Applying marginal analysis in determining the number of contractors: An approach for the Advisory and Assistance Services (A&AS) and Department of Defense (DOD)

Ray M. Valadez
Pepperdine University

Leo A. Mallette
Pepperdine University

Aaron Albrecht
Pepperdine University

ABSTRACT

The Department of Defense (DOD) finds itself with budget constraints and having to account not only for its deliverance of its core missions but for its efficient use of resources as well. Contractors are considered an important resource. Several publications have recently suggested the DOD needs a better budget allocation methodology as well as a better census of contractors. It has been criticized for not even knowing how many contractors it has under contract.

This paper suggests the use of an economic concept called marginal analysis to help project managers, directors, contracting officers, and other decision-makers in government and non-government agencies manage the allocated budget. Arriving at an efficient use of contractors, while not losing control of the DOD's responsibilities or outsourcing inherently governmental functions intimately related to public interest, may be provided by using marginal analysis. The DOD relies on organizations under the Advisory and Assistance Services (A&AS) contracts to provide services that help improve the quality and timely delivery of contractor's services while minimizing costs. The services provided by A&AS take the form of information, advice, opinions, alternatives, analyses, evaluations, recommendations, training, and technical support. The researchers using recent data, a hypothetical budget, and marginal analysis where fixed costs are locked in, suggest that the A&AS should aim for the number of contractors that gains its most efficient use of resources by minimizing costs while ensuring mission success.

Keywords: marginal analysis, project management, Department of Defense, DOD contracting

INTRODUCTION

The recent U.S. government impasse on approving the budget by March 1, 2013, has created the implementation of automatic cutbacks in government spending. According to news reports approximately half of the automatic budget cuts of 1.2 trillion dollars will be in defense (Przbyola & Rubin, 2013). While political efforts are taking place to prevent such drastic cuts, budgets will be slashed in almost every area of spending including defense. The Department of Defense (DOD) finds itself not only with having to account for its deliverance of its core missions but for its efficient use of resources as well under these budget reductions. One of the considerations is the reduction of the use of independent contractors.

Contractors are considered an important resource. Several publications have recently suggested the DOD needs a better budget allocation methodology as well as a better census of contractors in order to make budget cuts (Weigelt, 2011). Budget allocations for contractors are based on the term, Full Time Equivalent (FTE) in measuring the dollar amount for each contractor to arrive at the number of contractors. The DOD has been criticized for not even knowing how many contractors it has under contract (Clark, 2011).

This paper suggests the use of an economic concept called marginal analysis to help project managers, directors, contracting officers, and other decision-makers in government and non-government agencies manage the allocated budget. Arriving at an efficient use of contractors while not losing control of the DOD's responsibilities, may be provided by using marginal analysis. The analysis presented in this paper is from a purely economic point of view and other factors in decision making, such as maintaining the inherently functional responsibilities of the government internally, are not addressed.

The DOD relies on organizations under the Advisory and Assistance Services (A&AS) contracts to provide services that help improve the quality and timely delivery of contractor's services while minimizing costs. This paper was the result of a directed study and provides an approach to assist decision makers manage budgets. It begins with who will benefit from the marginal analysis approach. The methodology and definitions of terms is given. Then an explanation of the results is provided along with tables and figures. Finally, a conclusion and recommendation is stated suggesting the government decision makers consider applying the concept of marginal analysis in deciding on the most efficient use of resources.

BENEFICIARIES OF THE SUGGEST APPROACH

Project managers, directors, contracting officers, and other decision-makers in government and commercial enterprises are required to perform a make-buy analysis when selecting a part, subsystem, or company to perform a task. There are many reasons for making a *make* decision; such as to maintain core competence, lower production cost, utilize surplus labor or facilities, obtain unique items, protect personnel from a layoff, or increase or maintain size of company (Heizer & Render, 2010).

Similarly, there are many reasons for making a *buy* decision; such as freeing management to deal with its core competence, lower acquisition cost, obtain technical or management ability, inadequate managerial or technical resources, or product is protected by a patent or trade secret (Heizer & Render, 2010). The analysis presented in this paper is from a purely economic point of view and these other factors in the make-buy decision are not addressed.

GOVERNMENT SUPPORTING ORGANIZATIONS

The DOD defines Advisory and Assistance Service (A&AS) as:

> … identifying services acquired by contract from non-governmental sources to support or improve organization policy development, decision making, management and administration; support program and/or project management and administration; provide management and support services for Research & Development (R&D) activities; provide engineering and technical support services; or improve the effectiveness of management processes or procedures. These services may take the form of information, advice, opinions, alternatives, analyses, evaluations, recommendations, training, or technical support. (Office of the Secretary of Defense, 2013, p. 2)

The A&AS services take the form of information, advice, opinions , alternatives, analyses, evaluations, recommendations, training, and technical support (Office of the Secretary of Defense, 2012). Within the A&AS, the following types of service organizations may benefit by using marginal analysis. Two of these are broadly defined as Systems Engineering and Technical Assistance (SETA) contractors and Federally Funded Research and Development Centers (FFRDC) contractors.

SETA. Many civilian employees of companies provide assistance to the government. These companies are often called Systems Engineering and Technical Assistance (SETA) contractors. These

> contractors are civilian employees or government contractors who are contracted to assist the United States Department of Defense (DoD) components, and acquisition programs. (In some areas of DoD, the acronym SETA refers to "Systems Engineering and Technical Assessment" contractors; also refers to "Systems Engineering and Technical Advisors.") SETA contractors provide analysis and engineering services in a consulting capacity, working closely with the government's own engineering staff members. SETA contractors provide the flexibility and quick availability of expertise without the expense and commitment of sustaining the staff long-term. (SETA, 2013, p. 1)

FFRDC. There are about 40 Federally Funded Research and Development Centers (FFRDC) according to Master (2005). One of the better known FFRDCs is the Jet Propulsion Laboratory (JPL) which is managed by the California Institute of Technology (Caltech) in Pasadena California. Part 2.101 of the Federal Acquisition Regulation (1983) defines them as:

> *Federally Funded Research and Development Centers (FFRDC's)* means activities that are sponsored under a broad charter by a Government agency (or agencies) for the purpose of performing, analyzing, integrating, supporting, and/or managing basic or applied research and/or development, and that receive 70 percent or more of their financial support from the Government; and—(1) A long-term relationship is contemplated; (2) Most or all of the facilities are owned or funded by the Government; and (3) The FFRDC has access to Government and supplier data, employees, and facilities beyond that common in a normal contractual relationship. (p. 31)

METHODOLOGY

Marginal analysis was primarily used in teaching business management to either maximize profits or minimize losses in manufacturing. It has since evolved as a tool to help management make decisions when deciding at what production levels of goods and services would make the most efficient use of resources. In this paper, the concept is being applied to determine on a fixed budget what number of contractors should be considered to minimize cost without being inefficient. Of course, there are many variables that affect efficiency. However, the attempt using marginal analysis will seek efficient use of resources such as contractors.

The researchers took the estimated budget for the A&AS for 2013 (Office of the Secretary of Defense, 2013) as shown in Table 1 of the Appendix and adjusted the actual budgets for 2010 and 2011 as well as the enacted budget for 2012. The actual budget for 2012 was not available, therefore the enacted budget was used and was adjusted based on the 2013 year. Additionally, from a Government Accounting Office (GAO) publication the average direct labor cost using the Acquisition, Technology and Logistics (AT&L) guidance number of $131,000 per FTE contractor (Hutton & Solis, 2011, p. 12) was used to back in the averages for 2010-1013 respectively. The guideline of 51 percent of the obligated contract for the contractor was used as the variable cost. Knowing the variable costs and the average direct labor costs gives us the data points to solve for the relationship. These data points were used to arrive at a polynomial equation for the variable cost curve as shown in Figure 1 in the Appendix. Excel was used to solve for the equation. The equation for the variable cost curve is:

$$y = 0.0004557659x^2 - 13.6560248362x + 229{,}704.277 \qquad (1)$$

Where

y = average cost per A&AS FTE contractor (dollars)
x = number of A&AS contractors

The total cost formula is made up of two elements, the fixed costs and variable costs. The Fixed cost were calculated from the fixed cost in 2010 per employee times the number of A&AS contractors for that year. Using the assumptions in Table 1 and extracting the polynomial equation from Figure 1, Table 2 was created as shown in the Appendix. Once a budget has been set and using the guidelines as suggested by the GAO, one locks in the *fixed cost* (49 percent of the allocated budget). In 2013 using a fixed cost of $1,457,204,140 and formula (1), one can create Table 2. The *number of contractors* (column A) was assumed. The *fixed cost* (column B) was defined as 49 percent of the allocated budget. The *variable cost* (column B) was calculated using formula (1) as previously noted. The *total cost* is simple adding the fixed cost and variable cost. The *marginal cost* is the *change* in total cost (column D) divided by the *change* in the number of contractors (column A). The *average fixed cost* is arrived by taking the total cost (column B) and dividing it by the number of contractors (column A). The *average variable cost* is similarly arrived at by taking the variable cost (column C) and dividing it by the number of contractors (column A). Finally, the *average total cost* is found by taking the total cost (column D) and dividing it by the number of contractors (column A).

Table 2 numbers were then graphed as shown in Figure 2 of the Appendix. Notice that the marginal cost curve represents the numbers in column E of Table 2 and looks like a typical “J” curve for which the marginal curve is known for in economics. The average fixed cost, average variable cost, and average total cost curves come from the numbers in columns F through H of Table 2 respectively. Also, special attention should be placed on where the marginal cost curve crosses the average total cost curve. This point happens to be the minimum point of the average total cost which suggests effective use of resources in economics.

Expanding on Table 2 and Figure 2, Table 3 was created to demonstrate further the effective use of resources by attempting to measure profit/loss using different levels of contractors. Column A of Table 3 is the *number of contractors*. Column B is the *wrap rate per contractor* and will be considered to be the hypothetical *price* of the contractor or the total cost to the government per contractor. In this case the wrap rate is assumed to be $262,513.73 per contractor. Colum C is the total cost to the government as has been previously calculated in Table 2. Column D is the *total revenue* generated by taking the assumed price per contractor and multiplying it by the number of contractors. Column E is the marginal cost by taking the *change* in total cost and dividing it by the *change* in the number of contractors similar to the way it was calculated in Table 2. Column F is the marginal revenue, which is nothing more than the price used per contractor. Finally, column G is the difference between total revenue (column D) and total cost (column C) to reveal the profit/loss at each level of contractors. Notice that one maximizes profit (gain) between levels 20,000 and 25,000.

The numbers from Table 3 are graphed and shown in Figure 3 in the Appendix. Abstractly, one can visually see where the total revenue curve exceeds the total cost curve resulting and displaying the profit/loss curve. Again, notice that the number maximizing the profit is somewhere between 20,000 and 25,000 contractors. Further display of the numbers are isolated and displayed in Figure 4. This figure is very consistent with other marginal analysis showing the intersection of the marginal cost and marginal revenue. In economic terms, one says this would be the ideal quantity of producers. In this case, quantity of producers is used interchangeably with quantity of products or units. Figure 4a is zooming in on Figure 4 for better discernment of the intersection between the two curves, marginal cost and marginal revenue.

RESULTS

Marginal analysis seeks the intersection of economic costs where the marginal cost crosses the average total cost at its minimum point. As seen, the marginal cost (MC) in Figure 2 in the Appendix intersects the average variable cost (AVC) and average total cost (ATC) at the minimum points. This is the result of a relationship called the marginal-average rule. "The marginal-average rule states that when marginal cost is below average cost, average cost falls… [and] when marginal cost is above average cost, average cost rises" (Tucker, 2011, p. 191). The best way to understand this rule is to apply it in other noneconomic terms. In sports, if a player is added with an average scoring record exceeding the team's average, the team's average score will increase. In this paper's hypothetical example using Excel, it was determined that below 22,188 the average costs were dropping, and above 22,188, they were rising. Thus, concluding this was the minimum points of the cost curves for the AVC and ATC.

Further exploration of the mathematical representations of the marginal cost curve, average variable cost curve, and average total cost curve were done using Excel by taking the data from Table 2 and Figure 2. The following equations (equations 2-4) represent these polynomial curves respectively:

$$y = 34182x^2 - 170743x + 309379 \tag{2}$$

$$y = 11394x^2 - 91063x + 309365 \tag{3}$$

$$y = 19665x^2 - 172075x + 584879 \tag{4}$$

Where
y = dollar cost of each contractor
x = units of 5000 contactors

Letting *x* represent *units of 5000 contractors* and setting equations (2) and (4) equal to each other provides:

$$34182x^2 - 170743x + 309379 = 19665x^2 - 172075x + 584879, \text{ or}$$

$$14517x^2 + 1332x - 275500 = 0 \tag{5}$$

Solving equation (5) for *x* using the formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Provides

$$x = \frac{-1332 \pm \sqrt{(1332)^2 - [(4)*(14517)*(275500)]}}{(2)*(14517)} \approx 4.31 \text{ (pos. \#)} \tag{6}$$

The negative number in the above answer of -4.40 was not used because this would give a negative number of contractors. From formula (6), one gets an answer for *x* as 4.31. Since each *x* represents a unit of 5000 contractors, the number of contractors at the minimum average cost and where marginal cost equal marginal revenue will be approximately

$$5000x \approx 21{,}550 \tag{7}$$

To check the number resulting from formula (7), one gets approximately 21,550 contractors as being the ideal number of contractors based upon the budget and the allocated direct labor cost. Excel's parameter solver under the *Data menu* was used by matching the marginal cost figure with the marginal revenue figure and solving for the number of contractors. In economics we often use the marginal revenue equals marginal cost method to determine the maximizing level of output (Tucker, 2011, p. 216). In Table 3 column (A) line 15 was calculated using this method and resulted in 22,188 contractors. This was a minor difference from the quadratic formula resulting from formulas (2) and (4). However, the quadratic formulas 2 through 4 are *polynominal estimates* to the second degree using the Excel line trends function, and therefore, they may explain the minor difference. Consequently, the use of Excel's data solver may be more reliable, and the researchers would lean towards using 22,188 as a more reasonable number.

CONCLUSIONS AND RECOMMENDATIONS

This paper was the result of a directed study at Pepperdine University and provides a marginal analysis approach to assist government decision makers manage budgets that use Full Time Equivalent (FTE) contractors. Its focus was primarily on arriving at the number of FTE contractors used by the Department of Defense (DOD).

Project managers, directors, contracting officers, and other decision-makers in government and commercial enterprises are required to perform a make-buy analysis when selecting a part, subsystem, or company to perform a task using independent contractors. More importantly, the profit window for contractors' to bid on A&AS contracts may be relatively small as has been discovered in this study. The researchers using recent data, a hypothetical budget estimated for 2013, and marginal analysis where fixed costs are locked in, suggest that the A&AS should target the number of contractors that gains its most efficient use of resources by minimizing costs while ensuring mission success. The target is where marginal costs meet marginal revenue.

Given a budget and knowing what portion will be used for direct labor costs or variable cost allows the decision maker a method to arrive at the ideal number of contractors using marginal analysis. More importantly with this type of analysis, the Executive and Congressional branches can more accurately answer the controversial question of how much assistance from A&AS is appropriate for the DOD. Besides determining the budget, considering what will be outsourced and what will be kept functionally inside, and setting the percent allocation for direct labor cost, the decision maker will be able to determine the number of contractors most appropriate by minimizing costs. Additionally, performing this analysis will provide the marginal cost of adding one additional contractor which can be compared to adding one more government employee.

Because of limited access to data, the researchers only approximated the ideal number of contractors to be used by A&AS in 2013. More access to accurate data would provide better estimates and results. Finally with budget constraints becoming a political issue, it becomes imperative that the decision makers use different approaches to solving the dilemma of the number of contractors to be hired given a fixed budget. Finally, contents of this paper represent personal opinion and thoughts and should in no way be construed as the opinion of the United States Air Force, Department of Defense, or the Advisory and Assistance Services.

REFERENCES

Clark, S. (2011, February). Pentagon to reduce number of contractors, doesn't know how many it has. *Fox News*. Retrieved from http://www.foxnews.com/politics/2011/02/09/pentagon-seeks-reduce-number-contractors-knowing/

Executive Correspondence. (2011). *Executive Correspondence* - Letter with Enclosed Documents from Ohio Senators Mike DeWine and George V Voinovich and Representatives, Sequence: 13 | UNT Digital Library. Retrieved 22 Sept. 2012 from http://digital.library.unt.edu/ark%3A/67531/metadc20946/m1/13/

Federal Acquisition Regulation. (1983). *Federal Acquisition Regulation*. Retrieved February 22, 2013 from http://www.gpo.gov/fdsys/pkg/CFR-2010-title48-vol1/pdf/CFR-2010-title48-vol1-part2.pdf

Hutton, J. P., & Solis, W. (2011). Report to Congressional Committee. *Defense acquisitions* (GAO Publication No. GAO-11-192) Retrieved 1 March, 2013 from http://www.gao.gov/assets/320/314659.pdf.

Heizer & Render. (2010). *Operations Management*, Tenth edition, Upper Saddle River, NJ: Pearson/Prentice Hall

Jolliffe, R. B. (2010). *Advisory and Assistance Services Contracts in Support of the Air Force Combat Search and Rescue Helicopter*. Office of the Deputy Inspector General for Auditing. Retrieved 22 Sept. 2012 from http://www.dodig.mil/audit/reports/fy10/10-054_redacted.pdf

Kingsbury, N. (1994). *Government Contractors Measuring Costs of Service Contractors Versus Federal Employees.* Government Accountability Office. Retrieved on 22 Sept. 2012 from http://www.gao.gov/assets/220/219269.pdf

Master. (2005). *Master government list of federally funded research and development centers*. Retrieved February 22, 2013 from http://www.nsf.gov/statistics/nsf05306/

Office of the Secretary of Defense. (2012). Office of the Secretary of Defense - Budget Materials. Retrieved on 22 Sept. 2012 from http://comptroller.defense.gov/defbudget/fy2012/budget_justification/pdfs/01_Operation_and_Maintenance/O_M_VOL_2_PARTS/5_PB-15.pdf

Office of the Secretary of Defense. (2013). Office of the Secretary of Defense - Budget Materials. Retrieved on 22 March, 2013 from http://comptroller.defense.gov/defbudget/fy2013/budget_justification/pdfs/01_Operation_and_Maintenance/O_M_VOL_2_PARTS/5_Advisory_and_Assistance_Services.pdf

SETA. (2013). *Systems engineering and technical assistance*. Retrieved February 22, 2013 from http://en.wikipedia.org/wiki/Systems_Engineering_and_Technical_Assistance

Przybyla, H., & Rubin, R. (2013, January). Spending cuts including to defense seen to start in March. *Bloomberg News*, Retrieved from http://www.bloomberg.com/news/print/2013-01-30/automatic-u-s-budget-cuts-more-likely-as-stances-harden.html

Weigelt, M. (2011, January 20). DOD needs better census of contractors. *Washington Technology*. Retrieved from http://washingtontechnology.com/articles/2011/01/20/gao-dod-service-contract-inventory.aspx

AUTHORS

Ray M. Valadez. Ed.D. , MBA is a professor of economics at Pepperdine University and serves in various faculty committees including the elected office of Faculty Council. He has published several award winning papers as well as serves as a reviewer and advisor for academic publishing journals. He previously held line and staff positions in the financial services industry and was a registered principal before the NASD. Besides teaching, he is a practitioner and consults for international businesses.

Leo A. Mallette, Ed.D. is an adjunct faculty at Pepperdine University. He is currently associated with the Aerospace Corporation. Dr. Mallette has published over 70 conference and peer-reviewed journal articles and is co-author of the book *Writing for Conferences* (Greenwood, 2011) and co-editor of *The SPELIT Power Matrix* (CreateSpace, 2007).

Aaron Albrecht is a contract negotiator for the United States Air Force at the Los Angeles Air Force Base and has worked for the Air Force for over 9 years. He is completing his MBA from the Graziadio School of Business and Management, Pepperdine University.

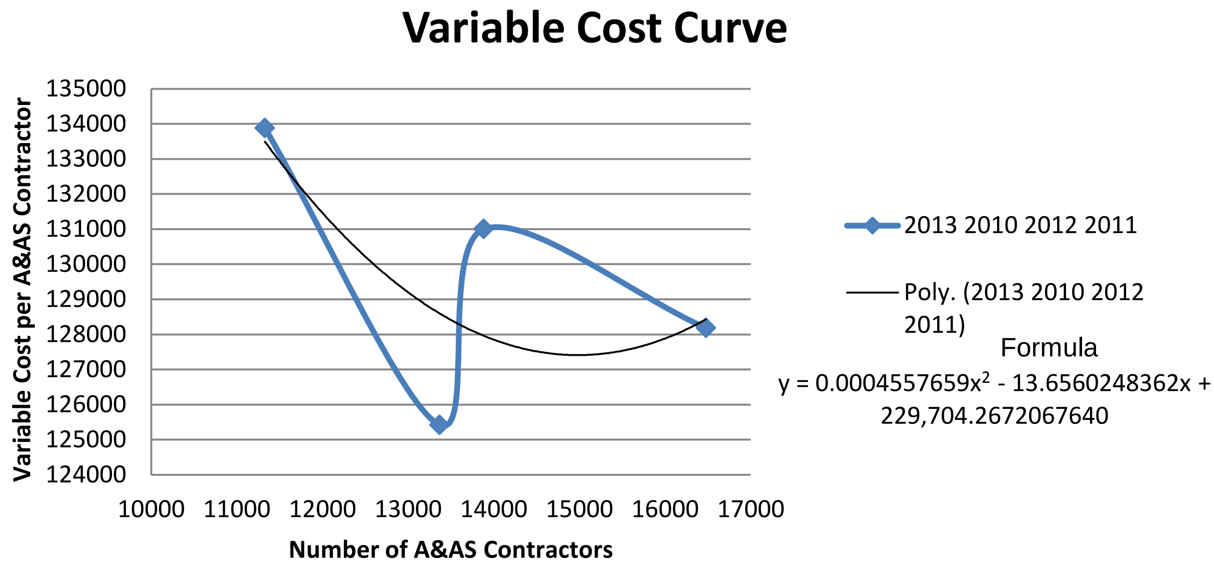
APPENDIX

Table 1. Assumptions

(A)	(B)	(C)	(D)	(E)	(F)	(G)
	* 2010 adj	* 2011 adj	2012 enacted	2013 estimated		
Budget for A&AS	$3,287,154,176	$4,141,398,536	$3,566,485,685	$2,973,886,000	2013	1.00
Average direct labor cost using AT&L guidelines	$125,420.78	$128,180.04	$131,000.00	$133,882.00	2012	0.98
Consumer price index inflation last 5 years			2.20%		2011	0.96
**** AT&L formula guideline**	49.00%	49.00%	49.00%	49.00%	2010	0.93
Total Fixed fees (costs)	$ 1,610,705,546	$ 2,029,285,282	$ 1,747,577,986	$ 1,457,204,140		
Variable labor costs	$ 1,676,448,630	$ 2,112,113,253	$ 1,818,907,699	$ 1,516,681,860		
Number of A&AS FTE contractors	13,367	16,478	13,885	11,328		
Wrap Rate per Contractor	$245,923.10	$251,333.41	$256,862.75	$262,513.73		
*** The actual numbers were adjusted using a base year of 2013**						
**** GAO suggested change with publication GAO-11-192 Services Contractor Inventories**						

Source: Valadez, Mallette, & Albrecht (2013) Adapted from data of the Office of the Secretary of Defense-Budget Materials. Retrieved on 22 March, 2013 from http://comptroller.defense.gov/defbudget/fy2013/budget_justification/pdfs/01_Operation_and_Maintenance/O_M_VOL_2_PARTS/5_Advisory_and_Assistance_Services.pdf

Figure 1. Variable Cost Formulation



Source: Valadez, Mallette, & Albrecht (2013) Adapted from Budget tables of the A&AS for 2011-2013 (2013 base year)

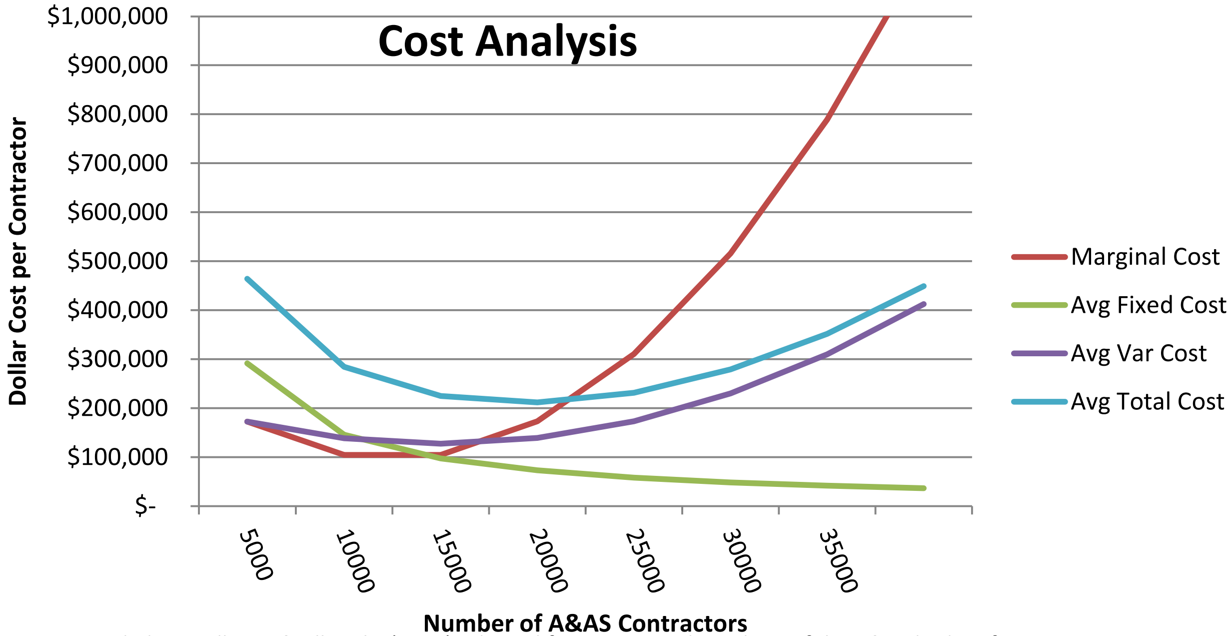
Table 2. Cost Analysis

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Number of Contractors A&AS	Total Fixed Cost	Total Variable Cost	Total Cost	Marginal Cost	Avg Fixed Cost	Avg Var Cost	Avg Total Cost
0	$1,457,204,140	$0	$1,457,204,140	$ 291,441	$0	$0	$0
5000	$1,457,204,140	$864,091,453	$2,321,295,593	$ 172,818	$291,441	$172,818	$464,259
10000	$1,457,204,140	$1,387,206,088	$2,844,410,228	$ 104,623	$145,720	$138,721	$284,441
15000	$1,457,204,140	$1,911,168,332	$3,368,372,472	$ 104,792	$97,147	$127,411	$224,558
20000	$1,457,204,140	$2,777,802,610	$4,235,006,750	$ 173,327	$72,860	$138,890	$211,750
25000	$1,457,204,140	$4,328,933,345	$5,786,137,485	$ 310,226	$58,288	$173,157	$231,445
30000	$1,457,204,140	$6,906,384,964	$8,363,589,104	$ 515,490	$48,573	$230,213	$278,786
35000	$1,457,204,140	$10,851,981,890	$12,309,186,030	$ 789,119	$41,634	$310,057	$351,691
40000	$1,457,204,140	$16,507,548,550	$17,964,752,690	$ 1,131,113	$36,430	$412,689	$449,119
45000	$1,457,204,140	$24,214,909,369	$25,672,113,509	$ 1,541,472	$32,382	$538,109	$570,491
50000	$1,457,204,140	$34,315,888,770	$35,773,092,910	$ 2,020,196	$29,144	$686,318	$715,462
55000	$1,457,204,140	$47,152,311,179	$48,609,515,319	$ 2,567,284	$26,495	$857,315	$883,809
60000	$1,457,204,140	$63,066,001,022	$64,523,205,162	$ 3,182,738	$24,287	$1,051,100	$1,075,387
65000	$1,457,204,140	$82,398,782,723	$83,855,986,863	$ 3,866,556	$22,419	$1,267,674	$1,290,092

70000	$1,457,204,140	$105,492,480,707	$106,949,684,847	$ 4,618,740	$20,817	$1,507,035	$1,527,853

Source: Valadez, Mallette, & Albrecht (2013) Adapted from the A&AS budget projections for 2013 and using a four-year historical variable cost formula.

Figure 2. Graphical Analysis of Costs



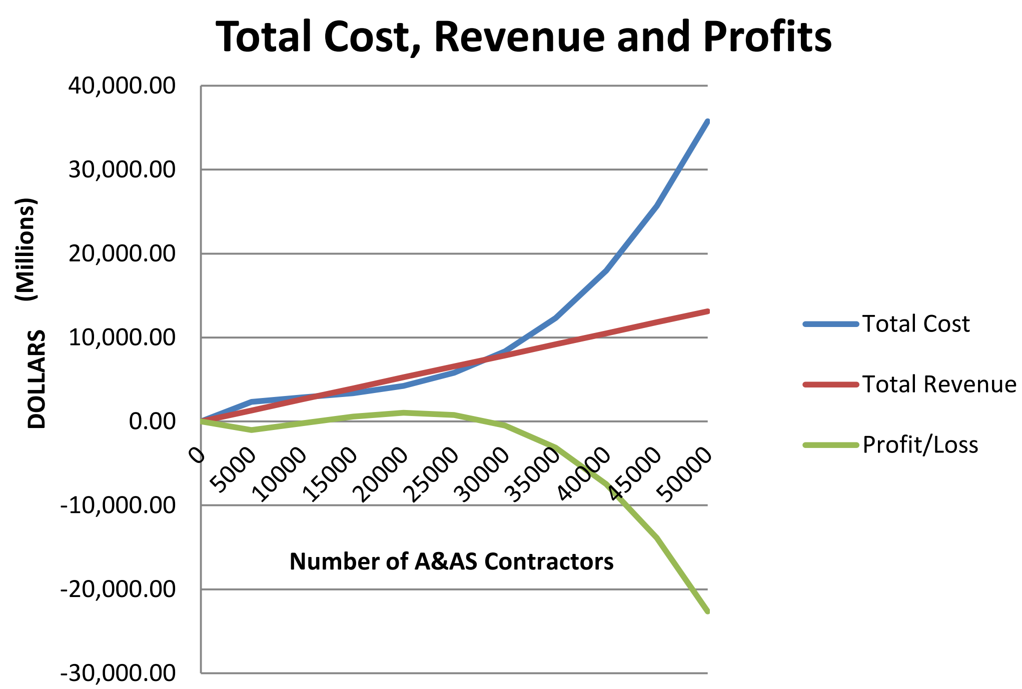
Source: Valadez, Mallette, & Albrecht (2013) Adapted from projected numbers of the A&AS budget for 2013

Table 3. Marginal Analysis

(A) Number of Contractors	(B) Price	(C) Total Cost	(D) Total Revenue	(E) Marginal Cost	(F) Marginal revenue	(G) Profit/Loss
0	$262,514	$ 262,514	$0			-$262,514
5000	$262,514	$ 2,321,295,593	$1,312,568,627	$464,207	$262,514	-$1,008,726,965
10000	$262,514	$ 2,844,410,228	$2,625,137,255	$104,623	$262,514	-$219,272,974
15000	$262,514	$ 3,368,372,472	$3,937,705,882	$104,792	$262,514	$569,333,410
20000	$262,514	$ 4,235,006,750	$5,250,274,510	$173,327	$262,514	$1,015,267,760
25000	$262,514	$ 5,786,137,485	$6,562,843,137	$310,226	$262,514	$776,705,652
30000	$262,514	$ 8,363,589,104	$7,875,411,765	$515,490	$262,514	-$488,177,339
35000	$262,514	$ 12,309,186,030	$9,187,980,392	$789,119	$262,514	-$3,121,205,638
40000	$262,514	$ 17,964,752,690	$10,500,549,020	$1,131,113	$262,514	-$7,464,203,671
45000	$262,514	$ 25,672,113,509	$11,813,117,647	$1,541,472	$262,514	-$13,858,995,861
50000	$262,514	$ 35,773,092,910	$13,125,686,275	$2,020,196	$262,514	-$22,647,406,635
Total A&AS Contractors Employed by DOD	Price	Total Cost	Total Revenue	Marginal Cost	Marginal revenue	Profit Paid
22,188	$262,514	$ 4,809,317,360	$5,824,585,210	$262,514	$262,514	$1,015,267,850

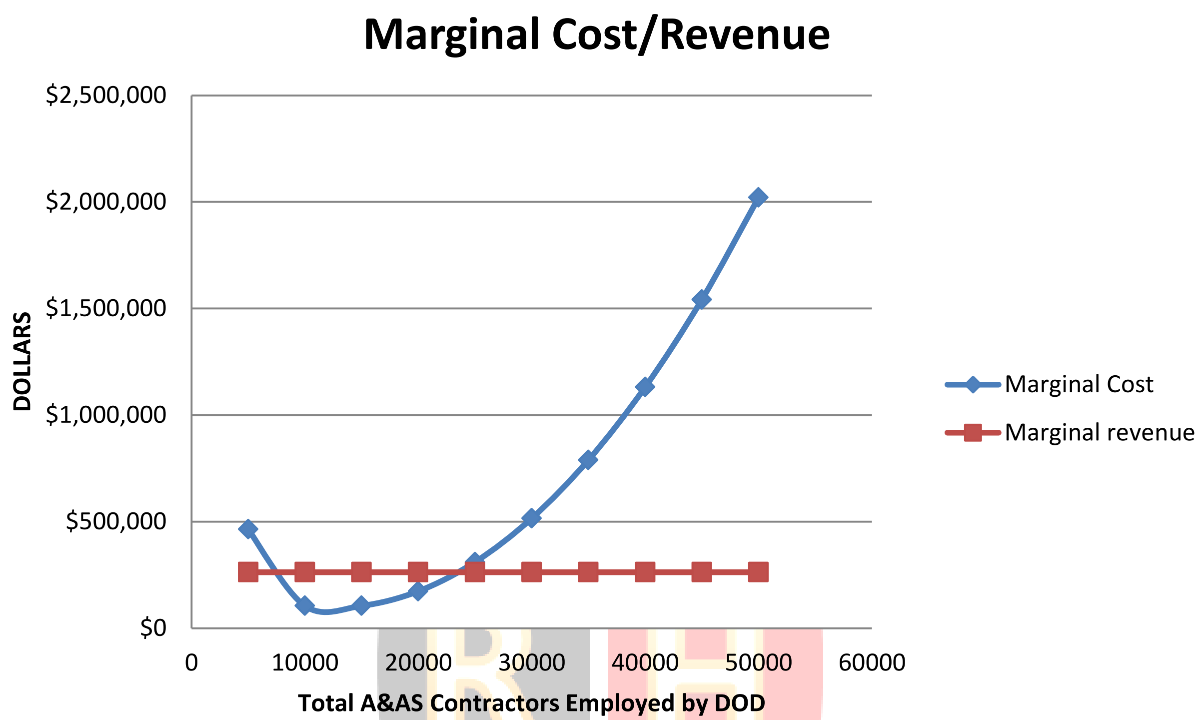
Source: Valadez, Mallette, & Albrecht (2013) Adapted from the A&AS budget projections for 2013, using a four-year historical variable cost formula, an assumed wrap rate for the price entry, and solving for the number of A&AS contractors using Excel parameter solver.

Figure 3. Cost and Revenue Analysis



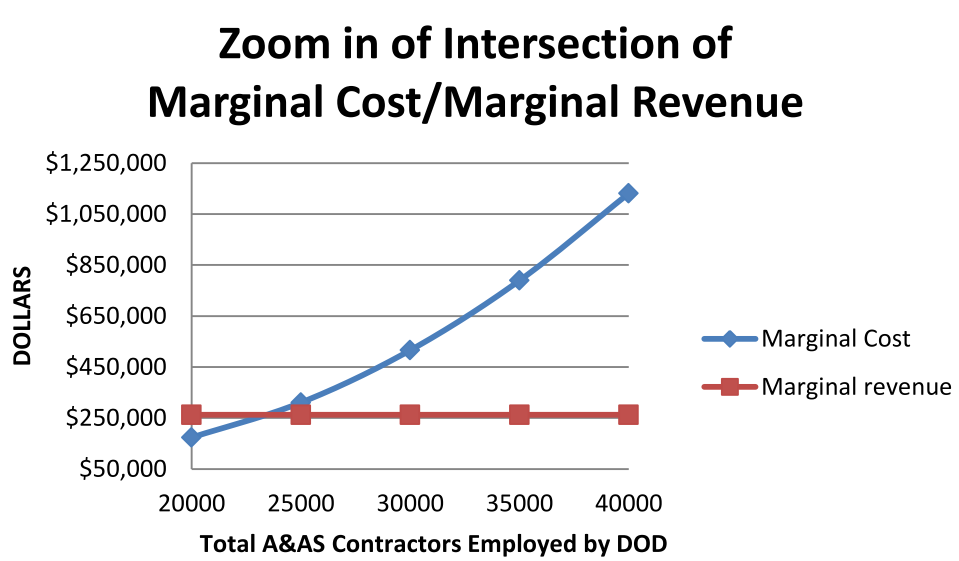
Source: Valadez, Mallette, & Albrecht (2013) Adapted from the A&AS budget projections for 2013, using a four-year historical variable cost formula, and an assumed wrap rate for the price entry.

Figure 4. The Intersection of Marginal Cost and Marginal Revenue



Source: Valadez, Mallette, & Albrecht (2013) Adapted from the A&AS budget projections for 2013, using a four-year historical variable cost formula, and an assumed wrap rate for the price entry.

Figure 4a. The Intersection of Marginal Cost and Marginal Revenue Zoom in



Source: Valadez, Mallette, & Albrecht (2013) Adapted from the A&AS budget projections for 2013, using a four-year historical variable cost formula, and an assumed wrap rate for the price entry.