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Small Business Participation in Air Force Procurement: Participation Trends and the Effect of Acquisition Reform Initiatives on Air Force Procurement via Selected Contract Types in Selected Product Categories

Douglas E. Leedy

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THESIS

Douglas E. Leedy, Captain, USAF

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DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

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Douglas E. Leedy, AS, BBA

Captain, USAF

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Douglas E. Leedy, AS, BBA
Captain, USAF

Approved:

/signed/	19 Mar 04
Patricia G. Luna (Chairperson)	date
/signed/	19 Mar 04
Michael A. Greiner (Member)	date
/signed/	19 Mar 04
Timothy S. Reed (Member)	date
/signed/	19 Mar 04
Teresa F. Rendon (Member) ASC/BC, Wright-Patterson AFB	date

Abstract

Small Businesses have been of recognized import to the Federal Government for many years. This thesis explores the role of small business contractors in Air Force procurement and the effects of recent acquisition reform initiatives on their involvement, including their method of involvement (contract type), product areas in which they participate, and possible new areas of measurement.

This thesis answers the research and investigative questions in three ways. First, it explores the correlation of acquisition reform initiatives to small business participation as a whole, via selected contract types, and in selected product categories via causal regression models. Next, it identifies trends in Air Force procurement via selected contract types in selected product categories via descriptive numerical comparison. Finally, it identifies possible product areas for improved small business recruitment.

The results of this thesis are as varied as the methodologies employed to answer the research and investigative questions. First, very little correlation was found between acquisition reform initiatives and small business participation. Next, small business participation trends via the selected contract types in the selected product areas varied much greater than overall small business participation. Finally, several product categories were identified as suffering from a decreasing level of small business participation.

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I. Introduction

Background

The benefits of small businesses to the national economy have been recognized for some time. Acs (1992) best summarized these benefits by stating that small businesses inject innovation into the marketplace, provide a mechanism for market regeneration, promote international competition through newly created niches, and create a preponderant share of new jobs. This section outlines the background of small business legislation, presidential support, effects to small business participation in government procurement, government small business participation goals, and the role of the Air Force Office of Small and Disadvantaged Business Utilization.

Given the recognized benefits of small businesses, legislation has been crafted to promote small business through the Small Business Act and the Small Business Investment Act of 1958. These acts were later amended in 1978 by Public Law 95-507, which stated that it was the goal of the Government to provide the "maximum practicable opportunities" to small businesses in its acquisitions and directed that each agency establish an Office of Small and Disadvantaged Business Utilization. In 1988, The Business Opportunity Development Reform Act (Public Law 100-656) set forth the first quantifiable government-wide small business goal; it stated that the federal government

must expend 20% of its procurement budget with small businesses. This goal was later increased to 23% by the Small Business Administration (SBA) Reauthorization Act of 1999 (United States Congress, 1999).

In conjunction with these laws, the executive branch has reinforced the desire to select small business contractors via executive orders that sought to streamline acquisition processes, thereby making it easier for more small businesses to participate, and promote small business solicitation. Executive Order (EO) 12866, Regulatory Planning and Review, emphasized efficiency in government by defining a "Regulatory Philosophy," which directed federal agencies to draft regulations only as they are "required by law…or are made necessary by compelling public need…" This EO also directed that "each agency shall tailor its regulations to impose the least burden on society, including individuals, businesses of differing sizes, and other entities…" (Clinton, 1993). EO 12928 more explicitly called for small business involvement by directing federal procurement agencies to turn to small businesses owned by economically and socially disadvantaged individuals.

The practice of ensuring small business involvement in government's acquisition process has been echoed in the current administration. President George W. Bush supports several initiatives designed to aid small businesses and small business employees, such as changes in tax laws which would simplify tax accounting procedures for small businesses, better health benefits for small business employees, and strengthened small business assistance programs. Also, he has directed agencies to ensure that recent initiatives designed to reform and improve the government procurement process do not exclude small businesses (The White House, 2003).

President Bush recognizes that the strength of our country and economy "depends upon the strength of the small business community all across America." (Bush, 2003)

Despite this attention, many have suggested that efforts to involve small businesses are overcome by initiatives to transform the government's procurement process. One recent initiative that is perceived to exclude small business participation is the practice of encouraging agencies to combine multiple similar requirements onto a single contract as a means to reduce administrative burdens. Contract bundling, as this practice has been termed, may lead to a disproportionately low number of small businesses that are able to compete for federal contracts configured in this manner (Murphy, 2003). Small businesses, while able to perform many different jobs on a small scale, are sometimes unable to perform the same jobs on a large scale. Large businesses can more easily scale their level of effort across a broader range and are able to compete on either small or large jobs (SBA Advocacy Report, 2000). Contract bundling has been blamed for the 23% decrease in the number of contracts awarded to small businesses from 1997 to 2000 (Contract Bundling: How it Hurts Small Business, 2003).

Thus, government leaders are continually struggling to balance the call to involve small businesses with the goal of making procurement process improvements. Legislation and initiatives such as the Defense Acquisition Workforce Improvement Act, the Federal Acquisition Streamlining Act of 1994, the Clinger-Cohen Act of 1996, and the Federal Acquisition Regulation Rewrite attempted to both update the federal procurement process and restructure the workforce that implements federal procurement programs. The effects of these efforts, however, may negatively impact federal small business programs.

In addition to the overall small business goal of 23 percent, Congress sets agency goals for procurement with several subsets of small businesses to include small disadvantaged businesses, women-owned small businesses, small businesses in Historically Underutilized Business Zones (HUB Zones), and small businesses owned by service-disabled veterans. Besides formulating and administrating agency programs, agency SADBU offices work closely with the SBA to establish annual agency-specific program goals (What We Do, 2002).

The Air Force established their Office of Small and Disadvantaged Business Utilization to improve small business involvement and to track small business participation in AF contracting. The director of the Air Force Office of Small and Disadvantaged Business Utilization, Mr. Joseph Diamond, outlined his office's efforts in his Air Force Small Business and Historically Black Colleges and Universities/Minority Institutions Program Plan for Fiscal Years 2003-2007. The strategic plan includes goals and initiatives designed to improve small business and HBCU/MI participation in AF contracting, develop a small business education and training program, and enhance the effectiveness of their programs through the use of data and analysis (Diamond, 2002).

As mandated by Congress, the AF SADBU office primarily measures small business involvement as Congress established it: percentage of total obligations directly awarded to small businesses. However, there is some question as to whether this method of measuring small business involvement is the most appropriate measure, given the complexities of the procurement system and the myriad of goods and services purchased. Thus the Director of Air Force Small Business Utilization Office created a Data and Analysis Integrated Product Team (hereafter referred to as the IPT) as part of a goal to

enhance the effectiveness of the Air Force Small Business Program (AFSBP). With its mix of multi-level small business utilization experts and researchers, the IPT was specifically suited to tackle goal four of the small business strategic plan, which was to use data analysis to identify trends in small business participation and identify targets of opportunity for improvement (Diamond, 2002).

One project in particular that the IPT set out to investigate was a better understanding of small business participation in Air Force procurement via two contract types, Firm Fixed-Price and Indefinite Delivery. A further breakout by four product areas within both contract types was also determined by the IPT. The four product areas included: supplies & equipment, services & leases, construction, and research & development.

This thesis will augment the Air Force Small Business Program's primary measure, percent-of-total-obligations, by exploring the extent to which two of its components, namely, contract type and industry areas, offer insights into small business involvement. By identifying the level, history, and trend of small business involvement in the product areas via the contract types, this thesis will assist the Air Force in developing small business utilization and development efforts.

Problem Statement

The extent to which the current AFSBP small business participation measure, percent-of-total-obligations, lends insight into the health of the program or the nuances of small business participation is not known. AFSBP leadership suggests that this measure neither provides adequate insight, nor reflects the true involvement of small business participation in Air Force procurement. Additional areas of measurement that have been proposed, but not previously researched include the capture of possible trends in both the

method by which the Air Force procures with small businesses (contract type) and the industries in which small businesses compete. A second area of research of particular interest to acquisition and small business leadership raises the question of whether acquisition reforms have had any impact on small business participation. As a heightened emphasis on improved efficiencies and consolidated buys becomes a central focus of the Federal Government and, specifically, the Department of Defense, the question remains what impact, if any, have these reforms had on small business participation?

Research Objectives

The purpose of this research is to determine if acquisition reform initiatives affected a change in Air Force small business utilization. Specifically, to answer the following research questions:

1. Have acquisition reform initiatives had an impact on small business utilization? More specifically, have acquisition reforms affected a change in the use of procurement vehicles by the Air Force? If so, what has been the impact to small business utilization?
2. What alternative measures of small business participation can be employed to effectively evaluate performance outside of percentage of total obligations?

Beyond the overall research questions, this study will also answer the following investigative questions:

1. Have acquisition reform initiatives affected a change in the Air Force's use of contract types to procure goods and services in selected product categories?

a. To what extent has the Air Force used firm fixed-price contracts (C-type) & indefinite delivery (D-type) contracts to procure goods and services from small businesses between the years of 1990 to present? Analyzing trends in small business participation via these contract types may lead to a better understanding of small business participation preferences, which could lead to more focused efforts of small business participation strategies.

b. To what extent has the Air Force used firm fixed-price (C-type) contracts & indefinite delivery (D-type) contracts to procure goods and services in selected product categories from small businesses between the years of 1990 to present? Analyzing trends in small business participation via these contract types within specific product areas may lead to a better understanding of small business ability and participation preferences, which could lead to more focused efforts of small business participation strategies.

Research Scope

This study will be accomplished in two phases. First it will research and identify applicable small business legislation and acquisition reform initiatives. Then, it will collect the data required for analysis of the research and investigative questions. The primary source of data will be that collected from contract awards and contained in the Air Forces' J001 Database of Procurement Actions; specifically, data which were reported by each Air Force contracting organization via the Department of Defense form 350 (DD350), Individual Contracting Action Report, will be used. Every contract action

over $25,000 is required to be reported via a DD350 and included in this database. Each contract award dated between October 1, 1989 and September 30, 2003 (Fiscal Years 1990 through 2003) will be copied from the database, to include data for each action as related to its date of award, amount of award, type of entity receiving the award, type of contract vehicle upon which it was awarded, and stock class under which the purchased item or service was categorized.

Assumptions/Limitations

Although the J001 is the most comprehensive of all Air Force contract reporting databases, changes in regulation and policy during the period may have resulted in missing or incomplete data. This study will be limited to only those actions containing each data point under study; only those reported actions containing an entity type, a contract type, and a stock class will be analyzed.

Thesis Structure

Chapter 2 of this thesis will provide background on the AF Small Business Program and discuss literature relating to the research objectives, including the importance of small business, acquisition reform and small business legislation, product areas, and contract typology. Chapter 3 will discuss the research methodologies employed. Chapter 4 will provide data analysis and results. Chapter 5 will provide conclusions and recommendations for further research.

II. LITERATURE REVIEW

Introduction

This chapter reviews applicable literature relating to the successful investigation of the research questions. Specifically discussed will be the regulatory history of small business assistance, the benefits to using small businesses, acquisition reform initiatives, contract bundling, types of contracts, and government reporting methods.

Small Business Assistance

Government-wide small business assistance began with the Small Business Act of 1953. This Act was not the first legislation to recognize the importance of small businesses to the national economy. However, previous legislation, such as the Small Business Mobilization Act of 1942 and the Armed Services Procurement Act of 1947, recognized the importance of small businesses, but mainly as means of maintaining a strong industrial base in support of war efforts (United States Congress, 1942 and United States Congress, 1947). It was not until the Small Business Act that congress established a formal support mechanism for small businesses, The Small Business Administration (United States Congress, 2001).

The Small Business Act of 1953, as enacted, contained several key provisions. Primarily, it directed the SBA to provide several types of assistance to small businesses, including technical and management assistance, loans, and assistance in obtaining government contracts. The Act also authorized the SBA to co-sign federal contracts with small minority firms and directed efforts that would lead to small business participation in larger government contracts as subcontractors. (United States Congress, 2001)

In the years since 1953, Congress has made many revisions to the Small Business Act. Most notable among the revisions were additional provisions that required large businesses award government contracts to provide small businesses subcontracting opportunities (Subcontracting Opportunities, 2003). Additional revisions established a program for small business loan guarantees (United States Congress, 1974 and United States Congress, 1976), quantitative small business utilization goals, and the establishment of offices in each agency that oversee small business utilization efforts (referred to as Offices of Small and Disadvantaged Business Utilization, or SADBU) (United States Congress, 1978). All of this legislation reflects congressional acknowledgment of the Federal Government's role in supporting a strong small business base, but it was the latter two initiatives (small business goals and the establishment of agency SADBU offices) which seem to have had the greatest impact on small business utilization efforts.

The establishment of a Federal goal for small business participation in its procurements was first stated in the Armed Services Procurement Act of 1947 as simply "a fair proportion" and was reaffirmed in the Small Business Act of 1953. It was not until 1978, however, that Congress directed Federal agencies to establish more explicit small business utilization goals (United States Congress, 1978). This was further refined in 1988 when Congress specified that a quantifiable percentage, 20%, of total federal procurement dollars must be spent with small businesses(United States Congress, 1988). Then, in 1999, Congress increased the Federal agency small business goal to 23%. (United States Congress, 1999)

In the SBA, Congress created an agency to aid national small business growth. The SBA does this through various programs including loan guarantees, a minority small business program, a venture capital program, and more. Between fiscal years 1991 and 2000, the SBA brokered over $94 billion in loans to almost 435,000 small businesses. In fact, the SBA could be considered the largest single financial backer of businesses in the country with over 219,000 current loans worth more than $45 billion. (Overview and History of the SBA, 2004) The guiding principles of the SBA include supporting entrepreneurs through a vast network of resource partners, facilitating an environment necessary for small business success, and, most importantly, measuring SBA performance by small business success (SBA's Guiding Principles, 2004).

The Air Force Office of Small and Disadvantaged Business Utilization was created to implement small business utilization efforts at the Air Force level. The leadership at the AF-OSDBU has developed three primary goals in its strategic plan as follows: 1) promote outreach efforts to encourage and assist small businesses; 2) promote acquisition policies and procedures that provide maximum opportunity for small business involvement in AF procurements; and 3) implement an organized system for planning, executing, and measuring the effectiveness of AF small business programs (Small Business (SB), 2003).

The legislation discussed above and detailed in Table 2-1 review the foundation of small business involvement in Government procurement. The next section will review the various benefits to procuring from small businesses.

Table 2-1: Small Business Legislation

Small Business Legislation	Key Points
Small Business Mobilization Act of 1942	- Authorized small business price differential during wartime
Armed Services Procurement Act of 1947	- Declared that a "fair proportion" of Federal purchases must be made with small businesses
Small Business Act of 1953	- Created the SBA - Authorized the SBA to make guaranteed loans to small businesses - Directed the SBA to provide small businesses with technical and management assistance - Authorized the SBA to enter into contracts with Federal agencies and subcontract 100% of the effort with small businesses - Directed the SBA to assist small businesses in obtaining government contracts
Revision to the Small Business Act of 1953 (1978)	- Required Federal agencies to establish small business procurement goals - Required small business subcontracting goals for Federal contracts awarded to small businesses - Reserved all Federal contract awards under $25,000 for small businesses - Required establishment of agency Offices of Small and Disadvantaged Business Utilization (SADBU)
Business Opportunity Development Reform Act of 1988	- Required Federal agencies to expend 20% of its procurement budget with small businesses
Federal Acquisition Streamlining Act of 1994	- Established micro-purchases and the Simplified Acquisition Threshold - Reserved all Federal contract awards between $2,500 and $100,000 for small businesses
SBA Reauthorization Act of 1999	- Required Federal agencies to expend 23% of its procurement budget with small businesses

Benefits to Using Small Business

There are many benefits to the Federal Government using small businesses as a source of supplies and services. There are benefits to using them as a source of supply, as a source of innovation, and as a source of economic growth. This section will review these benefits.

Small Businesses as a Source of Supply

As a part of national industry, small businesses are believed to be an important part of defense mobilization. In 1942 Congress recognized that small businesses may not be able to compete effectively against large businesses and enacted legislation allowing for a small business price differential, which basically stated that it was acceptable for the Government to procure goods and services from small businesses at a higher cost than if procured from large businesses. The primary goal of this early legislation was to "mobilize aggressively the productive capacity of all small business concerns, and to determine the means by which such concerns can be most efficiently and effectively utilized to augment war production." (United States Congress, 1942). In 1953, with the passage of The Small Business Act, legislators recognized that small businesses should be continuously primed for possible DoD utilization (United States Congress, 2001).

To this day, Small businesses continue to be an important source of supply for the Federal Government. In fact, many federal agencies exceed the mandated 23% small business procurement goal. During Fiscal Year 2002, 21 agencies exceeded 50% and two agencies purchased 100% of their goods and services from small businesses (Biglow, 2003). Clearly, small businesses can effectively support the procurement needs of the Government.

Small Businesses as a Source of Innovation

Technological innovation is not limited to large businesses. In fact, Acs (1988) found that small firms enjoy a larger per employee rate of innovative activity (new patent filings, etc.) than large firms. Innovation in small firms, however, is limited by the resources which the small businesses can employ (Acs, 1992). It is these resources that government programs, such as the Small Business Innovation Research (SBIR) Program, provide. The SBIR, passed into law under the Small Business Innovation Development Act of 1982, established guidelines for exploiting and growing the innovative talents of small businesses. It was designed to stimulate technological innovation and increase small business participation in federally-funded research and development efforts. (United States Congress, 1982)

Small Businesses as a Source of Economic Growth

Small businesses act as more than suppliers and as more than sources of innovation; they are a key component of the national economy. Small businesses employ half of all private sector employees, generate 60 to 70 percent of net new jobs annually, and employ 39 percent of high tech workers (Office of Advocacy, 2003). By ensuring their preference as a source of supply, small business programs improve the performance of new ventures and increase economic development (Chrisman and McMullan, 1996). Programs, such as those that sponsor innovation, create demand for new categories of goods or increase demand for existing categories of goods (Chrisman and McMullan, 2002). Terleckyj supports this view by stating that new, small, innovative firms

eventually grow to be large and, along the way, aid the emergence of new industries (Terleckyj, 1999).

It is in the above ways that the benefits to small business utilization are realized. The next section will discuss recent reform initiatives designed to update and streamline the manner in which the Federal government procures.

Acquisition Reform

For the Federal Government, the 1990s was the decade of acquisition reform. After over two centuries of growth and change, the federal procurement process had become mired in the weight of its own policies, rules, and procedures. In 1994 the Deputy Under Secretary of Defense for Acquisition Reform testified to the House Committee on Small Business that the combined result of these many years of legislative and regulatory changes has resulted in a procurement system that is too complex and too cumbersome (The ABC's of Acquisition Reform, 1995). The efforts to change and streamline federal acquisition processes are known as acquisition reform.

The efforts of Congress during this period are well documented in the three primary pieces of acquisition reform legislation: The Federal Acquisition Streamlining Act of 1994 (FASA), The Clinger-Cohen Act of 1996, and The Defense Workforce Improvement Act (DAWIA). This legislation also eventually brought on Federal Acquisition Regulation (FAR) rewriting initiatives. DAWIA restructured and outlined training requirements for the federal acquisition workforce. FASA directed the first true acquisition policy changes of the era and the Clinger-Cohen Act followed-up the policy changes with new tools needed to do the job. FAR rewriting initiatives attempted to incorporate and implement the aforementioned changes in law.

The Defense Acquisition Workforce Improvement Act

Perhaps the first of the era's acquisition reform initiatives was the Defense Acquisition Workforce Improvement Act (DAWIA). The act recognized the importance of those that manage and implement acquisition programs. In essence, acquisition program success is contingent on the abilities of the employees. DAWIA's goal was to improve the effectiveness of acquisition personnel and, thereby, improve the quality of acquisition programs (Garcia et. al., 1997). Specifically, the act identified twelve civilian and military acquisition career fields for which the Secretary of Defense was required to establish education, training, and experience requirements (DAWIA, 2003).

The Federal Acquisition Streamlining Act of 1994

FASA has been termed "revolutionary" for its impact on the federal acquisition process (Chart of Laws that Effect Contracting, 2003). It had three main goals: 1) reduce the time and cost to procure goods and services; 2) reduce the purchase price of procured goods and services; and 3) assure that the Government utilizes the best technology and methods to meet its procurement needs. In the furtherance of these goals, FASA modified or repealed over 225 procurement statutes. (United States Congress, 1994)

Most relevant to Federal Government small business utilization efforts was FASA's changes to small business procurement thresholds. Prior to FASA, all acquisitions were termed either small purchases or large purchases, with the pivot value being $25,000. Small purchases were specifically reserved for small businesses. FASA redefined government purchases to fall under two thresholds: $2,500 and the Simplified Acquisition Threshold (SAT) (normally $100,000). Those purchases $2,500 or less were termed Micro-Purchases and were exempted from competition and business size

requirements. Purchases valued between $2,500 and SAT were accomplished using new Simplified Acquisition Procedures (SAP) and were specifically set-aside for small businesses. All purchases greater than SAT remained under "full and open" competition rules (United States Congress, 1994).

Also newly authorized by FASA was a procurement vehicle known as a multiple award contract (MAC). A MAC is a task- or delivery-order contract whereby the procuring agency contracts with multiple vendors for the same or similar products. This contract vehicle was designed to increase purchasing flexibility and decrease administrative workload (Hecker, 2001).

The Clinger-Cohen Act of 1996

The Clinger-Cohen Act was the combination of the Information Technology Management Reform Act and the Federal Acquisition Reform Act (FARA). It primarily focused on the increased use of information technology (IT) in streamlining government acquisition, such as overall agency IT investment, Electronic Commerce/Electronic Data Interchange, and the repeal of outdated and burdensome Federal IT legislation enacted under the Brooks Act (Clinger-Cohen Act of 1996, 2003 and Fedchak, 2003). Other provisions in the Act specify decentralized procurement authority, the role of Chief Information Officers, pilot programs, and modular contracting (Fedchak, 2003).

A little known provision of the Clinger-Cohen Act authorized the use of multi-agency indefinite delivery indefinite quantity (IDIQ) contracts. These contracts are commonly referred to as government-wide agency contracts (GWAC). This provision authorized any government agency (such as DoD) to purchase goods and services from a contract let by another agency (such as GSA). Small business proponents believe that this

consolidation of purchasing power represents a lack of competition and could reduce the ability of small businesses to compete for federal contract dollars (Fedchak, 2003).

Federal Acquisition Regulation (FAR) Rewrite

During the period of acquisition reform, legislation enacted by Congress directed many changes in acquisition policy and law. These changes sparked a rewrite of the instructions used to guide contracting officers as they purchase goods and services. Besides updating the regulation to reflect changes in law, FAR rewrite efforts were designed to encourage innovation in contracting practices and eliminate the idea that if a practice was not expressly permitted, it was prohibited (Federal Acquisition Regulation (FAR) Changes, 2003). In other words, the revision was intended to allow for flexibility and innovation in the contracting process itself.

Accompanying the FAR rewrite, agencies updated and streamlined their own supplements to the regulations. For example, between 1996 and 2002, the Air Force reduced the page count of its supplement. This reduction was designed to accomplish three main goals: 1) eliminate unnecessary regulation, overly-detailed procedures, and outdated information; 2) emphasize an agile acquisition philosophy; and 3) empower the Air Force acquisition community with new designations and delegations. These changes aimed to give the contracting officer flexibility in daily decisions by encouraging innovation instead of discouraging practices not expressly authorized. (James, 2002)

Industry was skeptical of the benefits of these regulation rewrites. They believed that the increased discretion afforded acquisition personnel could lead to the "suppression of competitive market forces." Specifically, they cite acquisition reform initiatives, such as the FAR rewrite, which elevate efficiency over fairness. Paramount was industry's

concern that the rewrite would allow acquisition personnel subjective decisions in their evaluation of such things as competitive range, a determination which could allow the arbitrary rejection of bids. (HHGFAA, Allies Testify on FAR Rewrite, 1997)

Contract Bundling

Although not officially an acquisition reform initiative or a practice resulting from acquisition reform legislation, contracting bundling is a practice carried out in the spirit of streamlining the acquisition process. Contract bundling is a process whereby a single agency would "bundle" the requirements of several agencies, request bids for the bundled requirements, then award a single contract to one contractor under which multiple agencies could place orders. This process eliminates the duplication of effort which has traditionally been the case when individual agencies solicit, award, and administer their own contracts for the same effort.

Primary of opponents' arguments is that contract bundling unfairly excludes small businesses from competing for work which they could otherwise perform (Hecker, 2001). The practice effects this exclusion by its very nature. A bundled contract is the consolidation of two or more requirements for similar goods or services made unsuitable for award to a small business due to its large scope or geographical separation of performance sites (United States Congress, 1999).

Contract bundling is perceived by some as a contributing factor to a disproportionately fewer number of small businesses that are able to compete for federal contracts configured in this manner and has been blamed for the 23% decrease in the number of contracts awarded to small businesses from 1997 to 2000 (Contract Bundling: How it Hurts Small Business, 2003 and Murphy, 2003). This possible effect to small

business participation has garnered contract bundling much attention in the acquisition reform era.

The increased use of contract bundling has been linked to acquisition personnel's desire to decrease their workload and the creation of acquisition reform initiatives designed to streamline both the acquisition workforce and acquisition procedures. Research suggests that contract bundling can, in fact, lower total costs and improve service. It results in the contractor's more effective use of employees and better coordination among related activities, which results in a lower overall price, higher customer satisfaction, and a greater consistency in service (Bundled Services: A Framework for Cutting Costs, Improving Performance, and Supporting Small Businesses, 2001).

A bundled contract, however, may simply be too much work for a small business to perform. Small businesses, while able to perform many different jobs on a small scale, are sometimes unable to perform the same jobs on a large scale. Large businesses can more easily scale their level of effort across a broader range and are able to compete on either small or large jobs (SBA Advocacy Report Finds Contract Bundling Hurts Small Business, 2000).

Government Reporting Methods

Government agencies report both the quantitative results of their procurements and the qualitative assessment of their procurement programs. The quantitative data is compiled by the Federal Procurement Data Center (FPDC). The qualitative strategic plans are submitted and reviewed in accordance with the Government Performance and Results Act of 1993.

Quantitative Reporting

Automated Federal procurement data collection began in 1978 as a result of the Office of Federal Procurement Policy Act. The Act established the FPDC as the central collection point for Federal procurement data and directed the construction of the Federal Procurement Data System (FPDS), the first fully automated database of federal procurement actions. The FPDC compiles and summarizes procurement data in its yearly Federal Procurement Data Report (FPDR). The FPDR is considered "a reliable basis for measuring and assessing the impact of Federal acquisition policy and management improvement." (Biglow, 2003)

Strategic Planning and Reporting

It was not until Congress passed the Government Performance and Results Act of 1993 that Federal agencies were required to submit and report the results of strategic plans to Congress. Prior to the Act, Federal managers were considered disadvantaged in their efforts to improve program efficiency and Congress was considered handicapped in their policymaking by inattention to program performance (United States Congress, 1993).

Under the Act, the head of each agency is required to submit a yearly strategic plan for their programs' activities. The Act requires each strategic plan to include six main sections as follows:

- Section 1: A mission statement and description of the major functions of the agency.
- Section 2: A list of outcome-related goals and objectives the major functions of the agency.

- Section 3: A description of how the agency's goals and objectives will be achieved, including processes, technology, information, and personnel.
- Section 4: A description of how the performance goals of the agency relate to its general goals.
- Section 5: A description of key external factors beyond the control of the agency which could significantly the success of the agency's goals.
- Section 6: A description of the program evaluations used in determining the agency's goals, including a schedule for future evaluations.

Also under the Act, each agency is required to submit a yearly performance plan. Each performance plan must: 1) establish performance goals for each program; 2) express the performance goals in an objective, quantifiable, and measurable manner; 3) describe the processes, skills, technology, and resources necessary to meet the performance goals; 4) establish performance indicators to be used in measuring or assessing the relevant outcomes of each activity; 5) provide a basis for comparing actual program results with the established performance goals; and 6) describe the method to be used to verify and validate measured values.

Finally, the Act requires the head of each agency to submit a yearly program performance report. Each performance report is required to review actual program results and report the following: 1) the success of achieving the performance goals of the fiscal year; 2) an evaluation of the performance plan for the current fiscal year; and 3) an explanation and description of where performance goals were not met, including why the goal was not met, plans and schedules for meeting the goal, and an opinion of whether the performance goal is impractical or infeasible.

In 2001, the House Government Reform Subcommittee on Government Efficiency, Financial Management, and Intergovernmental Relations heard testimony on the status and perception of the implementation and success of the Act. Witnesses testified on the shortcomings of the Act, including: “the inability to assess an agency’s performance, the inability to compare programs across government, inadequate data on performance, and unwillingness among agencies to set goals to resolve long-standing problems.” The process of agencies learning the intricacies of the Act and its reporting requirements are ongoing and, “until GPRA is integrated into the authorization and appropriation process, progress will probably remain at glacial speed.” The committee was warned, however, not to turn GPRA into a “technical exercise.” (House Government Reform Subcommittee on Government Efficiency, Financial Management, and Intergovernmental Relations, 2001)

The GPRA became a critical tool in determining the results of agency programs and Federal policy (United States General Accounting Office, 2002). It did this by shifting the focus of decision making away from the intricacies of specific activities towards the results of those activities. Combined, these two aspects of reporting, quantitative and qualitative, reinforce one another and provide the tools necessary to correct the inherent defects of Federal funding practices prior to the Act (The Results Act: Turning Washington on its Head by making Federal Programs Accountable for Results, 2004).

Types of Contracts

Through multiple legislative acts, Congress established specific guidelines for the expenditure of discretionary appropriated funds. These guidelines in law are codified in the Code of Federal Regulations (CFR) along with rules established by Executive

departments and agencies. Title 48 of the CFR, Federal Acquisition Regulations System, organizes the laws and guidelines into the cornerstone Federal Acquisition Regulation (FAR) and its agency supplements, such as the Defense Federal Acquisition Regulation Supplement (DFARS) and the Air Force Federal Acquisition Regulation Supplement (AFFARS). This section reviews the basic requirements of FAR part 16, Types of Contracts. (GPO, 2002a)

FAR part 16 outlines the use of many different types and sub-types of contracts, commonly referred to as "contract types". These contract types fit into seven categories, grouped by general use and administration. The contract categories outlined in the FAR are fixed-price, cost-reimbursement, incentive, indefinite delivery, time-and-materials, labor-hour, and agreements. (GPO, 2002c)

DoD agency contracting offices report their contract awards via forms that further categorize award actions. Awards are reported in procurement categories according to the procurement method (contract type), stage in the procurement (e.g. letter contracts), and agency association (e.g. orders against Federal schedules). At their highest level of categorization, actions are reported as letter contracts, definitive contracts, orders under agreements, orders under indefinite-delivery contracts, orders under federal schedules, BPA orders under federal schedules, orders from UNICOR or JWOD, or awards under FAR Part 12. (GPO, 2002c)

Each contract awarded by Federal agencies is labeled with a contract number. This number identifies the awarding contracting office and agency, the type of contract, and a contract-specific serial identifier. For the DoD, each action is labeled with a Procurement Instrument Identification Number (PIIN). Within each award PIIN is single digit

identifier specifying the type of action being awarded (e.g. C-type or D-type) (GPO, 2002b). These identifiers related specifically to the categories of contract types identified above.

Conclusion

This chapter reviewed literature relating to the investigation of the research questions. Specifically, this chapter discussed the regulatory history of small business assistance, the benefits to using small businesses, acquisition reform initiatives, contract bundling, types of contracts, and government reporting methods. Chapter 3 will outline the methodology employed in answering the research questions.

III. Research Method

This chapter explains the method that will be used to analyze the data. Specifically, it will describe the database from which the data were collected, the specific data selected, possible methods of analysis, and descriptions of the methods used.

Database Description

The data were compiled from the Air Force Contract Reporting System (AFCRS), more commonly referred to as the J001 Database of Procurement Actions. The J001 is the Air Force warehouse for reportable contract action data. DoD-wide data is further collected in the Defense Contract Action Data System (DCADS) prior to its transmission to the Federal Procurement Data System (FPDS), which is maintained by the Office of Federal Procurement Policy (OFPP) (Department of the Air Force, 2000).

Based upon the data transmitted to it, the J001 includes both summary and action-specific data fields. It includes action-specific data fields for all actions valued greater than $25,000 and summary data fields for actions valued $25,000 or less. Contracting organizations report their contract award data via two DoD forms, the DD Form 350, Individual Contracting Action Report (DD350), and the DD Form 1057, Monthly Procurement Summary of Actions $25,000 or Less (DD1057) (Department of the Air Force, 2000). The DD350 is used to report individual contract award actions valued greater than $25,000 and includes many details of the contract action. The DD1057, however, is a periodic summary report (normally submitted monthly), cumulating less detailed procurement data than the DD350. Via these two forms, each contracting organization transmits all of its available contract award data to the J001.

As the primary warehouse for Air Force procurement data, the J001 houses a massive amount of data in dozens of data fields. As a means to easily collect and transmit the data pulled from the J001, the data were compiled in Microsoft Excel spreadsheets. Due to the amount of data collected, data were pulled from the J001 in manageable batch sizes consistent with Excel's inherent spreadsheet size constraints. The detailed process followed to collect and organize the data is presented in Appendix A.

Following is a discussion of the data selected from the database for analysis.

Data Selection

The director of SAF/SB established the IPT to achieve the fourth goal of the Small Business Plan, "enhance the effectiveness of the SB and SBCU/MI program through the use of data and analysis." (Diamond, 2003) The team was tasked with objectively assessing the effectiveness of the SB and HBCU/MI Program and identifying targets of opportunities for improvement. To achieve this goal, Mr. Diamond assembled a group of individuals with experience and in positions uniquely suited to lending insight into the problems under exploration. The team consisted of major command and center directors of small business, small business specialists, data managers, and Air Force Institute of Technology student researchers. The team identified eight projects. This study is limited to small business participation within certain contract types and product areas. The relevant parameters are as follows:

Time Frame

Due mainly to the unavailability (or inaccessibility) of contract award data prior to 1990, the boundaries of the contract award date will be those complete fiscal years between 1990 and 2003.

Contract Types

When posting a contract award, the DD Form 350 allows for the selection of eight general contract types, recorded as discrete numerical codes. The buyer or contracting officer selects the appropriate entry based on the general type of resultant contract action being awarded. The possible selections include Letter Contract (1), Definitive Contract (3), Order Under and Agreement (4), Order Under Indefinite-Delivery Contract (5), Order Under Federal Schedule, (6), Blanket Purchase Agreement Order Under Federal Schedule (7), Order from UNICOR or JWOD (8), and Award Under FAR Part 13 (9). This study explored contract awards via two contract types, Definitive Contracts and Orders Under Indefinite-Delivery Contracts.

Product Types

When posting a contract award, the DD Form 350 records the appropriate Federal Supply Class or Service Code of the action. For the purposes of this research, the Air Force Office of Small and Disadvantaged Business Utilization believed it appropriate to explore not just the trends in contracts vehicles used to procure from small businesses, but the spending trends in major product areas of goods and services.

The Data IPT leader selected product/service areas based on those areas reported by the Federal Procurement Data Center in the annual Federal Procurement Data Report. The report categorizes federal procurement spending into three groups: Research & Development, Other Services & Construction, and Supplies & Equipment. The IPT chose to break apart Other Services & Construction into two separate groups, resulting in four major groups of interest. Within these groups, the Federal Procurement Data Report further breaks down the product areas into hierarchical levels of categorization. The IPT

chose to analyze cumulative data for the Construction and Services and Leases categories and limited subcategories of the Supplies & Equipment and Services & Leases categories. By preserving continuity among Government reports in this way, the IPT's report will be additive and can be compared in parallel with other government reports. Table 3-1 details the inclusive product categories.

Table 3-1: Product Categories

Product Category Code	Product Category Name	Inclusive Federal Stock Class Codes
1	Supplies & Equipment	10 through 99
1A	Automated Data Processing Equipment	70
1B	Systems	1510, 1520, 1540, & 1550
1C	Aircraft Components	1560 & 16
1D	Communication & Radar Equipment	58
1E	Engines & Components	28
1 Other	Other Supplies & Equipment	All Remaining Categories
2	Services & Leases	B through X
2A	Professional Services	R
2B	Utilities	S111, S112, S113, S114, & S119
2C	Base Operating Support Services	S201 through S299
2D	Repair of Equipment	J
2E	Government Owned Contractor Operated Parts Stores	M
2F	Modification of Equipment	K
2 Other	Other Services & Leases	All Remaining Categories
3	Construction	Y & Z
4	Research & Development	A

Method of Analysis

The research and investigative questions deal with both trend analysis and causal relationships. Specifically, they ask if acquisition reform initiatives effected small business and contract type utilization and they ask to what extent the Air Force has used certain contract types. Three methods lend themselves to answering these types of questions: Descriptive Numerical Comparison, Standard Multiple Regression, and Time-

Series Analysis. This section outlines these three methods and the methods selected for this study.

Standard Multiple Regression

Regression analysis is a method for analyzing and evaluating the relationship between one or more independent variables to a single dependent variable. Multiple regression is the term used when more than one independent variable is introduced into the model. (Tabachnick and Fidell, 2001)

The appropriateness of regression analysis can be characterized by the following possible applications (Kleinbaum, Kupper, Muller, and Nizam, 1998):

- Characterize the relationship between the dependent and independent variables by determining the extent, direction, and strength of the association.
- Define a quantitative formula or equation to describe the dependent variable as a function of the independent variables.
- Describe the relationship between the independent variables and the dependent variable while controlling for the effects of other variables.
- Determine which of several independent variables are important and which are not for describing or predicting a dependent variable.
- Determine the best mathematical model for describing the relationship between a dependent variable and one or more independent variables.
- Assess the interactive effects of two or more independent variables with regard to a dependent variable.
- Obtain a valid and precise estimate of one or more regression coefficients from a larger set of regression coefficients in a given model.

The result of regression is an equation that represents the best prediction of the dependent variable from one or more independent variables (Tabachnick and Fidell, 2001). The equation is as follows: $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \in$. The response variable, *y*, represents the predicted value of the dependent variable. The y-intercept, β_0, represents the value of *y* given all null estimators (all values of *x* equal zero), given a total of *k* estimators. The predictor variables, *x*, represent the independent variables assigned to the model. The error component of the model is represented by $\in$.

Time-Series Analysis

Time series analysis is a method for analyzing repeated observations over time. Time series analysis has three main goals: identify patters in the sequence of numbers of time, which are correlated with themselves, but offset in time; test the impact of one or more interventions; and forecast future patters of events or to compare series of different kinds of events. (Tabachnick and Fidell, 2001)

The appropriateness of time-series analysis can be characterized by the following possible applications (Tabachnick and Fidell, 2001):

- Determine patterns of autocorrelation.
- Determine seasonal cycles and trends.
- Forecast future values of observations.
- Determine the effect of interventions.
- Compare patterns over time for different variables or populations.
- Assess the relevance of predictors (covariates).
- Determine the strength of the model's association and power.

There are two prominent types of time-series analysis: time domain and spectral domain. Tabachnick and Fidell (2001) best describe the two methods as follows:

> Time domain analyses deal directly with the [dependent variable] over time; spectral domain analyses decompose a time series into its sine wave components. Either time or spectral domain analyses can be used for identification, estimation, and diagnosis of a time series. However, current statistical software offers no assistance for intervention analysis using spectral methods.

One of the most popular time-series models is called the ARIMA (*p, d, q*) model. The ARIMA acronym stands for auto-regressive, integrated, moving average. It incorporates three primary elements: *p*, the auto-regressive element that controls for lingering effects of preceding scores; *d*, the integrated element that represents trends in the data; and *q*, the moving average element. (Tabachnick and Fidell, 2001)

Descriptive Numerical Comparison

Descriptive quantitative research involves either identifying the characteristics of an observed phenomenon or exploring possible correlations among two or more phenomena (Leedy and Ormrod, 2001). While the previously discussed techniques, Standard Multiple Regression and Time Series Analysis, explore correlations, Descriptive Numerical Comparison seeks to define observed traits in the data. By observing these traits, value can be derived from their comparison.

Selected Methods

The research and investigative questions beg for two methods of analyses: a method of causal/correlation analysis and a method of descriptive comparison. Possibly the most effective method available to test the contribution of multiple (independent) variables to that of a single (dependent) variable is multiple regression (Leedy and Ormrod, 2001). The choice of this type of analysis was most appropriate for this study in particular, as

there were only 13 time-series data points available. Tabachnick and Fidell adamantly point that time-series analysis can only be used when observations are made repeatedly over 50 or more time periods (Tabachnick and Fidell, 2001). Clearly, the most effective model available to answer the causal research questions is standard multiple regression. For the investigative questions that ask the question of what happened, Descriptive Numerical Comparison will provide for the most effective identification of data characteristics.

Standard Multiple Regression Analysis

This section describes the construction of the regression model, including dependent variables, independent variables, the multiple regression model, hypotheses related to the regression model, and regression analysis techniques.

Dependent Variables

The response variables of the model, $y_{(1 \text{ through } 39)}$, are the dependent variables to be modeled. By fitting the models to a set of data, responses for each model can be used to answer the research and investigative questions (McClave, Benson, and Sincich, 2001). A model was constructed for each of the 39 response variables of interest.

The following variables will test the effect of acquisition reform initiatives on the Air Force's use of procurement vehicles:

y_1 = Percentage of Air Force contract dollars awarded via C-type contracts

y_2 = Percentage of Air Force contract dollars awarded via D-type contracts

The following variables will test the effect of acquisition reform initiatives on Air Force small business utilization overall and within certain contract types:

y_3 = Percentage of Air Force contract dollars awarded to small businesses

y_4 = Percentage of Air Force contract dollars awarded to small businesses via C-type contracts

y_5 = Percentage of Air Force contract dollars awarded to small businesses via D-type contracts

The following variables will test the effect of acquisition reform initiatives on the Air Force's use of C-type contracts to procure goods and services in the Supplies & Equipment product category.

y_6 = Percentage of Air Force contract dollars awarded via C-type contracts in the Supplies & Equipment product category

y_7 = Percentage of Air Force contract dollars awarded via C-type contracts in the Supplies & Equipment: Automated Data Processing product subcategory

y_8 = Percentage of Air Force contract dollars awarded via C-type contracts in the Supplies & Equipment: Systems product subcategory

y_9 = Percentage of Air Force contract dollars awarded via C-type contracts in the Supplies & Equipment: Aircraft Components product subcategory

y_{10} = Percentage of Air Force contract dollars awarded via C-type contracts in the Supplies & Equipment: Communication & Radar Equipment product subcategory

y_{11} = Percentage of Air Force contract dollars awarded via C-type contracts in the Supplies & Equipment: Engines & Components product subcategory

y_{12} = Percentage of Air Force contract dollars awarded via C-type contracts in the Supplies & Equipment: Other Supplies & Equipment product subcategory

The following variables will test the effect of acquisition reform initiatives on the Air Force's use of C-type contracts to procure goods and services in the Services & Leases product category.

y_{13} = Percentage of Air Force contract dollars awarded via C-type contracts in the Services & Leases product category

y_{14} = Percentage of Air Force contract dollars awarded via C-type contracts in the Services & Leases: Professional Services product subcategory

y_{15} = Percentage of Air Force contract dollars awarded via C-type contracts in the Services & Leases: Utilities product subcategory

y_{16} = Percentage of Air Force contract dollars awarded via C-type contracts in the Services & Leases: Base Operating Support Services product subcategory

y_{17} = Percentage of Air Force contract dollars awarded via C-type contracts in the Services & Leases: Repair of Equipment product subcategory

y_{18} = Percentage of Air Force contract dollars awarded via C-type contracts in the Services & Leases: Government Owned Contractor Operated Supply Stores product subcategory

y_{19} = Percentage of Air Force contract dollars awarded via C-type contracts in the Services & Leases: Modification of Equipment product subcategory

y_{20} = Percentage of Air Force contract dollars awarded via C-type contracts in the Services & Leases: Other Services & Leases product subcategory

The following variables will test the effect of acquisition reform initiatives on the Air Force's use of C-type contracts to procure goods and services in the Construction product category.

y_{21} = Percentage of Air Force contract dollars awarded via C-type contracts in the Construction product category

The following variables will test the effect of acquisition reform initiatives on the Air Force's use of C-type contracts to procure goods and services in the Research & Development product category.

y_{22} = Percentage of Air Force contract dollars awarded via C-type contracts in the Research & Development product category

The following variables will test the effect of acquisition reform initiatives on the Air Force's use of D-type contracts to procure goods and services in the Supplies & Equipment product category.

y_{23} = Percentage of Air Force contract dollars awarded via D-type contracts in the Supplies & Equipment product category

y_{24} = Percentage of Air Force contract dollars awarded via D-type contracts in the Supplies & Equipment: Automated Data Processing product subcategory

y_{25} = Percentage of Air Force contract dollars awarded via D-type contracts in the Supplies & Equipment: Systems product subcategory

y_{26} = Percentage of Air Force contract dollars awarded via D-type contracts in the Supplies & Equipment: Aircraft Components product subcategory

y_{27} = Percentage of Air Force contract dollars awarded via D-type contracts in the Supplies & Equipment: Communication & Radar Equipment product subcategory

y_{28} = Percentage of Air Force contract dollars awarded via D-type contracts in the Supplies & Equipment: Engines & Components product subcategory

y_{29} = Percentage of Air Force contract dollars awarded via D-type contracts in the Supplies & Equipment: Other Supplies & Equipment product subcategory

The following variables will test the effect of acquisition reform initiatives on the Air Force's use of D-type contracts to procure goods and services in the Services & Leases product category.

y_{30} = Percentage of Air Force contract dollars awarded via D-type contracts in the Services & Leases product category

y_{31} = Percentage of Air Force contract dollars awarded via D-type contracts in the Services & Leases: Professional Services product subcategory

y_{32} = Percentage of Air Force contract dollars awarded via D-type contracts in the Services & Leases: Utilities product subcategory

y_{33} = Percentage of Air Force contract dollars awarded via D-type contracts in the Services & Leases: Base Operating Support Services product subcategory

y_{34} = Percentage of Air Force contract dollars awarded via D-type contracts in the Services & Leases: Repair of Equipment product subcategory

y_{35} = Percentage of Air Force contract dollars awarded via D-type contracts in the Services & Leases: Government Owned Contractor Operated Supply Stores product subcategory

y_{36} = Percentage of Air Force contract dollars awarded via D-type contracts in the Services & Leases: Modification of Equipment product subcategory

y_{37} = Percentage of Air Force contract dollars awarded via D-type contracts in the Services & Leases: Other Services & Leases product subcategory

The following variables will test the effect of acquisition reform initiatives on the Air Force's use of D-type contracts to procure goods and services in the Construction product category.

y_{38} = Percentage of Air Force contract dollars awarded via D-type contracts in the Construction product category

The following variables will test the effect of acquisition reform initiatives on the Air Force's use of D-type contracts to procure goods and services in the Research & Development product category.

y_{39} = Percentage of Air Force contract dollars awarded via D-type contracts in the Research & Development product category

Independent Variables

The predictor variables of the model, $x_{(1 \text{ through } 9)}$, are the independent variables used to predict the value of the response variable (McClave, Benson, and Sincich, 2001). This model incorporates both quantitative and qualitative predictor variables. The quantitative variables are numeric in nature and are derived from summary parameters of yearly DD350 data. The qualitative variables are not numerical in nature and, therefore, require alternate representation in the model. By coding the qualitative variables with numeric indicators they can be modeled beside the quantitative variables (McClave, Benson, and Sincich, 2001). Data collected for a given period can be known to have been collected either during an applicable acquisition reform period or not during an applicable acquisition reform period; therefore, within the model, the qualitative variable can be "turned on" with a value of 1 or "turned off" with a value of 0.

The model will utilize nine predictor variables. Four variables (x_1 through x_4) will account for the applicability of acquisition reform initiatives. One variable (x_5) will account for the total contract dollars. Four variables (x_6 through x_9) will account for the percentage of dollars awarded via specific contract vehicles (C-type, D-type, MAC, and GWAC).

The Multiple Regression Model

Although there are 39 response variables of interest and, therefore, 39 separate models, each model shares the same predictor variables. The model, in equation form, is as follows:

$$y_{(1 \text{ through } 39)} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 + \in$$

where

$y_{(1 \text{ through } 39)}$ = (Identified above)

x_1 = Defense Acquisition Workforce Improvement Act (0 if pre-DAWIA, 1 if post-DAWIA)

x_2 = Federal Acquisition Streamlining Act (0 if pre-FASA, 1 if post-FASA)

x_3 = Clinger-Cohen Act (0 if pre-Clinger-Cohen Act, 1 if post-Clinger-Cohen Act)

x_4 = Far Part 15 Re-write (o if pre-FAR 15 Re-write, 1 if post-FAR 15 Re-write)

x_5 = DD350 Contract dollars

x_6 = C-type contract percentage

x_7 = D-type contract percentage

x_8 = Multiple Award Contract percentage

x_9 = Government Wide Agency Contract percentage

Hypotheses

The regression model will allow hypotheses to be tested and, therefore, establish a basis for answering the research and investigative questions. Each hypotheses is tied to a response variable (e.g. H_1 will be answered by y_1, H_2 will be answered by y_2, etc.) and serves to answer the associated research and investigative questions. The hypotheses are as follows:

H_1: Acquisition reform initiatives changed (increased or decreased) the Air Force's use of C-type contracts.

H_2: Acquisition reform initiatives changed (increased or decreased) the Air Force's use of D-type contracts.

H_3: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force contract dollars awarded to small businesses.

H_4: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force contract dollars awarded to small business via C-type contracts.

H_5: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force contract dollars awarded to small business via D-type contracts.

H_6: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment contract dollars awarded to small business via C-type contracts.

H_7: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Automated Data Processing contract dollars awarded to small business via C-type contracts.

H_8: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Systems contract dollars awarded to small business via C-type contracts.

H_9: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Aircraft Components contract dollars awarded to small business via C-type contracts.

H_{10}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Communication & Radar Equipment contract dollars awarded to small business via C-type contracts.

H_{11}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Engines & Components contract dollars awarded to small business via C-type contracts.

H_{12}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Other Supplies & Equipment contract dollars awarded to small business via C-type contracts.

H_{13}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases contract dollars awarded to small business via C-type contracts.

H_{14}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Professional Services contract dollars awarded to small business via C-type contracts.

H_{15}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Utilities contract dollars awarded to small business via C-type contracts.

H_{16}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Base Operating Support Services contract dollars awarded to small business via C-type contracts.

H_{17}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Repair of Equipment contract dollars awarded to small business via C-type contracts.

H_{18}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Government Owned Contractor Operated Parts Stores contract dollars awarded to small business via C-type contracts.

H_{19}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Modification of Equipment contract dollars awarded to small business via C-type contracts.

H_{20}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Other Services & Leases contract dollars awarded to small business via C-type contracts.

H_{21}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Construction contract dollars awarded to small business via C-type contracts.

H_{22}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Research & Development contract dollars awarded to small business via C-type contracts.

H_{23}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment contract dollars awarded to small business via D-type contracts.

H_{24}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Automated Data Processing contract dollars awarded to small business via D-type contracts.

H_{25}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Systems contract dollars awarded to small business via D-type contracts.

H_{26}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Aircraft Components contract dollars awarded to small business via D-type contracts.

H_{27}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Communication & Radar Equipment contract dollars awarded to small business via D-type contracts.

H_{28}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Engines & Components contract dollars awarded to small business via D-type contracts.

H_{29}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Other Supplies & Equipment contract dollars awarded to small business via D-type contracts.

H_{30}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases contract dollars awarded to small business via D-type contracts.

H_{31}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Professional Services contract dollars awarded to small business via D-type contracts.

H_{32}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Utilities contract dollars awarded to small business via D-type contracts.

H_{33}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Base Operating Support Services contract dollars awarded to small business via D-type contracts.

H_{34}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Repair of Equipment contract dollars awarded to small business via D-type contracts.

H_{35}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Government Owned Contractor Operated Parts Stores contract dollars awarded to small business via D-type contracts.

H_{36}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Modification of Equipment contract dollars awarded to small business via D-type contracts.

H_{37}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Other Services & Leases contract dollars awarded to small business via D-type contracts.

H_{38}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Construction contract dollars awarded to small business via D-type contracts.

H_{39}: Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Research & Development contract dollars awarded to small business via D-type contracts.

Regression Analysis Techniques

Standard Multiple Regression will allow for the systematic test of each hypothesis as quantified with its related regression model. Each of the 39 models will be analyzed using the statistical analysis software JMP Version 5.0.1. The units for analysis include: the Multiple Correlation Coefficient (R^2), the Adjusted Multiple Correlation Coefficient (R^2_{adj}), the *p*-value of the F-statistic, and the Parameter Characteristics (estimates of β and their *p*-values).

The Multiple Correlation Coefficient (R^2). R^2 is a measure of explained variance. Its value represents the proportion of variation in the model that is explained by the model. For example, when a model has an R^2 of 0.9, that model explains 90% of the variance in the response variable (y) with the included regressors ($x_{1 \text{ thru } n}$). The downside of the R^2

measurement, however, is that as additional regressors are added to the model, R^2 always increases. In other words, one can drive R^2 to 1.0 (a perfect fit) simply by adding more regressors. (Lattin, Carroll, and Green, 2003)

The Adjusted Correlation Coefficient (R^2_{adj}). Like R^2, R^2_{adj} is a measure of explained variance. Due to its calculation accounting for the degrees of freedom of the model, however, R^2_{adj} does not increase with the inclusion of more regressors. In fact, R^2_{adj} will decrease with the inclusion of each regressor at a rate comparable to each regressor's *p*-value (e.g. The higher the *p*-value of the regressor, the more it's effect lowers the model's R^2_{adj}.) The comparison of a model's R^2 to its R^2_{adj} will show how well the model explains the variation in the response variable and whether the model's R^2 has been driven unreasonably high. (Lattin, Carroll, and Green, 2003)

The *p*-value of the *F*-statistic. The *F*-statistic tests the statistical significance of the overall model. The *p*-value of the *F*-statistic represents the probability of at least one of the β coefficients equaling zero. An *F*-statistic *p*-value of 0.05 or less ($\alpha = 0.05$) would indicate that at least one of the β coefficients is not zero and, therefore, implies a successful model. (Lattin, Carroll, and Green, 2003)

Parameter Characteristics. The characteristics of the model's parameters (regressors) include the estimates of the regressors (their β-values) and their *p*-values. The value of a regressor's β is the value by which that regressor is multiplied in the model (e.g. $\beta_1 x_1$). A β-value of 5.0 would indicate that for every 1.0 increase of the regressor, the response variable (y)would increase by 5.0. Calculated with each β-value is a *p*-value. The *p*-value of a given β represents the probability that the given β is zero. A *p*-value of 0.05 or

less ($\alpha = 0.05$) indicates that the given β is statistically significant because there is only a 5% (or less) chance of the given β equaling zero.

Descriptive Numerical Comparison

Two of the investigative questions (1a and 1b) represent an effort to identify the value of the extent to which the Air Force has procured goods and services via selected contract types in selected product categories from small businesses. This effort is solely an attempt to quantify small business contract awards during the research period (1990 thru 2003), not to assert any effects of legislation or other factors. Hence, these investigative questions will be answered with a simple descriptive comparison of the numerical data.

Several points of comparison will be made. Chief among these will be the trend of small business utilization, computed as the slope of the least squares regression line through the yearly small business utilization rates. Differences in small business utilization in the selected contract types and product categories will be computed and compared with each other and the overall small business utilization rate.

Conclusion

This chapter outlined the methodology used in this study. It reviewed the database, the selection of data, and the methods used to analyze the data. The methodology detailed in this chapter will be used to address the hypotheses and answer the research and investigative questions.

IV. Data Analysis

Introduction

This chapter details the analysis performed on the data as outlined in Chapter 3. It will present the data included for regression and trend analysis, then discuss the analyses in detail.

Summary of Data

Regression Data

Contract award data were compiled for incorporation into the regression models. Data for analyses are presented in Table 4-1.

Table 4-1: Summary Data for Regression Analysis

Year *	x_1 DAWIA	x_2 FASA	x_3 Clinger-Cohen	x_4 FAR 15	x_5 Total Dollars **	x_6 % C-type	x_7 % D-type	x_8 % MAC	x_9 % GWAC
1990	0	0	0	0	59,630,960	15.82	11.32	0.00	0.00
1991	0	0	0	0	58,945,512	22.03	15.18	0.00	0.00
1992	1	0	0	0	48,243,892	11.54	15.78	0.00	0.00
1993	1	0	0	0	54,555,821	19.27	17.02	0.00	0.00
1994	1	0	0	0	52,113,265	16.00	19.37	0.00	0.00
1995	1	0	0	0	45,679,591	16.08	19.68	0.00	0.00
1996	1	1	0	0	46,023,123	23.87	21.42	5.36	0.00
1997	1	1	1	0	40,240,647	65.34	21.43	4.82	0.00
1998	1	1	1	0	38,378,342	63.02	22.45	6.15	0.00
1999	1	1	1	0	40,144,284	65.42	23.46	7.55	0.00
2000	1	1	1	0	41,746,694	58.19	23.54	5.85	0.00
2001	1	1	1	0	42,033,536	55.98	26.05	6.98	0.00
2002	1	1	1	1	48,121,971	52.77	27.35	7.75	0.65
2003	1	1	1	1	40,456,561	57.07	29.82	13.76	0.61

* Fiscal year of summary data included only for reference, not as available in the regression models.
** Presented in thousands of fiscal year 2003 dollars (FY03$000).

The data for the regression analysis were normalized and adjusted in three ways. First, applicability of the acquisition reform initiatives were represented with a binary selection. If the initiative did not apply in a given year, the initiative was represented with a zero (0) in the model. If the initiative applied in a given year, the initiative was

represented with a one (1). Second, the total contract dollars for the given years were inflated so as to represent constant fiscal year 2003 dollars. Third, the percentage-of-dollars variables (x_6 through x_9) were computed by dividing the total type (C-type, D-type, MAC, and GWAC) dollars in a given year by that year's total contract dollars.

Small Business Utilization in Selected Contract Types Trend Data

Contract award small business percentage data for the selected contract types (C-type and D-type) were compiled for analysis. Data for analysis is presented in Table 4-2.

Table 4-2: SB Percentage Trend in Selected Contract Types

Contract Type	1990	1991	1992	1993	1993	1995	1996	1997	1998	1999	2000	2001	2002	2003
All	7.5	8.0	8.7	10.1	10.1	11.5	11.1	11.6	11.7	10.7	11.5	10.6	10.8	8.2
C-Type	18.0	12.1	30.2	19.6	21.4	25.0	14.6	10.4	10.7	9.0	10.0	10.3	10.0	6.6
D-Type	22.0	19.6	20.5	22.4	19.9	23.1	20.6	19.1	19.1	17.0	16.5	15.1	16.3	12.0

Small Business Utilization in Selected Contract Types by Product Categories Trend Data

Contract award small business percentage data for the selected contract types (C-type and D-type) in the selected product categories were compiled for analysis. Data for analysis is presented in Tables 4-3, 4-4, and 4-5.

Table 4-3: SB Percentage Trend in Selected Contract Types & Product Catagory 1

Contract Type	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Cat. 1														
All	4.7	4.9	5.6	6.1	5.8	7.1	5.3	6.5	6.6	6.1	6.3	4.9	5.7	5.1
C-Type	13.6	7.7	27.6	10.6	10.1	18.1	4.6	4.4	3.8	4.0	3.4	3.8	4.0	3.4
D-Type	13.9	16.4	22.8	26.5	14.2	23.5	13.7	15.6	15.6	11.9	12.1	8.7	10.7	8.8
Cat. 1A														
All	11.5	27.4	30.8	26.8	25.1	28.9	16.9	9.8	12.4	10.9	20.3	7.8	10.4	6.6
C-Type	46.8	26.7	44.2	42.1	40.5	46.5	46.5	9.4	3.5	3.5	1.4	4.2	11.5	7.7
D-Type	6.5	38.3	42.3	32.8	30.0	44.7	17.4	9.9	20.5	17.9	15.2	15.8	16.6	9.4
Cat. 1B														
All	0.1	1.1	0.4	0.1	0.4	0.1	0.1	0.3	0.3	0.1	0.4	0.8	0.7	0.9
C-Type	0.0	1.0	0.0	0.2	0.0	0.0	0.2	0.2	0.1	0.1	0.0	0.7	0.8	0.7
D-Type	22.2	17.7	16.1	8.8	100.0	0.0	0.2	6.0	1.7	1.8	3.9	1.9	0.5	1.6
Cat. 1C														
All	9.1	14.7	8.9	12.7	15.9	8.6	10.2	12.5	12.4	7.9	8.7	8.3	13.0	11.1
C-Type	33.0	38.8	19.5	41.0	21.9	28.1	18.4	9.9	15.5	8.1	11.5	15.0	12.2	15.7
D-Type	21.8	20.4	20.2	30.2	37.0	11.4	11.7	31.9	20.4	17.5	10.4	3.5	13.2	7.2
Cat. 1D														
All	2.0	5.6	6.7	4.9	5.8	4.8	5.4	3.9	3.1	4.8	6.2	4.9	6.5	4.7
C-Type	5.4	5.5	16.9	4.2	7.3	8.3	10.7	3.0	2.5	4.7	2.9	3.7	7.7	1.4
D-Type	8.3	5.8	14.4	20.3	26.8	18.8	8.0	6.9	2.7	3.8	8.3	6.9	6.4	6.7
Cat. 1E														
All	3.3	2.5	4.4	5.0	2.8	7.4	4.5	9.0	5.3	3.3	3.7	3.0	4.3	2.9
C-Type	44.9	31.2	40.6	10.6	51.1	14.9	44.3	13.7	4.6	9.1	4.3	9.8	10.2	4.7
D-Type	10.0	5.5	8.8	9.4	1.5	8.9	4.2	8.2	6.8	2.0	3.7	1.6	2.9	2.2
Cat. 1 Other														
All	9.5	7.2	12.1	12.6	16.4	13.7	12.9	15.9	15.1	15.8	18.8	14.1	12.3	14.8
C-Type	25.1	10.8	32.9	15.6	16.2	20.5	13.3	11.1	9.2	11.1	10.5	9.0	7.5	10.7
D-Type	19.6	19.7	24.5	33.3	25.1	28.5	35.3	31.0	32.9	24.6	27.6	29.0	29.2	21.8

Table 4-4: SB Percentage Trend in Selected Contract Types & Product Catagory 2

Contract Type	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Cat. 2														
All	13.4	12.6	12.8	13.9	13.6	12.9	14.1	13.2	13.0	13.3	14.7	14.1	14.6	18.2
C-Type	12.4	13.4	19.3	13.9	14.4	17.2	19.4	11.3	11.2	11.5	12.7	15.5	17.4	7.3
D-Type	22.8	17.6	16.5	16.8	18.4	17.3	18.3	16.3	15.7	16.5	15.1	15.3	15.0	14.6
Cat. 2A														
All	13.4	14.0	14.0	17.1	15.2	15.7	17.3	20.8	20.9	18.6	19.2	16.8	15.8	15.4
C-Type	14.5	15.3	4.8	29.2	13.7	30.8	34.9	15.9	16.7	15.5	17.2	21.2	22.7	22.2
D-Type	41.4	32.9	29.4	27.6	26.6	28.1	29.0	28.6	28.2	28.1	18.1	18.0	16.6	16.7
Cat. 2B														
All	5.0	4.0	4.9	3.4	6.2	6.0	4.0	3.2	4.5	4.5	5.2	3.6	5.9	15.3
C-Type	26.8	51.1	12.2	3.0	18.4	31.8	18.1	7.0	8.4	3.3	23.0	7.6	2.4	8.6
D-Type	7.7	5.1	3.4	3.5	4.4	3.6	3.9	2.9	4.2	4.7	4.2	3.6	7.7	24.0
Cat. 2C														
All	62.5	37.3	45.0	61.7	55.8	49.1	52.6	46.2	45.3	44.5	50.2	45.1	37.6	33.7
C-Type	62.5	49.1	51.8	49.1	40.7	51.1	57.2	46.9	53.3	51.1	51.4	44.6	46.3	43.0
D-Type	82.0	77.8	71.3	69.8	69.4	70.5	69.3	56.5	37.2	39.2	58.8	55.2	33.2	25.0
Cat. 2D														
All	5.9	7.0	5.5	6.8	6.4	6.3	11.0	6.9	5.8	5.9	8.3	11.8	10.7	7.2
C-Type	3.6	14.9	14.6	4.7	22.1	18.7	20.9	4.7	2.8	3.1	5.2	10.2	11.0	10.6
D-Type	8.3	9.1	7.0	10.0	11.8	12.6	19.8	12.2	10.6	9.8	10.8	12.4	10.1	6.1
Cat. 2E														
All	3.8	4.6	4.1	6.0	7.8	9.3	9.2	8.5	12.5	13.8	14.9	17.9	17.2	14.8
C-Type	1.7	69.2	59.2	20.5	19.4	8.7	21.9	8.1	11.5	13.8	14.6	17.4	17.3	15.7
D-Type	0.3	0.3	0.1	0.6	0.2	2.0	4.2	4.6	12.3	14.4	18.7	23.0	18.3	28.5
Cat. 2F														
All	4.4	2.8	8.4	6.1	5.3	2.7	0.6	1.5	1.7	1.8	4.3	2.1	9.4	3.3
C-Type	3.7	0.7	7.3	0.7	1.4	17.0	0.3	0.3	1.8	0.3	4.3	1.8	12.7	3.0
D-Type	0.4	0.8	6.3	12.8	3.2	1.7	0.4	3.1	1.6	3.2	5.1	1.8	6.1	3.8
Cat. 2 Other														
All	24.1	18.5	20.7	19.4	18.0	15.2	15.0	14.0	12.5	12.1	13.5	11.2	11.8	8.2
C-Type	14.8	11.7	50.7	11.7	8.3	7.7	7.0	11.4	9.8	7.6	7.0	9.0	8.9	2.5
D-Type	32.3	20.4	21.8	24.4	23.7	19.8	17.2	15.9	15.6	16.5	17.5	16.1	14.4	22.2

Table 4-5: SB Percentage Trend in Selected Contract Types & Product Catagories 3 & 4

Contract Type	1990	1991	1992	1993	1993	1995	1996	1997	1998	1999	2000	2001	2002	2003
Cat. 3														
All	60.4	59.9	61.8	64.4	62.1	60.4	59.2	54.0	60.0	51.9	56.1	66.2	67.7	49.4
C-Type	67.2	65.1	50.9	70.5	71.6	33.9	64.5	57.6	63.2	53.0	62.5	73.2	74.0	52.9
D-Type	89.8	80.4	59.1	60.4	56.5	58.0	57.2	48.2	53.8	49.4	46.9	59.9	63.9	46.3
Cat. 4														
All	4.4	5.0	5.4	6.0	6.1	7.0	8.3	8.6	8.5	8.3	9.5	9.1	8.6	12.6
C-Type	17.7	6.8	13.7	23.1	28.7	30.6	20.4	9.5	10.2	8.0	10.2	10.1	10.1	13.5
D-Type	27.7	19.9	25.0	25.1	25.0	19.3	23.9	20.6	23.6	14.8	16.4	8.4	11.2	8.3

Results of Regression Analysis

This section details the results of the analyses of the 39 regression models. Presented for each model are analyses of the model's Multiple Correlation Coefficient (R^2), Adjusted Correlation Coefficient (R^2_{adj}), *p*-value of its *F*-statistic, and Parameter Characteristics; then, the results of the regression analyses will be used to test the hypotheses.

Regression Model y_1

The results of the analysis of model y_1 are presented in Table 4-6.

Table 4-6: Regression Analysis of Model y_1

y_1: Percentage of Air Force contract dollars awarded via C-type contracts			
		Value	**Statistically Significant?**
	R^2	1	
	R^2_{adj}	1	
	ε	*0*	
***p*-value *of* the *F*-statistic**		*null*	No
Parameter Characteristics			
Parameter	**Estimate**	***p*-value**	
β_0	–0.0000040	*null*	No
β_1	0.0000020	*null*	No
β_2	0.0000038	*null*	No
β_3	–0.0000008	*null*	No
β_4	0.0000987	*null*	No
β_5	0.0000000	*null*	No
β_6	1.0000001	*null*	No
β_7	–0.0000001	*null*	No
β_8	–0.0000008	*null*	No
β_9	–0.0001520	*null*	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 1. When viewed alone, this would seem to indicate that the model explains 100% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 1. When viewed alone, this, too, would seem to indicate that the model explains 100% of the variance in the data. This result, however, is contrary to the definition of R^2_{adj}. With nine included regressors in the model, R^2_{adj} should at least be slightly lower than R^2. Further analysis of the model is obviously required.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a null *p*-value of the *F*-statistic. As revealed in the analysis of the parameter characteristics, this result occurred due to linear dependencies in the design of the model.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in exceptionally low parameter estimates and null *p*-values of the parameter estimates. Online JMP documentation revealed that this occurs when there are exact linear dependencies in the design of the model (FAQ # 1231, 2004). Tabachnick and Fidell describe this problem as one of either multicollinearity or singularity (Tabachnick and Fidell, 2001). Multicollinearity occurs when the variables are very highly correlated and singularity occurs when the variables are redundant (a combination of two or more other variables). As the variables in this model are not combinations of other variables in this model, the result of the analysis of the *p*-values of this model would indicate a problem of multicollinearity.

Overall Model Analysis. This model fails to provide any causal insight into the relationship of the regressors to the response variable. As indicated above, this model has issues of variable multicollinearity. Although it may be possible to remove certain "offending" variables from the model and, thereby, improve the accuracy (or successfulness) of the model, such is not the focus of this thesis (Tabachnick and Fidell, 2001).

Regression Model y_2

The results of the analysis of model y_2 are presented in Table 4-7.

Table 4-7: Regression Analysis of Model y_2

y_2: Percentage of Air Force contract dollars awarded via D-type contracts			
		Value	**Statistically Significant?**
	R^2	1	
	R^2_{adj}	1	
	ε	0	
***p*-value *of* the *F*-statistic**		<.0001	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	–0.0000100	0.1269	No
β_1	–0.0000001	0.8960	No
β_2	0.0000034	0.1435	No
β_3	–0.0000003	0.8857	No
β_4	0.0000517	0.1974	No
β_5	0.0000000	0.2113	No
β_6	0.0000000	0.6090	No
β_7	1.0000002	<.0001	Yes
β_8	–0.0000006	0.1517	No
β_9	–0.0000810	0.1957	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 1. When viewed alone, this would seem to indicate that the model explains 100% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 1. When viewed alone, this, too, would seem to indicate that the model explains 100% of the variance in the data. This result, however, is contrary to the definition of R^2_{adj}. With nine included regressors in the model, R^2_{adj} should at least be slightly lower than R^2. Further analysis of the model is obviously required.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of <.0001. This is below the model rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in only one statistically significant parameter estimate: β_7. The model estimates that for every 1% increase in the proportion of dollars awarded via D-type contracts, the proportion of dollars awarded via D-type contracts increased 1.0000002%. This is a somewhat obvious correlation. It is more interesting to note that the effect of the other variables is not statistically significant.

Overall Model Analysis. This model has only one of nine statistically significant regressors and a dubiously-high R^2 and R^2_{adj}. It appears to show that, within the confines of the model, only the proportion of D-type contract spending itself has a statistically significant impact on the proportion of D-type contract spending.

Regression Model y_3

The results of the analysis of model y_3 are presented in Table 4-8.

Table 4-8: Regression Analysis of Model y_3

y_3: Percentage of Air Force contract dollars awarded to small businesses			
		Value	**Statistically Significant?**
	R^2	0.92943	
	R^2_{adj}	0.770648	
	ε	0.48676	
***p*-value *of* the *F*-statistic**		0.0521	No
Parameter Characteristics			
Parameter	**Estimate**	***p*-value**	
β_0	8.3926329	0.2335	No
β_1	0.7401476	0.5844	No
β_2	2.3296368	0.3431	No
β_3	–3.5428800	0.2521	No
β_4	–9.3351130	0.8232	No
β_5	–0.0000001	0.3980	No
β_6	0.0856425	0.2487	No
β_7	0.2261749	0.1839	No
β_8	–0.5862010	0.1871	No
β_9	15.8631160	0.8070	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.92943. When viewed alone, this indicates that the model explains 93% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.77065, which is expectedly small than the R^2. This indicates that the model explains 77% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0521. Being greater than 0.05, the *p*-value of the *F*-statistic indicates that the β coefficients may not be greater zero and, therefore, implies an unsuccessful model.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant parameter estimates. This result was expected considering *p*-value of the *F*-statistic of this model.

Overall Model Analysis. This model presented no statistical inference between the regressors and response variable.

Regression Model y_4

The results of the analysis of model y_4 are presented in Table 4-9.

Table 4-9: Regression Analysis of Model y_4

y_4: Percentage of Air Force contract dollars awarded to small businesses via C-type contracts			
		Value	**Statistically Significant?**
	R^2	0.994766	
	R^2_{adj}	0.9830	
	ε	0.8242	
***p*-value *of* the *F*-statistic**		0.0003	Yes
Parameter Characteristics			
Parameter	**Estimate**	***p*-value**	
β_0	77.5852490	0.0006	Yes
β_1	5.4616739	0.0281	Yes
β_2	–6.7641530	0.0746	No
β_3	13.0597300	0.0193	Yes
β_4	–95.9288300	0.1328	No
β_5	–0.0000006	0.0050	Yes
β_6	–0.5264240	0.0031	Yes
β_7	–0.9231430	0.0073	Yes
β_8	0.3691194	0.4846	No
β_9	153.7478900	0.1239	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.994766. When viewed alone, this indicates that the model explains 99% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.9830, which is expectedly small than the R^2. This indicates that the model explains 98% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0003. This is well below the model rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in five statistically significant regressors (β_1, β_3, β_5, β_6, and β_7). The model estimates that:

- The DAWIA influenced the percentage of contract dollars awarded to small businesses via C-type contracts by 5%,
- The Clinger-Cohen Act influenced the percentage of contract dollars awarded to small businesses via C-type contracts by 13%
- The total amount of Air Force DD-350 contract dollars spent influenced the percentage of contract dollars awarded to small businesses via C-type contracts by -0.0000007% for every $1,000 spent (or -0.7% for every $1Billion).
- Every 1% of contract dollars spent via C-type contracts influenced the percentage of contract dollars awarded to small businesses via C-type contracts by -0.5%.
- Every 1% of contract dollars spent via D-type contracts influences the percentage of contract dollars awarded to small businesses via C-type contracts by -0.9%.

Overall Model Analysis. This model presented possible statistical inference between several of the regressors and response variable, as detailed above.

Regression Model y_5

The results of the analysis of model y_5 are presented in Table 4-10.

Table 4-10: Regression Analysis of Model y_5

y_5: Percentage of Air Force contract dollars awarded to small businesses via D-type contracts			
		Value	**Statistically Significant?**
	R^2	0.933423	
	R^2_{adj}	0.7836	
	ε	2.0906	
***p*-value *of* the *F*-statistic**		0.0468	Yes
Parameter Characteristics			
Parameter	**Estimate**	***p*-value**	
β_0	35.4398490	0.0461	Yes
β_1	0.9742918	0.7251	No
β_2	0.6508293	0.8918	No
β_3	–9.5328280	0.1575	No
β_4	–42.3407800	0.6293	No
β_5	–0.0000002	0.3281	No
β_6	0.1647833	0.2787	No
β_7	–0.3726750	0.2711	No
β_8	–0.4558950	0.5829	No
β_9	71.8284210	0.5991	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.933423. When viewed alone, this indicates that the model explains 93% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.7836, which is expectedly small than the R^2. This indicates that the model explains 78% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0468. This is below the model rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant parameter estimates, other than the *y*-intercept.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_6

The results of the analysis of model y_6 are presented in Table 4-11.

Table 4-11: Regression Analysis of Model y_6

y_6: Percentage of Air Force contract dollars awarded via C-type contracts in the Supplies & Equipment product category (Category 1)			
		Value	**Statistically Significant?**
	R^2	0.992734	
	R^2_{adj}	0.9764	
	ε	10.219	
***p*-value *of* the *F*-statistic**		0.0006	Yes
Parameter Characteristics			
Parameter	**Estimate**	***p*-value**	
β_0	–46.1778700	0.1675	No
β_1	2.6310576	0.6688	No
β_2	16.6028370	0.1700	No
β_3	–26.3890800	0.0954	No
β_4	213.5937300	0.2995	No
β_5	0.0000007	0.1811	No
β_6	1.5468076	0.0060	Yes
β_7	0.1666474	0.8091	No
β_8	–1.9469380	0.3134	No
β_9	–321.2038000	0.3131	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0..992734. When viewed alone, this indicates that the model explains 99% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.9764, which is expectedly small than the R^2. This indicates that the model explains 98% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0006. This is well below the model rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in one statistically significant regressor: β_6. The model estimates that for every 1% of contract dollars spent via C-type contracts influenced the percentage of contract dollars awarded to small businesses via C-type contracts in Product Category 1 by 1.5%.

Overall Model Analysis. This model presented possible statistical inference between one of the regressors and the response variable, as detailed above.

Regression Model y_7

The results of the analysis of model y_7 are presented in Table 4-12.

Table 4-12: Regression Analysis of Model y_7

y_7: Percentage of Air Force contract dollars awarded via C-type contracts in the Supplies & Equipment: Automated Data Processing product sub-category (Category 1A)			
		Value	**Statistically Significant?**
	R^2	0.98633	
	R^2_{adj}	0.9556	
	ε	1.6281	
***p*-value *of* the *F*-statistic**		0.0022	Yes
Parameter Characteristics			
Parameter	**Estimate**	***p*-value**	
β_0	18.0162310	0.1752	No
β_1	3.1293786	0.2416	No
β_2	–9.7114280	0.0705	No
β_3	–6.3007620	0.2633	No
β_4	40.3157780	0.6034	No
β_5	–0.0000001	0.5784	No
β_6	0.6735077	0.0044	Yes
β_7	–0.8150390	0.0341	Yes
β_8	–0.2869590	0.6924	No
β_9	–59.1556000	0.6229	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.98633. When viewed alone, this indicates that the model explains 99% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.9556, which is expectedly small than the R^2. This indicates that the model explains 96% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0022. This is below the model rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in two statistically significant regressors (β_6 and β_7). The model estimates that:

- Every 1% of contract dollars spent via C-type contracts influenced the percentage of contract dollars awarded in the specific product category via C-type contracts by 0.7%.
- Every 1% of contract dollars spent via D-type contracts influenced the percentage of contract dollars awarded in the specific product category via C-type contracts by -0.8%.

Overall Model Analysis. This model presented possible statistical inference between two of the regressors and the response variable, as detailed above.

Regression Model y_8

The results of the analysis of model y_8 are presented in Table 4-13.

Table 4-13: Regression Analysis of Model y_8

y_8: Percentage of Air Force contract dollars awarded via C-type contracts in the Supplies & Equipment: Systems product sub-category (Category 1B)			
		Value	**Statistically Significant?**
	R^2	0.984119	
	R^2_{adj}	0.9484	
	ε	52.9	
***p*-value *of* the *F*-statistic**		0.0030	Yes
Parameter Characteristics			
Parameter	**Estimate**	***p*-value**	
β_0	–22.2806500	0.7391	No
β_1	–6.9739670	0.6198	No
β_2	16.3523420	0.5094	No
β_3	–43.0278500	0.1942	No
β_4	–165.1767000	0.7063	No
β_5	–0.0000006	0.5935	No
β_6	1.9330743	0.0432	Yes
β_7	–1.1016960	0.4951	No
β_8	3.0375868	0.4736	No
β_9	260.5161500	0.7021	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.984119. When viewed alone, this indicates that the model explains 98% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.9484, which is expectedly small than the R^2. This indicates that the model explains 95% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0030. This is below the model rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in one statistically significant regressor: β_6. The model estimates that for every 1% of contract dollars spent via C-type contracts influenced the percentage of contract dollars awarded in the specific product sub-category via C-type contracts by 1.9%.

Overall Model Analysis. This model presented possible statistical inference between one of the regressors and the response variable, as detailed above.

Regression Model y_9

The results of the analysis of model y_9 are presented in Table 4-14.

Table 4-14: Regression Analysis of Model y_9

y_9: Percentage of Air Force contract dollars awarded via C-type contracts in the Supplies & Equipment: Aircraft Components product sub-category (Category 1C)			
		Value	**Statistically Significant?**
	R^2	0.824937	
	R^2_{adj}	0.431046	
	ε	156.291	
***p*-value *of* the *F*-statistic**		0.2480	No
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	117.0269800	0.3366	No
β_1	14.6387680	0.5478	No
β_2	29.5220600	0.4897	No
β_3	7.9978838	0.8744	No
β_4	447.2191800	0.5584	No
β_5	–0.0000010	0.5805	No
β_6	0.6304869	0.6090	No
β_7	–3.3819510	0.2516	No
β_8	–5.3730960	0.4618	No
β_9	–671.6208000	0.5709	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.824937. When viewed alone, this indicates that the model explains 82% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.431046, which is expectedly small than the R^2. This indicates that the model explains 43% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.2480. This is above the model rejection threshold of 0.05 and indicates that this is an unsuccessful model.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable, as detailed above.

Regression Model y_{10}

The results of the analysis of model y_{10} are presented in Table 4-15.

Table 4-15: Regression Analysis of Model y_{10}

y_{10}: Percentage of Air Force contract dollars awarded via C-type contracts in the Supplies & Equipment: Communications and Radar Equipment product sub-category (Category 1D)			
		Value	**Statistically Significant?**
	R^2	0.956539	
	R^2_{adj}	0.858752	
	ε	52.401	
***p*-value *of* the *F*-statistic**		0.0211	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	–3.6630020	0.9558	No
β_1	6.7344174	0.6299	No
β_2	–0.8638040	0.9712	No
β_3	–30.3456000	0.3315	No
β_4	196.3873000	0.6540	No
β_5	0.0000000	0.9722	No
β_6	1.9513438	0.0415	Yes
β_7	–0.6366360	0.6858	No
β_8	–2.6913650	0.5206	No
β_9	–299.3031000	0.6599	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.956539. When viewed alone, this indicates that the model explains 96% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.858752, which is expectedly small than the R^2. This indicates that the model explains 86% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0211. This is below the model's rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in one statistically significant regressor: β_6. The model estimates that for every 1% of contract dollars spent via C-type contracts influenced the percentage of contract dollars awarded in the specific product sub-category via C-type contracts by 2.0%.

Overall Model Analysis. This model presented possible statistical inference between one of the regressors and the response variable, as detailed above.

Regression Model y_{11}

The results of the analysis of model y_{11} are presented in Table 4-16.

Table 4-16: Regression Analysis of Model y_{11}

y_{11}: Percentage of Air Force contract dollars awarded via C-type contracts in the Supplies & Equipment: Engines & Components product sub-category (Category 1E)			
		Value	**Statistically Significant?**
	R^2	0.700173	
	R^2_{adj}	0.025561	
	ε	108.464	
***p*-value *of* the *F*-statistic**		0.5276	No
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	–43.2334000	0.6538	No
β_1	21.6719940	0.3087	No
β_2	–2.9790900	0.9311	No
β_3	–7.8055790	0.8531	No
β_4	402.1617200	0.5291	No
β_5	0.0000007	0.6631	No
β_6	0.8281945	0.4315	No
β_7	–0.5072150	0.8214	No
β_8	–1.8398440	0.7550	No
β_9	–611.1400000	0.5376	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.824937. When viewed alone, this indicates that the model explains 82% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.025561, which is expectedly smaller than the R^2. This indicates that the model explains only 3% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.5276. This is above the model rejection threshold of 0.05 and indicates a possibility that all of the model's coefficients are equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_{12}

The results of the analysis of model y_{12} are presented in Table 4-17.

Table 4-17: Regression Analysis of Model y_{12}

y_{12}: Percentage of Air Force contract dollars awarded via C-type contracts in the Supplies & Equipment: Engines & Components product sub-category (Category 1 Other)			
		Value	**Statistically Significant?**
	R^2	0.952358	
	R^2_{adj}	0.845163	
	ε	46.582	
***p*-value *of* the *F*-statistic**		0.0251	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	−120.3519000	0.1090	No
β_1	11.2650130	0.4077	No
β_2	0.8289023	0.9707	No
β_3	−13.5966100	0.6275	No
β_4	235.0976900	0.5725	No
β_5	0.0000015	0.1785	No
β_6	1.5323623	0.0692	No
β_7	2.4955558	0.1446	No
β_8	–4.7763210	0.2561	No
β_9	–356.2746000	0.5814	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.952358. When viewed alone, this indicates that the model explains 95% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.845163, which is expectedly smaller than the R^2. This indicates that the model explains only 85% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0251. This is below the model's rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_{13}

The results of the analysis of model y_{13} are presented in Table 4-18.

Table 4-18: Regression Analysis of Model y_{13}

y_{13}: Percentage of Air Force contract dollars awarded via C-type contracts in the Services & Leases product category (Category 2)			
		Value	**Statistically Significant?**
	R^2	0.995224	
	R^2_{adj}	0.984479	
	ε	6.421	
***p*-value *of* the *F*-statistic**		0.0003	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	31.1356370	0.2254	No
β_1	5.4181541	0.2973	No
β_2	2.2881266	0.7858	No
β_3	26.6609450	0.0503	No
β_4	130.2716200	0.4113	No
β_5	–0.0000002	0.5735	No
β_6	0.3948707	0.1620	No
β_7	–1.3118320	0.0625	No
β_8	–0.0869590	0.9513	No
β_9	–208.4202000	0.3986	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.995224. When viewed alone, this indicates that the model explains 100% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.984479, which is expectedly smaller than the R^2. This indicates that the model explains only 98% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0003. This is below the model's rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_{14}

The results of the analysis of model y_{14} are presented in Table 4-19.

Table 4-19: Regression Analysis of Model y_{14}

y_{14}: Percentage of Air Force contract dollars awarded via C-type contracts in the Services & Leases: Professional Services product sub-category (Category 2A)			
		Value	**Statistically Significant?**
	R^2	0.990776	
	R^2_{adj}	0.970021	
	ε	13.825	
***p*-value *of* the *F*-statistic**		0.0010	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	53.9214000	0.1662	No
β_1	7.7903796	0.3058	No
β_2	–0.0834740	0.9946	No
β_3	23.6505510	0.1692	No
β_4	–98.6973800	0.6608	No
β_5	–0.0000006	0.3300	No
β_6	0.5992869	0.1512	No
β_7	–2.0555290	0.0521	No
β_8	–0.2633130	0.8999	No
β_9	151.5963800	0.6642	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.990776. When viewed alone, this indicates that the model explains 99% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.970021, which is expectedly smaller than the R^2. This indicates that the model explains only 97% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0010. This is below the model's rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_{15}

The results of the analysis of model y_{15} are presented in Table 4-20.

Table 4-20: Regression Analysis of Model y_{15}

y_{15}: Percentage of Air Force contract dollars awarded via C-type contracts in the Services & Leases: Utilities product sub-category (Category 2B)			
		Value	**Statistically Significant?**
	R^2	0.994324	
	R^2_{adj}	0.981553	
	ε	2.704	
***p*-value *of* the *F*-statistic**		0.0004	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	10.0206270	0.5167	No
β_1	2.5464924	0.4348	No
β_2	–18.5251500	0.0223	Yes
β_3	–9.8270200	0.1906	No
β_4	148.1738100	0.1835	No
β_5	–0.0000001	0.5362	No
β_6	0.4089679	0.0523	No
β_7	–0.6081430	0.1412	No
β_8	3.0868814	0.0238	Yes
β_9	–212.4547000	0.2123	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.994324. When viewed alone, this indicates that the model explains 99% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.981553, which is expectedly small than the R^2. This indicates that the model explains 98% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0004. This is below the model rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in two statistically significant regressors (β_2 and β_8). The model estimates that:

- The FASA influenced the percentage of contract dollars awarded in the specific product category via C-type contracts by -18.5%.
- Every 1% of contract dollars spent via MAC contracts influenced the percentage of contract dollars awarded in the specific product category via C-type contracts by 3.1%.

Overall Model Analysis. This model presented possible statistical inference between two of the regressors and the response variable, as detailed above.

Regression Model y_{16}

The results of the analysis of model y_{16} are presented in Table 4-21.

Table 4-21: Regression Analysis of Model y_{16}

y_{16}: Percentage of Air Force contract dollars awarded via C-type contracts in the Services & Leases: Base Operating Support Services product sub-category (Category 2C)			
		Value	**Statistically Significant?**
	R^2	0.980023	
	R^2_{adj}	0.935073	
	ε	33.146	
***p*-value *of* the *F*-statistic**		0.0047	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	–0.5272030	0.9920	No
β_1	2.5452657	0.8167	No
β_2	18.4142590	0.3615	No
β_3	44.8134360	0.1097	No
β_4	421.5632000	0.2619	No
β_5	0.0000002	0.8071	No
β_6	0.1344716	0.8101	No
β_7	0.1223292	0.9213	No
β_8	–3.6583390	0.2956	No
β_9	–665.6696000	0.2552	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.980023. When viewed alone, this indicates that the model explains 98% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.935073, which is expectedly smaller than the R^2. This indicates that the model explains only 94% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0047. This is below the model's rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_{17}

The results of the analysis of model y_{17} are presented in Table 4-22.

Table 4-22: Regression Analysis of Model y_{17}

y_{17}: Percentage of Air Force contract dollars awarded via C-type contracts in the Services & Leases: Repair of Equipment product sub-category (Category 2D)			
		Value	**Statistically Significant?**
	R^2	0.987225	
	R^2_{adj}	0.958480	
	ε	22.281	
***p*-value *of* the *F*-statistic**		0.0020	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	21.7686190	0.6194	No
β_1	17.4576320	0.1071	No
β_2	2.2608353	0.8850	No
β_3	25.6990900	0.2249	No
β_4	–403.9715000	0.2019	No
β_5	0.0000004	0.5545	No
β_6	0.5856422	0.2444	No
β_7	–3.3621650	0.0243	Yes
β_8	2.5585405	0.3631	No
β_9	610.6494000	0.2118	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.987225. When viewed alone, this indicates that the model explains 99% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.958480, which is expectedly small than the R^2. This indicates that the model explains 96% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0020. This is below the model's rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in one statistically significant regressor: β_7. The model estimates that for every 1% of contract dollars spent via D-type contracts influenced the percentage of contract dollars awarded in the specific product sub-category via C-type contracts by -3.4%.

Overall Model Analysis. This model presented possible statistical inference between one of the regressors and the response variable, as detailed above.

Regression Model y_{18}

The results of the analysis of model y_{18} are presented in Table 4-23.

Table 4-23: Regression Analysis of Model y_{18}

y_{18}: Percentage of Air Force contract dollars awarded via C-type contracts in the Services & Leases: Government Owned Contractor Operated Supply Stores product sub-category (Category 2E)			
		Value	**Statistically Significant?**
	R^2	0.9997	
	R^2_{adj}	0.999024	
	ε	1.93	
***p*-value *of* the *F*-statistic**		<.0001	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	–3.9701110	0.7560	No
β_1	3.3438182	0.2494	No
β_2	–3.5622640	0.4561	No
β_3	86.3115870	<.0001	Yes
β_4	–280.1496000	0.0229	Yes
β_5	0.0000001	0.5692	No
β_6	0.0920051	0.5075	No
β_7	–0.2228110	0.4722	No
β_8	0.6801134	0.4072	No
β_9	421.2652900	0.0254	Yes

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.9997. When viewed alone, this indicates that the model explains 100% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.999024, which is expectedly small than the R^2. This indicates that the model explains 100% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of <0.0001. This is below the model rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in three statistically significant regressors (β_3, β_4, and β_9). The model estimates that:

- The Clinger-Cohen Act influenced the percentage of contract dollars awarded in the specific product category via C-type contracts by 86.3%.
- The FAR Part 15 Re-write influenced the percentage of contract dollars awarded in the specific product category via C-type contracts by -280.1%.
- Every 1% of contract dollars spent via GWAC contracts influenced the percentage of contract dollars awarded in the specific product category via C-type contracts by 421.3%.

Overall Model Analysis. This model presented possible statistical inference between three of the regressors and the response variable, as detailed above.

Regression Model y_{19}

The results of the analysis of model y_{19} are presented in Table 4-24.

Table 4-24: Regression Analysis of Model y_{19}

y_{19}: Percentage of Air Force contract dollars awarded via C-type contracts in the Services & Leases: Modification of Equipment product sub-category (Category 2F)			
		Value	**Statistically Significant?**
	R^2	0.911335	
	R^2_{adj}	0.711839	
	ε	78.702	
***p*-value *of* the *F*-statistic**		0.0788	No
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	87.9174490	0.3124	No
β_1	–6.1036400	0.7197	No
β_2	29.9197860	0.3388	No
β_3	–0.3449610	0.9923	No
β_4	545.1578200	0.3349	No
β_5	–0.0000008	0.5515	No
β_6	0.9965206	0.2846	No
β_7	–2.7496600	0.1998	No
β_8	–6.0269280	0.2680	No
β_9	–796.2787000	0.3612	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.911335. When viewed alone, this indicates that the model explains 91% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.711839, which is expectedly smaller than the R^2. This indicates that the model explains only 71% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0788. This is above the model rejection threshold of 0.05 and indicates a possibility that all of the model's coefficients are equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_{20}

The results of the analysis of model y_{20} are presented in Table 4-24.

Table 4-25: Regression Analysis of Model y_{20}

y_{20}: Percentage of Air Force contract dollars awarded via C-type contracts in the Services & Leases: Other product sub-category (Category 2 Other)			
		Value	**Statistically Significant?**
	R^2	0.953288	
	R^2_{adj}	0.848187	
	ε	49.135	
***p*-value *of* the *F*-statistic**		0.0242	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	13.5519960	0.8326	No
β_1	1.6767960	0.8999	No
β_2	–3.3899640	0.8839	No
β_3	34.0057160	0.2705	No
β_4	466.5058300	0.3012	No
β_5	–0.0000001	0.9079	No
β_6	–0.1908550	0.7797	No
β_7	0.5195814	0.7323	No
β_8	0.4096259	0.9173	No
β_9	–748.7491000	0.2875	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.953288. When viewed alone, this indicates that the model explains 95% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.848187, which is expectedly smaller than the R^2. This indicates that the model explains only 85% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0242. This is below the model's rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_{21}

The results of the analysis of model y_{21} are presented in Table 4-26.

Table 4-26: Regression Analysis of Model y_{21}

y_{21}: Percentage of Air Force contract dollars awarded via C-type contracts in the Construction product sub-category (Category 3)			
		Value	**Statistically Significant?**
	R^2	0.925526	
	R^2_{adj}	0.757959	
	ε	117.586	
***p*-value *of* the *F*-statistic**		0.0575	No
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	502.6497700	0.0057	No
β_1	–18.6991800	0.3889	No
β_2	–52.9753600	0.1911	No
β_3	10.8614800	0.8050	No
β_4	–686.1623000	0.3225	No
β_5	–0.0000060	0.0114	Yes
β_6	–0.8780990	0.4238	No
β_7	–3.3656930	0.1993	No
β_8	1.6614953	0.7863	No
β_9	1119.4911000	0.3017	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.925526. When viewed alone, this indicates that the model explains 93% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.757959, which is expectedly small than the R^2. This indicates that the model explains 76% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0575. Being greater than 0.05, the *p*-value of the *F*-statistic indicates that at least one of the β coefficients may not be greater zero and, therefore, implies an unsuccessful model.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in one statistically significant regressor: β_5. The model estimates that the total amount of DD-350 contract dollars spent influenced the percentage of contract dollars awarded to small businesses via C-type contracts in Product Category 3 by -0.000006% for every $1,000 spent (or -6% for every $1Billion).

Overall Model Analysis. This model presented possible statistical inference between one of the regressors and the response variable, as detailed above.

Regression Model y_{22}

The results of the analysis of model y_{22} are presented in Table 4-27.

Table 4-27: Regression Analysis of Model y_{22}

y_{22}: Percentage of Air Force contract dollars awarded via C-type contracts in the Research & Development product sub-category (Category 4)			
		Value	**Statistically Significant?**
	R^2	0.992418	
	R^2_{adj}	0.975358	
	ε	29.68	
***p*-value *of* the *F*-statistic**		0.0007	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	–10.6587900	0.8308	No
β_1	–0.5575290	0.9570	No
β_2	–20.9890200	0.2828	No
β_3	44.7285080	0.0966	No
β_4	–374.8841000	0.2873	No
β_5	0.0000001	0.8700	No
β_6	0.4424603	0.4225	No
β_7	0.2507901	0.8309	No
β_8	4.0350767	0.2337	No
β_9	559.9471500	0.3035	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.992418. When viewed alone, this indicates that the model explains 99% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.975358, which is expectedly smaller than the R^2. This indicates that the model explains only 98% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0007. This is below the model's rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_{23}

The results of the analysis of model y_{23} are presented in Table 4-28.

Table 4-28: Regression Analysis of Model y_{23}

y_{23}: Percentage of Air Force contract dollars awarded via D-type contracts in the Supplies & Equipment product category (Category 1)			
		Value	**Statistically Significant?**
	R^2	0.975291	
	R^2_{adj}	0.9197	
	ε	2.1119	
***p*-value *of* the *F*-statistic**		0.0071	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	−1.1719550	0.9296	No
β_1	−1.2378830	0.6583	No
β_2	−3.7871160	0.4489	No
β_3	1.1724066	0.8421	No
β_4	−64.4724600	0.4733	No
β_5	0.0000000	0.8421	No
β_6	−0.0379020	0.7886	No
β_7	0.9457962	0.0322	Yes
β_8	0.8656631	0.3228	No
β_9	94.1973100	0.4983	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.975291. When viewed alone, this indicates that the model explains 98% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.9197, which is expectedly small than the R^2. This indicates that the model explains 92% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0071. This is below the model's rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in one statistically significant regressor: β_7. The model estimates that every 1% of contract dollars spent via D-type contracts influenced the percentage of contract dollars awarded in the specific product sub-category via D-type contracts by .9%.

Overall Model Analysis. This model presented possible statistical inference between one of the regressors and the response variable, as detailed above.

Regression Model y_{24}

The results of the analysis of model y_{23} are presented in Table 4-29.

Table 4-29: Regression Analysis of Model y_{24}

y_{24}: Percentage of Air Force contract dollars awarded via D-type contracts in the Supplies & Equipment: Automated Data Processing product sub-category (Category 1A)			
		Value	**Statistically Significant?**
	R^2	0.970726	
	R^2_{adj}	0.9049	
	ε	12.569	
***p*-value *of* the *F*-statistic**		0.0099	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	26.4096620	0.4342	No
β_1	15.2674190	0.0734	No
β_2	5.7490813	0.6294	No
β_3	–38.6686500	0.0453	Yes
β_4	358.1471400	0.1461	No
β_5	0.0000003	0.5254	No
β_6	1.0198801	0.0341	Yes
β_7	–1.2148970	0.1651	No
β_8	–3.2777450	0.1552	No
β_9	–548.3496000	0.1506	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.970726. When viewed alone, this indicates that the model explains 97% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.9049, which is expectedly small than the R^2. This indicates that the model explains 90% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of .0099. This is below the model rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in three statistically significant regressors (β_3 and β_6). The model estimates that:

- The Clinger-Cohen Act influenced the percentage of contract dollars awarded in the specific product category via C-type contracts by -38.7%.
- Every 1% of contract dollars spent via C-type contracts influenced the percentage of contract dollars awarded in the specific product sub-category via D-type contracts by 1.0%.

Overall Model Analysis. This model presented possible statistical inference between two of the regressors and the response variable, as detailed above.

Regression Model y_{25}

The results of the analysis of model y_{25} are presented in Table 4-30.

Table 4-30: Regression Analysis of Model y_{25}

y_{25}: Percentage of Air Force contract dollars awarded via D-type contracts in the Supplies & Equipment: Systems product sub-category (Category 1B)			
		Value	**Statistically Significant?**
	R^2	0.979655	
	R^2_{adj}	0.9339	
	ε	0.43427	
***p*-value *of* the *F*-statistic**		0.0049	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	−12.5047800	0.0915	No
β_1	1.8113648	0.1986	No
β_2	0.6718885	0.7593	No
β_3	5.3796322	0.0980	No
β_4	9.3918843	0.8120	No
β_5	0.0000003	0.0378	Yes
β_6	−0.6873000	0.3157	No
β_7	−0.1370020	0.3617	No
β_8	0.5017452	0.2231	No
β_9	−12.3511400	0.8402	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.979655. When viewed alone, this indicates that the model explains 98% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.9339, which is expectedly small than the R^2. This indicates that the model explains 93% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0049. This is below the model's rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in one statistically significant regressor: β_5. The model estimates that the total amount of DD-350 contract dollars spent influenced the percentage of contract dollars awarded to small businesses via D-type contracts in Product Sub-Category 1B by 0.0000003% for every $1,000 spent (or .3% for every $1Billion).

Overall Model Analysis. This model presented possible statistical inference between one of the regressors and the response variable, as detailed above.

Regression Model y_{26}

The results of the analysis of model y_{26} are presented in Table 4-31.

Table 4-31: Regression Analysis of Model y_{26}

y_{26}: Percentage of Air Force contract dollars awarded via D-type contracts in the Supplies & Equipment: Aircraft Componentsproduct sub-category (Category 1C)			
		Value	**Statistically Significant?**
	R^2	0.933445	
	R^2_{adj}	0.783696	
	ε	20.481	
p-value *of* the F-statistic		0.0468	Yes
Parameter Characteristics			
Parameters	**Estimate**	**p-value**	
β_0	–5.8491620	0.8875	No
β_1	–11.7182100	0.2207	No
β_2	2.3546953	0.8752	No
β_3	16.0144960	0.4041	No
β_4	–45.3300900	0.8670	No
β_5	–0.0000002	0.7628	No
β_6	–0.7831990	0.1300	No
β_7	3.1292611	0.0267	Yes
β_8	0.1255305	0.9607	No
β_9	63.9792620	0.8790	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.933445. When viewed alone, this indicates that the model explains 93% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.783696, which is expectedly small than the R^2. This indicates that the model explains 78% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0468. This is below the model's rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in one statistically significant regressor: β_7. The model estimates that every 1% of contract dollars spent via D-type contracts influenced the percentage of contract dollars awarded in the specific product sub-category via D-type contracts by 3.1%.

Overall Model Analysis. This model presented possible statistical inference between one of the regressors and the response variable, as detailed above.

Regression Model y_{27}

The results of the analysis of model y_{27} are presented in Table 4-32.

Table 4-32: Regression Analysis of Model y_{27}

y_{27}: Percentage of Air Force contract dollars awarded via D-type contracts in the Supplies & Equipment: Communications and Radar Equipment product sub-category (Category 1D)			
		Value	**Statistically Significant?**
	R^2	0.906533	
	R^2_{adj}	0.696232	
	ε	50.243	
***p*-value *of* the *F*-statistic**		0.0865	No
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	–36.6000400	0.5797	No
β_1	–2.4422010	0.8564	No
β_2	–1.3337270	0.9546	No
β_3	39.0117390	0.2208	No
β_4	–70.7621000	0.8674	No
β_5	0.0000007	0.4774	No
β_6	–0.8974020	0.2365	No
β_7	1.5172302	0.3492	No
β_8	2.5306935	0.5364	No
β_9	97.3374330	0.8824	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.906533. When viewed alone, this indicates that the model explains 91% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.696232, which is expectedly smaller than the R^2. This indicates that the model explains 70% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0865. This is above the model rejection threshold of 0.05 and indicates a possibility that all of the model's coefficients are equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_{28}

The results of the analysis of model y_{28} are presented in Table 4-33.

Table 4-33: Regression Analysis of Model y_{28}

y_{28}: Percentage of Air Force contract dollars awarded via D-type contracts in the Supplies & Equipment: Engines & Components product sub-category (Category 1E)			
		Value	**Statistically Significant?**
	R^2	0.855954	
	R^2_{adj}	0.531850	
	ε	241.691	
p-value *of* the F-statistic		0.1815	No
Parameter Characteristics			
Parameters	**Estimate**	**p-value**	
β_0	–63.5838600	0.6584	No
β_1	–13.5153200	0.6519	No
β_2	37.8399580	0.4773	No
β_3	–1.5777950	0.9800	No
β_4	100.3019800	0.9140	No
β_5	–0.0000003	0.8993	No
β_6	–0.4167780	0.7830	No
β_7	7.8025031	0.0679	No
β_8	–6.5147990	0.4722	No
β_9	–190.0413000	0.8952	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.855954. When viewed alone, this indicates that the model explains 86% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.531850, which is expectedly smaller than the R^2. This indicates that the model explains only 53% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.1815. This is above the model rejection threshold of 0.05 and indicates a possibility that all of the model's coefficients are equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_{29}

The results of the analysis of model y_{29} are presented in Table 4-34.

Table 4-34: Regression Analysis of Model y_{29}

y_{29}: Percentage of Air Force contract dollars awarded via D-type contracts in the Supplies & Equipment: Engines & Components product sub-category (Category 1 Other)			
		Value	**Statistically Significant?**
	R^2	0.905984	
	R^2_{adj}	0.694449	
	ε	12.3862	
***p*-value *of* the *F*-statistic**		0.0874	No
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	1.5345007	0.9619	No
β_1	3.3518941	0.6221	No
β_2	–8.7651480	0.4678	No
β_3	9.1582662	0.5308	No
β_4	72.7292620	0.7313	No
β_5	0.0000001	0.8867	No
β_6	–0.1212000	0.7243	No
β_7	0.4887615	0.5297	No
β_8	1.5340569	0.4559	No
β_9	–127.1506000	0.6997	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.905984. When viewed alone, this indicates that the model explains 91% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.694449, which is expectedly smaller than the R^2. This indicates that the model explains 69% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0874. This is above the model rejection threshold of 0.05 and indicates a possibility that all of the model's coefficients are equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_{30}

The results of the analysis of model y_{30} are presented in Table 4-35.

Table 4-35: Regression Analysis of Model y_{30}

y_{30}: Percentage of Air Force contract dollars awarded via D-type contracts in the Services & Leases product category (Category 2)			
		Value	**Statistically Significant?**
	R^2	0.688118	
	R^2_{adj}	-0.013620	
	ε	12.8294	
***p*-value *of* the *F*-statistic**		0.5530	No
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	1.5745056	0.9616	No
β_1	4.3229555	0.5362	No
β_2	1.2794280	0.9140	No
β_3	–11.9413600	0.4295	No
β_4	–6.8830810	0.9743	No
β_5	0.0000004	0.4350	No
β_6	0.3087004	0.3972	No
β_7	0.5944131	0.4576	No
β_8	–0.3755520	0.8524	No
β_9	20.6114160	0.9505	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.688118. When viewed alone, this indicates that the model explains 69% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of -0.013620, which is expectedly smaller than the R^2. This indicates that the model explains none of the variance in the data after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.5530. This is above the model rejection threshold of 0.05 and indicates a possibility that all of the model's coefficients are equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_{31}

The results of the analysis of model y_{31} are presented in Table 4-36.

Table 4-36: Regression Analysis of Model y_{31}

y_{31}: Percentage of Air Force contract dollars awarded via D-type contracts in the Services & Leases: Professional Services product sub-category (Category 2A)			
		Value	**Statistically Significant?**
	R^2	0.916391	
	R^2_{adj}	0.728272	
	ε	15.9079	
***p*-value *of* the *F*-statistic**		0.0709	No
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	–25.5505500	0.4968	No
β_1	8.6225062	0.2927	No
β_2	7.6510395	0.5705	No
β_3	6.0462013	0.7101	No
β_4	368.3724100	0.1751	No
β_5	0.0000005	0.3718	No
β_6	0.0208463	0.9570	No
β_7	1.3989129	0.1576	No
β_8	–2.1645370	0.3626	No
β_9	–571.6165000	0.1754	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.916391. When viewed alone, this indicates that the model explains 92% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.728272, which is expectedly smaller than the R^2. This indicates that the model explains 73% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0709. This is above the model rejection threshold of 0.05 and indicates a possibility that all of the model's coefficients are equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_{32}

The results of the analysis of model y_{32} are presented in Table 4-37.

Table 4-37: Regression Analysis of Model y_{32}

y_{32}: Percentage of Air Force contract dollars awarded via D-type contracts in the Services & Leases: Utilities product sub-category (Category 2B)			
		Value	**Statistically Significant?**
	R^2	0.994324	
	R^2_{adj}	0.981553	
	ε	2.704	
p-value *of* the F-statistic		0.0004	Yes
Parameter Characteristics			
Parameters	**Estimate**	**p-value**	
β_0	52.6634090	0.1243	No
β_1	30.9443480	0.0054	Yes
β_2	15.4418750	0.1913	No
β_3	–23.8455200	0.1181	No
β_4	–80.2720300	0.6745	No
β_5	0.0000000	0.9127	No
β_6	0.4728955	0.1758	No
β_7	–0.1286020	0.8503	No
β_8	–3.0386220	0.1433	No
β_9	114.1536000	0.7000	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.994324. When viewed alone, this indicates that the model explains 99% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.981553, which is expectedly small than the R^2. This indicates that the model explains 98% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0004. This is below the model's rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in one statistically significant regressor: β_1. The model estimates that the DAWIA influenced the percentage of contract dollars awarded in the specific product category via C-type contracts by 30.9%.

Overall Model Analysis. This model presented possible statistical inference between one of the regressors and the response variable, as detailed above.

Regression Model y_{33}

The results of the analysis of model y_{33} are presented in Table 4-38.

Table 4-38: Regression Analysis of Model y_{33}

y_{33}: Percentage of Air Force contract dollars awarded via D-type contracts in the Services & Leases: Base Operating Support Services product sub-category (Category 2C)			
		Value	**Statistically Significant?**
	R^2	0.980023	
	R^2_{adj}	0.935073	
	ε	33.146	
p-value *of* the F-statistic		0.0047	No
Parameter Characteristics			
Parameters	**Estimate**	**p-value**	
β_0	16.2115760	0.5961	No
β_1	8.0824502	0.2405	No
β_2	–10.1483200	0.3766	No
β_3	–0.6413120	0.9615	No
β_4	–301.6341000	0.1772	No
β_5	0.0000003	0.5107	No
β_6	–0.0604060	0.8498	No
β_7	–0.8499190	0.2697	No
β_8	3.8121162	0.0932	No
β_9	481.5546300	0.1679	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.980023. When viewed alone, this indicates that the model explains 98% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.935073, which is expectedly smaller than the R^2. This indicates that the model explains 94% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.00479. This is above the model rejection threshold of 0.05 and indicates a possibility that all of the model's coefficients are equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_{34}

The results of the analysis of model y_{34} are presented in Table 4-39.

Table 4-39: Regression Analysis of Model y_{34}

y_{34}: Percentage of Air Force contract dollars awarded via D-type contracts in the Services & Leases: Repair of Equipment product sub-category (Category 2D)			
		Value	**Statistically Significant?**
	R^2	0.938847	
	R^2_{adj}	0.801253	
	ε	36.773	
***p*-value *of* the *F*-statistic**		0.0400	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	46.1642080	0.4251	No
β_1	−8.3413380	0.4841	No
β_2	−7.9776660	0.6938	No
β_3	52.5111440	0.0847	No
β_4	230.5036300	0.5353	No
β_5	0.0000005	0.5864	No
β_6	−1.2079140	0.0938	No
β_7	−0.3850240	0.7690	No
β_8	2.7828530	0.4342	No
β_9	−350.3463000	0.5436	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.938847. When viewed alone, this indicates that the model explains 94% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.801253, which is expectedly smaller than the R^2. This indicates that the model explains 80% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0400. This is below the model's rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_{35}

The results of the analysis of model y_{35} are presented in Table 4-40.

Table 4-40: Regression Analysis of Model y_{35}

y_{35}: Percentage of Air Force contract dollars awarded via D-type contracts in the Services & Leases: Government Owned Contractor Operated Supply Stores product sub-category (Category 2E)			
		Value	**Statistically Significant?**
	R^2	0.949191	
	R^2_{adj}	0.834870	
	ε	30.706	
***p*-value *of* the *F*-statistic**		0.0283	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	−23.6018200	0.6456	No
β_1	10.2517670	0.3587	No
β_2	−18.5587700	0.3418	No
β_3	15.4651310	0.5031	No
β_4	87.3052610	0.7928	No
β_5	0.0000014	0.1367	No
β_6	−0.1868370	0.7298	No
β_7	−1.2426850	0.3293	No
β_8	1.3362810	0.6719	No
β_9	−138.2997000	0.7888	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.949191. When viewed alone, this indicates that the model explains 95% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.834870, which is expectedly smaller than the R^2. This indicates that the model explains 83% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0400. This is below the model's rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_{36}

The results of the analysis of model y_{36} are presented in Table 4-41.

Table 4-41: Regression Analysis of Model y_{36}

y_{36}: Percentage of Air Force contract dollars awarded via D-type contracts in the Services & Leases: Modification of Equipment product sub-category (Category 2F)			
		Value	**Statistically Significant?**
	R^2	0.972238	
	R^2_{adj}	0.909774	
	ε	24.34	
***p*-value *of* the *F*-statistic**		0.0089	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	−29.2457000	0.5276	No
β_1	1.9393261	0.8366	No
β_2	0.8267959	0.9596	No
β_3	−16.6253100	0.4249	No
β_4	99.1482610	0.7383	No
β_5	0.0000002	0.7750	No
β_6	0.4534669	0.3696	No
β_7	1.6170294	0.1801	No
β_8	2.5470061	0.3840	No
β_9	−191.0204000	0.6798	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.972236. When viewed alone, this indicates that the model explains 97% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.909774, which is expectedly smaller than the R^2. This indicates that the model explains 91% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0089. This is below the model's rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_{37}

The results of the analysis of model y_{37} are presented in Table 4-42.

Table 4-42: Regression Analysis of Model y_{37}

y_{37}: Percentage of Air Force contract dollars awarded via D-type contracts in the Services & Leases: Other product sub-category (Category 2 Other)			
		Value	**Statistically Significant?**
	R^2	0.858968	
	R^2_{adj}	0.541646	
	ε	65.352	
***p*-value *of* the *F*-statistic**		0.1753	No
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	64.3025220	0.4063	No
β_1	–4.1746000	0.7868	No
β_2	6.3937253	0.8117	No
β_3	–54.8476000	0.1485	No
β_4	–273.0072000	0.5797	No
β_5	0.0000003	0.7967	No
β_6	1.0983641	0.2097	No
β_7	–0.2418520	0.8895	No
β_8	–2.6413910	0.5699	No
β_9	464.4568400	0.5457	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.858968. When viewed alone, this indicates that the model explains 86% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.541646, which is expectedly smaller than the R^2. This indicates that the model explains 54% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.1753. This is above the model rejection threshold of 0.05 and indicates a possibility that all of the model's coefficients are equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Regression Model y_{38}

The results of the analysis of model y_{38} are presented in Table 4-43.

Table 4-43: Regression Analysis of Model y_{38}

y_{38}: Percentage of Air Force contract dollars awarded via D-type contracts in the Construction product sub-category (Category 3)			
		Value	**Statistically Significant?**
	R^2	0.99586	
	R^2_{adj}	0.986545	
	ε	1.704	
***p*-value *of* the *F*-statistic**		0.0002	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	–6.2050010	0.6090	No
β_1	–0.5498560	0.8251	No
β_2	5.8221459	0.2245	No
β_3	23.5810920	0.0089	Yes
β_4	–8.1220230	0.9170	No
β_5	0.0000001	0.6471	No
β_6	–0.6866530	0.0044	Yes
β_7	2.4276246	0.0008	Yes
β_8	–0.2435870	0.7418	No
β_9	8.9704529	0.9409	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.99586. When viewed alone, this indicates that the model explains 100% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.986545, which is expectedly small than the R^2. This indicates that the model explains 99% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of .0002. This is below the model rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in three statistically significant regressors (β_3, β_6, and β_7). The model estimates that:

- The Clinger-Cohen Act influenced the percentage of contract dollars awarded in the specific product category via C-type contracts by 23.6%.
- Every 1% of contract dollars spent via C-type contracts influenced the percentage of contract dollars awarded in the specific product sub-category via D-type contracts by -.7%.
- Every 1% of contract dollars spent via D-type contracts influenced the percentage of contract dollars awarded in the specific product sub-category via D-type contracts by 2.4%.

Overall Model Analysis. This model presented possible statistical inference between three of the regressors and the response variable, as detailed above.

Regression Model y_{39}

The results of the analysis of model y_{39} are presented in Table 4-44.

Table 4-44: Regression Analysis of Model y_{39}

y_{39}: Percentage of Air Force contract dollars awarded via D-type contracts in the Research & Development product sub-category (Category 4)			
		Value	**Statistically Significant?**
	R^2	0.981222	
	R^2_{adj}	0.938972	
	ε	2.1955	
***p*-value *of* the *F*-statistic**		0.0042	Yes
Parameter Characteristics			
Parameters	**Estimate**	***p*-value**	
β_0	–13.0952100	0.3612	No
β_1	–1.4339490	0.6167	No
β_2	1.5184189	0.7581	No
β_3	13.2845330	0.0775	No
β_4	176.7278800	0.1007	No
β_5	0.0000002	0.4747	No
β_6	–0.2769870	0.1092	No
β_7	0.8254966	0.0510	No
β_8	0.0616492	0.9410	No
β_9	–279.2229000	0.0966	No

Analysis of the Multiple Correlation Coefficent (R^2). As presented in the table, the analysis of this model resulted in an R^2 of 0.981222. When viewed alone, this indicates that the model explains 98% of the variance in the data.

Analysis of the Adjusted Correlation Coefficient (R^2_{adj}). As presented in the table, the analysis of this model resulted in an R^2_{adj} of 0.938972, which is expectedly smaller than the R^2. This indicates that the model explains 94% of the variance in the data, even after being adjusted by the model's degrees of freedom.

Analysis of the *p*-value of the *F*-statistic. As presented in the table, the analysis of this model resulted in a *p*-value of the *F*-statistic of 0.0042. This is below the model's rejection threshold of 0.05, which indicates that at least one of the model's coefficients is not equal to zero.

Analysis of the Parameter Characteristics. As presented in the table, the analysis of this model resulted in no statistically significant regressors.

Overall Model Analysis. This model presented no statistical inference between the regressors and the response variable.

Testing the Hypotheses

After each regression model was analyzed, their results were paired with their corresponding hypotheses. Each hypothesis was tested based on the statistical significance of the appropriate regressors. If the regressors were found to be significant (i.e. the *p*-value of their parameter estimates were below 0.05), than they were deemed to have had an effect on the corresponding response variable. Following are the results of the hypotheses tests.

Hypothesis 1. **Acquisition reform initiatives changed (increased or decreased) the Air Force's use of C-type contracts**. Analysis of the data through regression analysis of Model y_1 revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the Air Force's use of C-type contracts.

Hypothesis 2. **Acquisition reform initiatives changed (increased or decreased) the Air Force's use of D-type contracts**. Analysis of the data through regression analysis of Model y_2 revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the Air Force's use of D-type contracts.

Hypothesis 3. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force contract dollars awarded to small businesses**. Analysis of the data through regression analysis of Model y_3 revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force contract dollars awarded to small businesses.

Hypothesis 4. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force contract dollars awarded to small business via C-type contracts**. Analysis of the data through regression analysis of Model y_4 revealed that there is sufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force contract dollars awarded to small businesses via C-type contracts. Specifically identified in regression model y_4 was that both the DAWIA and the Clinger-Cohen Act has a statistically significant positive impact on the percentage of Air Force contract dollars awarded to small businesses via C-type contracts.

Hypothesis 5. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force contract dollars awarded to small business via D-type contracts**. Analysis of the data through regression analysis of Model y_5 revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force contract dollars awarded to small businesses via D-type contracts.

Hypothesis 6. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment contract dollars awarded to small business via C-type contracts**. Analysis of the data through regression analysis of Model y_6 revealed that there is insufficient evidence to suggest that acquisition reform

initiatives effected a change in the percentage of Air Force Supplies & Equipment contract dollars awarded to small businesses via C-type contracts.

Hypothesis 7. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Automated Data Processing contract dollars awarded to small business via C-type contracts**. Analysis of the data through regression analysis of Model y_7 revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Supplies & Equipment: Automated Data Processing contract dollars awarded to small businesses via C-type contracts.

Hypothesis 8. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Systems contract dollars awarded to small business via C-type contracts**. Analysis of the data through regression analysis of Model y_8 revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Supplies & Equipment: Systems contract dollars awarded to small businesses via C-type contracts.

Hypothesis 9. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Aircraft Components contract dollars awarded to small business via C-type contracts**. Analysis of the data through regression analysis of Model y_9 revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Supplies & Equipment: Aircraft Components contract dollars awarded to small businesses via C-type contracts.

Hypothesis 10. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Communication & Radar Equipment contract dollars awarded to small business via C-type contracts**. Analysis of the data through regression analysis of Model y_{10} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Supplies & Equipment: Communication & Radar Equipment contract dollars awarded to small businesses via C-type contracts.

Hypothesis 11. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Engines & Components contract dollars awarded to small business via C-type contracts**. Analysis of the data through regression analysis of Model y_{11} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Supplies & Equipment: Engines & Components contract dollars awarded to small businesses via C-type contracts.

Hypothesis 12. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Other Supplies & Equipment contract dollars awarded to small business via C-type contracts**. Analysis of the data through regression analysis of Model y_{12} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Supplies & Equipment: Other Supplies & Equipment contract dollars awarded to small businesses via C-type contracts.

Hypothesis 13. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases contract dollars awarded to small**

business via C-type contracts. Analysis of the data through regression analysis of Model y_{13} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Services & Leases contract dollars awarded to small businesses via C-type contracts.

Hypothesis 14. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Professional Services contract dollars awarded to small business via C-type contracts**. Analysis of the data through regression analysis of Model y_{14} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Services & Leases: Professional Services contract dollars awarded to small businesses via C-type contracts.

Hypothesis 15. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Utilities contract dollars awarded to small business via C-type contracts**. Analysis of the data through regression analysis of Model y_{15} revealed that there is sufficient evidence to suggest that an acquisition reform initiative effected a change in the percentage of Air Force Services & Leases: Utilities contract dollars awarded to small businesses via C-type contracts. Specifically identified in regression model y_{15} was that the FASA had a statistically significant negative impact on the percentage of Air Force Services & Leases: Utilities contract dollars awarded to small businesses via C-type contracts.

Hypothesis 16. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Base Operating Support Services contract dollars awarded to small business via C-type contracts**. Analysis of the data

through regression analysis of Model y_{16} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Services & Leases: Base Operating Support Services contract dollars awarded to small businesses via C-type contracts.

Hypothesis 17. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Repair of Equipment contract dollars awarded to small business via C-type contracts**. Analysis of the data through regression analysis of Model y_{17} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Services & Leases: Repair of Equipment contract dollars awarded to small businesses via C-type contracts.

Hypothesis 18. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Government Owned Contractor Operated Parts Stores contract dollars awarded to small business via C-type contracts**. Analysis of the data through regression analysis of Model y_{18} revealed that there is sufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Services & Leases: Government Owned Contractor Operated Parts Stores contract dollars awarded to small businesses via C-type contracts. Specifically identified in regression model y_{18} was that the Clinger-Cohen Act had a statistically significant positive impact and that the Far part 15 Re-write had a statistically significant negative impact on the percentage of Air Force Services & Leases: Government Owned Contractor Operated Parts Stores contract dollars awarded to small businesses via C-type contracts.

Hypothesis 19. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Modification of Equipment contract dollars awarded to small business via C-type contracts**. Analysis of the data through regression analysis of Model y_{19} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Services & Leases: Modification of Equipment contract dollars awarded to small businesses via C-type contracts.

Hypothesis 20. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Other Services & Leases contract dollars awarded to small business via C-type contracts**. Analysis of the data through regression analysis of Model y_{20} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Services & Leases: Other Services & Leases contract dollars awarded to small businesses via C-type contracts.

Hypothesis 21. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Construction contract dollars awarded to small business via C-type contracts**. Analysis of the data through regression analysis of Model y_{21} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Construction contract dollars awarded to small businesses via C-type contracts.

Hypothesis 22. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Research & Development contract dollars awarded to small business via C-type contracts**. Analysis of the data through regression analysis of

Model y_{22} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Research & Development contract dollars awarded to small businesses via C-type contracts.

Hypothesis 23. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment contract dollars awarded to small business via D-type contracts**. Analysis of the data through regression analysis of Model y_{23} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Supplies & Equipment contract dollars awarded to small businesses via D-type contracts.

Hypothesis 24. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Automated Data Processing contract dollars awarded to small business via D-type contracts**. Analysis of the data through regression analysis of Model y_{24} revealed that there is sufficient evidence to suggest that an acquisition reform initiative effected a change in the percentage of Air Force Supplies & Equipment: Automated Data Processing contract dollars awarded to small businesses via D-type contracts. Specifically identified in regression model y_{24} was that the Clinger-Cohen Act had a statistically significant negative impact on the percentage of Air Force Supplies & Equipment: Automated Data Processing contract dollars awarded to small businesses via D-type contracts.

Hypothesis 25. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Systems contract dollars awarded to small business via D-type contracts**. Analysis of the data through regression analysis of Model y_{25} revealed that there is insufficient evidence to suggest

that acquisition reform initiatives effected a change in the percentage of Air Force Supplies & Equipment: Systems contract dollars awarded to small businesses via D-type contracts.

Hypothesis 26. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Aircraft Components contract dollars awarded to small business via D-type contracts**. Analysis of the data through regression analysis of Model y_{26} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Supplies & Equipment: Aircraft Components contract dollars awarded to small businesses via D-type contracts.

Hypothesis 27. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Communication & Radar Equipment contract dollars awarded to small business via D-type contracts**. Analysis of the data through regression analysis of Model y_{27} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Supplies & Equipment: Communication & Radar Equipment contract dollars awarded to small businesses via D-type contracts.

Hypothesis 28. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Engines & Components contract dollars awarded to small business via D-type contracts**. Analysis of the data through regression analysis of Model y_{28} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air

Force Supplies & Equipment: Engines & Components contract dollars awarded to small businesses via D-type contracts.

Hypothesis 29. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Supplies & Equipment: Other Supplies & Equipment contract dollars awarded to small business via D-type contracts**. Analysis of the data through regression analysis of Model y_{29} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Supplies & Equipment: Other Supplies & Equipment contract dollars awarded to small businesses via D-type contracts.

Hypothesis 30. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases contract dollars awarded to small business via D-type contracts**. Analysis of the data through regression analysis of Model y_{30} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Services & Leases contract dollars awarded to small businesses via D-type contracts.

Hypothesis 31. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Professional Services contract dollars awarded to small business via D-type contracts**. Analysis of the data through regression analysis of Model y_{31} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Services & Leases: Professional Services contract dollars awarded to small businesses via D-type contracts.

Hypothesis 32. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Utilities contract dollars awarded to small business via D-type contracts**. Analysis of the data through regression analysis of Model y_{32} revealed that there is sufficient evidence to suggest that an acquisition reform initiative effected a change in the percentage of Air Force Services & Leases: Utilities contract dollars awarded to small businesses via D-type contracts. Specifically identified in regression model y_{32} was that the DAWIA had a statistically significant positive impact on the percentage of Air Force Services & Leases: Utilities contract dollars awarded to small businesses via D-type contracts.

Hypothesis 33. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Base Operating Support Services contract dollars awarded to small business via D-type contracts**. Analysis of the data through regression analysis of Model y_{33} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Services & Leases: Base Operating Support Services contract dollars awarded to small businesses via D-type contracts.

Hypothesis 34. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Repair of Equipment contract dollars awarded to small business via D-type contracts**. Analysis of the data through regression analysis of Model y_{34} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Services & Leases: Repair of Equipment contract dollars awarded to small businesses via D-type contracts.

Hypothesis 35. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Government Owned Contractor Operated Parts Stores contract dollars awarded to small business via D-type contracts**. Analysis of the data through regression analysis of Model y_{35} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Services & Leases: Government Owned Contractor Operated Parts Stores contract dollars awarded to small businesses via D-type contracts.

Hypothesis 36. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Modification of Equipment contract dollars awarded to small business via D-type contracts**. Analysis of the data through regression analysis of Model y_{36} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Services & Leases: Modification of Equipment contract dollars awarded to small businesses via D-type contracts.

Hypothesis 37. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Services & Leases: Other Services & Leases contract dollars awarded to small business via D-type contracts**. Analysis of the data through regression analysis of Model y_{37} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Services & Leases: Other Services & Leases contract dollars awarded to small businesses via D-type contracts.

Hypothesis 38. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Construction contract dollars awarded to small business**

via D-type contracts. Analysis of the data through regression analysis of Model y_{38} revealed that there is sufficient evidence to suggest that an acquisition reform initiative effected a change in the percentage of Air Force Construction contract dollars awarded to small businesses via D-type contracts. Specifically identified in regression model y_{38} was that the Clinger-Cohen Act had a statistically significant positive impact on the percentage of Air Force Construction contract dollars awarded to small businesses via D-type contracts.

Hypothesis 39. **Acquisition reform initiatives changed (increased or decreased) the percentage of Air Force Research & Development contract dollars awarded to small business via D-type contracts**. Analysis of the data through regression analysis of Model y_{39} revealed that there is insufficient evidence to suggest that acquisition reform initiatives effected a change in the percentage of Air Force Research & Development contract dollars awarded to small businesses via D-type contracts.

Results of the Trend Analysis

This section details the results of the analyses of small business utilization via selected contract types and by selected product categories. Presented will be comparative trend data by contract type; then, comparative trend data by contract type in the product categories.

Small Business Utilization in Selected Contract Types Trends

Table 4-45: Small Business Percentage Trend in Selected Contract Types

Contract Type	1990	2003	Change	Trend	Minimum	Maximum	Average	Standard Deviation
All	7.5	8.2	0.7	0.15	7.5	11.7	10.2	1.4
C-Type	18.0	6.6	-11.4	-1.16	6.6	30.2	14.8	6.7
D-Type	22.0	12.0	-10.0	-0.63	12.0	23.1	18.8	3.0

Table 4-45 presents the Air Force's small business utilization trend data in both C-type and D-type contracts as well as a total for all DD-350 actions. Over the researched period, total SB participation rose to as high as 11.7% and varied by as much as 1.4%, while SB participation via C-type and D-type contracts reached 30.2% and 23.1% and varied by as much as 6.7% and 3.0%, respectively. While total SB participation in 2003 ended above its minimum and at just below its average for the period, SB participation via the two contract types ended the period with their lowest recorded rates. A least squares regression line fitted through the data indicates a positive trend for overall SB participation and negative trends for SB participation via C-type and D-type contracts.

Small Business Utilization in Selected Contract Types by Product Categories Trends

Table 4-46 presents the Air Force's small business utilization trend data in Product Category 1 in both C-type and D-type contracts as well as a total for all DD-350 actions.

Table 4-46: SB Percentage Trend in Selected Contract Types & Product Category 1

Product Category	Contract Type	1990	2003	Change	Trend	Minimum	Maximum	Average	Standard Deviation
1	*All*	4.7	5.1	0.3	0.02	4.7	7.1	5.8	0.7
	C-Type	13.6	3.4	-10.2	-1.12	3.4	27.6	8.5	6.9
	D-Type	13.9	8.8	-5.1	-0.85	8.7	26.5	15.3	5.2
1A	*All*	11.5	6.6	-5.0	-1.39	6.6	30.8	17.5	8.4
	C-Type	46.8	7.7	-39.1	-3.67	1.4	46.8	23.9	18.7
	D-Type	6.5	9.4	2.9	-1.55	6.5	44.7	22.7	12.1
1B	*All*	0.1	0.9	0.8	0.02	0.1	1.1	0.4	0.3
	C-Type	0.0	0.7	0.7	0.03	0.0	1.0	0.3	0.4
	D-Type	22.2	1.6	-20.6	-2.42	0.0	100.0	13.0	25.1
1C	*All*	9.1	11.1	2.0	-0.11	7.9	15.9	11.0	2.5
	C-Type	33.0	15.7	-17.3	-1.93	8.1	41.0	20.6	10.2
	D-Type	21.8	7.2	-14.6	-1.34	3.5	37.0	18.4	9.3
1D	*All*	2.0	4.7	2.8	0.06	2.0	6.7	4.9	1.2
	C-Type	5.4	1.4	-4.0	-0.43	1.4	16.9	6.0	3.9
	D-Type	8.3	6.7	-1.5	-0.72	2.7	26.8	10.3	6.8
1E	*All*	3.3	2.9	-0.4	-0.01	2.5	9.0	4.4	1.8
	C-Type	44.9	4.7	-40.2	-2.96	4.3	51.1	21.0	16.7
	D-Type	10.0	2.2	-7.7	-0.51	1.5	10.0	5.4	3.1
1 Other	*All*	9.5	14.8	5.3	0.42	7.2	18.8	13.7	2.8
	C-Type	25.1	10.7	-14.4	-1.18	7.5	32.9	14.5	6.9
	D-Type	19.6	21.8	2.2	0.31	19.6	35.3	27.3	4.8

Product Category 1: Supplies & Equipment. Over the researched period, total SB participation rose to as high as 7.1% and varied by as much as .7%, while SB participation via C-type and D-type contracts reached 27.6% and 26.5% and varied by as much as 6.9% and 5.2%, respectively. While total SB participation in 2003 ended above its minimum and at just below its average for the period, SB participation via C-type contracts ended the period with its lowest recorded rate. A least squares regression line fitted through the data indicates a positive trend for overall SB participation and negative trends for SB participation via C-type and D-type contracts.

Product Sub-Category 1A: Supplies & Equipment: Automated Data Processing Equipment. Over the researched period, total SB participation rose to as high as 30.8% and varied by as much as 8.4%, while SB participation via C-type and D-type contracts reached 46.8% and 44.7% and varied by as much as 18.7% and 12.1%, respectively. While total SB participation in 2003 ended at its minimum value, SB participation via the two contract types ended the period above their lowest recorded rates. A least squares regression line fitted through the data indicates a negative trend for overall SB participation, SB participation via C-type contracts, and SB participation via D-type contracts.

Product Sub-Category 1B: Supplies & Equipment: Systems. Over the researched period, total SB participation rose to as high as 1.1% and varied by as much as .3%, while SB participation via C-type and D-type contracts reached 1.0% and 100.0% and varied by as much as .4% and 25.1%, respectively. While total SB participation in 2003 ended above its minimum and its average for the period, SB participation via the two contract types ended the period at or just above their lowest recorded rates. A least squares

regression line fitted through the data indicates a positive trend for overall SB participation and SB participation via C-type contracts and a negative trend for SB participation via D-type contracts.

Product Sub-Category 1C: Supplies & Equipment: Aircraft Components. Over the researched period, total SB participation rose to as high as 15.9% and varied by as much as 2.5%, while SB participation via C-type and D-type contracts reached 41.0% and 37.0% and varied by as much as 10.2% and 9.3%, respectively. Total SB participation in 2003 ended above its minimum and at just above its average for the period. SB participation via the two contract types also ended the period above their minimum, but below their average. A least squares regression line fitted through the data indicates a negative trend for overall SB participation, SB participation via C-type contracts, and SB participation via D-type contracts.

Product Sub-Category 1D: Supplies & Equipment: Communication & Radar Equipment. Over the researched period, total SB participation rose to as high as 6.7% and varied by as much as 1.2%, while SB participation via C-type and D-type contracts reached 16.9% and 26.8% and varied by as much as 3.9% and 6.8%, respectively. While total SB participation in 2003 ended above its minimum and at just below its average for the period, SB participation via C-type contracts ended the period with its lowest recorded rate. A least squares regression line fitted through the data indicates a positive trend for overall SB participation and negative trends for SB participation via C-type and D-type contracts.

Product Sub-Category 1E: Supplies & Equipment: Engines & Components. Over the researched period, total SB participation rose to as high as 9.0% and varied by as much as

1.8%, while SB participation via C-type and D-type contracts reached 51.1% and 10.0% and varied by as much as 16.7% and 3.1%, respectively. Total SB participation, SB participation via C-type contracts, and SB participation via D-type contracts ended above their minimum values and below their average values for the period. A least squares regression line fitted through the data indicates a negative trend for overall SB participation, SB participation via C-type contracts, and SB participation via D-type contracts.

Product Sub-Category 1 Other: Supplies & Equipment: Other. Over the researched period, total SB participation rose to as high as 18.8% and varied by as much as 2.8%, while SB participation via C-type and D-type contracts reached 32.9% and 35.3% and varied by as much as 6.9% and 4.8%, respectively. While total SB participation in 2003 ended above its minimum and its average for the period, SB participation via the two contract types ended the period between their lowest and average recorded rates. A least squares regression line fitted through the data indicates a positive trend for overall SB participation and SB participation via D-type contracts and a negative trend for SB participation via C-type contracts.

Table 4-47 presents the Air Force's small business utilization trend data in Product Category 2 in both C-type and D-type contracts as well as a total for all DD-350 actions.

Table 4-47: SB Percentage Trend in Selected Contract Types & Product Category 2

Product Category	Contract Type	1990	2003	Change	Trend	Minimum	Maximum	Average	Standard Deviation
2	*All*	13.4	18.2	4.8	0.22	12.6	18.2	13.9	1.3
	C-Type	12.4	7.3	-5.0	-0.23	7.3	19.4	14.1	3.3
	D-Type	22.8	14.6	-8.2	-0.38	14.6	22.8	16.9	2.0
2A	*All*	13.4	15.4	2.0	0.27	13.4	20.9	16.7	2.3
	C-Type	14.5	22.2	7.8	0.43	4.8	34.9	19.6	7.6
	D-Type	41.4	16.7	-24.6	-1.45	16.6	41.4	26.4	6.7
2B	*All*	5.0	15.3	10.3	0.31	3.2	15.3	5.4	2.9
	C-Type	26.8	8.6	-18.2	-1.82	2.4	51.1	15.8	13.2
	D-Type	7.7	24.0	16.3	0.55	2.9	24.0	5.9	5.2
2C	*All*	62.5	33.7	-28.8	-1.15	33.7	62.5	47.6	8.2
	C-Type	62.5	43.0	-19.5	-0.62	40.7	62.5	49.9	5.4
	D-Type	82.0	25.0	-57.0	-3.77	25.0	82.0	58.2	17.3
2D	*All*	5.9	7.2	1.2	0.25	5.5	11.8	7.5	2.0
	C-Type	3.6	10.6	7.0	-0.32	2.8	22.1	10.5	6.6
	D-Type	8.3	6.1	-2.3	0.02	6.1	19.8	10.7	3.1
2E	*All*	3.8	14.8	10.9	1.11	3.8	17.9	10.3	4.7
	C-Type	1.7	15.7	14.0	-1.85	1.7	69.2	21.4	18.4
	D-Type	0.3	28.5	28.2	2.20	0.1	28.5	9.1	9.5
2F	*All*	4.4	3.3	-1.1	-0.07	0.6	9.4	3.9	2.5
	C-Type	3.7	3.0	-0.7	0.10	0.3	17.0	3.9	4.9
	D-Type	0.4	3.8	3.5	0.02	0.4	12.8	3.6	3.2
2 Other	*All*	24.1	8.2	-15.9	-0.98	8.2	24.1	15.3	4.2
	C-Type	14.8	2.5	-12.3	-1.30	2.5	50.7	12.0	11.1
	D-Type	32.3	22.2	-10.1	-0.76	14.4	32.3	19.9	4.6

Product Category 2: Services & Leases. Over the researched period, total SB participation rose to as high as 18.2% and varied by as much as 1.3%, while SB participation via C-type and D-type contracts reached 19.4% and 22.8% and varied by as much as 3.3% and 2.0%, respectively. While total SB participation in 2003 ended at its maximum rate for the period, SB participation via C-type and D-type contracts ended the period with their lowest recorded rate. A least squares regression line fitted through the data indicates a positive trend for overall SB participation and negative trends for SB participation via C-type and D-type contracts.

Product Sub-Category 2A: Services & Leases: Professional Services. Over the researched period, total SB participation rose to as high as 20.9% and varied by as much

as 2.3%, while SB participation via C-type and D-type contracts reached 34.9% and 41.4% and varied by as much as 7.6% and 6.7%, respectively. While total SB participation in 2003 ended at just below its average rate for the period, SB participation via C-type contracts ended the period with a higher than average rate and SB participation via D-type contracts ended the period with just higher than its lowest recorded rate. A least squares regression line fitted through the data indicates a positive trend for overall SB participation and SB participation via C-type contracts and a negative trends for SB participation via D-type contracts.

Product Sub-Category 2B: Services & Leases: Utilities. Over the researched period, total SB participation rose to as high as 15.3% and varied by as much as 2.9%, while SB participation via C-type and D-type contracts reached 51.1% and 24.0% and varied by as much as 13.2% and 5.2%, respectively. While total SB participation in 2003 ended at just below its average rate for the period, SB participation via C-type and D-type contracts ended the period at or just higher than their minimum recorded rate. A least squares regression line fitted through the data indicates a positive trend for overall SB participation and SB participation via D-type contracts and a negative trends for SB participation via C-type contracts.

Product Sub-Category 2C: Services & Leases: Base Operating Support Services. Over the researched period, total SB participation rose to as high as 62.5% and varied by as much as 8.2%, while SB participation via C-type and D-type contracts reached 62.5% and 82.0% and varied by as much as 5.4% and 17.3%, respectively. While total SB participation in 2003 and SB participation via D-type contracts ended at their minimum rate for the period, SB participation via C-type contracts ended the period just higher than

its lowest recorded rate. A least squares regression line fitted through the data indicates a negative trend for overall SB participation, SB participation via C-type contracts, and SB participation via D-type contracts.

Product Sub-Category 2D: Services & Leases: Repair of Equipment. Over the researched period, total SB participation rose to as high as 11.8% and varied by as much as 2.0%, while SB participation via C-type and D-type contracts reached 22.1% and 19.8% and varied by as much as 6.6% and 3.1%, respectively. While total SB participation in 2003 ended at just below its average rate for the period, SB participation via C-type contracts ended above its average rate and SB participation via D-type contracts ended at its minimum recorded rate. A least squares regression line fitted through the data indicates a positive trend for overall SB participation and SB participation via D-type contracts and a negative trends for SB participation via C-type contracts.

Product Sub-Category 2E: Services & Leases: Government Owned Contractor Operated Parts Stores. Over the researched period, total SB participation rose to as high as 17.9% and varied by as much as 4.7%, while SB participation via C-type and D-type contracts reached 69.2% and 28.5% and varied by as much as 18.4% and 9.5%, respectively. While total SB participation in 2003 ended above its average rate for the period, SB participation via C-type contracts ended just below its average rate and SB participation via D-type contracts ended at its maximum recorded rate. A least squares regression line fitted through the data indicates a positive trend for overall SB participation and SB participation via D-type contracts and a negative trends for SB participation via C-type contracts.

Product Sub-Category 2F: Services & Leases: Modification of Equipment. Over the researched period, total SB participation rose to as high as 9.4% and varied by as much as 2.5%, while SB participation via C-type and D-type contracts reached 17.0% and 12.8% and varied by as much as 4.9% and 3.2%, respectively. While total SB participation in 2003 and SB participation via C-type contracts ended just below its average rate for the period, SB participation via D-type contracts ended just above its average rate. A least squares regression line fitted through the data indicates a negative trend for overall SB participation and SB participation via C-type contracts and a positive trend for SB participation via D-type contracts

Product Sub-Category 2 Other: Services & Leases: Other. Over the researched period, total SB participation rose to as high as 24.1% and varied by as much as 4.2%, while SB participation via C-type and D-type contracts reached 50.7% and 32.3% and varied by as much as 11.1% and 4.6%, respectively. Total SB participation in 2003 and SB participation via C-type contracts ended at their minimum rate for the period, SB participation via D-type contracts ended just above its average rate. A least squares regression line fitted through the data indicates a negative trend for overall SB participation, SB participation via C-type contracts, and SB participation via D-type contracts

Table 4-48 presents the Air Force's small business utilization trend data in Product Categories 2 and 3 in both C-type and D-type contracts as well as a total for all DD-350 actions.

Table 4-48: SB Percentage Trend in Selected Contract Types & Product Categories 3 & 4

Product Category	Contract Type	1990	2003	Change	Trend	Minimum	Maximum	Average	Standard Deviation
3	*All*	60.4	49.4	-11.0	-0.29	49.4	67.7	59.5	5.0
	C-Type	67.2	52.9	-14.3	0.10	33.9	74.0	61.4	10.6
	D-Type	89.8	46.3	-43.4	-1.96	46.3	89.8	59.3	11.9
4	*All*	4.4	12.6	8.2	0.48	4.4	12.6	7.7	2.1
	C-Type	17.7	13.5	-4.2	-0.70	6.8	30.6	15.2	7.5
	D-Type	27.7	8.3	-19.3	-1.31	8.3	27.7	19.2	6.2

Product Category 3: Construction. Over the researched period, total SB participation rose to as high as 67.7% and varied by as much as 5.0%, while SB participation via C-type and D-type contracts reached 74.0% and 89.9% and varied by as much as 10.6% and 11.9%, respectively. While total SB participation in 2003 and SB participation in D-type contracts ended at their minimum rates for the period, SB participation via D-type contracts ended the period just below its average recorded rate. A least squares regression line fitted through the data indicates a negative trend for overall SB participation, SB participation via C-type contracts, and SB participation via D-type contracts.

Product Category 4: Research & Development. Over the researched period, total SB participation rose to as high as 12.6% and varied by as much as 2.1%, while SB participation via C-type and D-type contracts reached 30.6% and 27.7% and varied by as much as 7.5% and 6.2%, respectively. While total SB participation in 2003 and ended at its maximum rate for the period, SB participation via C-type contracts ended the period just below its average recorded rate and SB participation via D-type contracts ended the period at its minimum rate. A least squares regression line fitted through the data indicates a positive trend for overall SB participation, and a negative trend for SB participation via C-type and D-type contracts.

Summary

This chapter detailed the analysis performed on the data. It presented the data included for regression and trend analysis and discussed the analyses in detail. Chapter 5 will discuss conclusions of the analysis and recommendations.

V. Conclusions & Recommendations

Introduction

This chapter summarizes the results of the thesis. First, it reviews the research problem. Next, it discusses the results of the research as applied to the research and investigative questions. Then, it discusses the limitations of the results of the analysis. Finally, it recommends suggested topics for future research.

Review of the Research Problem

This thesis began with a question of the health of the Air Force small business program. Specifically, it asked for insight into the involvement of small businesses in Air Force procurement. With the breadth of these overall quandaries being quite large, the objectives of this research were narrowed so as to provide a picture of how the Air Force procures (contract types) and what the Air Force procures (product areas).

The study asked the question of what could affect changes in how and what the AF procures. It identified several pieces of legislation and related procurement initiatives (acquisition reform), types of procurement vehicles (contract types), and common product areas. This study asked if the identified initiatives changed the AF's use of procurement vehicles; then, further asked if identified changes impacted small business participation. Then, this study asked if the identified initiatives changed the AF's use of procurement vehicles in common product areas. Also, it asked for the identification of trends in contract type/product area utilization. Finally, it asked for the identification of a more pointed measure of small business participation other than percent of total obligations.

Discussion of Results

This section will discuss the results of the research as they apply to the research and investigative questions. The discussion will comment on the results and discuss their possible meaning and implications. The regression models used for Research Question 1 and Investigative Question 1 each had the capacity to yield three different results: 1) one or more statistically significant regressors, 2) no statistically significant regressors, or 3) a failed model (i.e. the model was unable to calculate a regression line using the given data). Only the third result can be considered to have no significant input to the posed hypotheses as it fails to provide any insight into the regressor/response relationship whatsoever. The first two possibilities, however, lend the statistical results necessary to either accept or reject the hypotheses. The failure of any given regression model to yield a statistically significant regressor is not a failure of the model itself. That a given regressor is not statistically significant within the model *is* a successful answer.

Research Question 1

Research Question 1 asked if acquisition reform initiatives affected a change in small business utilization or the Air Force's use of procurement vehicles and, if so, what has been the impact to small business utilization?

Research revealed that there was little correlation between acquisition reform initiatives and the AF's use of either tested contract type or the percentage of AF contract dollars awarded to small businesses. Only one model (y_4) provided enough evidence to suggest that two acquisition reform initiatives (the DAWIA and the Clinger-Cohen Act) positively affected the percentage of C-type contract dollars awarded to small businesses. One model, however, failed to effectively analyze the data. Regression Model y1 could

not complete a strait line through the responses; therefore, the result of this model is that one must come to the same conclusion as if the model revealed no statistically significant regressors.

These results are telling in that they reveal how little influence acquisition reform initiatives had on the Air Force's use of these two contract types and the overall ability of small businesses to compete for Air Force contract dollars. Only two of the acquisition reform initiatives were found to have had a statistically significant impact and that impact was positive. Overall, the tested acquisition reforms and SB participation in AF contracting are mutually exclusive.

Investigative Question 1

Investigative Question 1 asked if acquisition reform initiatives effected a change in the Air Force's use of contract types to procure goods and services in selected product categories.

Research revealed that there was some correlation between acquisition reform initiatives and the AF's use of either tested contract type to procure goods and services in the selected product categories. This research revealed the following results:

- The Defense Acquisition Workforce Improvement Act possibly increased the percentage of Air Force Services & Leases: Utilities contract dollars awarded to small businesses via D-type contracts.
- The Federal Acquisition Streamlining Act possibly decreased the percentage of Air Force Services & Leases: Utilities contract dollars awarded to small businesses via D-type contracts.
- The Clinger-Cohen Act possibly:

- Increased the percentage of Air Force Services & Leases: Government Owned Contractor Operated Parts Stores contract dollars awarded to small business via D-type contracts.
- Decreased the percentage of Air Force Supplies & Equipment: Automated Data Processing contract dollars awarded to small business via D-type contracts.
- Increased the percentage of Air Force Construction contract dollars awarded to small business via D-type contracts.

- The FAR Part 15 Re-write possibly decreased the percentage of Air Force Services & Leases: Government Owned Contractor Operated parts Stores contract dollars awarded to small businesses via D-type contracts.
- The proportion of Air Force procurement dollars awarded via Multiple Award Contracts possibly increased the percentage of Air Force Services & Leases: Utilities contract dollars awarded to small businesses via D-type contracts.
- The proportion of Air Force procurement dollars awarded via Government-Wide Agency Contracts possibly increased the percentage of Air Force Services & Leases: Government Owned Contractor Operated parts Stores contract dollars awarded to small businesses via D-type contracts.

Interesting to note is that via at least one of the two selected contract types, each of the six acquisition reform initiatives effected a statistically significant change in the Air Force's small business utilization rate and that this change in small business utilization occurred in only four of the 15 product categories/subcategories. As identified above, the categories/subcategories affected were:

- Automated Data Processing Equipment: Decreased via D-type contracts by the Clinger-Cohen Act
- Utilities: Decreased via C-type contracts by FASA, but increased via C- and D-type contracts by DAWIA the use of MACs.
- Government-Owned Contractor-Operated Parts Stores: Decreased via C-type contracts by the FAR 15 Re-write, but increased via C-type contracts by the Clinger-Cohen Act and the use of GWACs.
- Construction: Increased via D-type contracts by the Clinger-Cohen Act.

Investigative Question 1a

Investigative Question 1a asked to what extent the Air Force used firm fixed-price contracts (C-type) & indefinite delivery (D-type) contracts to procure goods and services from small businesses between the years of 1990 to present. To answer this question, SB participation via the two contract types was compared with overall SB participation. The results of this comparison are as follows:

- The trend of overall SB participation indicates an increase in participation.
- The trend of SB participation via C-type contracts indicates a decrease in participation.
- The trend of SB participation via D-type contracts indicates a decrease in participation.

This analysis revealed that although the trend is toward less small business participation via the two researched contract types, overall small business participation is increasing. This possibly indicates a shift in the preference of small businesses to bid on other contract types, the preference of the AF to contract via other contract types, or both.

Although the regression analysis of model y_3 was primarily performed to test the effect of acquisition reform initiatives on small business utilization, it also revealed that the proportion of C-type and D-type contracts awarded by the AF did not have a statistically significant effect on overall small business participation. This indicates that possible efforts to increase small business participation via these contract types would have a negligible effect on overall small business participation.

Missing in the analysis, however, is any indication of why small business participation changed (overall and via the two contract types) and from where the increased overall small business participation came. Combining the results of the hypotheses posed in the other research/investigative questions and the results of this investigative question seem to indicate that, whatever the trend in small business participation, it was probably not caused by AR initiatives.

Investigative Question 1b

Investigative Question 1b asked to what extent the Air Force used firm fixed-price contracts (C-type) & indefinite delivery (D-type) contracts to procure goods and services in selected product categories from small businesses between the years of 1990 to present. To answer this question, SB participation via the two contract types was compared with overall SB participation in each of the product areas. The results of this comparison are presented in Chapter 4.

The review of the analyses for the selected product categories revealed somewhat similar results as the review conducted for Investigative Question 1. Three of the four product categories (Supplies & Equipment, Services & Leases, and Research & Development) experienced a positive trend in small business participation, but a negative

trend in small business participation via both of the selected contract types. Again, this seems to indicate a shift in small business utilization in the product categories via contract types other than those researched for this study, but, again, the cause of this shift is unknown.

Review of specific product subcategories also revealed several areas in which the trend in small business participation dropped overall and via both of the selected contract types. Among the Supplies & Equipment subcategories, this rate of decrease was greater (more negative trend) for both C- and D-type contracts than it was for the overall subcategory. This, again, indicates a shift in small business participation from these contract types to other contract types but, again, the cause of this shift is unknown.

Research Question 2

Research Question 2 asked what alternative measures of small business participation can be employed to effectively evaluate performance outside of percentage of total obligations. This question is based on the widely-held view that the current measure of the small business program's performance, percent of total obligations, provides policy-makers with limited insight into small business participation in government contracting. Percent of total obligations is a broad metric that provides the aggregate measure of small business participation across many different industries, from office supplies to weapon systems. It provides no expanded insight.

As revealed in the literature review, the last decade of legislation reflects a Congress (and, therefore a voter base) interested in controlling the ballooning costs of Government procurement and tracking the performance and results of expensive Government programs. In the interest of ensuring small business participation while complying with

legislation designed to reduce government spend, the AFSADBU seeks insight into the effects that previous government programs (or acquisition reforms) have had on small business utilization and target area for future small business utilization efforts.

At the very least, the efforts of this thesis revealed just how varied small business participation in AF procurement has been over the past 13 fiscal years. Yearly small business participation in individual product areas reached as high as 67.7% (Construction in 2002) and as low as 0.1% (Systems in 6 out of 13 years), while the aggregate small business percentage measure ranged from 7.5% to 11.7%. Clearly, small businesses participate in AF procurement at different levels in different product areas.

From a common sense perspective, product areas experiencing a decline in small business participation would seem to require a more targeted effort than product areas experiencing an increase in small business participation. Table 5-1 lists the trends in small business participation in the researched product areas and is a derivation of Tables 4-45, 4-46, and 4-47, which were accomplished for analysis under Investigative Questions 1a and 1b. It identifies those product areas which have experienced a negative trend in small business participation over the researched period. The trend itself is identified as the slope of the least squares regression line calculated through the yearly percentages of small business participation in the stated product categories.

Table 5-1: SB Participation Trends (FY1990 thru FY 2003)

Product Category	Trend
All	0.15
1A	-1.39
1C	-0.11
1E	-0.01
2C	-1.15
2F	-0.07
2 Other	-0.98
3	-0.29

Overall, the positive trend of small business participation in all product categories indicates that between 1990 and 2003, small business participation increased. A simplified view of this trend line may lead to the expectation that FY 2004 small business participation would be 0.15% greater than in 2003. This simplified view has very little statistical accuracy, however, and should not be used for projecting future small business participation rates. This table merely reflects an observed strait-line trend and indicates possible product categories in which small businesses have been loosing procurement ground.

As stated, the trend values indicated in the table are the slope of the trend lines. A smaller trend value indicates a product category in which SB participation has been dropping the most (large negative slope) and a larger trend value indicates a product category in which SB participation has been dropping the least (small negative slope). For example, SB participation in product category 1A (Supplies & Equipment: Automated Data Processing) is decreasing at a rate of 1.39% per year and SB participation in product category 1E (Supplies & Equipment: Engines & Components) is decreasing at a rate of only .01% per year.

What the exploration of this research question revealed was not a complex new measurement of small business participation, but the need to employ the current measurement at a finer level of detail. The overall measure, Percent of Total Obligations, reveals little of the true variations in small business participation. Although there are a few industry-focused small business recruiting and training efforts, such as the SBIR Program or the Manufacturing Technical Assistance Production Program, most government-wide, congressionally-reported small business recruiting efforts focus on the

type of small business being recruited (e.g. small disadvantaged, woman-owned, etc.), not the industry in which the small business operates. The industries identified in Table 5-1 need help developing and maintaining small business involvement.

Contributions of the Research

This research serves to settle at least a few questions regarding the effect of AR initiatives on SB participation in AF contracting. Shown in this research is that, except within a few select product areas, only a few causal relationships between SB participation and AR initiatives can be made. AR initiatives have not driven down SB participation. In fact, the research provides evidence that, where AR initiatives effected SB participation, they did so positively in three out of five product areas. The research also shows that two of the perceived SB participation killers, MACs and GWACs, have only positively effected SB participation.

Limitations of the Research

This study is limited in its application in several ways. First, this study specifically excluded all AF contract actions below $25,000. Second, since data were compiled at the AF-level, the results of this study should only be applied at that level (not command-level or base-level). Third, this study linked several acquisition reform initiatives with several response variables. One must remember that these links imply correlation, not causation. Finally, none of the regression models accomplished in this study are suitable for projecting future response values.

Recommendations for Future Research

This study revealed several areas in which future research could prove helpful to small business participation efforts. Suggested research as follows:

- Employ the regression models built in this thesis to data points aggregated at a level lower than total AF (e.g. data points at major command-level, base-level, or contracting office-level).
- Test the regression models built in this thesis with data collected for FY 2004.
- Develop weighted measures of the small business utilization trends. For example, it may be more appropriate to weight the small business utilization values depending upon their age. Recent utilization rates should possibly be weighted more than older utilization rates.
- Develop regression models to test the interactive effects contract type usage with small business participation within the contract types and as a whole.

Conclusion

This chapter summarized the results of the thesis. It reviewed the research problem, discussed the results of the research as applied to the research and investigative questions, discussed the limitations of the results of the analysis, and recommended topics for future related research.

Appendix A: Data Collection and Organization

The Air Force stores its contract award information in the J001, Database of Procurement Actions. Each contract award, or reported DD Form 350, is called an "action." Each search of the J001 is called a query. As a relational database, the J001 stores actions that are accessible/searchable by limiting queries with filters, such as filtering by the date of award, by the contract type, by any other entry in any block of the DD Form 350, or by combinations of entries and blocks.

Results of J001 queries are output as Microsoft Excel spreadsheets. Each query results in a separate spreadsheet. Each spreadsheet contains a header row and multiple data rows. Each header cell contains text identifying the content of the cells under it. Each row contains the queried information specific to one action.

For example, the J001 could be queried for all actions awarded in fiscal year 2001 via definitive contracts. Besides the limiting factors, one would have to specifically select the output data, such as each action's dollar amount, date of award, Contracting Office Code, and contract type. The result of the query would be an Excel spreadsheet with a header row of cells labeled (in selectable order): B8, B3, A3B, and B13A, where B8 = Obligated or Deobligated Dollars, B3 = Action Date, A3B = Contracting Office Code, and B13A = Contract or Order. Because the query was limited to definitive contract actions in fiscal year 2001, for each action, or row, the cell under the column header B13A would read "3," for Definitive Contract, and the cells under the column header B3 would read between 20001001 and 20010930, with the date format "yyyymmdd."

Output data can also be calculated. For instance, in the above example, one of the output data was Block B8, Obligated or Deobligated Dollars. This data is stored as a

whole, positive number—one would not know from this block alone whether or not this action obligated funds or deobligated funds. For a complete picture, one would also have to query block B7, Type Obligation. Stored in this block is one of three codes: 1, if the action was an obligation; 2, if the action was a deobligation; or 3, if the action was for zero dollars. To simplify the output report, a calculated output field can be added to the query such that Block B8 is compared with Block B7 and the output field is the positive or negative dollar value of the action.

To complete the necessary analysis, several queries will be required. As the raw data in this study is expected to be quite large (one row of data for each Air Force contracting action between 1990 and 2002), several queries will no doubt be necessary as Microsoft excel limits the number of available rows per spreadsheet to 65,536 (Excel 2002, 2001). Whether it is by fiscal year, major command, operational contracting office, or other such grouping, the factor of interest for each query will be left to the expertise of the query generator.

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Vita

Captain Douglas E. Leedy was born in Salem, Oregon and graduated from Sunset High School in Beaverton, Oregon. He enlisted in the Air Force immediately following graduation and completed Basic Military Training as an Honor Graduate.

After graduating from the Apprentice Contracting Specialist Course at Lowry AFB, Colorado, he arrived for his first assignment at Eaker AFB, Arkansas. There, he served as a commodities buyer and the chief of the Management Analysis and Support Flight.

He was next assigned to Beale AFB, California. There, he served as a commodities, services, and construction buyer and completed an Associate of Science degree in Contracts Management. Also, after successfully completing the BOOTSTRAP program with a Bachelor of Business Administration (Cum Laude) from Golden Gate University, he served as the Chief of the Simplified Acquisition Flight. While at Beale, he was twice recognized as the 9th Contracting Squadron Airman of the Year.

Later, he applied and was accepted for Air Force Officer Training School. Upon graduation and commissioning, he was assigned to the Joint STARS Joint Program Office as a Contracts Manager where he was recognized as the Joint STARS Contracts Company Grade Officer of the Quarter and the Electronic Systems Center Contracting Company Grade Officer of the Quarter.

Upon graduation from the Air Force Institute of Technology with a Master of Science degree in Acquisition Management he will be assigned to Air Logistic Center, Tinker AFB, Oklahoma.

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Graduate School of Engineering and Management (AFIT/EN)
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Air Force Small Business
Mr. Joseph Diamond, Director
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14. ABSTRACT

Small Businesses (SB) have been of recognized import to the Federal Government for many years. This thesis explores the role of SB contractors in Air Force (AF) procurement and the effects of recent acquisition reform (AR) initiatives on their involvement, including their method of involvement (contract type), product areas in which they participate, and possible new areas of measurement. This thesis answers the research and investigative guestions in three ways. First, it explores the correlation of AR initiatives to SB participation as a whole, via selected contract types, and in selected product categories via causal regression models. Next, it identifies trends in AF procurement via selected contract types in selected product categories via descriptive varied as the methodologies employed to answer the research and investigative questions. First, very little correlation was found between AR initiatives and SB participation. Next, SB participation trends via the selected contract types in the selected product areas varied much greater than overall SB participation. Finally, several product categories were identified as suffering from a decreasing level of SB participation.

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