



ACQUISITION RESEARCH PROGRAM SPONSORED REPORT SERIES

Federal Contractors and Sticky Costs

5 November 2014

Stephen C. Hansen, Associate Professor

Graduate School of Business & Public Policy

Naval Postgraduate School

Approved for public release; distribution is unlimited.

Prepared for the Naval Postgraduate School, Monterey, CA 93943.



Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 05 NOV 2014		2. REPORT TYPE		3. DATES COVERED 00-00-2014 to 00-00-2014	
4. TITLE AND SUBTITLE Federal Contractors and Sticky Costs				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School, Graduate School of Business & Public Policy, 555 Dyer Rd, Monterey, CA, 93943				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT Federal contractors must deal with an exceptional amount of paperwork and bureaucracy relative to firms that deal only with the private sector. I investigate whether federal contractor???s costs have different responses to revenue increases and decreases. I start by generating a set of federal focus firms that have a business unit name that incorporates the words federal, military, and defense. These firms have built their organizational structure around federal contracting. Because extra paperwork costs are likely to be part of the Selling, General, and Administrative (SGA) costs, I estimate a model of SGA sticky costs. I find that when revenues increase, federal focus firms have greater increases in SGA costs compared to controls. This increase is consistent with higher fulfillment costs for federal contracts. When revenues decrease, federal focus firms have a much lower decrease in SGA costs compared to controls. Federal focus firms have extremely sticky SGA costs. This stickiness is consistent with federal focus firms having higher fixed costs in their procurement systems.					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 35	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

The research presented in this report was supported by the Acquisition Research Program of the Graduate School of Business & Public Policy at the Naval Postgraduate School.

To request defense acquisition research, to become a research sponsor, or to print additional copies of reports, please contact any of the staff listed on the Acquisition Research Program website (www.acquisitionresearch.net).



ACQUISITION RESEARCH PROGRAM
GRADUATE SCHOOL OF BUSINESS & PUBLIC POLICY
NAVAL POSTGRADUATE SCHOOL

Abstract

Federal contractors must deal with an exceptional amount of paperwork and bureaucracy relative to firms that deal only with the private sector. I investigate whether federal contractor's costs have different responses to revenue increases and decreases. I start by generating a set of federal focus firms that have a business unit name that incorporates the words federal, military, and defense. These firms have built their organizational structure around federal contracting. Because extra paperwork costs are likely to be part of the Selling, General, and Administrative (SGA) costs, I estimate a model of SGA sticky costs. I find that when revenues increase, federal focus firms have greater increases in SGA costs compared to controls. This increase is consistent with higher fulfillment costs for federal contracts. When revenues decrease, federal focus firms have a much lower decrease in SGA costs compared to controls. Federal focus firms have extremely sticky SGA costs. This stickiness is consistent with federal focus firms having higher fixed costs in their procurement systems.

Keywords: Federal Contractors, SGA Costs, Sticky Costs



THIS PAGE INTENTIONALLY LEFT BLANK



About the Author

Stephen C. Hansen is an associate professor of Financial Management in the Graduate School of Business & Public Policy at the Naval Postgraduate School in Monterey, California, where he teaches courses related to accounting and finance.

He previously taught in the business schools at Northwestern University, Stanford University, the University of California at Los Angeles, and George Washington University.

Professor Hansen's research fields are management accounting and industrial organization. His management accounting research uses simulation methods to examine the best approaches to group and allocate costs. For instance, he examines whether the largest costs should be in separate cost pools or combined into one cost pool. His industrial organization work uses financial and economic data to investigate localization synergies. For example, he tests whether auditor industry experts are more efficient if they are located in the same city. Professor Hansen's work has been published in *Management Science*, *The Accounting Review*, *Decision Support Systems*, *Public Choice*, and many other journals.

His other DOD related projects include understanding the cost drivers of the Military Commissary system and the fuel efficiency standards of Naval Aviation.

Professor Hansen has a Ph.D. in Accounting and Master of Science in Economics from Carnegie-Mellon University, and a Bachelor of Science in Mathematics/Economics from the University of Nebraska at Lincoln.

Stephen C. Hansen
Graduate School of Business & Public Policy
Naval Postgraduate School
Monterey, CA 93943-5000
Tel: (831) 656-3930
Fax: (831) 656-3407
E-mail: schansen@nps.edu



THIS PAGE INTENTIONALLY LEFT BLANK





ACQUISITION RESEARCH PROGRAM SPONSORED REPORT SERIES

Federal Contractors and Sticky Costs

5 November 2014

Stephen C. Hansen, Associate Professor

Graduate School of Business & Public Policy

Naval Postgraduate School

Disclaimer: The views represented in this report are those of the author and do not reflect the official policy position of the Navy, the Department of Defense, or the federal government.



THIS PAGE INTENTIONALLY LEFT BLANK



Table of Contents

Introduction	1
Literature Review	3
The Sticky Cost Models	4
Sample Creation and Descriptive Statistics	6
Federal Focus Firms	6
Control Sample.....	9
Descriptive Statistics	10
Estimation Results	12
Selling, General, and Administrative Costs Results	12
Cost of Goods Sold	14
Robustness checks	16
Conclusions	17
References	19



THIS PAGE INTENTIONALLY LEFT BLANK



List of Figures

Figure 1.	The Change in the SGA Ratio as a Result of Revenue Increases and Decreases	14
Figure 2.	The Change in the COGS Ratio as a Result of Revenue Increases and Decreases	16



THIS PAGE INTENTIONALLY LEFT BLANK



List of Tables

Table 1.	The Sample Creation	7
Table 2.	Federal Focus Companies by Naics Sector	8
Table 3.	Descriptive Statistics and Pairwise Tests.....	11
Table 4.	Sticky Cost Regressions	12



THIS PAGE INTENTIONALLY LEFT BLANK



Introduction

The Department of Defense (DOD) is currently implementing the Better Buying Power initiative (DOD, n.d.), which focuses on “the implementation of best practices to strengthen the Defense Department’s buying power, improve industry productivity, and provide an affordable, value-added military capability to the Warfighter.” An important plank of this approach is “Eliminate Unproductive Processes and Bureaucracy” (DOD, n.d.).

Government contractors have the normal concerns about costs of production/profit margin. However, they also must deal with an exceptional amount of paperwork relative to non-governmental contracts, and usually must hire specialized staff to generate and maintain the required information (Kovacic, 1992). The additional paperwork and extra staff clearly qualify as potentially unproductive processes and as bureaucracy.

My research examines whether these additional costs are sufficiently large to affect the firm’s financial statements. If these government-specific costs are real and substantial, then they should skew the cost behavior of government contractors relative to private sector firms doing comparable work.

I investigate the effect of these costs on the Income Statement. Income Statements have two major cost categories. The Cost of Goods Sold captures the product cost for units sold and is obtained from matching the cost of products to the units sold. These costs are fairly direct and have comparatively little wiggle room for adjustments. The Selling, General, and Administrative (SGA) costs reflect the marketing, administrative, and general overhead costs of the organization. These costs contain many allocations and are the likely place where any additional government contracting costs are going to show up.¹

My research builds upon prior work that investigates the behavior of SGA costs. A classic paper, Andersen, Banker, & Janakiraman (2003) investigated the behavior of SGA costs when revenue increased versus revenue decreased. They found that SGA costs are sticky in that SGA costs increase more when revenues rise than SGA costs decrease when revenues fall. Potential explanations for the stickiness include the existence of SGA fixed costs (Balakrishnan, Labro, & Soderstrom, 2010), or that managers are reluctant to reduce SGA capacity when they believe that a short run cut in revenues is likely to be reversed in the near future (Andersen, et al., 2007; Balakrishnan & Gruca, 2008).

¹ While the government has explicit rules about how these costs are presented in their forms, the published financial statements follow financial accounting rules known as the Generally Accepted Accounting Principles.



I extend the SGA sticky cost framework to investigate whether firms with significant federal contracting have different SGA responses to revenue increases and/or decreases. If a firm believes that the expertise in federal procurement practice is a core competency, then it will be reluctant to reduce its procurement staff in response to lower revenues. I conjecture that federal focus firms will have much stickier costs than will firms in the private sector.

An important innovation in my paper is the creation of a federal focus sample. Prior work has investigated the behavior of federal contractors by assuming that the firms with the largest dollar sales to the federal government are most affected by federal contracts (Wang & San Miguel, 2012). However, an important problem with this approach is that a very large firm like Proctor and Gamble may be one of the most important sellers to the federal government, but the federal sales may be a small percentage of Proctor and Gamble's total sales. In addition, Proctor and Gamble may supply generic products such as toothpaste which do not require satisfying unique federal requirements (and related paperwork). For these reasons, it may not be correct to say that Proctor and Gamble is a federal focus firm.

My federal focus sample is created in a different fashion. I use Compustat's Segment database to identify firms that have a business segment which contain the words federal, government, or military. These federal focus companies believe that federal business is so important that they have built their organization structure on this business. Their organization structure signals they have a federal focus. While there is some overlap between my list of federal focus companies and the list of firms with the greatest sales to the federal government, roughly two-thirds of my federal focus firms are not on the list of the largest 500 federal dollar contractors.

Once I generate the federal focus sample, I estimate an SGA sticky cost regression where I include interaction terms for federal focus firms. The results show that the control firms have mild SGA cost stickiness. Raising revenue by 1% leads to a 0.69% rise in SGA costs, while lowering revenues by 1% leads to a 0.63% decline in SGA costs. The main analysis compares the federal focus firms to the controls. There are significant differences for federal focus firms. Raising revenues by 1% leads to a 0.83% rise in SGA costs, a 20% increase over the control firms. Federal focus firms have higher ramp up in SGA costs, possibly due to increased paperwork for fulfilling government orders. In the same vein, lowering revenues by 1% leads to a 0.45% drop in SGA costs, a 29% smaller drop than the controls. SGA costs for federal focus companies are much stickier than for the control firms. This increased stickiness could be due to a reluctance to fire highly trained procurement staff or, alternatively, much higher fixed SGA costs.



As a check on the reasonableness of my model, I estimated a COGS sticky cost model. My results show that federal focus firms display a symmetric response to revenue increases or decreases. A 1% increase (decrease) in revenues leads to a statistically identical 1% increase (decrease) in COGS. This symmetry is consistent with the use of fixed price contracts which specify both the revenues and cogs in advance. My control firms display a slightly different result. The control firms are similar to federal focus firms when revenues fall. A 1% revenue decline leads to a statistically identical 1% drop in COGS. However, a 1% increase in control firm revenues leads to a 1.04% increase in COGS. My control firms exhibit decreasing returns to scale. In addition, the difference between COGS behavior when revenues increase and decrease suggests a mild form of COGS stickiness for my control firms.

Robustness tests suggest that my results are knife edge. Changing the time period or the control group leads to insignificant results.

The remainder of the paper is organized as follows: The second section discusses prior research, followed by a presentation of the sticky cost models. The sample is then created and descriptive statistics are calculated. Estimation results follow, and the final section contains the conclusion.

Literature Review

There has been a fair amount of prior work that has used published financial statements to examine various features of acquisition and contracting. Arnold, McNicol, and Fasana (2009) investigated the impact of various contract forms on contract performance. Berteau, Levy, Ben-Ari, and Moore (2011) used financial statements to analyze the ability of government contractors to obtain capital throughout defense booms and busts. Wang and San Miguel (2012) investigated whether government contractors are obtaining excessive profits. My work complements those prior works by providing an analysis of costs, an important component in determining both performance and profits.

My work investigates the total cost numbers for the organization. The reason is straightforward. Prior work has shown that firms have the incentives and capability to shift costs from the private sector to the government sector (McGowan and Vondrak, 2002; Rogerson, 1992). Cost shifting between the firm's private and public units generates canceling positive and negative entries when the total firm costs are calculated.

Balakrishnan and Gruca (2008) examined sticky costs at the department level in hospitals. They found that in downturns, hospital administrators are reluctant to trim costs and capacity in core activities directly related to patient care. Administrators first adjust costs and capacity in peripheral areas. This research



suggests that in a downturn, firms with a federal focus may wish to maintain critical government contract-related processes.

The Sticky Cost Models

Andersen, Banker, and Janakiraman (ABJ; 2003) performed the seminal analysis of SGA cost stickiness. Their model discriminated between periods when revenues increase and those when revenues decrease. Costs are sticky when the costs have a greater rise when revenues increase than costs fall when revenues decrease.

Equation 1 provides their basic sticky cost model specification,²

$$\log\left(\frac{SGA_{i,t}}{SGA_{i,t-1}}\right) = \alpha_0 + \alpha_1 \log\left(\frac{Revenue_{i,t}}{Revenue_{i,t-1}}\right) + \alpha_2 DecrDum_{i,t} * \log\left(\frac{Revenue_{i,t}}{Revenue_{i,t-1}}\right) + \varepsilon_{i,t}, \quad (1)$$

where *DecrDum* is one for firm *i* when sales revenues fall from period *t-1* to *t* and is zero otherwise. If SGA costs are sticky, then the coefficient α_2 should be negative and significant.

I extend equation (1) to investigate whether federal focus firms have different SGA stickiness than control firms. I create a set of interaction variables which separate out the incremental effect of federal focus firms. Specifically, I use a dummy variable *FSeg* which is one if the firm has a separate government/federal/military segment and is zero otherwise. My SGA Sticky Cost model is presented in equation 2:³

$$\begin{aligned} \log\left(\frac{SGA_{i,t}}{SGA_{i,t-1}}\right) = & \alpha_0 + \alpha_1 \log\left(\frac{Revenue_{i,t}}{Revenue_{i,t-1}}\right) + \alpha_2 DecrDum_{i,t} * \log\left(\frac{Revenue_{i,t}}{Revenue_{i,t-1}}\right) \\ & + \alpha_3 FSeg + \alpha_4 FSeg * \log\left(\frac{Revenue_{i,t}}{Revenue_{i,t-1}}\right) \\ & + \alpha_5 FSeg * DecrDum_{i,t} * \log\left(\frac{Revenue_{i,t}}{Revenue_{i,t-1}}\right) + \delta_{i,t}. \end{aligned} \quad (2)$$

² The ABJ model allows for a cross-section analysis across a wide range of industries, with large differences in the size of firm. Prior work (Davidson & MacKinnon, 1981) rejected a linear form in favor of the log-log specification.

³ The variable *Decrdum* is defined in the text. The data for the other variables is drawn from Compustat, Fundamental Annual. *Revenue* is the Compustat variable sale, while SGA is the Compustat variable xsga.

While I believe that federal focus firms will have different SGA responses than the control firms, the direction of these changes is not obvious. If federal focus firms respond differently to revenue increases, then coefficient a_4 should be significant. If it is significantly positive (negative), then SGA costs have greater increases (decreases) than the controls. If federal focus firms respond differently to revenue decreases, then the expression $(a_4 + a_5)$ should be significant. If the sum is significantly positive (negative), then federal focus firms have less (more) sticky SGA costs than the controls.

We can obtain additional insight into the differences between federal focus firms and the controls by repeating the sticky cost analysis for Cost of Goods Sold (COGS), the other major expense on most firm's Income Statements. SGA costs contain many indirect costs of the organization. In contrast, the major component of COGS is the value of products/services sold that period, which tends to have a more straightforward relationship with revenues. I anticipate that either COGS has a symmetric response to revenue increases and decreases - COGS is not sticky - or that COGS is less sticky than SGA.

My COGS sticky cost model is a variant on Equation 2 and shown as Equation 3:⁴

$$\begin{aligned} \log\left(\frac{COGS_{i,t}}{COGS_{i,t-1}}\right) = & \beta_0 + \beta_1 \log\left(\frac{Revenue_{i,t}}{Revenue_{i,t-1}}\right) + \beta_2 DecrDum_{i,t} * \log\left(\frac{Revenue_{i,t}}{Revenue_{i,t-1}}\right) \\ & + \beta_3 FSeg + \beta_4 FSeg * \log\left(\frac{Revenue_{i,t}}{Revenue_{i,t-1}}\right) \\ & + \beta_5 FSeg * DecrDum_{i,t} * \log\left(\frac{Revenue_{i,t}}{Revenue_{i,t-1}}\right) + \mu_{i,t} \end{aligned} \quad (3)$$

As with SGA costs, I believe that there will be a difference in how federal focus firms' COGS responds to revenue changes, but have no prediction as to the direction of the changes. If federal focus firms' COGS responds differently to revenue increases, then coefficient β_4 should be significant. If federal focus firms' COGS responds differently to revenue decreases, then the expression $(\beta_4 + \beta_5)$ should be significant.

Now that I have presented the models, I turn to the data.

⁴ The variable *Decrdum* is defined in the text. The data for the other variables is drawn from Compustat, Fundamental Annual. *Revenue* is the Compustat variable sale, while *COGS* is the Compustat variable cogs.



Sample Creation and Descriptive Statistics

My sample was created in two steps. I first obtained a set of federal focus firms, then generated control firms for these companies.

Federal Focus Firms

The critical element in my research is identifying companies with a federal focus. Prior research (Wang & San Miguel, 2012) has examined the behavior of companies with the greatest dollar value contracts with the federal Government. One problem with this approach is that a large dollar value may not reflect a federal focus. For instance, Proctor and Gamble has significant sales to the government, but its sales tend to be for off-the-shelf items such as toothpaste. Proctor and Gamble may not need to deal with issues involving government-specific specifications and may have minimal incremental paperwork requirements. Because of these issues, I use a different approach to identify federal focus firms.

Financial accounting standards require publicly traded firms to separately report information about major business segments. Segment reporting is intended to give information to investors and creditors regarding the financial results and position of the most important operating units of a company.⁵ Firms that report a federal segment have identified themselves as having a significant line of business related to the federal government.

Table 1, Panel A describes how I generated my list of federal focus firms. I began with all observations on the Compustat Segment database which lists all reported segments for all publicly traded companies in the US. The Compustat Annual Updates—Segment database is comparatively new and only has data for the last four years, 2010–2013. I searched the database for segment names that contained the term “Defense,” “Military,” “Federal,” “Government,” or “Govt.” This search process identified 39 unique parent companies. Each of these companies believes that their Federal/Government/Military segment is sufficiently different and important to warrant separate presentation in their financial statements.

⁵ Accounting Tools, <http://www.accountingtools.com/questions-and-answers/what-is-segment-reporting.html>, provides an excellent description of segment reporting on its website:

Under Generally Accepted Accounting Principles (GAAP), an operating segment engages in business activities from which it may earn revenues and incur expenses, has discrete financial information available, and whose results are regularly reviewed by the entity's chief operating decision maker for performance assessment and resource allocation decisions.

Follow these rules to determine which segments need to be reported:

- Aggregate the results of two or more segments if they have similar products, services, processes, customers, distribution methods, and regulatory environments.
- Report a segment if it has at least 10% of the revenues, 10% of the profit or loss, or 10% of the combined assets of the entity.



Table 1. The Sample Creation

Panel A. Federal Focus Firms

Active and Inactive Observations From Compustat Annual Updates – Segments (Non-historical) 2010 - 2013	166,898
Parent Firms with Federal, Government, or Military Segment	39
Observations for Federal focus from Compustat, Fundamental Annual, 1993 - 2012	517
Less:	
Outliers	473
Influential Observations	<u>269</u>
Total Observations	269
Number of Unique Companies	35

Panel B. Control Firms

Active and Inactive Observations From Compustat, Fundamental Annual 1993 - 2012	211,513
Less observations excluded because they are:	
Foreign Companies	191,744
Missing or Infeasible data	89,214
Sales decrease and SGA/COGS increase or SGA > Sales	80,096
Not in Fed Focus Industry or Year	49,741
Outliers	43,103
Influential Observations	<u>39,539</u>
Total Observations	39,539
Number of Unique Companies	6,991



I used the parent company identification to draw data from Compustat, Fundamental Annual for the years 1993–2012.⁶ At this stage there were 517 observations. Later analysis trimmed outliers and removed influential observations. The final list of federal focus firms contains 269 observations for 35 unique companies.

My list of 35 federal focus firms and their associated industry, their Naics Sector, is provided in Table 2. While the majority of the firms are in manufacturing industries, there is a wide divergence of other industries represented, from construction to educational services.

Table 2. Federal Focus Companies by Naics Sector

CONSTRUCTION - 23

FLUOR CORP*
KBR INC

MANUFACTURING - 32, 33

USEC INC
ALLIANT TECHSYSTEMS INC*
ANAREN INC
BOEING CO*
CUBIC CORP
EMS TECHNOLOGIES INC
FEDERAL SIGNAL CORP
FLIR SYSTEMS INC
GENCORP INC
HARRIS CORP*
II-VI INC
IROBOT CORP
ITT CORP*
MOOG INC -CL A
NATIONAL PRESTO INDS INC
RAYTHEON CO*
SPARTON CORP
SYMMETRICOM INC
TEL-INSTRUMENT ELECTRONICS
TELEDYNE TECHNOLOGIES INC*
TRIMAS CORP

WHOLESALE TRADE - 42

AAR CORP*
NASH FINCH CO

INFORMATION - 51

SAPIENT CORP

FINANCE AND INSURANCE - 52

HEALTH NET INC*

PROFESSIONAL, SCIENTIFIC AND TECHNICAL - 54

BAKER (MICHAEL) CORP*
CH2M HILL COS LTD
INTEGRAL SYSTEMS INC*
SAIC INC
URS CORP*

ADMINISTRATIVE AND SUPPORT - 56

ENERGYSOLUTIONS INC
KFORCE INC

EDUCATIONAL SERVICES - 61

GP STRATEGIES CORP

* A top 500 recipient of defense contracts for 2008.

⁶ Following ABJ, I use 20 years of data to estimate my models.



As was mentioned previously, my approach to identifying firms with federal focus differs from prior work. For instance, Wang and San Miguel (2012) used Fedspending.org to identify 112 publicly traded companies in the 500 companies with the largest dollar values of defense contracts awarded in 2008. Comparing their list to Table 2 shows that there are 12 firms in common. Untabulated results show that the 12 common firms are substantially larger than the other 23 firms.⁷

Control Sample

My control sample provides a benchmark to judge the performance of the federal focus firms. Table 1, Panel B provides the details.

The control sample began with the entire set of active and inactive Compustat firms for 1993–2012. I deleted foreign firms. I then removed observations missing data or with infeasible data (e.g., negative revenues). Next, I dropped observations if Sales decreased, but SGA or COGS rose. Following ABJ, I also removed observations if the firm's their SGA costs were greater than Revenues. I then deleted all year * industry observations with no federal focus observation in that year * industry.

Prior work has consistently found that sticky costs only show up in the estimation results after extensive data cleaning. For instance, ABJ trimmed 1% of all variables and threw out all influential regression observations in order to generate results. My sample contains a later time period than ABJ and includes the Great Recession. It therefore contains many more outliers than ABJ. In order to obtain baseline results with SGA (COGS) sticky costs, I removed the top and bottom 5% of the $\log\left(\frac{Revenue_{i,t}}{Revenue_{i,t-1}}\right)$ observations and the top (bottom) 0.5% of the $DecrDum_{i,t} * \log\left(\frac{Revenue_{i,t}}{Revenue_{i,t-1}}\right)$ observations. Although I trimmed many observations, the range of variation in my data in the retained data is comparable to prior work.

My final data reduction removed all observations that were influential in either the SGA or COGS Sticky Cost regressions.⁸ My final set of controls consists of 39,539 observations over 20 years for 6,991 firms in nine industries.

My estimation sample combines the control firms with the federal focus firms. One important observation is that there are comparatively few federal focus (269) to control observations (39,539). A major concern is that the signal from the small number of federal focus observations could be drowned out by the large number of

⁷ The 12 firms on both lists have average assets (sales) of 7,786 (8,927), while the 23 other firms in my sample have average assets (sales) of 995 (1,434).

⁸ Deleting observations for each regression separately generates qualitatively identical results.



controls. Although this is a valid issue, the regression results generate statistically significant, and intuitive, estimates.

The imbalance between the number of control and federal focus observations may explain the knife-edge nature of my results. The federal focus signal is strong only under a tightly controlled set of data conditions.

Descriptive Statistics

Table 3, Panel A provides the descriptive statistics for my sample. Supplemental information shows that average total assets are comparable for federal focus and control firms (3,972 million versus 3,892 million), but that on average federal focus firms have more employees (16,803 versus 5,556). In addition, federal focus firms have higher revenues, higher SGA expense, and greater COGS. These disparities are excellent reasons why equations 2 and 3 use ratios to control for scale effects.

Table 3, Panel B runs Wilcoxon non-parametric test for differences between variables in the control and federal focus sub-samples. The tests fail to reject that the dependent variables, $\left\{ \log \left(\frac{SGA_{i,t}}{SGA_{i,t-1}} \right), \log \left(\frac{COGS_{i,t}}{COGS_{i,t-1}} \right) \right\}$, and one of the independent variables, $\log \left(\frac{Revenue_{i,t}}{Revenue_{i,t-1}} \right)$, are drawn from the same distribution. However, the interaction term, $DecrDum_{i,t} * \log \left(\frac{Revenue_{i,t}}{Revenue_{i,t-1}} \right)$, does show a significant difference between federal focus and control observations. This difference has two sources. First, federal focus firms have fewer revenue decreases than controls (11.9% versus 19.5%). Second, untabulated results show that, conditional on revenues falling, the federal focus firms have a smaller reduction in the log revenue ratio (-0.0787 versus -0.190). When revenues fall, federal focus firms are not hit as hard as the control firms.



Table 3. Descriptive Statistics and Pairwise Tests

Panel A. Variables

Variable	Combined N = 39,808		Federal Focus N = 269		Controls N = 39,539	
	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
Supplemental Information						
Total Assets ¹	3,892.2	35,221	3,971.5	9,867.4	3,891.7	35,221
Number Employees ²	5.6322	21.460	16.803	30.914	5.5563	21.460
Components						
SGA ¹	332.09	1,484.2	508.75	1,029.5	330.89	1,484.2
COGS ¹	1,142.9	6,858.1	3,799.6	8,217.0	1,124.8	6,858.1
Revenue ¹	1,794.1	9,296.1	4,749.2	10,175	1,773.9	9,296.1
Decrdum	0.1948	0.3961	0.1190	0.3243	0.1953	0.3961
Dependent Variables						
Log(SGA _{it} /SGA _{it-1})	0.0753	0.1814	0.0685	0.0860	0.0754	0.1814
Log(COGS _{it} /COGS _{it-1})	0.0970	0.2332	0.0920	0.0979	0.0970	0.2332
Independent Variables						
Log(Revenue _{it} /Revenue _{it-1})	0.1014	0.2064	0.0897	0.0950	0.1015	0.2064
Decrdum *	-0.0369	0.1036	-0.0009	0.0349	-0.0371	0.1036
Log(Revenue _{it} /Revenue _{it-1})						
FSeg	0.0067	0.0819	1	-	0	-

Panel B. Pairwise Tests for Dependent and Independent Variables

Variable	Federal Focus	Control s	F Value	Pr. > F
Dependent Variables				
Log(SGA _{it} /SGA _{it-1})	0.0685	0.0754	0.3793	0.5380
Log(COGS _{it} /COGS _{it-1})	0.0920	0.0970	0.1242	0.7245
Independent Variables				
Log(Revenue _{it} /Revenue _{it-1})	0.0897	0.1015	0.8674	0.3517
Decrdum *				
Log(Revenue _{it} /Revenue _{it-1})	-0.0009	-0.0371	19.124 ***	< 0.0001

¹ Millions

² Thousands

Now that I have described the data, I turn to the regression analysis.



Estimation Results

Selling, General, and Administrative Costs Results

Table 4, Column 1, contains the estimation results for the Selling, General and Administrative (SGA) Sticky Cost model.⁹ The model uses a log-log specification, which means that all coefficients (except the constants) generate an elasticity.

Table 4. Sticky Cost Regressions,¹ Dependent Variables $\log[SGA_t/SGA_{(t-1)}]$, $\log[COGS_t/COGS_{(t-1)}]$

Variable	SGA Costs	COGS Costs
	Coefficient (p-value)	Coefficient (p-value)
<i>LRevratio</i> a_1	0.6922*** (0.000)	1.0427*** (0.000)
<i>Decr*LRevratio</i> a_2	-0.0628*** (0.000)	-0.0543*** (0.000)
<i>FSeg</i> a_3	-0.0113** (0.029)	0.0127*** (0.000)
<i>FSeg*LRevratio</i> a_4	0.1360*** (0.000)	-0.0395** (0.037)
<i>FSeg*Decr*LRevratio</i> a_5	-0.3186** (0.000)	0.0684** (0.021)
Adj R ²	0.5855	0.8187
N	39,808	39,808

¹Industry fixed effects are not reported. Standard errors are calculated using the Stata robust option.

My control sample's behavior is captured by coefficients a_1 and a_2 . The control results demonstrate sticky SGA costs, though the costs are less sticky than in older samples.¹⁰ Combining the correct coefficients shows that a 1% increase in the revenue ratio (a_1) leads to a 0.692% increase in the control firms' SGA, while a

⁹ The models are estimated with fixed industry effects and use robust standard errors. The VIF scores show no significant multicollinearity in either equation.

¹⁰ Anderson, Banker, and Janakiraman 2003 estimate cost stickiness for 20 years; from 1979 to 1998 for all but the financial services industry. They find [Table 2, Model (I)] a comparable increase in SGA costs when revenues rise (0.5459 versus my 0.6922), but a larger decline when costs fall (-0.1914 to my -0.0628). I conjecture the differences are due to my restriction to a subset of industries as well as the different time periods.



1% decrease (a_1+a_2) leads to a 0.629% decrease in SGA. The SGA costs are 0.063% sticky (a_2). I can benchmark the magnitude of these effects by evaluating the elasticity at the mean sample values. When revenues (average 1,794 million) increase/decrease by 1%, they change by 17.94 million. When revenues rise (fall) by 17.94 million; SGA costs (average 332.1 million) increase (fall) by 2.30 (2.09) million. At the median combined sample values, SGA costs stick by 0.21 million, or roughly \$210,000.

The impact of a federal focus on the SGA costs is identified through the interaction terms. Combining the correct coefficients for federal-focused companies (a_1+a_3), when the revenue ratio rises by 1%, the SGA ratio rises by 0.828%, which is 0.136% more than for the controls (a_4). When revenues rise, federal focus companies have a $.136/.692 = 19.7\%$ increase in SGA over the controls. This incremental rise could reflect greater paperwork requirements/fulfillment costs for federal focus firms. Combining the correct coefficients ($a_1+a_2+a_3+a_4$), when revenues fall by 1%, the SGA ratio for federal focus falls by 0.447%, which is 0.182% less than for the controls (a_1+a_2). When revenues fall, federal focus companies have a $.182/.629 = 28.9\%$ smaller decrease in SGA costs than control companies. The slower fall could reflect greater fixed costs for federal focus companies; in particular, greater fixed staff costs in the procurement process.

The dollar impact for federal focus companies can be evaluated using the mean sample values. When revenues rise by 1% (17.94 million), SGA costs rise by 2.75 million for federal focus companies versus 2.30 million for the controls - a 0.45 million cost difference. When revenues fall by 1% (17.94 million), SGA costs fall by 1.48 million for federal focus companies, and by 2.09 million for the controls - a 0.61 million cost difference. The dollar value of the federal focus difference is understated since federal focus firms tend to be much larger than the control firms¹¹

¹¹ If the numbers are evaluated at the median federal focus firm value [SGA 508.75], then a 1% revenue increase would cause SGA for controls to rise by 3.522 and federal focus by 4.213, a difference of 0.691 million. A 1% revenue decrease would cause SGA for controls to fall by 3.202 million, and federal focus by 2.273 million, a difference of 0.929 million.



Figure 1 illustrates the qualitative behavior of SGA costs for both the controls and the federal focus companies. If a firm is federal focused, then SGA costs rise faster when revenue increases, but fall slower when revenue decreases.

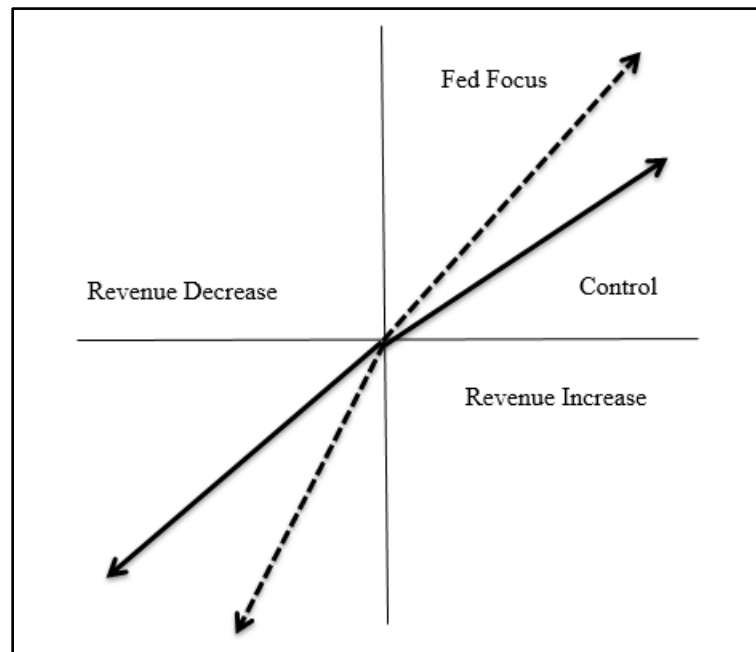


Figure 1. The Change in the SGA Ratio as a Result of Revenue Increases and Decreases

Cost of Goods Sold

Table 4, Column 2 presents the estimation results for the COGS cost stickiness model.

The control group exhibits some COGS cost stickiness (COGS equation a_2 , 0.054%) though it is less than for the control SGA stickiness (SGA equation a_2 , 0.063%). Combining the correct COGS equation coefficients shows that 1% increase in revenues (a_1) leads to a 1.043% increase in COGS, while a 1% decrease (a_1+a_2) leads to a 0.988% decrease in COGS.¹² The COGS costs are 0.056% sticky (a_2).

Although the COGS has a higher percentage increase (1.043%) than the percentage revenue increase (0.988%), this does not mean that profits are negative. Evaluating the elasticities at the mean sample values shows the following. When revenues (average 1,794 million) rise by 1% (17.94 million), then COGS (mean 1,143) increases by 11.92 million. When revenues fall by 17.94 million, then COGS declines by 11.30 million.

¹² The incremental change in SGA for non-federal contractors for an increase in revenues is a_1 , and a decrease in revenues is (a_1+a_2) .

When revenues fall, the control firm's 0.988% decrease in COGS is suspiciously close to 1%. An untabulated test supports the idea that the COGS decrease is 1% [$p = 0.8650$].¹³ The interpretation is that when revenues fall by 1%, the control firms have a lockstep 1% drop in COGS. This lockstep change is consistent with a stronger linkage between revenues and COGS than between revenues and SGA.

As with the SGA analysis, the impact of federal focus is captured by the interaction terms. Combining the correct coefficients ($a_1 + a_3$) for federal focus firms, when the revenue ratio rises by 1%, the COGS ratio rises by 1.003%, which is 0.0395% less than for non-contractors. An untabulated test shows that the federal focus COGS rise is statistically insignificantly different from 1% [$p = 0.2679$]. When revenues rise by 1%, federal-focused firms have COGS rise in lockstep by 1%. Combining the correct coefficients ($a_1 + a_2 + a_3 + a_4$), provides the decline for federal focus companies when revenues fall, 1.0173%. A further statistical test shows that the drop in the COGS ratio is also statistically identical to 1% [$p = 0.4464$].

Combining the previous results, federal focus firms have a linear relationship between revenues and COGS. When revenues increase or decrease by 1%, COGS does the same. This strong connection could be due to the use of fixed price government contracts, where both the revenues and profit margins are determined in advance.

Figure 2 illustrates the qualitative behavior of COGS for both the control group and the firms with federal focus. A federal focus firm has COGS rise symmetrically with revenue increases and decreases. A 1% rise (fall) in revenues leads to a 1% rise (fall) in COGS. Control firms have a similar 1% drop in COGS for a drop in revenue, but have a faster rise in COGS for an increase in revenues.

¹³ The test fails to reject the hypothesis that the $a_1 + a_3 = 1$.



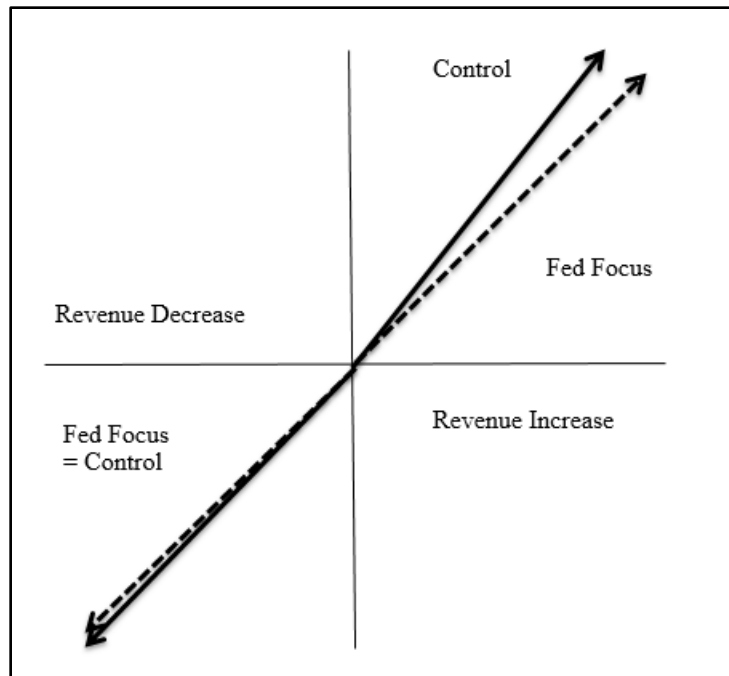


Figure 2. The Change in the COGS Ratio as a Result of Revenue Increases and Decreases

Robustness checks

My robustness tests suggest that my results are delicate, are knife-edge. Reducing the time period from 20 to 15 (10) years generates qualitatively similar control coefficients, but the federal focus coefficients become insignificant. Alternatively, using the median industry values as controls leads to all coefficients becoming insignificant.

Conclusions

Federal government contractors are qualitatively different than other firms (Kovacic, 1992). Contractors complain about excessive paperwork requirements, fixed margins, and long lead times to obtain contracts. I examine whether these problems are large enough to show up in the published financial accounting data. I use the behavior of costs on firms' published Income Statements to address this issue.

There are two major expense categories on the income statement: Selling, General, and Administrative (SGA) expense, and Cost of Goods Sold (COGS) expense. My analysis compares and contrasts the behavior of these two expense categories for a sample of federal focus and control firms.

An important innovation in my paper is the creation of a federal focus sample.

I use Compustat's Segment database to identify firms that have a business segment labeled federal, government, or military. These federal focus companies believe that their federal government business is so important that they have built their organization structure around it. While there is some overlap between my list of federal focus companies and the firms with the greatest sales to the federal government, roughly two-thirds of my federal focus firms are not on the list of the largest 500 federal dollar contractors. My sample contains a different, and possibly superior, set of companies than offered by prior work.

Once I generated the federal focus sample, I estimated a SGA sticky cost regression where I included interaction terms for federal focus firms. The results show that the controls have mild SGA cost stickiness. Raising revenue 1% leads to a 0.70% rise in SGA costs, while lowering revenues 1% leads to a 0.63% decline in SGA costs. My main results show that there are significant differences for federal-focused firms. Raising revenues 1% leads to a 0.82% rise in SGA costs, a 20% increase over the controls. When revenues rise, federal-focused firms have higher ramp up in SGA costs, possibly due to increased paperwork for fulfilling government orders. In the same vein, lower revenues 1% leads to a 0.45% drop in SGA costs, about 29% below the reduction for the control group. SGA costs for federal focus companies are much stickier than for the controls. The reluctance to reduce SGA costs is consistent with federal focus firms maintaining their core federal procurement process in a downturn.

As a reasonableness check, I estimate a COGS sticky cost regression. Federal focus firms display a symmetric response to revenue increases or decreases. A 1% increase (decrease) in revenues leads to a statistically identical 1% increase (decrease) in COGS. This symmetry is consistent with the more direct nature of COGS as well as fixed price government contracts. My control firms



display a slightly different result. The controls are similar to federal focus firms when revenues fall. A 1% revenue ratio decline leads to a statistically identical 1% drop in COGS. However, a 1% increase in revenues leads to a 1.04% increase in COGS. The control firms exhibit both decreasing returns to scale as well as a mild amount of COGS stickiness.

Robustness tests suggest that my sample is delicate. Changing the time frame or the approach to generating controls leads to no significant results. This delicacy may be due to the small number of federal focus observations relative to control observations.

My paper provides evidence that SGA costs behave differently for government contractors. Balakrishnan, Petersen, and Soderstrom (2004) provided evidence that the magnitude of the change matters. They showed that very large changes in costs lead to greater responsiveness (less stickiness) than smaller changes, and argued that transaction costs will dampen or remove small changes, but not affect larger changes. While similar behavior might hold for federal contractors, I cannot investigate this issue. My sample contains too few observations to analyze this issue.

My analysis looks at the behavior of firms which have a federal focus. However, it does not investigate one other important aspect of government contracting: the form of the contracts. A large body of theoretical literature explores the relationship between optimal contracts and information in procurement (Laffont & Tirole, 1986; Rogerson, 1994). For instance, cost plus contracts may lead to improved risk sharing, but can lead firms to shift costs from commercial to government contracts (Rogerson, 1992; Chen & Gunny, 2014). In contrast, fixed price contracts provide no incentives to shift costs, but may lead firms to underinvest in fixed assets to support the contract. My SGA sticky cost results are consistent with the cost shifting of cost plus contract, but I have no information as to the actual contract form. Future work could connect the contract form with my analysis.



References

- Anderson, M., Banker, R., Huang, R., & Janakiraman, S. (2007). Cost behavior and fundamental analysis of SG&A costs. *Journal of Accounting, Auditing, and Finance*, 22(1), 1–23.
- Anderson, M., Banker, R., & Janakiraman, S. (2003). Are selling, general, and administrative costs “sticky”? *Journal of Accounting Research*, 41(1), 47–63.
- Arnold, S., McNicol, D., & Fasana, K. (2009). *Can profit policy and contract incentives improve defense contract outcomes?* (Working Paper). Alexandria, VA: Institute for Defense Analyses.
- Balakrishnan, R., & Gruca, T. (2008). Cost stickiness and core competency: A note. *Contemporary Accounting Research*, 25(4), 993–1006.
- Balakrishnan, R., Labro, E., & Soderstrom, N. (2010). *Cost structure and sticky costs* (Working Paper). Iowa City, IA: University of Iowa.
- Balakrishnan, R., Petersen, M., & Soderstrom, N. (2004). Does capacity utilization affect the “stickiness” of cost? *Journal of Accounting, Auditing, and Finance*, 19, 283–299.
- Berteau, D., Levy, R., Ben-Ari, G., & Moore, C. (2011). *Wall Street and the Pentagon: Defense industry access to capital markets, 1990–2010* (Working Paper). Washington, DC: Center for Strategic and International Studies.
- Chen, H., & Gunny K. (2014). *Profitability and cost shifting in government procurement contracts* (Working Paper). Boulder, CO: University of Colorado at Boulder.
- Davidson, R., & MacKinnon, J. (1981). Several tests for model specification in the presence of alternative hypotheses. *Econometrica*, 49(3), 781–793.
- Department of Defense (DOD). (n.d.). Better Buying Power. Retrieved from <http://bbp.dau.mil/>
- Kovacic, W. (1992). Regulatory controls as barriers to entry in government procurement. *Policy Science*, 25, 29–42.
- Laffont, J., & Tirole, J. (1993). *A theory of incentives in procurement and regulation*. Cambridge, MA: MIT Press.
- McGowan, A., & Vendryzk, V. (2002). The relation between cost shifting and segment profitability in the defense-contracting industry. *The Accounting Review*, 77(4), 949–969.
- Rogerson, W. (1992). Overhead cost allocation and



incentives for cost minimization in defense procurement. *The Accounting Review*, 67(4), 671–690.

North American Industry Classification System—1987 Standard Industrial Classification Replacement, 62 Fed. Reg. 17287–17337 (April 9, 1997).

Rogerson, W. (1994). Economic incentives and the defense procurement process. *Journal of Economic Perspectives*, 8(4), 65–90.

Wang, C., & San Miguel, J. (2012). *The excessive profits of defense contractors: Evidence and determinants* (Working Paper). Monterey, CA: Naval Postgraduate School, Acquisition Research Program.





ACQUISITION RESEARCH PROGRAM
GRADUATE SCHOOL OF BUSINESS & PUBLIC POLICY
NAVAL POSTGRADUATE SCHOOL
555 DYER ROAD, INGERSOLL HALL
MONTEREY, CA 93943

www.acquisitionresearch.net