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Analyzing the Effects of Source Selection Method, Acquisition Type, and Service Component on Acquisition Outcomes

Lieutenant Colonel Karen A. F. Landale, USAF—is an Assistant Professor at the Graduate School of Business and Public Policy, Naval Postgraduate School, Monterey, CA. She teaches strategic sourcing and category management as part of the contracting curriculum. Lt Col Landale received her PhD from the Kenan-Flagler Business School at the University of North Carolina at Chapel Hill. Her research focuses on talent management, services marketing, and contracting in the public domain. She is married to LTC Gordon Landale, USA, and they have two daughters, Amelia and Caroline. [kalandal@nps.edu]

Rene G. Rendon—is an Associate Professor at the Graduate School of Business and Public Policy, NPS, where he teaches defense acquisition and contract management courses. He also serves as the Academic Associate for the MBA specialization in contract management. Prior to joining the NPS faculty, he served for over 20 years as an acquisition contracting officer in the United States Air Force. His career included assignments as a contracting officer for the Peacekeeper ICBM, Maverick Missile, and the F-22 Raptor. He was also a contracting squadron commander and the director of contracting for the Space Based Infrared Satellite program and the Evolved Expendable Launch Vehicle rocket program. Rene has published in the Journal of Public Procurement, the *Journal of Contract Management*, the *Journal of Purchasing and Supply Management*, and the *International Journal of Procurement Management.* [rgrendon@nps.edu]

Introduction

For years, one of the most hotly contested debates in contracting and acquisition has been the choice of source selection method and the contract-related consequences of that choice. While policy memos encourage contracting officers to “select the appropriate source selection process … to match the specific requirement, meet Warfighter needs, and deliver a contracted solution that will provide the required performance levels at the lowest cost” (Kendall, 2015, p. 3), stakeholders on both sides of the table have differing views about how the choice of source selection method affects contract outcomes.

Anecdotally, from the perspective of the government, lowest priced technically acceptable (LPTA) procedures offer a faster time-to-contract, as the technical acceptability criteria is binary and the evaluation of price—the most important factor in LPTA source selections—is objective. Hence, theoretically, the requirement can be put on contract faster, with less likelihood of protest. The sellers’ perspective, however, is that the LPTA source selection method stifles innovation, because price is more important than, say, an innovative approach that may ultimately better serve the government (Calisti, 2015). Critics argue that the LPTA method often results in the selection of a contractor that has undercut the cost of the requirement. They argue that the contractor has essentially achieved “buy-in” by proposing an unreasonably low price that will later have to be adjusted (i.e., increased) via modification in order to fulfill the terms and conditions of the contract. This sort of gamesmanship of the LPTA method has been the argument of federal contractors for many years. Further, opponents of the LPTA method believe the process represents a “race to the bottom” price-wise, and mockingly dub the outcomes achieved by LPTA contracts as “Lousy Project, Tragic Act” (Weckstein & Delgado, 2012). In other words, opponents feel LPTA source selections produce inferior products and services. Proponents suggest this is not the case, and that by providing clear technical acceptability criteria, the government can avoid receiving inferior products and services.

On the opposite spectrum of the best value continuum, the tradeoff (TO) source selection method is anecdotally believed to take more time because of the subjective nature of the evaluation and the increased likelihood of protest. Customers and contractors alike seem to prefer this approach, as it allows customers to feel a certain measure of control over selecting the contractor that represents the best value to the government—that by ranking the evaluation factors in terms of importance, they have the option of tailoring the evaluation to fully meet their needs. Contractors also seem to prefer this method, as it allows them to provide innovative solutions to government requirements, without the burden of competing mainly based on price. Proponents of the TO method argue that it results in higher quality products and services because contractors are not "squeezed" on price. Opponents argue that the method does not necessarily produce better contractual outcomes (i.e., better contract performance), particularly given the anecdotal belief that TO acquisitions take longer to put on contract.

Choosing which method is appropriate for a given acquisition is clearly established by policy and is not the focus of this research. Instead, we aim to use scientific methods to confirm or deny the anecdotal beliefs associated with each source selection method. We use multivariate analysis of variance (MANOVA) and multivariate analysis of covariance (MANCOVA) methods to determine if statistically significant differences in contract outcomes exist based on source selection method. This first-of-kind research uses actual contract file data from the Air Force and Navy to test hypotheses associated with the anecdotal beliefs. Specifically, we examine whether differences exist in Contractor Performance Assessment Reporting System (CPARS) scores and procurement administrative lead time (PALT) based on choice of source selection method (LPTA or TO), while taking into account several different covariates related to the acquisitions.

The remainder of this paper proceeds as follows: The Literature Review section provides a detailed review of the contract management process, the best value continuum, and the relationship between contract type and source selection method. Following that is a discussion of the data collection and analysis methodologies, results of the analysis, and finally, a review of practical and managerial implications, as well as limitations and areas for further research.

Literature Review

Contract Management Process

The contract management process consists of three main phases that encompass six basic steps (for a more thorough review, see Garrett, 2010). The pre-award phase consists of three steps: procurement planning, solicitation planning, and solicitation. The award phase consists of just one step: source selection. Finally, the post-award phase consists of two steps: contract administration and contract closeout.

The first step, procurement planning, involves determining whether the government should produce the requirement organically or outsource production. This is known as the "make or buy" decision. Procurement planning also involves scoping out the requirement, conducting market research, and discussing acquisition strategy in terms of the type of contract to use, the appropriate source selection method, and the appropriate procurement method (sealed bidding or contracting by negotiation). The results of market research will indicate the availability of commercial items or services that meet the requirement, the nature of the competitive environment, and the variability in the technology used in industry to develop the supplies or services. Based on the results of the market research, the solicitation document can be developed.

The second step, solicitation planning, occurs after the decision to outsource has been made. In solicitation planning, the acquisition team continues to refine the requirement and the procurement methods, and it establishes the evaluation criteria that will be used to select a contractor. Clearly, these first two steps—procurement planning and solicitation planning—have a significant impact on the resulting success or failure of the contract. Poor planning or an inadequate requirement definition in the procurement and solicitation planning steps can result in unclear solicitation documents or in the inability to properly evaluate and choose an offer that represents the best value for the government. It is critical that the acquisition team has a clear understanding of the requirement, of how it will be solicited, and of how proposals will be evaluated. Any confusion or uncertainty will be passed on to potential offerors, who may interpret the requirement differently. In terms of the research performed in this study, these first two steps are the most impactful.

The third step, solicitation, involves publicizing the requirement and instructing potential offerors how, where, and when to submit their proposals. Clarifying questions often arise, and the government buyer ensures all questions are answered and provided to all potential offerors. Lamoreux, Murrow, and Walls (2015) note that

> the fourth step, source selection, involves using the evaluation criteria established during the solicitation planning step and specified in the solicitation document to formally evaluate each offer. Depending on the size and complexity of the procurement, this may involve source selection boards, technical panels, and any other expert required to evaluate the offers received. Further, the source selection may involve directly negotiating with one or more vendors on price, technical factors, or personnel. Finally, the acquisition team selects the winner during this step; it is the most vulnerable to protests from unsuccessful vendors. (p. 15)

A successful source selection is a reflection of a successful planning process. Source selection is the execution of the evaluation strategy that was designed during solicitation planning, which highlights the importance of ensuring the acquisition team has adequate time to properly plan for the acquisition.

The fifth step, contract administration, is typically the longest step in terms of the overall life of the acquisition. In this step, the contractor produces the good or service, and the government monitors performance and provides feedback. Both parties play an active role in ensuring the terms and conditions of the contract are enforced.

Finally, contract closeout, the sixth step, involves confirming that all work has been accomplished and the contractor has been paid in full before finalizing contract details and closing the contract. This step also includes the important task of assessing the contractor's performance using the Contractor Performance Assessment Reporting System (CPARS).

Best Value Continuum

In government contracting, the best value continuum recognizes the fact that there are a variety of ways in which an organization can obtain the best value for their dollar. The Federal Acquisition Regulation (FAR) states,

> An agency can obtain best value in negotiated acquisitions by using any one or a combination of source selection approaches. In different types of acquisitions, the relative importance of cost or price may vary. For example, in acquisitions where the requirement is clearly definable and the risk of unsuccessful contract performance is minimal, cost or price may play a dominant role in source selection. The less definitive the requirement, the

> more development work required, or the greater the performance risk, the more technical or past performance considerations may play a dominant role in source selection. (FAR 15.101)

For practical purposes, we typically envision the best value continuum using its poles: on one end is LPTA, and on the other, TO.[1] Both strategies can result in the best value to the government, but selecting a proposal that represents the best value varies for each method.

In LPTA source selections, best value is obtained by choosing the lowest priced offer that still meets established minimum quality thresholds (i.e., technical acceptability). The government establishes minimum thresholds and conveys them via the solicitation document. LPTA works best when the requirement is well-defined and the risk of unsuccessful performance is minimal. It "should be used in situations where the DoD would not realize any value from a proposal exceeding its minimum technical or performance requirements" (Government Accountability Office [GAO], 2014, p. 6). The LPTA method is typically used in contracting commercially-available goods or services, as the market has already established reasonably acceptable quality levels, and, assuming an adequate number of offerors supply the market, competition is based on price alone. Source selection for an LPTA requirement is typically performed by ranking the proposals from lowest to highest price, then evaluating whether the lowest-priced proposal meets the minimum quality thresholds (i.e., whether the lowest-priced proposal is technically acceptable).[2] If it is, the evaluation stops, and the lowest-priced offeror is declared the winner. If the lowest-priced proposal is not technically acceptable, it is removed from the competition and the next lowest-priced proposal is evaluated for technical acceptability. The process continues until the evaluation team finds the lowest-priced, technically acceptable offer. In general,

> LPTA acquisitions tend to be simpler than tradeoffs, [as] contracting offices can move more quickly through the six-step contract management process, reducing administrative operating costs. [T]he generally inflexible nature of the LPTA source selection method does not grant contracting officers discretion, which serves as a guard against the appearance of favoritism, promoting the perception of integrity, fairness, and openness. (Lamoureux et al., 2015, p. 20)

TO source selections, on the other hand, acknowledge that best value may result from higher quality ratings, which might consist of a host of factors (e.g., technical capability, management practices, past performance, etc.), and that higher quality may cost more. The TO method allows the government to establish which evaluation factors are most important and which are less important, and the government is allowed to trade cost or price factors for non-cost or non-price factors. Using the TO method "is appropriate when it may be in the best interest of the Government to consider award to other than the lowest priced offeror or other than the highest technically rated offeror" (FAR 15.101-1(a)). In a memorandum

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[1] In reality, LPTA is on one end of the continuum and highest technically rated offer (HTRO) is on the other. Because the FAR requires the evaluation of cost or price in each source selection, the federal government can never make an award based only on the HTRO.

[2] Ranking of non-price criteria is not permitted. Technical acceptability is binary: A proposal is technically acceptable or it is not.

detailing the appropriate use of source selection processes, Under Secretary of Defense for Acquisition, Technology, and Logistics, Frank Kendall, asserts that “whenever the Warfighter is willing to pay more for above threshold requirements or performance standards and may benefit from an innovative and technologically superior solution to meet their needs, a tradeoff source selection process between cost or price and non-cost factors is optimal” (Kendall, 2015, p. 2).

Offerors still have to meet minimum standards; however, they may be rewarded for surpassing minimum standards where advantageous to the government. The government must establish how they will assess each offeror’s quality, cost, and past performance, as well as the relative importance of these factors and any subfactors. The government communicates the importance of each evaluation factor through numerical and/or textual ranking specified in the solicitation document. For instance, the government might state that technical capability is twice as important as cost, which is twice as important as past performance. This implies a sort of numerical ranking (e.g., technical capability is worth 40 points, cost is worth 20 points, and past performance is worth 10 points). Alternatively, a textual ranking might say something like “technical capability is significantly more important than cost, which is more important than past performance.” Using this sort of language implies that the technical capability is the most important factor, and that it is much more important than either cost or past performance. Naturally, the evaluation of “significantly more important” or “more important” are left open to interpretation when comparing offerors. This sort of subjective assessment provides the government the flexibility to select the offeror that represents the best value to the government; however, it is also subject to potential pitfalls. One potential pitfall is that the evaluation of each offer may take more time and involve many rounds of internal discussions. A second potential pitfall is that the subjective nature of the assessment results in higher risk of the government failing to comply with the evaluation process as stated in the solicitation, which can result in a protest that delays the acquisition.

The TO method works best for complex acquisitions where requirements are not well-defined, and where increased contractor capability could make the acquisition less risky. Source selection for a TO requirement typically involves a source selection authority, a source selection advisory council, and a source selection evaluation board. Members of the source selection evaluation board evaluate each evaluation criteria independently, scoring proposals according to the source selection procedures established in the solicitation. The independent scores for each evaluation criterion are presented to the source selection advisory council, which then makes an award recommendation to the source selection authority. The source selection authority is the ultimate decision-maker—they can choose to accept the recommendation or choose a different offeror for the award.

Clearly, the TO source selection process is more bureaucratic than its LPTA counterpart. Further, because of the subjectivity involved in evaluating and rating proposals, TO source selections are often more susceptible to protests. However, “proponents of tradeoffs argue that the initial costs of a higher-priced vendor are ultimately more efficient, as the incentive structure encourages vendors to avoid cutting costs that could jeopardize the effort after award” (Lamoureux et al., 2015, p. 21).

In sum, the best value continuum balances the need to receive quality goods and services for the customer with the need to procure those goods and services in a way that is fiscally responsible for the taxpayer. Many articles and reports discuss the implications of choosing one source selection method over the other, see, for example, GAO (2014), Duncombe and Prentice (2013), and Nichols and Totman (2013). For most acquisitions, the choice of source selection method that best fits the requirement is clear. However, some

acquisitions do fall into gray territory, and for those, the choice of source selection method ultimately comes down to a cost-benefit analysis. For a detailed discussion of the costs and benefits of each method, particularly the tradeoff method, see Lamoureux et al. (2015).

Contract Type and Source Selection Methodology

While contract type and source selection methodology are two distinct decisions, source selection method is influenced by contract type. Further, both decisions are influenced by the type of requirement being outsourced and the results of market research during the procurement planning step.

In federal government contracting, there are two overarching contract types: fixed-price and cost-type contracts. FAR 16.202-1 states,

> A firm-fixed-price contract provides for a price that is not subject to any adjustment on the basis of the contractor's cost experience in performing the contract. This contract type places upon the contractor maximum risk and full responsibility for all costs and resulting profit or loss. It provides maximum incentive for the contractor to control costs and perform effectively and imposes a minimum administrative burden upon the contracting parties. (FAR 16.202-1)

Understanding this risk, contractors often apply a buffer in their proposed pricing to account for uncertainty. The more complex the requirement, the larger the buffer. For this reason, fixed-price contracts are typically used for commercial products and services. Naturally, the more clearly-defined the requirement, the more it lends itself to the LPTA source selection method, where price is considered the most important factor. In other words, when the requirements are well-defined and technical acceptability is easy to describe and evaluate, the determining factor for award is price—hence the relationship between fixed-price contracts and the LPTA source selection method.

On the other hand,

> Cost-reimbursement types of contracts provide for payment of allowable incurred costs, to the extent prescribed in the contract. These contracts establish an estimate of total cost for the purpose of obligating funds and establishing a ceiling that the contractor may not exceed (except at its own risk) without the approval of the contracting officer. (FAR 16.301-1)

Unlike fixed-price contracts, which are recommended for use whenever practical, cost-reimbursement contracts should only be used when the requirement cannot be sufficiently defined or when uncertainties in contract performance do not allow costs to be estimated sufficiently for a fixed-price arrangement (see FAR 16.301-2). In fact, "acquisition teams are prohibited from using cost-reimbursement contracts to procure commercial items, limiting their use to complex, uniquely governmental efforts" (Lamoureux et al., 2015, p. 17). Given the unique nature of many defense-related needs, it is not always possible for the federal government to have a well-defined requirement. Many of the weapons systems it procures have no equivalent anywhere in the world—they are purposefully different and represent innovative capabilities to achieve competitive advantage over our adversaries. Because they are "new to the world" requirements, they are often less defined and more difficult to clearly articulate to potential offerors. Less defined, more complex requirements are better procured using cost-type contracts. Because of the need for innovative solutions, cost-type contracts typically lend themselves to the TO source selection method, where the cost/price factor can be traded off for more important factors, such as technical capability.

Hypotheses

The purpose of this research is to empirically analyze popular assumptions related to source selection method and subsequent contract outcomes. To do this, we test four hypotheses.

Given that LPTA source selections typically occur when requirements are well-defined and lower risk, and the fact that LPTA source selections generally lend themselves to greater objectivity than TO source selections, we posit that LPTA source selections are faster (i.e., take less time from requirement generation to contract award) than TO source selections:

- Hypothesis 1: LPTA acquisitions have a shorter PALT than TO acquisitions.

Further, given that TO source selections are more flexible in allowing the government to trade cost/price for non-cost/non-price factors, and that TO source selections allow the acquisition team to rank the evaluation factors to best meet the needs of the requirement, we posit that TO source selections result in better contract performance[3] than LPTA source selections:

- Hypothesis 2: TO acquisitions produce higher CPARS scores than LPTA acquisitions.

We also examine whether different types of acquisitions (product acquisitions versus service acquisitions) produce different PALTs or CPARS scores. Because the data we collected were from systems-level buying organizations and/or from high dollar value contracts, the products and services acquired are more complex than those typically purchased at the installation level. Thus, given the similarity in complexity, we find no reason why product acquisitions and service acquisitions, using the same general procedures, would produce different contract outcomes:

- Hypothesis 3a: There is no difference in PALT between product acquisitions and service acquisitions.
- Hypothesis 3b: There is no difference in CPARS scores between product acquisitions and service acquisitions.

Next, we examine whether or not the contract outcomes are different between the service components. Because all service components are subject to the Federal Acquisition Regulation (FAR) and its Defense supplement (DFARS), we find no reason why different service components using the same general procedures would produce different contract outcomes:

- Hypothesis 4a: There is no difference in PALT between service components.
- Hypothesis 4b: There is no difference in CPARS scores between service components.

With the hypotheses in place, we turn to the details regarding the data and the analyses.

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[3] We use contractor performance (i.e., CPARS scores) as a surrogate measure for contract performance. The rationale is that if the contractor's performance is successful, the contract would also be considered successful.

Methodology

Data Collection

To collect the data required for this research, five teams of graduate students traveled to seven different Air Force and Navy contracting offices and pulled the data from actual contract files. Our goal was to choose contracts that were as similar in complexity as possible in order to better understand the effects that source selection method might have on contract outcomes. Thus, we purposely chose to collect data from systems-level buying organizations and/or high dollar value contracts. It is important to note that the contracting databases currently used in the Department of Defense (DoD) do not automatically collect these data. Thus, "scraping" the data from the physical contract files was required.[4]

Variables Examined

In group comparison statistical methods, like the ones used in this study, independent variables (IVs) serve as the grouping variables. They are categorical in nature (i.e., no single observation can belong to more than one group) and have at least two different categories, or groups. We have three IVs for this study: choice of source selection method (LPTA or TO), acquisition type (product or service), and service component (Air Force or Navy). Each IV is binary, where LPTA, product, and Air Force all equal zero, and TO, service, and Navy all equal one.

Dependent variables (DVs) are variables whose values depend on the IV. For this reason, they are often termed "outcome" or "response" variables. The DVs we chose for this study are meant to provide answers about how long the contracting process took (a process metric) and how well the contractor performed (a performance metric). Accordingly, we chose (1) PALT as the measure of time-to-contract and (2) CPARS scores as a measure of contractor performance. PALT is measured by the number of days from requirement identification to contract award. Consistent with FAR 42.15, CPARS data were collected and used for the following reporting categories: (1) cost control, (2) quality, (3) schedule, (4) business relationship, and (5) subcontracting. CPARS measures each category using the following Likert-style scale: 1 = unsatisfactory, 2 = marginal, 3 = satisfactory, 4 = very good, and 5 = excellent. These scores serve as a proxy for contractor performance, with higher numbers indicating better performance. Although we have CPARS data for each category, the average across the first four categories was used in this research, as the subcontracting category had relatively few cases, and the listwise deletion resulted in too few cases to run the analyses.

Covariates are secondary variables that can also affect the relationship of primary interest: the relationship between the IV and the DV. For this study, our goal is to parcel out the effects of covariates in order to more clearly see the relationship between the IVs and the DVs. We identified six potential covariates: (1) contract dollar value (VALUE), (2) number of reviews the solicitation and contract were subject to prior to award (NUMREVIEWS), (3) number of evaluation factors in the source selection plan

[4] While not the focus of this study, we found during the course of our research that a more comprehensive database is needed that captures many metrics the DoD should be capturing in order to quickly and continuously monitor performance of our contracts and contracting processes. See the Areas for Further Research section for more details.

(NUMEVALFACT), (4) number of offers received (NUMOFFERS), (5) number of contract line items in the contract (NUMCLINS), and (6) number of people on the source selection team (NUMPEOPLE). Each of these covariates could potentially affect PALT and/or CPARS scores, thus our goal was to parcel out their effect(s) in order to more clearly understand the effect of the IVs on the DVs.

Data Description

Our sample consists of 139 cases, which is sufficient for accurate analysis. The distribution of cases is unbalanced for each IV. There are 61 LPTA cases and 78 TO cases; 40 product acquisition cases and 99 service acquisition cases; and 52 Air Force cases and 87 Navy cases. This unbalanced design can cause ambiguity about the mean as the intercept and make assignment of sums of squares more difficult. There are, however, solutions to these issues. A weighted mean can be used in place of the grand mean and the STATA software (v12) we used for these analyses automatically handles the assignment of the sums of squares. Thus, we proceed with our analysis despite these limitations.

Analysis

Because our intent is to analyze differences in contract outcomes based on source selection methodology, acquisition type, and service component, a group comparison statistical methodology is necessary. We seek to find if there are differences in contract outcomes by group, both excluding and including the effect(s) of covariates.

MANOVA/MANCOVA

We use both multivariate analysis of variance (MANOVA) and multivariate analysis of covariance (MANCOVA) to assess group differences. Both methods create a new dependent variable using the information from the given dependent variables (PALT and CPARS scores). This new dependent variable is created in a way that maximizes differences between the grouping variable (the IVs).[5] Clearly, the only difference between the two methods is the use of covariates: MANOVA looks for differences in the DVs using the IVs only, while MANCOVA takes into account the effects of covariates when looking for group differences in the DVs. We use both methods to gain a better understanding of the effects of the covariates on the DVs. We describe the more complex method (MANCOVA) in detail.

MANCOVA addresses the following questions: Are mean differences among the groups on a combination of DVs (after adjusting for covariate effects) likely to have occurred by chance? Taken from another angle, is there a significant difference between the mean value for PALT and CPARS scores in LPTA source selections versus the mean value for PALT and CPARS scores in TO source selections, once the effects of the covariates have been parceled out?

If differences in outcomes are found using MANCOVA, we dig deeper to better understand the differences using univariate analysis of covariance (ANCOVA). ANCOVA

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[5] There is much debate as to whether Likert-type items like those used in our DV CPARS are considered interval or ordinal (see Carifio and Perla, 2007, for a review). MANCOVA requires the items be considered interval; however, we also used the Kruskal-Wallis H test, which considers CPARS an ordinal variable, to confirm our results. Due to space limitations, the results of this analysis are available from the first author.

also assesses group differences, however because it is univariate in nature, this method assesses one DV at a time (PALT *or* CPARS individually, rather than PALT *and* CPARS simultaneously). This method helps isolate where the difference(s) is (are) occurring.

Assumption Testing

Like all statistical methods, MANCOVA requires that certain assumptions about the data be tested to ensure accurate results. We tested six assumptions before proceeding. Beginning with 147 raw observations, we first searched for multivariate outliers using Mahalanobis' Distance. We found four outliers and chose to drop those observations from subsequent analyses (n = 143), as outliers are known to significantly affect MANCOVA (Tabachnick & Fidell, 2007). Further, we searched for univariate outliers in each cell of our design (see Table 1). We found four univariate outliers, which were subsequently deleted (n = 139).

Table 1. Cell Design

Cell Design		
	Air Force	**Navy**
Product Acquisition	LPTA (6)	LPTA (18)
	TO (2)	TO (14)
Service Acquisition	LPTA (13)	LPTA (24)
	TO (31)	TO (31)

Second, we tested multivariate normality among the DVs by examining density graphs, determining multivariate skewness and kurtosis in order to identify variables that might require transformation. For the DVs, PALT was deemed to be non-normal and was normalized via a logarithmic transformation. We also considered the normality of the covariates, as covariates are useful in reducing error, but not if they are non-normal and thus reduce power (Tabachnick & Fidell, 2007). Several covariates required transformation. Specifically, VALUE, NUMREVIEWS, NUMOFFERS, and NUMCLINS all received a logarithmic transformation, and to normalize NUMPEOPLE, the square root was taken. After these transformations, all variables were deemed to be multivariate normal. All further analyses and statistical output use the transformed variables, however the written results back-transform the variables into their original form for a better understanding of the effects. We use the untransformed variable nomenclature in the text for ease of reading.

Third, we assessed linearity by examining scatter plots of (1) the paired DVs, (2) all pairs of covariates, and (3) all pairs of DV-covariate combinations for each grouping variable (a total of 168 plots). The plots revealed that NUMCLINS and NUMPEOPLE were consistently not linear, thus those covariates were removed from further analyses. Other variables failed linearity sporadically, and we were careful to remove offending pairings.

Fourth, we assessed homogeneity of regression for each DV and grouping variable (a total of 24 assessments). This test was performed using an analysis of covariance (ANCOVA) that included the independent variables, each of the remaining covariates (VALUE, NUMREVIEWS, NUMEVALFACT, and NUMOFFERS), and the interaction between the independent variables and the covariates. When the interaction terms are not significant, the relationship between the dependent variables and each of the remaining covariates is the same at both levels of the independent variables, and the assumption of homogeneity of regression is upheld. There were three violations of homogeneity of regression. First, when PALT is the DV, the interactions between service component and number of reviews is significant. This means that the number of reviews the contracts we examined went through differed significantly between the Air Force (mean = 6.5 reviews)

and the Navy (mean = 5.5 reviews). Second, the interaction between acquisition type and number of offers is significant when PALT is the DV, meaning that product acquisitions (mean = 4.23 offers) receive significantly different number of offers than service acquisitions (mean = 4.43 offers). Finally, when CPARS scores is the DV, the interaction between service component and value is significant. Again, the value of the contracts differs significantly between the Air Force (mean = $52,000,000) and the Navy (mean = $32,300,000). We were careful to remove the offending covariates, where appropriate, from our analyses.

Fifth, we checked for multicollinearity by assessing the pooled within cell tolerance for each DV. The DVs are not highly correlated in any cell, thus multicollinearity is not an issue.

Finally, we checked for homogeneity of covariance matrices between groups using the multivariate test of means provided in STATA (v12). This test checks whether or not population variances and covariances of both dependent variables are equal for each of the IV groups. The results showed that all grouping cells are homogenous (source selection method: Box's M $X^2(3) = 1.88$, $p = .5967$; acquisition type: Box's M $X^2(3) = 4.12$, $p = .2484$; and service component: Box's M $X^2(3) = 6.08$, $p = .1078$).

Table 2 provides the remaining covariates available for each MANCOVA and subsequent ANCOVA.

Table 2. Covariates Available for MANCOVA/ANCOVAs

Covariates Available for MANCOVA/ANCOVAs			
Grouping Variable	**MANCOVA: PALT & CPARS Scores**	**ANCOVA: PALT**	**ANCOVA: CPARS Scores**
Source Selection Method	VALUE* NUMEVALFACT NUMOFFERS	VALUE NUMREVIEWS NUMEVALFACT NUMOFFERS	NUMEVALFACT NUMOFFERS
Acquisition Type	VALUE NUMEVALFACT	VALUE NUMREVIEWS NUMEVALFACT	VALUE NUMEVALFACT NUMOFFERS
Service Component	NUMEVALFACT*	VALUE NUMEVALFACT	NUMOFFERS
*Although these variables are not fully linear with both DVs, their departure from linearity was minor. We tested the MANCOVAs with and without these variables, and the results were similar. We chose to include them in our analyses.			

With all assumptions tested, we performed the MANOVAs and MANCOVAs. The results are provided in the next section.

Results

Descriptive Statistics

Basic descriptive statistics for each variable are shown in Table 3. The table presents results for each grouping variable.

Table 3. Descriptive Statistics

Descriptive Statistics						
Variable	Obs	Mean	StdDev	Min	Max	Grouping Variable
PALT (days)	133	303.02	271.71	3	1019	-
	60	143.38	110.02	3	482	LPTA SS
	73	*434.22*	*294.52*	*21*	*1019*	*Tradeoff SS*
	38	228.79	198.03	3	953	Product Acq
	95	*332.71*	*291.75*	*8*	*1019*	*Service Acq*
	51	329.10	294.40	21	1019	Air Force
	82	*286.79*	*257.13*	*3*	*990*	*Navy*
CPARS (average rating)	69	4.00	.78	2.5	5	-
	20	3.63	.67	3	5	LPTA SS
	49	*4.15*	*.79*	*2.5*	*5*	*Tradeoff SS*
	14	3.50	.64	2.5	5	Product Acq
	55	*4.13*	*.77*	*3*	*5*	*Service Acq*
	35	4.07	.78	3	5	Air Force
	34	*3.93*	*.80*	*2.5*	*5*	*Navy*
Contract Dollar Value	139	$39,700,000	$85,800,000	$27,819	$450,000,000	-
	61	$9,846,556	$57,400,000	$27,819	$450,000,000	LPTA SS
	78	*$63,000,000*	*$96,600,000*	*$36,000*	*$432,000,000*	*Tradeoff SS*
	40	$32,100,000	$84,900,000	$145,481	$450,000,000	Product Acq
	99	*$42,700,000*	*$86,300,000*	*$27,819*	*$432,000,000*	*Service Acq*
	52	$52,000,000	$105,000,000	$36,000	$432,000,000	Air Force
	87	*$32,300,000*	*$71,300,000*	*$27,819*	*$450,000,000*	*Navy*
Number of Reviews	118	5.89	5.83	1	28	-
	56	5.77	5.46	1	25	LPTA SS
	62	*6.00*	*6.19*	*1*	*28*	*Tradeoff SS*
	35	4.11	4.12	1	22	Product Acq
	83	*6.65*	*6.28*	*1*	*28*	*Service Acq*
	44	6.52	6.05	1	28	Air Force
	74	*5.53*	*5.69*	*1*	*25*	*Navy*
Number of Evaluation Factors	129	2.67	.86	1	5	-
	55	2.13	.55	1	3	LPTA SS
	74	*3.07*	*.83*	*2*	*5*	*Tradeoff SS*
	35	2.40	.77	1	4	Product Acq
	94	*2.77*	*.87*	*1*	*5*	*Service Acq*
	48	2.42	.61	1	4	Air Force
	81	*2.81*	*.95*	*1*	*5*	*Navy*
Number of Offers	139	4.37	4.33	1	23	-
	61	3.85	4.39	1	23	LPTA SS
	78	*4.78*	*4.27*	*1*	*22*	*Tradeoff SS*
	40	4.22	3.39	1	12	Product Acq
	99	*4.43*	*4.67*	*1*	*23*	*Service Acq*
	52	6.40	5.70	2	23	Air Force
	87	*3.16*	*2.63*	*1*	*12*	*Navy*
Data presented is in its original form, before transformation.						

MANOVA

We begin with a series of MANOVAs to determine the primary effects the grouping variables have on contract outcomes. We examine all three grouping variables together, and then each individually. Where significant effects are found, ANOVA is used to identify which outcome variable(s) is(are) affected.

Using all three grouping variables, we find the overall model is significant (*Wilks' Λ* = .7141, $F(6, 118) = 3.61$, $p < .01$). *Wilks' Λ* is high, suggesting that 71% of the variance in the outcome variables is not explained by the three grouping variables. The results suggest that the source selection method is driving significance.

When source selection method is the only grouping variable, the model is again significant (*Wilks' Λ* = .7818, *F*(2, 61) = 8.51, *p* < .01). Follow-up ANOVAs show that both PALT and CPARS scores are significantly affected by source selection method (PALT, *F* (1, 131) = 45.34, *p* < .01, partial η^2 = .25 and CPARS scores, *F* (1, 67) = 6.50, *p* < .05, partial η^2= .09). Although source selection method significantly affects both PALT and CPARS scores, it has a much more profound impact on PALT than on CPARS scores. The mean PALT for TO acquisitions is 67% longer than the mean PALT for LPTA acquisitions, whereas the mean CPARS rating for TO acquisitions is 13% higher than the mean CPARS rating for LPTA acquisitions. These results support Hypotheses 1 and 2.

Using only acquisition type as the grouping variable, the model is not significant (*Wilks' Λ* = .9228, *F*(2, 61) = 2.55, ns). However, post-hoc ANOVAs indicated that there is a significant difference in CPARS scores between product and service acquisitions (*F* (1, 67) = 7.85, *p* < .05, partial η^2 = .10). The mean CPARS score for service acquisitions is 15% higher than the mean CPARS score for product acquisitions. These results support Hypothesis 3a, but not 3b.

When service component was used as the grouping variable, the model was not significant (*Wilks' Λ* = .9876, *F*(2, 61) = .38, ns). Post-hoc ANOVAs found the same—there were no statistically significant differences in PALT or CPARS ratings between Air Force acquisitions and Navy acquisitions, supporting Hypotheses 4a and 4b.

MANCOVA

With the primary tests of the IVs on the DVs complete, we add covariates to our model to determine the impact that related aspects of the acquisition process have on PALT and CPARS scores.

Using source selection method as the grouping variable, we find the model is significant (*Wilks' Λ* = .5110, *F*(8, 106) = 5.28, *p* < .01). The substantially lower *Wilks' Λ* shows that an additional 27% of the variance in the DVs is captured when the covariates are included. Further highlighting the importance of the covariates, the univariate ANCOVAs show that when the covariates are included, source selection method is no longer significant. Instead, it is the value of the acquisition (*F* (1, 106) = 9.53, *p* < .01, partial η^2 = .08), the number of evaluation factors (F (1, 106) = 6.27, p < .05, partial η^2 = .06), and the number of offers (*F* (1, 106) = 7.02, *p* < .01, partial η^2 = .06) that significantly affect PALT, while no variables significantly affected CPARS scores. The mean number of evaluation factors and number of offers for LPTA acquisitions is 2.13 and 3.85, respectively, while the mean for TO acquisitions is 3.07 and 4.78, respectively. These results do not support Hypotheses 1 or 2; seeming to disprove popular assumptions about the effects of source selection method on contract outcomes. Because MANCOVA represents a more realistic view of the acquisition process, we deem these results to be more robust than the MANOVA results.

Using acquisition type as the grouping variable, the model is significant (*Wilks' Λ* = .5156, *F*(6, 108) = 7.07, *p* < .01). With the covariates included, we were able to capture an additional 41% of the variance in the DVs. The univariate ANCOVAs showed that it is again the value of the acquisition (*F* (1, 107) = 13.20, *p* < .01, partial η^2 = .11) and the number of evaluation factors (*F* (1, 107) = 7.60, *p* < .01, partial η^2 = .07) that significantly affect the PALT. In this analysis, CPARS scores are affected by acquisition type, with services acquisitions receiving statistically significantly higher CPARS scores than product acquisitions (*F* (1, 58) = 6.59, *p* < .05, partial η^2 = .10). CPARS scores were 15% higher for service acquisitions than for product acquisitions. These results support Hypotheses 3a, but not 3b—with the covariates included, there is no difference in PALT between product

acquisitions and service acquisitions; but there is a difference in CPARS scores between product acquisitions and service acquisitions.

Next, using service component as the grouping variable, the model was significant (*Wilks' Λ* = .6839, $F(4, 110) = 5.75$, $p < .01$). We were able to capture an additional 30% of the variance in the DVs by including the covariates. The univariate ANCOVAs once again showed the importance that value (F (1, 120) = 22.54, $p < .01$, partial $\eta^2 = .16$) and the number of evaluation factors (F (1, 120) = 4.81, $p < .05$, partial $\eta^2 = .04$) has on PALT. No variables significantly affected CPARS scores. These results support Hypotheses 4a and 4b—with the covariates included, there are no differences in PALT or CPARS scores between the Air Force acquisitions and Navy acquisitions.

Discussion & Conclusion

We broke new ground in this research by scientifically testing popular assumptions related to source selection methods and their subsequent contract outcomes. Further, we empirically showed that contract outcomes are the same between service components, but not necessarily between acquisition types. The following practical and managerial implications are provided for this research.

Using a simple MANOVA, we found there are significant differences in contract outcomes based on source selection method. The subsequent ANOVAs showed that PALT was 67% longer for TO source selections than for LPTA source selections. Further, the CPARS scores were, on average, 13% higher for TO source selections when compared to LPTA source selections. While these results appear to lend credence to popular anecdotes, when the details of the acquisition (i.e., the covariates) were included in the analysis, source selection method did not affect PALT or CPARS scores. Instead, it was the value of the acquisition, the number of evaluation factors, and the number of offers that affected PALT; and no variables affected CPARS scores.

This is a very interesting finding, as it suggests that it is the *details and processes of the acquisition itself*—some of which are controllable by the acquisition team—that affect time-to-contract. Specifically, the more evaluation factors included in the solicitation, the more time it takes to evaluate them and award a contract. This is common sense, of course, but the finding generates the question of the optimal number of evaluation factors. Is there a tipping point at which the number of evaluation factors included in the solicitation significantly affects PALT? Finding the answer to this question would help procurement teams plan their solicitations accordingly—either reducing the number of evaluation factors, or planning for extra time to assess many evaluation factors.

Further, the number of offers a requirement receives significantly affects PALT. Those in the field understand this finding, as more offers require more time to properly evaluate before awarding a contract. The number of offers a requirement receives is related to how wide the procurement team "cast the net"—how many offerors in the market were eligible to receive the contract. A procurement team can cast a wide net by using full and open competition solicitation methods, or they can cast a narrower net by limiting eligible respondents to small businesses, or even a sole source, when justified. Clearly, there is a balance to achieve between inspiring maximum competition and awarding the contract in the desired amount of time. Maximum competition often results in lower prices and increased quality, but comes with the cost of extended evaluation time, and, thus, a longer PALT. Minimizing competition might allow the contract to be awarded faster, but the procurement team may not achieve the best business deal. Here, again, the question of the optimal number of offers is raised.

Finding that there were significant differences in CPARS scores based on the type of acquisition is also interesting. We found that service acquisitions receive 15% higher CPARS scores than product acquisitions. These results may highlight criticism the DoD has received in recent years concerning the department's failure to properly evaluate/score service contract performance (e.g., lack of proper scoring metrics, failure to properly oversee and measure service performance, etc.). Higher CPARS scores for service acquisitions might reflect these failures. Without adequate justification to downgrade performance, scores may be artificially high.

Finally, we found no significant differences in PALT or CPARS scores between service components. This suggests that federal regulations, policies, and practices are being applied in a uniform manner across service components.

In summary, we feel the most important finding of this research is that the covariates matter. In other words, it is the details of the acquisition, solicitation document, and source selection processes that affect the time-to-contract. Each service component should ensure their processes are expedient and supportive, always aimed at producing optimal contract outcomes for the customer in a way that is least burdensome for the acquisition team.

Areas for Further Research

More data are needed to substantiate the results found in this research. Access to more data might also permit more covariates to pass assumptions, allowing for more comprehensive analyses.

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Graduate School of Business & Public Policy
Naval Postgraduate School
555 Dyer Road, Ingersoll Hall
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