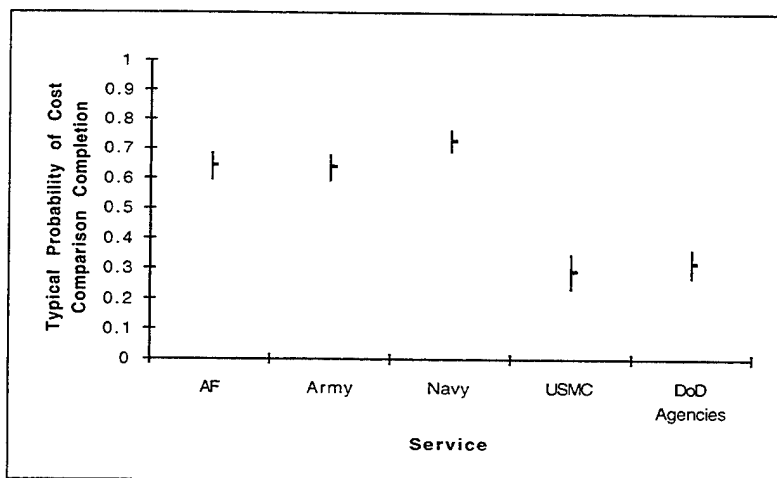
- Background on DoD Cost Comparisons
- •Patterns of Cost Comparison Cancellation
- Background on Completed Cost Comparisons
- Historical Duration of Cost Comparisons
- Concluding Observations

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Next, we are going to analyze the pattern of cost comparisons canceled versus completed. Because there have been roughly five cost comparisons canceled for every eight completed, and considering the nontrivial costs of fruitlessly undertaking a cost comparison, cost comparison cancellation has been a serious problem.

Defense Agency, Marine Corps Cost Comparisons Have Been Most Frequently Canceled

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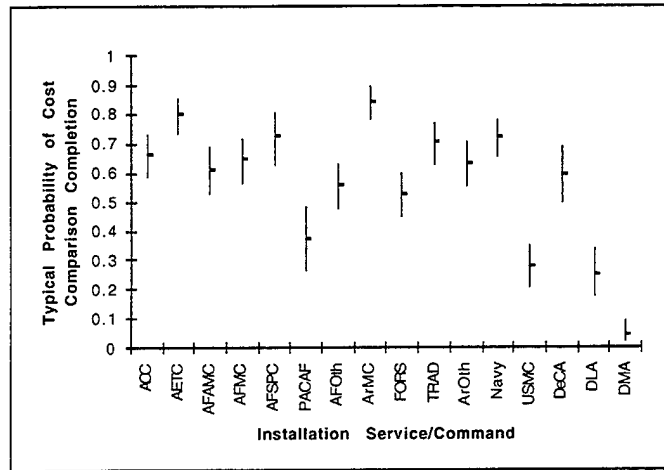
We undertook a probit estimation to evaluate whether service, type of function, time period, number of slots evaluated, or other factors influenced the probability a cost comparison would be completed versus canceled. (In-progress cost comparisons were not considered.) The appendix details the probit estimation results.

In this figure, we show our probit estimates for the propensity of services to complete their cost comparisons, controlling for differences in the type of function, time period, number of slots evaluated, and other factors. The middle tick on each line represents our best probit estimate of the services' probability of completing their cost comparisons with other variables evaluated at their mean values. The line on each side of the tick approximates plus and minus one standard error around each service's estimate. Two services' estimates are statistically significantly different at the 95 percent confidence level if their lines do not overlap.

This estimation suggests the Defense agencies and the Marine Corps (USMC) have had particular difficulty in concluding cost comparisons, controlling for other factors. The Navy has had the greatest success in completing cost comparisons. There could be lessons from the three largest services for the USMC and the defense agencies.

DMA, DLA, Marine Corps Cost Comparisons Have Been Most Frequently Canceled

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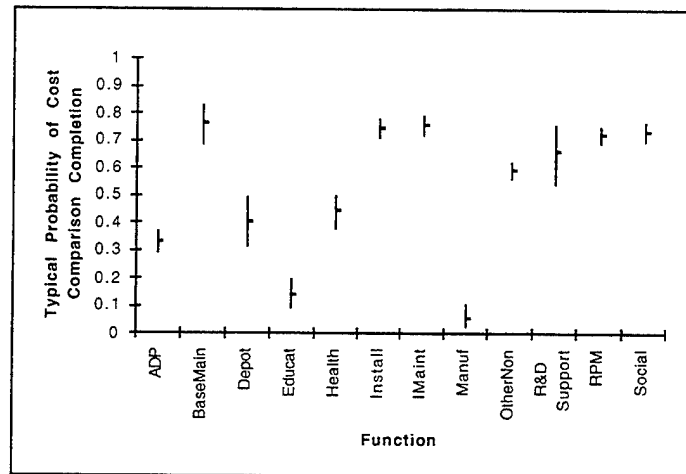


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This figure repeats page 10's analysis, but breaks the Army, Air Force, and DoD agencies into constituent components. Among Air Force command installations, Pacific Air Force (PACAF) installations have had particular problems in completing cost comparisons. Army Materiel Command (ArMC) installations have been most successful in completing cost comparisons. Meanwhile, among DoD agencies, the Defense Commissary Agency (DeCA) has done comparatively well, but the Defense Logistics Agency (DLA) and, especially, the Defense Mapping Agency (DMA) have had problems completing cost comparisons.

Manufacturing, Education and Training Cost Comparisons Have Been the Most Likely to Be Cancelled

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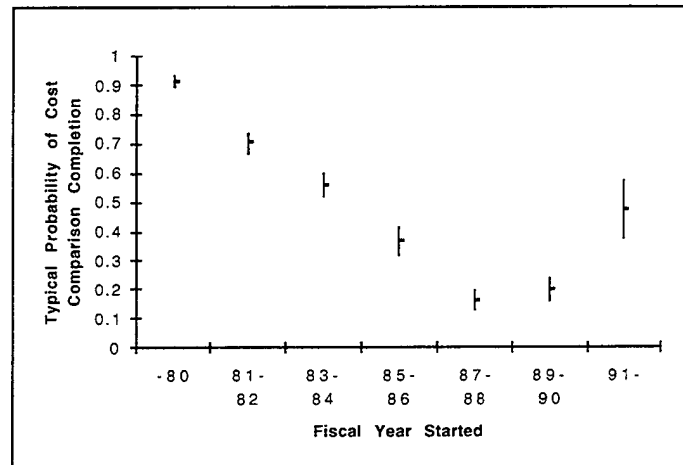
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This figure shows the estimated probabilities of concluding cost comparisons by function, controlling for other factors. Base Maintenance (BaseMain), Intermediate Maintenance (IMaint), and Installation Services (Install) cost comparisons were most often concluded. Cost comparison cancellation has been most common for In-House Manufacturing (Manuf) and Education and Training (Educat).

Defining the rest of the abbreviations: ADP is Automatic Data Processing, Depot is Depot Repair, Health is Health Services, OtherNon is Other Nonmanufacturing, R&D Support is Research and Development support, RPM is Real Property Maintenance, and Social is Social Services. Unlike R&D support, pure Research and Development is exempted from A-76 cost comparison. In practice, however, this distinction is fuzzy. See Tighe, Trunkey, and Kleinman (1996).

Late 1980s' Cost Comparisons Were Particularly Vulnerable to Cancellation

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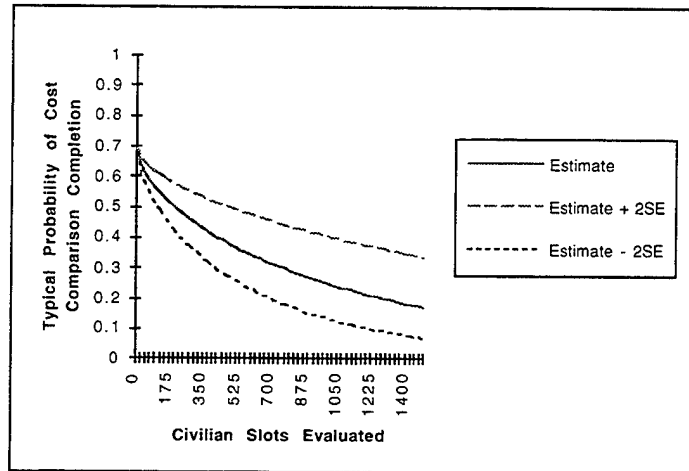
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This figure shows that cost comparisons started in the late 1980s were particularly vulnerable to cancellation. One possible reason is the policy first promulgated in the FY 1991 Appropriations Act of canceling single function initiatives after two years and multifunction initiatives after four years if they have not yet reached bid opening. This legislation applied to comparisons in progress at the time, as well as those started FY 1991 and later. Hence, a comparison started in FY 1987 but not yet completed in FY 1991 was to be immediately terminated.

It is also interesting to recall that page 4 indicated the number of comparisons started plunged in the late 1980s. An overburdening of contracting personnel was clearly not an explanation for this figure's pattern.

The More Government-Employed Civilians Evaluated, the More Likely Is Cost Comparison Cancellation

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Our estimation suggests that cost comparisons involving more government-employed civilians were less likely to be completed, controlling for other factors. The center line in the above figure is our best probit estimate of this tendency; the other lines are plus and minus two standard errors around this estimate. The data suggest large cost comparisons have been difficult to complete.

The scale on this figure was constructed to cover the range of cost comparison sizes attempted DoD-wide. The median attempted cost comparison, however, evaluated only 12 civilian slots whereas only 5 percent of the attempted comparisons evaluated more than 150 civilian slots. As discussed in the appendix, we used the square root of the number of civilian slots evaluated as the independent variable to reduce the right skewness in these data.

The largest competition started in the data set was a 1407 civilian slot clothing and textiles cost comparison at the Defense Personnel Support Center (DPSC) in Philadelphia that was canceled. The second largest attempted cost comparison and the largest completed cost comparison was a 1057 slot installation support competition at Aberdeen Proving Ground. However, the 3rd through 6th largest attempted cost comparisons (853 slots at the Fort Benning Directorate of Engineering and Housing, 840 slots at the Fort Benning Directorate of Logistics, 811 slots in base supply operations at Sunny Point Military Ocean Terminal, and 790 slots at the Crane Army Ammunition Plant Directorate of Logistics) were all canceled.

The appendix discusses a supplemental estimation that suggests these civilian slot cancellation problems are most acute in the Army. By contrast, the larger Air Force cost comparisons were not disproportionately prone to cancellation.

Bolten, Halliday, and Keating (1996) note that the Army's Fort Riley Directorate of Logistics has chosen to have a set of small contracts. By contrast, the Fort Riley Directorate of Public Works attempted to set up a large contract, but failed to do so after six years of effort. These results are consistent with the Fort Riley experience.

Outline

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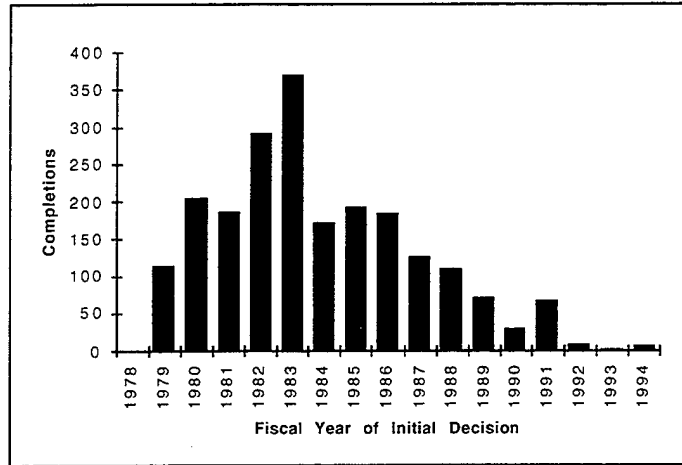
- Background on DoD Cost Comparisons
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Next, we provide some background information on those cost comparisons that were completed.

Cost Comparison Completions Peaked in the Early 1980s

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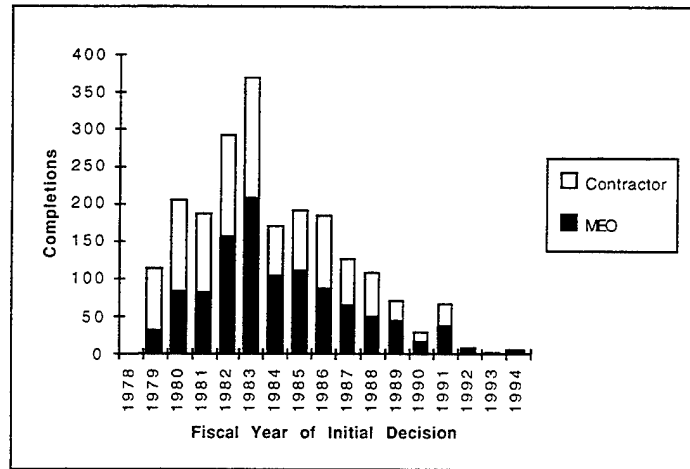
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The above figure tallies completed cost comparisons by year of initial decision. Fiscal Year (FY) 1983 with 370 completions was the DoD's peak. By contrast, only 113 cost comparisons were completed in the first five fiscal years of the 1990s.

In this and subsequent figures, we look at 2134 cost comparison completions, rather than the 2268 discussed earlier. We limited ourselves to cost comparisons for which the CAMIS record indicates the dollar value and duration of the award. Completed cost comparisons missing these data were not useful in our analysis.

Government Employees, Contractors Each Won About Half of Cost Comparisons

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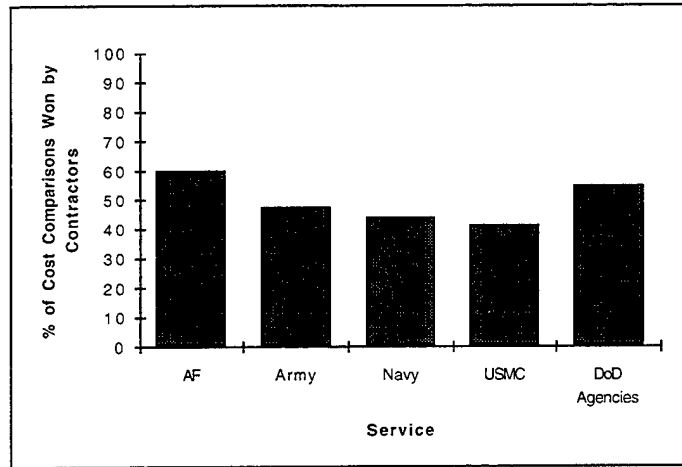


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Government employees (here labelled "MEO" for Most Efficient Organization, the designation given to the government employees' proposed approach) and contractors have almost exactly split the 2134 completed cost comparisons. Government MEOs have won 1055 cost comparisons versus 1079 won by contractors.

Contractors Have Had the Greatest Success Rate in the Air Force

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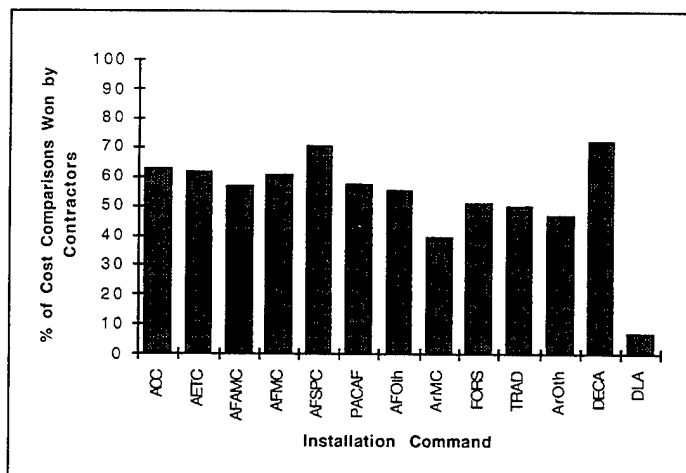


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The above figure tallies the percentage of cost comparisons won by contractors versus government-employee MEOs across the services. Contractors have had greatest success in the Air Force, winning 60.0 percent of cost comparisons, versus 47.5 percent in the Army and 43.6 percent in the Navy.

Contractor Success Rates Vary Widely Across Commands and Agencies

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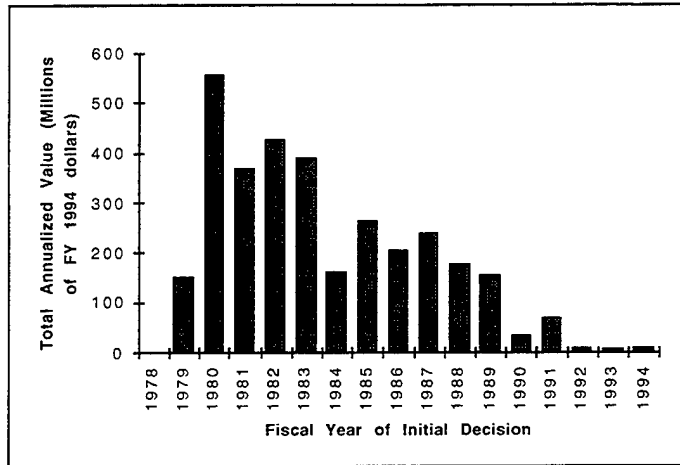


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The percentage of contractor versus MEO awards across Army and Air Force command installations plus the defense agencies are shown above. In percentage terms, contractors have been least successful in the Defense Logistics Agency (winning 7.1 percent of cost comparisons) and at Army Materiel Command installations (39.1 percent) and most successful in the Defense Commissary Agency (71.8 percent) and at Air Force Space Command installations (70.5 percent).

Real Dollar Value of Completed Cost Comparisons Has Declined Since FY 1980

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This figure presents the annualized FY 1994 dollar value of completed cost comparisons by year of completion.

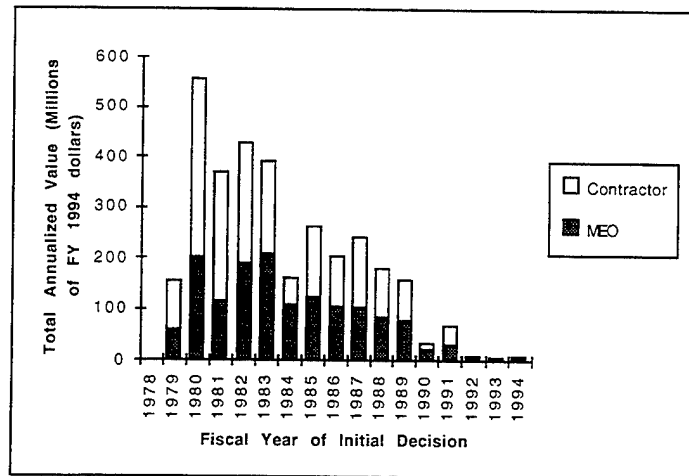
The annualized value represents the cost of the winning contractor or government-employee bid divided by the agreement's duration in years. The appendix presents the multipliers used to convert all totals into FY 1994 dollars.

In annualized FY 1994 dollars, FY 1980 was the peak year for completed cost comparisons at \$557 million. By contrast, \$132 million worth of cost comparisons were completed in the first five fiscal years of the 1990s.

There is no clear pattern in the average annualized FY 1994 value per completion by fiscal year. The median completed cost comparison had an annualized value of \$474,000; the mean was \$1,515,000. Five percent of the completions had annualized value less than \$59,000; 5 percent had annualized value greater than \$6,076,000. The average value ranged from \$0.9 million for comparisons completed in FY 1984 to \$3.9 million for the two comparisons completed in FY 1993.

Contractors Won Somewhat More Dollar Value Than Government Employees

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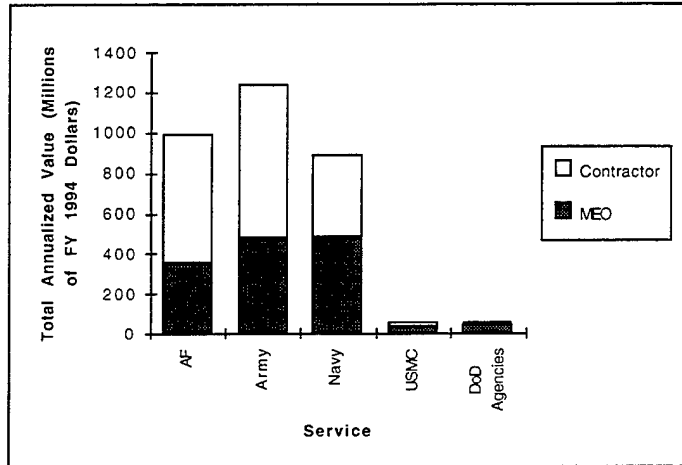


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In annualized FY 1994 dollar terms, contractors have won about \$1.8 billion worth of cost comparisons (57.1 percent) versus about \$1.4 billion won by government-employee MEOs (42.9 percent). Hence, combining this figure's results with page 18's, it follows that the average cost comparison won by contractors is somewhat larger than the average cost comparison won by government employees (\$1.7 million versus \$1.3 million in FY 1994 dollars).

The Army Has Completed Cost Comparisons Encompassing the Greatest Value

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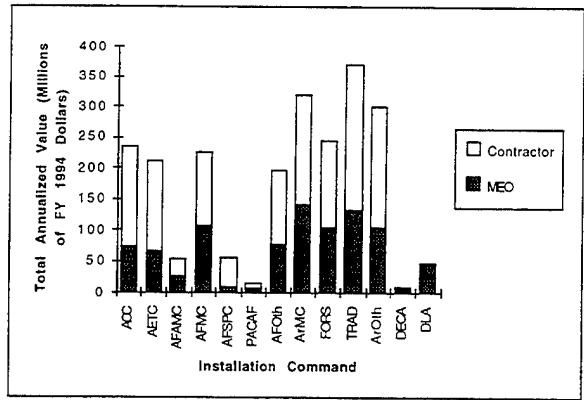


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This figure shows annualized dollars won by service. Note that whereas the Navy and the Air Force completed the most cost comparisons (776 and 760, respectively, versus 501 for the Army), the Army's completed cost comparisons sum to the greatest annualized value. The Army's average completed cost comparison was worth about \$2.5 million in annualized FY 1994 value versus \$1.3 million for the Air Force and \$1.1 million for the Navy.

TRADOC, ArMC Installation Comparisons Covered Greatest Value

NDRI

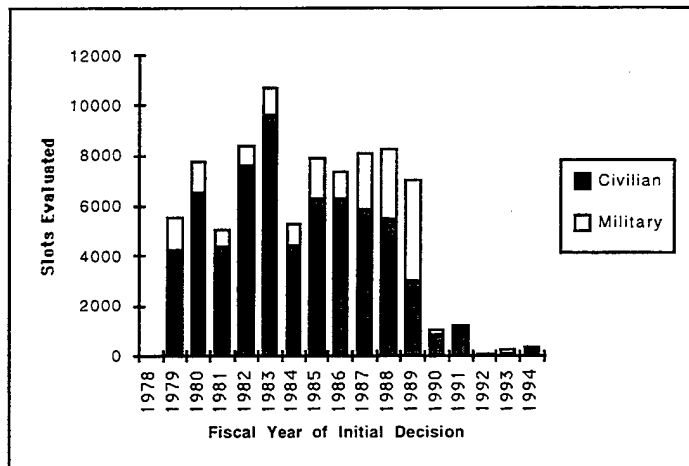


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The Army's Training and Doctrine Command (TRAD) installations and Materiel Command (ArMC) installations had the greatest value in completed cost comparisons, notwithstanding that page 8 showed the Army's Forces Command installations (158) as well as the Air Force's Air Combat Command installations (157), Air Education and Training Command installations (140), and Air Force Materiel Command installations (149) completed more cost comparisons than either TRAD installations (132) or ArMC installations (87).

A-76 Cost Comparisons Primarily Evaluated Government-Employed Civilians

NDRI

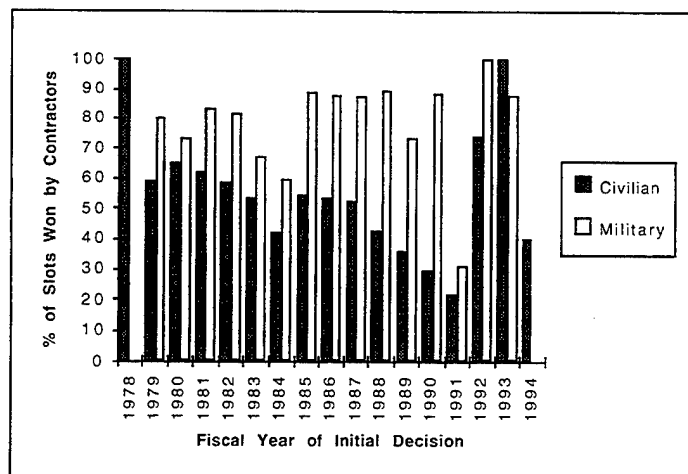


RAND

Most A-76 cost comparisons have evaluated government-employed civilian slots rather than military slots. In total, 65,741 government-employed civilians and 18,973 military had been evaluated in cost comparisons as of FY 1994. The median completed cost comparison evaluated 12 civilian slots; the mean was 31 civilian slots. Five percent of the completions evaluated 1 or 0 civilian slots; 5 percent evaluated 125 or more government-employed civilian slots. The median completed cost comparison evaluated 0 military slots; the mean was 9 military slots. Five percent of the completions evaluated 26 or more military slots.

Contractors Have Won 80% of Military Slots, Half of Civilian Slots Subject to Cost Comparison

NDRI



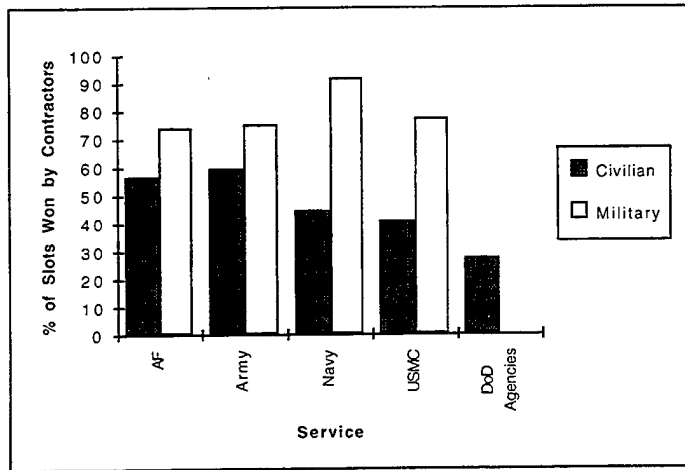
RAND

Not surprisingly, contractors have had a lower success rate winning government civilian slots cost-compared versus military slots cost-compared. 52.7 percent of government civilian slots subject to cost comparison resulted in a contractor winning, but contractors won 78.8 percent of the military slots subject to cost comparison. Government employees are much better positioned to retain workload they currently perform than to acquire workload currently performed by military personnel.

Marcus (1993) argues that commercial activities performed predominantly by military personnel hold disproportionate potential for cost savings.

In All Services, Contractors Have Usually Won Military Slots

NDRI

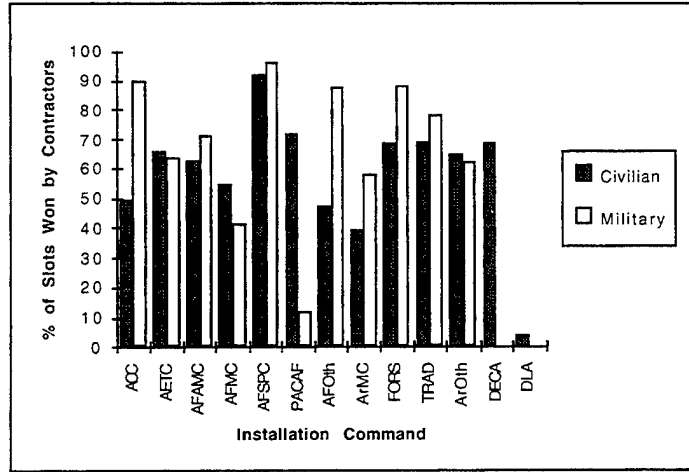


RAND

Echoing page 26, contractors won the predominant portion of military slots cost-compared in all services (e.g., 91.5 percent in the Navy, 74.8 percent in the Army, 74.2 percent in the Air Force). Contractors have had less success winning civilian slots, although contractors have won more than half the civilian slots competed in the Army (59.4 percent) and Air Force (56.6 percent).

Contractor Success Rates Have Varied Considerably Across Commands

NDRI

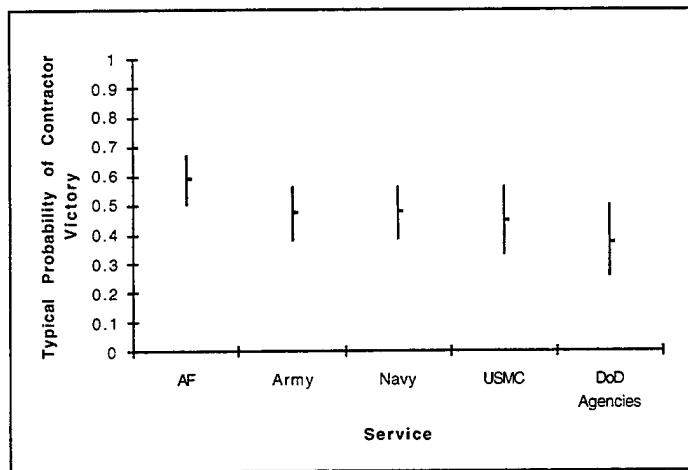


RAND

This figure breaks up page 27's data for the Air Force and Army command installations and the DoD agencies.

Contractors Have Had Greatest Success in Air Force Cost Comparisons

NDRI



RAND

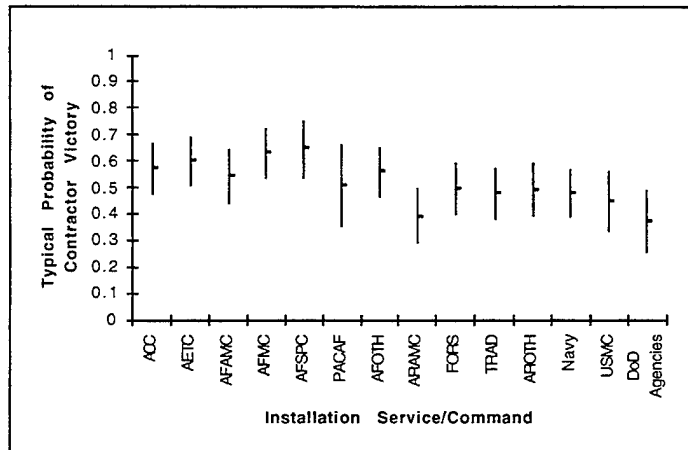
We ran a probit estimation to analyze when contractors, as opposed to government-employee MEOs, have won cost comparisons. The details are in the appendix.

This estimation controls for the fact that different services have, for example, different functional mixes. Raw contractor win rates, as discussed above, do not control for such functional mix differences.

Hence, for example, whereas page 27 showed contractors had a slightly higher success rate competing for civilian slots in the Army than in the Air Force, this estimation suggests that contractors have had the greatest relative success in Air Force cost comparisons, controlling for other factors, such as the type of function competed.

Contractors Have Done Best at Air Force Space Command Installations, Worst in DoD Agencies

NDRI

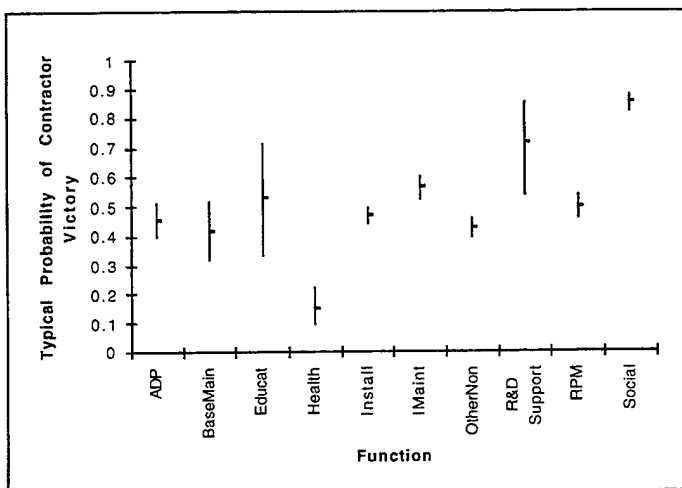


RAND

This figure breaks up page 29's results for the Air Force and Army command installations.

Contractors' Win Rates Have Varied Significantly by Function

NDRI



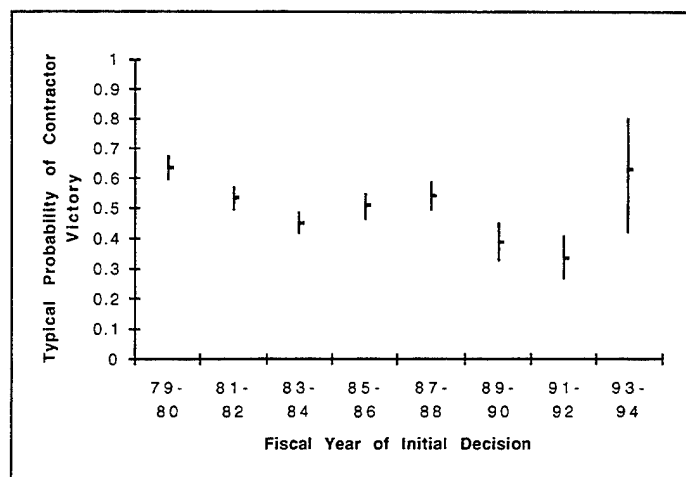
RAND

Contractors have had the greatest success in Social Services' cost comparisons and the least success in Health Services' cost comparisons, controlling for other factors.

There were nine completed Depot Repair cost comparisons, all won by government-employee MEOs, and two completed Manufacturing cost comparisons, both won by contractors. Because of the lack of variance in these functions' outcomes, they could not be included in this probit estimation.

Contractors Had Least Success in the Late 1980s

NDRI



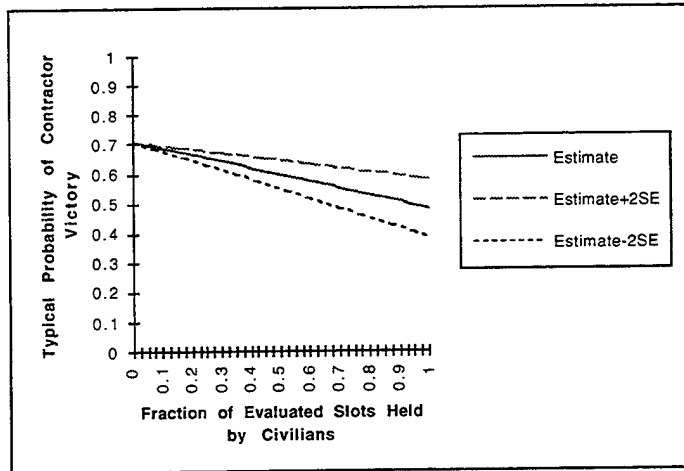
RAND

Controlling for other factors, contractors had least success winning cost comparisons completed in the late 1980s.

The 1993–1994 standard error is large because of the small number of comparisons completed during those years.

Contractors Have Had Greater Success When Military Slots Are Evaluated

NDRI



RAND

Our results suggest that cost comparisons that predominately involve military-held slots are more likely to be won by a contractor than cost comparisons involving government-employed civilian-held slots. It is not surprising that government employees appear to be better positioned to win cost comparisons involving functions already performed predominately by government-employed civilians.

Outline

NDRI

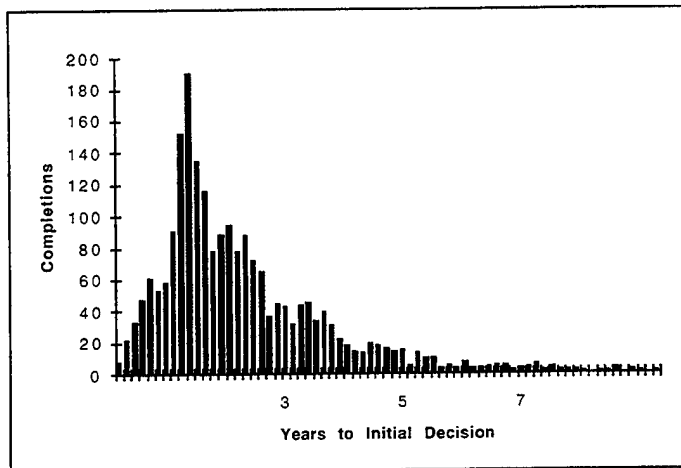
- Background on DoD Cost Comparisons
- Patterns of Cost Comparison Cancellation
- Background on Completed Cost Comparisons
- •Historical Duration of Cost Comparisons
- Concluding Observations

RAND

Next, we analyze the durations of completed cost comparisons.

The Cost Comparison Process Has Been Lengthy and Variable

NDRI



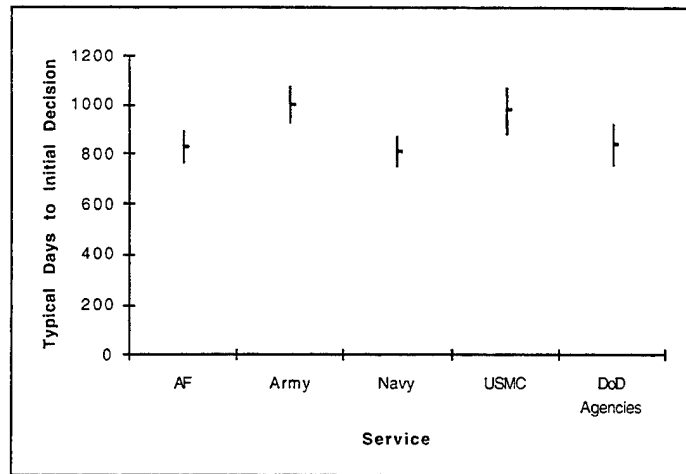
RAND

The DoD CAMIS file contains date stamps that record the duration of the cost comparison process. The above figure plots the distribution of realized durations between the date a cost comparison is announced and the date of an initial decision. We focus on the time from the announcement date to the initial decision date in this analysis. The performance start date is missing on many records. However, when it is included, the winning contractor or government employees often started performance prior to the final decision date. The final decision date falls, on average, 92 days after the initial decision.

The figure shows that the cost comparison process has been both lengthy (median duration of 664 days, mean duration of 810 days) and highly variable. Five percent of the completed cost comparisons took 189 or fewer days; 5 percent took 1902 or more days.

The Marine Corps and Army Cost Comparisons Have Been the Slowest

NDRI



RAND

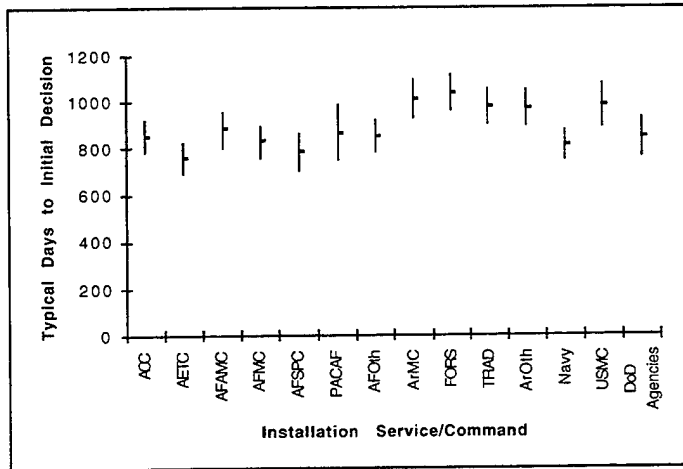
We attempted to find independent variables that explained the realized duration of cost comparisons. We looked at factors such as the command/service, function, year of completion, and the number of slots evaluated. See the appendix for the complete results.

This figure shows estimates of typical duration by service as well as one Tukey-Kramer adjusted standard error on each side of the estimate. These estimates come from an analysis of covariance that used the square roots of realized durations as the dependent variable. The point estimates displayed do not necessarily correspond in magnitude to sample means in the data. Hence, though the mean cost comparison ran 810 days, this type of display shows point estimates that are generally larger than 810 days. See the appendix plus Pearce (1982), Miller (1985), and SAS Institute (1990b) for discussions of this estimation procedure.

Controlling for other factors, the Marine Corps and Army completed cost comparisons have taken statistically significantly longer than the Air Force's. Combining this figure's results with page 10's, we see a troubling consistency that the Marine Corps had disproportionate trouble completing cost comparisons and their completions were unusually slow.

Forces Command Installations Have Had the Slowest Cost Comparison Completions

NDRI

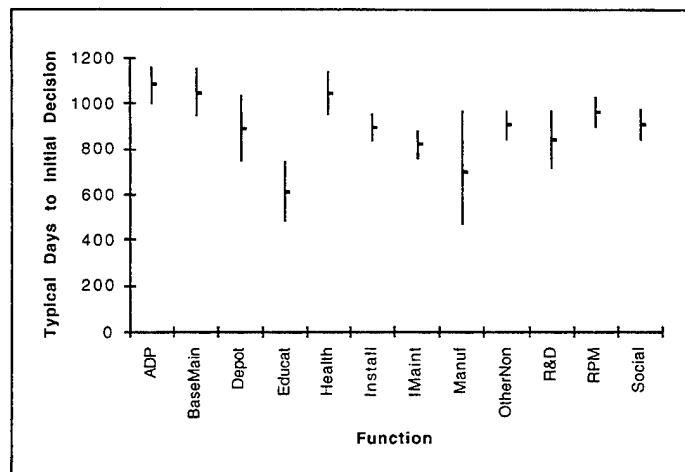


RAND

This figure provides more depth to page 36's findings. The Army Forces Command installations have been the slowest at completing cost comparisons, controlling for other factors. The Air Force's Air Education and Training Command installations and Space Command installations have been fastest.

Data Processing Cost Comparisons Have Been Particularly Lengthy

NDRI

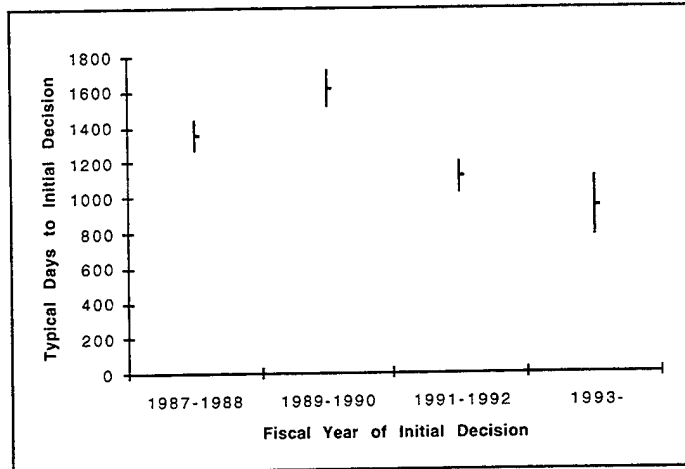


RAND

The estimation suggests Automatic Data Processing (ADP), Base Maintenance, and Health Services cost comparisons were particularly lengthy. Education and Training and In-House Manufacturing cost comparisons were completed most rapidly. Recall, however, that page 12 suggests these functions were least likely to have their cost comparisons completed. Hence, their apparent rapid speed may simply be a result of data censoring from widespread cost comparison cancellation.

Cost Comparisons May Be Getting More Rapid

NDRI



RAND

This figure suggests that cost comparisons completed in recent years have been completed somewhat more rapidly. The policy of canceling incomplete single function cost comparisons after two years may be one reason for this finding. The policy may be speeding initiatives or, referring to page 13, perhaps this apparent speed increase is at least in part a data censoring caused by more cost comparisons being canceled.

Also, there have been many fewer completions in recent years. Speed increases may be a result of fewer cost comparisons. Cost comparison personnel have had less work to do, so perhaps they have been able to complete the comparisons they have undertaken more quickly. Alternatively, perhaps learning has expedited the process.

The diminution in the number of completions in recent years also causes the standard error on the 1993 estimate to be larger than the other periods' estimates' standard errors.

We omit early 1980s' completions from this figure. Comparisons completed in the early 1980s were quite rapid, but this is somewhat tautological. Since this data set's cost comparisons started only in the late 1970s, any comparisons completed in the early 1980s were, by definition, fairly rapid.

Outline

NDRI

- Background on DoD Cost Comparisons
- Patterns of Cost Comparison Cancellation
- Background on Completed Cost Comparisons
- Historical Duration of Cost Comparisons
- •Concluding Observations

RAND

We provide a few summary observations to conclude.

Concluding Observations

NDRI

- **Cost Comparisons Have Been Lengthy**
- **Cost Comparison Cancellation Has Been a Major Problem**
- **Evaluation of More Government-Employed Civilians Appears to Increase the Probability of Cancellation**
- **Cost Comparisons Have Been Rare in the 1990s**

RAND

This briefing has made a number of points. Completed A-76 cost comparisons have taken, on average, around two years. Historically, about five cost comparisons have been cancelled for every eight completed. It appears that cost comparisons that evaluated large numbers of government-employed civilians have been particularly vulnerable to cancellation. There has been a sharp diminution in the number of cost comparisons attempted and completed in the 1990s after a peak in the early 1980s.

Again, however, we reiterate our caveat that this analysis covers only A-76 cost comparisons. There are other approaches the DoD can and has used to increase the role of contractors in providing goods and services to the military.

APPENDIX: AN ANALYSIS OF THE DOD CAMIS DATA SET

We obtained a copy of the Department of Defense (DoD) Commercial Activities Management Information System (CAMIS) data base. The data we obtained covered FY 1977-1994.

The CAMIS data track and record information about A-76 government/contractor cost comparisons. A-76 is the Office of Management and Budget circular describing the process by which government employees and contractors compete for the opportunity to provide a service on an installation. These data do not include other sorts of outsourcing initiatives, such as direct conversions where the only choice is among contractors. Only A-76 cost comparisons are covered in this analysis.

A CAMIS record is set up any time a function is nominated for potential outsourcing. Various milestones are tracked in CAMIS. Data are recorded on the type of function involved, the contract approach (e.g., sealed bid, negotiated), the winner of the comparison, the dollars involved, and many other characteristics of the process.

Not all cost comparisons that are started are completed. Indeed, as shown in Table A.1, approximately five cost comparisons have been canceled for every eight completed in the DoD. Table A.1 also shows that the number of comparisons started has diminished sharply since a peak in FY 1981. Table A.1 and subsequent analyses ignore CAMIS records that do not record the date a cost comparison started.

Table A.2 shows the current status of cost comparisons by service. The Marine Corps and DoD agencies (the Defense Commissary Agency, the Defense Logistics Agency, and the Defense Mapping Agency) have canceled more comparisons than they have completed.

Table A.1
DoD Cost Comparison Status by Fiscal Year Started

Start FY	Completed	Canceled	In Progress
1977	1	0	0
1978	70	21	0
1979	499	55	1
1980	65	7	0
1981	555	199	6
1982	371	215	15
1983	319	225	6
1984	206	201	0
1985	38	62	0
1986	36	83	0
1987	37	115	8
1988	9	62	0
1989	20	142	16
1990	25	4	14
1991	9	18	1
1992	7	7	5
1993	1	2	9
1994	0	0	10
Total	2268	1418	91

Table A.2
DoD Cost Comparison Status by Service

Service	Completed	Canceled	In Progress
Air Force	767	405	20
Army	517	315	39
Navy	883	454	1
Marine Corps	44	79	1
DoD agencies	57	165	30
Total	2268	1418	91

In light of the frequency and obvious cost of cost comparison cancellation, we ran a probit estimation to see if there has been a pattern in the sorts of comparisons that have been canceled. [Probit estimation is akin to linear regression but is more appropriate in a case like this with a dichotomous dependent variable. See, for example, Cramer (1989).] Table A.3 lists the independent variables used. All independent variables except the constant and the square roots of the number of military and civilian slots evaluated in the cost comparisons are dummy variables. We took the

square roots of the number of military and civilian slots evaluated to make these slot independent variables more normally distributed. These two square root slot terms are not highly correlated; their Pearson Correlation Coefficient in these data is 0.20323. Table A.3 groups the dummy variables into sets. Footnote (a) discusses the omitted variable for each set. The commands are those currently associated with the installation. Installations may have been in other commands when the cost comparison was started. The function (e.g., Automatic Data Processing, Base Maintenance) is the first functional category listed in the CAMIS function field. Some comparisons involved more than one functional category. This analysis, however, only uses the first listed functional category.

Table A.4 presents our completion probit estimates. The table suggests increasing the number of civilian slots evaluated decreases the probability a comparison is completed, holding other factors constant. Government-employed civilians may have been able to impede cost comparisons in a manner that decreased the probability of completion.

Among the commands and services, the Marine Corps, the Defense Logistics Agency, and, especially, the Defense Mapping Agency have had particular problems completing comparisons. Controlling for other factors, Army Materiel Command installations have had the greatest success completing comparisons.

There is considerable variability across functions in cancellation rates. Manufacturing and Education and Training cost comparisons have been particularly vulnerable to cancellation.

By time period, early comparisons were generally completed, but comparisons started in the late 1980s were particularly vulnerable to cancellation.

We wondered whether Table A.4's civilian billets result would hold for each of the three largest services separately. Hence, we undertook a supplemental estimation in which separate SQRTCIVS coefficients were estimated for each of the three largest services (plus a fourth for the Marine Corps and DoD agencies). Table A.5 shows the results.

Table A.5 suggests that the Navy and, particularly, the Army have had problems with cost comparisons that affect large numbers of civilians being disproportionately canceled, controlling for other factors. The Air Force does not appear to have faced similar difficulties.

Table A.3
DoD CAMIS Completion Probit Variables

Dependent Variable	1 if comparison completed, 0 if canceled
Independent Variable ^a	Variable Name
Constant	
Square root of number of military slots evaluated	SQRTMILS
Square root of number of civilian slots evaluated	SQRTCIVS
Air Combat Command installation comparison	ACC
Air Education and Training Command installation comparison	AETC
Air Mobility Command installation comparison	AFAMC
Air Force Materiel Command installation comparison	AFMC
Space Command installation comparison	AFSPC
Pacific Air Forces installation comparison	PACAF
Other Air Force Command installation comparison	AFOth
Army Materiel Command installation comparison	ArMC
Forces Command installation comparison	FORS
Training and Doctrine Command installation comparison	TRAD
Other Army Command installation comparison	ArOth
Navy comparison	NAVY
Marine comparison	USMC
Defense Logistics Agency comparison	DLA
Defense Mapping Agency comparison	DMA
Automatic Data Processing	ADP
Base Maintenance	BASEMAIN
Depot Repair	DEPOT
Education and Training	EDUCAT
Health Services	HEALTH
Intermediate Maintenance	IMAIN
Manufacturing	MANUF
Other Nonmanufacturing	OTHERNON
Research & Development	R&D
Real Property Maintenance	RPM
Social Services	SOCIAL
FY 1980 or earlier comparison start	FY7980
FY 1981–1982 comparison start	FY8182
FY 1983–1984 comparison start	FY8384
FY 1987–1988 comparison start	FY8788
FY 1989–1990 comparison start	FY8990
FY 1991 or later comparison start	FY9192

^aThe Defense Commissary Agency is the omitted command, Installation Services is the omitted function, and comparisons started in FY 1985 or FY 1986 are the omitted time period.

Table A.4
DoD Cost Comparison Probit on Completion

Dependent Variable	1 if comparison completed		
Observations	3686		
	Coefficient	Standard Error	P Value ^a
Intercept	-0.0180	0.2028	0.9292
SQRTMILS	-0.0065	0.0090	0.4671
SQRTCIVS	-0.0386	0.0069	0.0001
ACC	0.1747	0.1967	0.3744
AETC	0.5987	0.2048	0.0035
AFAMC	0.0433	0.2124	0.8383
AFMC	0.1304	0.1953	0.5043
AFSPC	0.3581	0.2618	0.1713
PACAF	-0.5735	0.2915	0.0491
AFOth	-0.1007	0.1905	0.5971
ArMC	0.7741	0.2299	0.0008
FORS	-0.1790	0.1877	0.3402
TRAD	0.2959	0.1951	0.1294
ArOth	0.0982	0.1934	0.6116
NAVY	0.3455	0.1778	0.0520
USMC	-0.8391	0.2190	0.0001
DLA	-0.9155	0.2574	0.0004
DMA	-1.9254	0.3361	0.0001
ADP	-1.0989	0.1028	0.0001
BASEMAIN	0.0564	0.2304	0.8068
DEPOT	-0.8986	0.2319	0.0001
EDUCAT	-1.7525	0.2353	0.0001
HEALTH	-0.8083	0.1530	0.0001
IMAINT	0.0416	0.1079	0.6998
MANUF	-2.2639	0.3646	0.0001
OTHERNON	-0.4266	0.0683	0.0001
R&D	-0.2504	0.2909	0.3893
RPM	-0.0645	0.0899	0.4734
SOCIAL	-0.0331	0.1097	0.7626
FY7980	1.7065	0.1181	0.0001
FY8182	0.8830	0.1008	0.0001
FY8384	0.4952	0.1042	0.0001
FY8788	-0.6474	0.1340	0.0001
FY8990	-0.5033	0.1496	0.0008
FY9192	0.2786	0.2441	0.2537

^aThe P value column in this case shows we cannot reject a null that the ACC coefficient, for instance, is zero at the 95 percent level, but we can reject a null that the SQRTCIVS coefficient is zero at the 99.99 percent confidence level (99.99 percent = 1-0.0001). This ACC estimate suggests we cannot reject a null hypothesis that ACC's cancellation probability is the same as the Defense Commissary Agency's, the omitted variable in this category

Table A.5
DoD Cost Comparison Probit on Completion with Service-Specific SQRTCIVS
Coefficients

Dependent Variable	1 if comparison completed		
Observations	3686		
	Coefficient	Standard Error	P Value
Intercept	-0.2858	0.2206	0.1950
SQRTMILS	-0.0119	0.0091	0.1922
Army SQRTCIVS	-0.0720	0.0099	0.0001
Air Force SQRTCIVS	0.0214	0.0168	0.2031
Navy SQRTCIVS	-0.0291	0.0122	0.0166
Other SQRTCIVS	0.0234	0.0235	0.3192
ACC	0.2852	0.2193	0.1783
AETC	0.6779	0.2290	0.0031
AFAMC	0.1530	0.2343	0.5137
AFMC	0.1296	0.2271	0.5681
AFSPC	0.4185	0.2816	0.1373
PACAF	-0.5105	0.3103	0.0999
AFOth	-0.0191	0.2156	0.9292
ArMC	1.3364	0.2623	0.0001
FORS	0.2759	0.2151	0.1996
TRAD	0.8366	0.2281	0.0002
ArOth	0.5522	0.2195	0.0119
NAVY	0.5760	0.2044	0.0048
USMC	-0.8467	0.2214	0.0001
DLA	-1.0490	0.2670	0.0001
DMA	-1.8339	0.3388	0.0001
ADP	-1.1138	0.1031	0.0001
BASEMAIN	-0.2520	0.2375	0.2886
DEPOT	-1.0190	0.2325	0.0001
EDUCAT	-1.7774	0.2362	0.0001
HEALTH	-0.8687	0.1536	0.0001
IMAIN	0.0664	0.1097	0.5451
MANUF	-2.1823	0.3467	0.0001
OTHERNON	-0.4292	0.0686	0.0001
R&D	-0.2808	0.2880	0.3296
RPM	-0.0960	0.0910	0.2914
SOCIAL	-0.0042	0.1117	0.9702
FY7980	1.7000	0.1186	0.0001
FY8182	0.8965	0.1012	0.0001
FY8384	0.4947	0.1046	0.0001
FY8788	-0.6587	0.1344	0.0001
FY8990	-0.4774	0.1496	0.0014
FY9192	0.2742	0.2438	0.2437

For the remainder of this appendix, we focus on those comparisons that were completed. Completed cost comparisons receive a dollar value, i.e., the value of the winning contractor or government employee (labeled "MEO" for Most Efficient Organization) bid. CAMIS dollar totals are then-year; for example, a cost comparison completed in 1982 has a dollar total in 1982 dollars. To compare completed cost comparisons over time, we standardized all cost comparison dollars to Fiscal Year (FY) 1994 dollars. Table A.6 shows the multipliers we used to do this.

United States Department of Commerce (1992) and the *Economic Report of the President* (1996) provide first and second calendar quarter aggregate price indices for various years in 1987 and 1992 dollars, respectively. We assumed the average of a calendar year's first and second quarter price indices is a reasonable price index for the corresponding fiscal year. (Fiscal years run October–September.) We used 1991 data to link the two price indices (that is, establish the correct relationship between 1987 and 1992 dollars). Through this process, we computed the FY 1994 Multiplier

Table A.6
FY 1994 Price Index Computation

FY	1987 = 100			1992 = 100			FY 1994 Multiplier
	1st Q	2nd Q	Average	1st Q	2nd Q	Average	
1977	54.3	55.4	54.8				2.29024
1978	58.2	59.7	59.0				2.13095
1979	63.5	64.8	64.2				1.95821
1980	69.2	70.8	70.0				1.79456
1981	76.5	77.9	77.2				1.62720
1982	82.3	83.4	82.8				1.51623
1983	86.0	86.6	86.3				1.45561
1984	89.7	90.6	90.2				1.39345
1985	93.3	94.0	93.6				1.34137
1986	96.0	96.5	96.2				1.30514
1987	98.8	99.5	99.2				1.26696
1988	102.1	103.2	102.6				1.22377
1989	106.9	108.0	107.4				1.16910
1990	111.1	112.3	111.7				1.12461
1991	115.9	116.8	116.4	96.3	97.0	96.6	1.07967
1992				99.1	99.8	99.4	1.04927
1993				101.8	102.4	102.1	1.02204
1994				104.1	104.6	104.4	1.00000

SOURCES: United States Department of Commerce (1992) and *Economic Report of the President* (1996).

column shown in Table A.6. We multiplied all dollar totals in CAMIS by the appropriate multiplier for the fiscal year in which a cost comparison was completed. All dollar totals used in this analysis are in FY 1994 dollars. Clearly, for early cost comparisons particularly, the FY 1994 dollar value is considerably greater than the then-year nominal dollar value actually provided in CAMIS.

The CAMIS system contains a variety of date stamps. These stamps include the date a cost comparison was announced, the date of an initial decision, the date of the final decision, and the date the contractor or MEO started.

The contract/MEO start date is the date the winning contractor or in-house employees began performing the function. However, this field is often missing in the data set. When the contract/MEO start date is provided, it often precedes the final decision date. The CAMIS records indicate the winning contractor or MEO often began work prior to the final decision. Hence, we decided to focus on the announcement date and the initial decision date as a reasonable approximation for the length of the cost comparison process.

For the duration analysis, we focused on completed cost comparisons only. That is, a decision was made that either government employees or a specific contractor would perform the specified function. Also, we deleted records lacking a contract dollar value or duration.

In total, we were left with 2134 completed cost comparisons. Table A.7 presents some basic statistics on our data. Days in our analysis are calendar days, not business days. Table A.7 and all subsequent tables cover only the 2134 completions that were not omitted because of the aforementioned data problems. Annualized dollars present the FY 1994 per-year value of the winning completed cost comparison bid—for example, the MEO value if government-employed civilians won the competition. Civilian slots is the number of government-employed

Table A.7
DoD CAMIS Completion Summary

Statistic	Min	5%	25%	Med	Mean	75%	95%	Max
Time to initial decision (days)	10	189	452	664	809	1041	1902	3444
Annualized FY94 dollars (000s)	7	59	192	474	1515	1176	6076	83350
Civilian slots compared	0	1	5	12	31	28	125	1057
Military slots compared	0	0	0	0	9	1	26	1016

civilian slots evaluated in completed cost comparisons; military slots is the number of military slots evaluated.

Each CAMIS record also includes a Department of Defense Functional Activity Code (DoDFAC), a categorization of the type of function competed. Table A.8 presents information about the completed cost comparisons by DoDFAC. As noted above, some CAMIS records listed multiple functions; we used the first listed function.

In real dollars, Installation Services is the high dollar category in these data. There have been nearly as many completed comparisons in Other Nonmanufacturing¹ as in Installation Services, but Installation Services' average completed cost comparison has been more than 70 percent larger.

It is also interesting to note that whereas government employees have won about half of the A-76 cost comparisons, their success rate varies considerably across the categories, e.g., 80 percent in Health Services versus 21 percent in Social Services.

Table A.9 shows that FY 1983 had the largest number of A-76 cost comparison completions and FY 1980 the highest real dollar value. There has been a distinct decline in A-76 activity in recent years. This decline

Table A.8
DoD Completed Cost Comparisons by DoD Functional Activity Code

DoDFAC	Total	Annualized Dollars (000s)	Average Value (000s)	Government Employees Won
Automatic Data Processing	95	66,339	698	55
Base Maintenance	28	191,957	6,856	16
Depot Repair	9	26,877	2,986	9
Education and Training	7	35,088	5,013	3
Health Services	35	25,351	724	28
Installation Services	655	1,062,362	1,622	349
Intermediate Maintenance	163	573,023	3,515	66
Manufacturing	2	63,168	31,584	0
Other Nonmanufacturing	588	543,717	925	334
Research & Development	12	75,629	6,302	3
Real Property Maintenance	316	456,712	1,445	144
Social Services	224	113,341	506	48
All completions	2134	3,233,565	1,515	1055

¹The "Other Nonmanufacturing" DoDFAC is largely composed of logistics-related functions such as storage and warehousing, transportation services, property disposal.

Table A.9
DoD Completed Cost Comparisons by Fiscal Year
of Initial Decision

FY Year	Total	Annualized Dollars (000s)	Average Annualized Dollars (000s)
1978	1	1,536	1,536
1979	114	152,934	1,342
1980	205	557,496	2,719
1981	186	369,334	1,986
1982	292	428,160	1,466
1983	370	390,584	1,056
1984	171	161,025	942
1985	192	263,502	1,372
1986	184	203,770	1,107
1987	127	239,844	1,889
1988	109	177,548	1,629
1989	70	156,242	2,232
1990	29	35,502	1,224
1991	66	67,945	1,029
1992	9	11,369	1,263
1993	2	7,712	3,856
1994	7	9,063	1,295
Total	2134	3,233,565	1,515

probably results, at least in part, from the FY 1989 National Defense Authorization Act directive that installation commanders have the sole authority to determine which functions to cost compare or direct convert (10 U.S.C. 2468). (This stipulation expired September 30, 1995.) Installation commanders on comparatively short tours are often reluctant to undertake painful A-76 cost comparisons, even if such cost comparisons have long-term benefits.² Further, the FY 1993 DoD Authorization Act imposed a DoD-wide moratorium on awarding contracts resulting from cost comparisons; it was removed effective April 1, 1994.

Table A.10 presents the number and annualized dollar value of A-76 cost comparisons won by government employees and contractors. Overall, government employees won 49 percent of the A-76 cost comparisons covering 43 percent of the competed annualized FY 1994 dollar value.

²Bolten, Halliday, and Keating (1996) discuss this problem in the Army and present some possible solutions (e.g., longer military tours or greater civilian control of installations).

Table A.10**Completed Cost Comparison Outcomes by Fiscal Year of Initial Decision**

FY Year	Government Employees Won	Annualized Dollars (000s)	Contractors Won	Annualized Dollars (000s)
1978	0	0	1	1,536
1979	29	55,611	85	97,324
1980	82	199,000	123	358,497
1981	79	111,819	107	257,515
1982	154	185,009	138	243,151
1983	206	202,910	164	187,674
1984	101	104,804	70	56,221
1985	109	120,763	83	142,739
1986	86	100,985	98	102,785
1987	62	99,978	65	139,866
1988	48	79,316	61	98,233
1989	41	75,085	29	81,158
1990	15	19,291	14	16,211
1991	35	27,505	31	40,440
1992	5	3,706	4	7,663
1993	1	355	1	7,356
1994	2	2,455	5	6,608
Total	1055	1,388,591	1079	1,844,974

Table A.11 tallies completed cost comparisons and annualized FY 1994 dollar value by service and year. The Navy completed the most comparisons, but the Army's comparisons encompassed the greatest value. Notice that for every service, the standard deviation of completed cost comparison size is considerably greater than the mean completed cost comparison size. Completed cost comparisons vary greatly in size within services.

We undertook another probit estimation to analyze when contractors, as opposed to government employees, won cost comparisons. Table A.12 presents our independent variables. Our independent variables are the same as in Table A.3, except DEPOT and MANUF are no longer considered (because of a lack of variance in their cost comparison winners) and we added dummy variables for sealed bid, negotiated, and unrestricted cost comparisons. (These three new dummy variable categories could not be used in Table A.4's estimation because these fields were frequently left empty in cost comparisons that were canceled.)

Table A.13 presents our winner probit estimates.

Table A.11

Completed Cost Comparisons by Service and Fiscal Year of Initial Decision

FY Year	AF No.	Annual Dollars (000s)	Army No.	Annual Dollars (000s)	Navy No.	Annual Dollars (000s)	USMC No.	Annual Dollars (000s)	DoD Agnc No.	Annual Dollars (000s)
1978	0	0	1	1,536	0	0	0	0	0	0
1979	55	113,002	14	16,042	41	20,701	4	3,190	0	0
1980	105	168,201	67	374,044	28	12,857	5	2,393	0	0
1981	88	203,091	79	152,668	15	11,351	4	2,223	0	0
1982	61	48,804	59	207,183	167	162,983	2	4,213	3	4,978
1983	83	39,474	60	135,022	216	206,570	8	7,232	3	2,284
1984	42	30,948	25	43,500	98	82,688	4	1,981	2	1,908
1985	65	44,995	41	60,146	75	113,158	7	9,418	4	35,785
1986	57	34,976	73	95,188	50	64,925	3	8,014	1	668
1987	64	50,451	14	58,430	42	121,849	3	8,430	4	683
1988	27	72,159	39	53,835	25	46,722	0	0	18	4,831
1989	33	90,862	12	17,821	17	44,263	2	1,131	6	2,165
1990	17	24,550	7	3,600	0	0	2	5,788	3	1,564
1991	50	52,229	6	10,222	1	2,820	0	0	9	2,674
1992	6	4,919	2	6,006	1	443	0	0	0	0
1993	1	7,356	1	355	0	0	0	0	0	0
1994	6	8,483	1	579	0	0	0	0	0	0
Tot	760	994,501	501	1,236,177	776	891,333	44	54,014	53	57,540
Average		1,309		2,467		1,149		1,228		1,086
Std Dev		3,304		6,683		2,787		1,710		2,425

Table A.13 suggests, controlling for other factors, that contractors were increasingly likely to win cost comparisons the smaller the fraction of evaluated slots originally held by government-employed civilians.

Among the commands, contractors had the greatest relative success winning Air Force Space Command installation cost comparisons and the least success in DoD agency comparisons (the omitted command/service).

By function, controlling for other factors, the estimation suggests that contractors had the greatest success in Social Services cost comparisons and the least success in Health Services cost comparisons. However, as noted in Table A.8, the data also included two Manufacturing cost comparisons, both won by contractors, and nine Depot Repair cost comparisons, all won by government employees. Given the lack of variance in these functions' outcomes, we had to omit them from this probit estimation.

Table A.12
DoD CAMIS Winner Probit Variables

Dependent Variable	1 if contractor won, 0 if government employees won
Independent Variable ^a	Variable Name
Constant	
Square root of annualized FY 1994 \$ value of contract	SQRTANMO
Fraction of evaluated slots held by government-employed civilians	CIVSLFRAC
Air Combat Command installation comparison	ACC
Air Education and Training Command installation comparison	AETC
Air Mobility Command installation comparison	AFAMC
Air Force Materiel Command installation comparison	AFMC
Space Command installation comparison	AFSPC
Pacific Air Forces installation comparison	PACAF
Other Air Force Command installation comparison	AFOth
Army Materiel Command installation comparison	ArMC
Forces Command installation comparison	FORS
Training and Doctrine Command installation comparison	TRAD
Other Army Command installation comparison	ArOth
Navy comparison	NAVY
Marine comparison	USMC
Automatic Data Processing	ADP
Base Maintenance	BASEMAIN
Education and Training	EDUCAT
Health Services	HEALTH
Intermediate Maintenance	IMAIN
Other Nonmanufacturing	OTHERNON
Research & Development	R&D
Real Property Maintenance	RPM
Social Services	SOCIAL
FY 1979–1980 comparison completion	FY7980
FY 1981–1982 comparison completion	FY8182
FY 1983–1984 comparison completion	FY8384
FY 1987–1988 comparison completion	FY8788
FY 1989–1989 comparison completion	FY8990
FY 1991–1992 comparison completion	FY9192
FY 1993–1994 comparison completion	FY9394
Sealed Bid	SEALED
Negotiated	NEGOTIATE
Unrestricted cost comparison	UNRESTRICTED

^aDoD agencies' comparisons is the omitted command. We combine DeCA (39 completions) and DLA (14 completions) in this category. Meanwhile, the Defense Mapping Agency had three completions, but they were omitted from this analysis because of lack of dollar value or duration in the CAMIS data. Installation Services is the omitted function; comparisons completed in FY 1985 or FY 1986 is the omitted time period; other types of contracts, including no type specified, is the omitted contract type; and other types of initiatives (e.g., restricted to small or disadvantaged businesses) is the omitted initiative type.

Table A.13
DoD Completed Cost Comparisons Probit on Winner

Dependent Variable	1 if comparison won by contractor		
Observations	2098		
	Coefficient	Standard Error	P Value
Intercept	0.1382	0.5765	0.8106
SQRTANMO	0.0011	0.0013	0.3787
CIVSLFRAC	-0.5851	0.1237	0.0001
ACC	0.5223	0.2401	0.0296
AETC	0.5934	0.2413	0.0139
AFAMC	0.4449	0.2556	0.0818
AFMC	0.6744	0.2422	0.0054
AFSPC	0.7203	0.2936	0.0142
PACAF	0.3498	0.3990	0.3806
AFOth	0.4798	0.2378	0.0436
ArMC	0.0576	0.2594	0.8243
FORS	0.3213	0.2409	0.1824
TRAD	0.2719	0.2412	0.2596
ArOth	0.3141	0.2488	0.2067
NAVY	0.2760	0.2211	0.2120
USMC	0.1985	0.2915	0.4959
ADP	-0.0374	0.1457	0.7975
BASEMAIN	-0.1359	0.2583	0.5990
EDUCAT	0.1431	0.4952	0.7726
HEALTH	-0.9561	0.2646	0.0003
IMAIN	0.2350	0.1205	0.0511
OTHERNON	-0.1089	0.0810	0.1786
R&D	0.6466	0.4734	0.1719
RPM	0.0684	0.0990	0.4895
SOCIAL	1.1147	0.1230	0.0001
FY7980	0.3292	0.1045	0.0016
FY8182	0.0661	0.0941	0.4828
FY8384	-0.1392	0.0911	0.1265
FY8788	0.8415	0.1114	0.4502
FY8990	-0.3038	0.1557	0.0510
FY9192	-0.4453	0.1872	0.0174
FY9394	0.3059	0.5179	0.5547
SEALED	-0.1072	0.5161	0.8354
NEGOTIATE	-0.1958	0.5191	0.7061
UNRESTRICTED	0.0977	0.0677	0.1488

A key question we wished to evaluate was why the process (as shown by these data) has been so lengthy and so highly variable (see Table A.7). As a first step toward answering this question, we regressed the square root of observed total duration from the Announcement to the Initial Decision on the same explanatory variables shown in Table A.12 and used in Table A.13, except that Depot Repair and Manufacturing were also considered, with Manufacturing the omitted function.

Table A.14 presents our regression results. Table A.15 shows the covariance-generated square root means and Tukey-Kramer adjusted standard error estimates for the square root of typical values of some of the dummy variable categories. Pearce (1982) describes analysis of covariance. Least-squares square root means, as shown in Table A.15, are estimates of the square root means that would be expected had other dummy variables been balanced in their frequency. They do not necessarily correspond in magnitude to sample square root means in the data. See SAS Institute (1990b), Volume 2, pages 908 and 948. Tukey-Kramer standard errors, meanwhile, are designed for pairwise comparisons. Two square root means in Table A.15 are significantly different if one adjusted standard error below the larger is larger than one adjusted standard error above the smaller. See Miller (1985).

Table A.14 shows that the independent variables explain only about 50 percent of the variance in the data. The cost comparison process is not only lengthy, but subject to variation not captured by the explanatory variables we have employed.

Among the commands and services, the Army's Forces and Materiel commands' installations are statistically significantly slower at the 95 percent confidence level than the defense agencies' zero baseline. None of the function dummy variables is statistically significant.

Tables A.14 and A.15 suggest that the cost comparison process slowed considerably in the late 1980s. However, this finding may be spurious. Cost comparisons started in earnest only in the late 1970s so, by definition, any comparisons completed in the late 1970s or early 1980s had to be rapid. In the mid- and late-1980s, many lengthy comparisons started in the late 1970s and early 1980s were completed.

There is some suggestion that the cost comparison process has sped up in recent years. Comparisons completed in FY 1989-1990 typically took some 678 days longer than comparisons completed FY 1993 and later, whereas comparisons completed in FY 1991-1992 typically took an

Table A.14
DoD Completed Cost Comparisons Square Root of Time to
Initial Decision Linear Regression

Dependent Variable	Square root of total duration		
R-Squared ^a	0.4910		
Observations	2109		
Analysis of variance	df	Sum of squares	F ^b : 55.511
Regression	36	81859.1234	
Residual	2072	84874.2580	Significance F:
Total	2108	166733.3814	0.0001
	Coefficient	Standard Error	P Value
Intercept	28.0467	2.8928	0.0001
SQRTANMO	0.0111	0.0062	0.0708
CIVSLFRAC	-1.2709	0.6042	0.0355
ACC	0.1277	1.1126	0.9086
AETC	-1.5163	1.1257	0.1781
AFAMC	0.6091	1.1932	0.6098
AFMC	-0.2770	1.1229	0.8052
AFSPC	-1.1064	1.3864	0.4249
PACAF	0.3711	1.9645	0.8502
AFOth	0.1480	1.1008	0.8930
ArMC	2.7682	1.2079	0.0220
FORS	3.2412	1.1213	0.0039
TRAD	2.1544	1.1219	0.0549
ArOth	2.1192	1.1631	0.0686
NAVY	-0.5644	1.1045	0.5780
USMC	2.2408	1.3916	0.1075
ADP	2.9364	0.7256	0.0001
BASEMAIN	2.4015	1.3008	0.0650
DEPOT	-0.1738	2.2081	0.9373
EDUCAT	-5.2659	2.4495	0.0317
HEALTH	2.3751	1.1679	0.0421
IMAINT	-1.3086	0.5941	0.0277
MANUF	-3.5429	4.6240	0.4437
OTHERNON	0.1794	0.4042	0.6573
R&D	-1.0103	2.0079	0.6149
RPM	1.1164	0.4959	0.0245
SOCIAL	0.1896	0.5527	0.7317
FY7980	-10.0411	0.5114	0.0001
FY8182	-3.7264	0.4632	0.0001
FY8384	-2.8512	0.4477	0.0001
FY8788	8.3766	0.5493	0.0001
FY8990	11.8051	0.7627	0.0001

Table A.14—continued

	Coefficient	Standard Error	P Value
FY9192	4.9607	0.9414	0.0001
FY9394	2.2167	2.4973	0.3748
SEALED	0.1771	2.6338	0.9464
NEGOTIATE	1.5301	2.6478	0.5634
UNRESTRICTED	0.1059	0.3358	0.7526

^aR-squared is a measure of regression goodness-of-fit. If the independent variables explained all variance in the dependent variable, the R-squared would be 1. In this case, the independent variables explain about 50 percent of the variance in the dependent variable.

^bThe regression F statistic is a test of the null hypothesis that all the regression coefficients, except the intercept, are actually zero. In this case, the F statistic of 55.511 is sufficiently large that we can reject the null that all the non-intercept coefficients are zero at an extremely high (99.99% = 1 - 0.0001) confidence level.

estimated 175 days longer than comparisons completed in FY 1993 and later. A possible explanation may lie in the policy (first promulgated in Section 8020 of the FY 1991 Appropriations Act) of canceling single function cost comparisons after two years and multifunction cost comparisons after four years if they have not yet reached bid opening. Perhaps the apparent speed increase results from data censoring caused by more cost comparisons being canceled.

However, only nine cost comparisons were completed in FY 1993 and later. Maybe personnel simply had a lower A-76 workload in recent periods. The apparent speed increase may not persist if the comparison workload increases.

As a complement to Table A.14's analysis, we ran a probit estimation. The dependent variable, LONG, was coded "1" if a completed cost comparison ran over a calendar year or if a cost comparison was ongoing for over a year. We wished to omit ongoing cost comparisons that had yet to run for a year, so we removed all FY 1994-started cost comparisons. Unlike Table A.14, the time dummy variables in this estimation cover starting year, not year of completion.

This estimation suggests that cost comparisons that evaluated more slots were more likely to run over a year, other things being equal.

The Air Force, Navy, and Marine Corps coefficients are negative, suggesting that the omitted category—DoD agencies and the Army—tended to have lengthy cost comparisons. Indeed, every Army cost comparison in the data ran over a year, so an Army coefficient per se was not estimable. For the same reason, we could not run this estimation with the Air Force broken into commands.

Table A.15

**DoD Completed Cost Comparisons Square Root of
Time to Initial Decision, Least-Squares Means and
Tukey-Kramer Adjusted Standard Errors**

Variable Name	Mean	Tukey-Kramer Adjusted Std Error
ACC	29.1713	1.1918
AETC	27.5260	1.2047
AFAMC	29.6536	1.2836
AFMC	28.7655	1.2025
AFSPC	27.9364	1.4662
PACAF	29.4166	2.0344
AFOth	29.1913	1.1877
ArMC	31.8084	1.2942
FORS	32.2223	1.1934
TRAD	31.2138	1.2276
ArOth	31.1622	1.2205
NAVY	28.4777	1.0866
USMC	31.2844	1.4615
DoD Agencies	29.0473	1.4134
ADP	32.8897	1.1873
BASEMAIN	32.3545	1.5605
DEPOT	29.7713	2.3854
EDUCAT	24.6960	2.6283
HEALTH	32.3306	1.4390
INSTALL	29.9501	0.9851
IMAIN	28.6433	1.0852
MANUF	26.4047	4.7234
OTHERNON	30.1325	1.0019
R&D	28.9435	2.1993
RPM	31.0684	1.0332
SOCIAL	30.1384	1.0658
FY7980	18.3949	1.0848
FY8182	24.7012	1.0810
FY8384	25.5854	1.0890
FY8586	28.4371	1.0902
FY8788	36.8113	1.1220
FY8990	40.2271	1.2234
FY9192	33.3918	1.3583
FY9394	30.6667	2.6795

Table A.16
DoD Cost Comparison Probit on Duration Over One Year

Dependent Variable	1 if comparison lasted over a year		
Observations	2331		
	Coefficient	Standard Error	P Value
Intercept	1.3455	0.2305	0.0001
SQRTMILS	0.0658	0.0215	0.0022
SQRTCIVS	0.0341	0.0129	0.0080
AIR FORCE	-0.7498	0.1097	0.0001
NAVY	-0.9369	0.1083	0.0001
USMC	-1.1237	0.2288	0.0001
ADP	0.5044	0.1582	0.0027
BASEMAIN	0.7092	0.4835	0.1424
DEPOT	0.5455	0.5395	0.3120
EDUCAT	-0.3048	0.4946	0.5377
HEALTH	0.8354	0.3846	0.0298
IMAINT	0.1668	0.1459	0.2530
MANUF	-0.8311	0.7800	0.2866
R&D	0.3319	0.4485	0.4593
RPM	0.5565	0.1183	0.0001
SOCIAL	0.6923	0.1469	0.0001
FY7980	-0.4456	0.2092	0.0332
FY8182	0.2857	0.2056	0.1646
FY8384	0.0714	0.2165	0.7415
FY8788	0.4402	0.3567	0.2172
FY8990	-0.7882	0.2653	0.0030
FY9193	-0.3149	0.3575	0.3784

Measured by starting year, cost comparisons started in FY 1979 and 1980 and again in FY 1989 and 1990 were statistically significantly more likely to run less than a year than FY 1985 and 1986-started cost comparisons, the omitted category. The FY 1989 and 1990 result combined with the FY 1991–1993 negative point estimate provide some support to the notion that more recently started cost comparisons have run somewhat more quickly.

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