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PERFORMANCE OF HISTORICALLY UNDERREPRESENTED FIRMS IN THE PUBLIC-PRIVATE SECTOR

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ABSTRACT

This study examines the performance of historically underrepresented firms, which includes women-owned businesses and socially disadvantaged businesses. We examine performance in the context of securing public contracts and compare the performance of these historically underrepresented firms to those of non-minority small and large businesses. Utilizing a sample of all contracts awarded by the Johnson Space Center, a NASA directorate located in Houston, Texas, which identified 5,676 contracts totaling approximately $157 billion, we found that small businesses received around 63% of all contracts. The results indicate that more diverse firms received higher awards than specialists and that disadvantaged firms received higher dollar awards than general small businesses. In addition, women-owned businesses neither outperformed nor performed more poorly than general small business in the dollar amounts of contracts received, and they are neither more or less specialized than general small and large businesses. A discussion, practical implications, and future research ideas are also presented.

Keywords: women owned businesses, socially disadvantaged businesses, historically underrepresented firms, public-private sector

INTRODUCTION

Strategic alliances, joint ventures, partnerships, and other interorganizational relationships between businesses have continued to grow in popularity in both business and research (Das & He, 2006; Kelly, 2007; Lee & Gongming, 2007). Small businesses have been recognized as being uniquely suited for partnerships with other organizations due to many advantages such as a simple organizational structure, a focus on growth and continuity, flexibility, and central decision making (Gelinas & Bigras, 2004). In addition, these small businesses have access to additional resources and learning opportunities that can boost performance (Beekman & Robinson, 2004).

For many small businesses, collaboration with the public sector is vital. In fact, many small businesses view public-private partnerships as their primary area of work and expertise. Public-private partnerships are gaining popularity as some research indicates that they increase innovation and opportunities for growth, and that they are the way of the future due to the interconnectedness of industries and work sectors (Richter, 2004).

Bovaird (2004) defines a public-private partnership as a working arrangement between a public sector organization and an organization outside of the public sector. The form of these partnerships can be very broad as can be the range of products and services they produce or render. One advantage of these business-to-business relationships is they can create value networks that make up a business ecosystem that can provide advantages to all parties involved (Beekman & Robinson, 2004; Sawhney & Zabin, 2002). These connections can take place in many arenas which include state and local governments, international agencies such as the UN, and even the federal government as these organizations partner with the commercial sector (Richter, 2004).

While many federal contracts go to large, publicly-traded firms, small businesses are well represented. For the past several decades, the federal government has recognized the job creation and innovation potential of small and mid-sized businesses (Audretsch, 2003). This recognition has led to increased emphasis on funding small to mid-sized businesses, thereby enhancing job creation benefits. Specific targeting of minority-owned and innovative businesses spurs the emergence and creation of such ventures (Cooper, 2003). Along these lines, public policy supporting preferential treatment of small businesses is aimed at the broader economic benefits resulting from heightened job creation and innovation.

For the federal government, the benefits accrued from the private-public partnership go beyond job creation. Small businesses with strong connections to public and non-profit entities - such as universities and other research institutions - achieve heightened levels of innovation with lower direct investment in R&D (Audretsch, 2003). Thus, federal procurement aimed at innovation, such as the Small Business Innovation Research (SBIR) program

enables the creation of many new business ventures and enhances the commercialization of government sponsored research (Held, 2007).

The second thrust of public policy addresses institutional inequities blocking certain entrepreneurs from equal market opportunities. Women-owned and minority-owned businesses are systematically underrepresented in most industries and face many institutional obstacles that extend well beyond simply running an effective small business. For example, minority-owned and women-owned businesses suffer excessively high mortality (Robb, 2002) and face substantial challenges in securing institutional sources of capital (Treichel & Scott, 2006). Seeking to mitigate these inequities, the federal government fills a gap in sourcing for entrepreneurial capital (Cooper, 2003), extending several programs targeting strategically disadvantaged businesses.

In addition to specialized sources of funds and initial funding, small businesses gain benefits of legitimacy from their business relationships with public institutions (Connell, 2009). The documentation required to become a candidate for receipt of federal procurement, along with the due diligence applied in awarding such contracts, makes the federal government an important ally for emerging ventures. This legitimacy carries forward to increased access and interest from venture capital for growth and technology oriented small businesses (Lerner, 1999).

While an emerging body of research offers insight into the nature of small-business performance within public procurement, little is known about the comparative performance of small business types within those systems. To date, the research tends towards descriptions of the benefits of specific programs (Abramowicz & Sparks, 2007; Connell, 2009), need for specifically targeted programs (Reardon, Nicosia, & Moore, 2007) or public performance of major government entities (Held, Edison, Pfleeger, Anton, & Clancy, 2006). We lack, however, information regarding the comparative performance of focal categories (e.g. women-owned and minority-owned ventures) relative to their counterparts. To this end, a gap exists in identification of whether the various focused programs result in performance gains for small business.

It is along these lines that we proceed in our current research. In this paper, we explore four research questions. First, how do small businesses fare in their receipt of contract awards? Second, are there differences in the extent of specialization and generalization between small and large businesses in their receipt of awards? Third, are focused categories of small business better (or worse) positioned in their receipt of contractual awards? Finally, are there differences in the specialization and generalization levels of focused categories of small businesses?

Our research examines the performance of small businesses and various types of small businesses in terms of their receipt of federal contracts and dollars awarded. We focus on the relationship with a single federal agency because of that agency's broad funding in supporting numerous projects. The businesses represented

include large multi-national firms, small businesses, and minority-owned businesses. The contracts awarded include basic services, research and development, construction, and substantial investments in technology.

FEDERAL CONTRACTS AND BUSINESS CATEGORIES

Our examination of small business performance distinguishes between several demographic categorizations of small business contracts. The distinctions we use to separate categories of small business are defined by the federal government. Each of these categories represents a classification of small business ownership of specific interest to the federal government. Depending on the category, this interest may involve historical underrepresentation, challenges in acquisition of capital, and proclivity to generate innovations. Each category consists of a series of rules and targets for the distribution of federally awarded contracts and, in some cases, provides for additional services (such as mentoring). We provide definitions and background information for each of these categories in the following subsections.

Small Business Categories

The Small Business Administration (SBA) provides standards for definitions of small businesses, categories of small business, and additionally manages the certification of firms following within certain special categorical programs. For all small business categories, the primary designation depends on the size aspect. The SBA uses classification standards based on both number of employees and annual sales revenues. Depending on NAICS classification, a firm is considered small if its sales are under the $12 million range. However, for certain industries such as most construction industries (NAICS 23), businesses are classified as small up through $35 million in sales. Similarly, for many segments of professional, scientific and technical (NAICS 54), firms are considered small through $27 million in sales. Using employee metrics, firms are generally considered small if they have fewer than 500 employees, although significant variation exists depending on the industry sector.

The federal government focuses procurement efforts on small businesses out of recognition of the significant economic impact and job creation typical of small ventures. Current guidelines from the federal government set targets for federal direct procurement contract awards for small businesses. This target has grown since its inception and currently provides 23% of direct procurement (Reardon et al., 2007). While the economic impact of successful small businesses is noteworthy, small businesses also face substantial failure rates.

Robb (2002) finds that four-year mortality rates for small businesses exceed 50%. Further, the mortality rate is substantially higher for minority-owned firms and women-owned businesses fail 2-3% more frequently than male owned businesses within each category. In addition to heightened failure rates, minority-owned (Robb, 2002) and women-owned (Reardon et al., 2007) businesses are substantially underrepresented in most industry

categories. Recognizing this, the federal government provides preferential treatment and offers support programs both through the SBA and through the agencies who manage procurement awards.

Women-Owned Businesses

The SBA defines a firm as women-owned if it meets the parameters for a small business and if a 51% ownership position is held by a woman. Federal procurement procedures provide preferential selection practices towards firms who are women-owned and additional preferential programs are available for firms whose minority owner is women-owned and economically disadvantaged (Reardon et al., 2007).

Women owners comprise a significant percentage of small businesses. White females (8.3%) are the fourth highest demographic likely to own or operate their own business following white males (14.4%), Asian (10.2%) and Hispanic (8.5%) (Blanchflower, 2009). Further, facing slow gains in employment opportunities and inequality in larger firms, women increasingly turn to self-employment. Through 1997, the growth of women-owned businesses was roughly three times that of male-owned businesses and the magnitude of change is projected to increase (Daniel, 2004). Daniel additionally notes that women who own businesses have an average income level 2.5 times that of women who are not business owners.

While Robb (2002) reports mortality rates for women-owned businesses as 2-3% more prevalent than male-owned counterparts, other evidence suggests that these mortalities may not represent firm failures. Indeed, discontinued firms with female ownership are substantially less likely to have entered bankruptcy than their male-owned counterparts (Robinson, 2007) suggesting that this difference is driven by higher risk-aversion in female entrepreneurs. While Robinson concludes that lower risk of firm failure should result in favorable capital access, women-owned firms have historically proven less likely to receive financing and receive lower financing amounts from institutional sources (Treichel & Scott, 2006).

There are other issues facing women-owned businesses that include less early startup capital (S. Carter & Rosa, 1998), more difficulty securing loans (Verheul, Risseeuw, & Bartelse, 2002), and less credit history (Shaw, Carter, & Brierton, 2001). In addition, many women-owned businesses also have less managerial and technical experience (Chaganti & Parasuraman, 1996) which may play a role in the higher mortality rate as indicated above. When these constraints are coupled with the fact that women-owned businesses are more likely to enter industry sectors with higher failure rates (N. M. Carter & Williams, 1997), it is easy to see why problems may exist.

In terms of federal procurement awards, women-owned businesses are targeted for 5% of all contracts. However, Reardon et al. (2007) cautions that this target has never been hit and women-owned businesses actually receive approximately 3.5% of all federal contracts. They additionally note that women typically receive fewer and smaller awards than their male counterparts.

Additionally, women-owned businesses are significantly underrepresented in virtually all industry categories when examining contracts awarded. Some of these findings may be the result of women-owned businesses not having the capital nor being able to secure the financing necessary to win these contracts.

Disadvantaged and 8(a) Disadvantaged Business

The SBA classifies socially disadvantaged businesses (SDB) as unconditionally owned by U.S. citizens from socially and economically disadvantaged groups. Under current classification, this includes (but may not be limited to) Black Americans, Hispanic Americans, Native Americans, and Asian Pacific Americans. Groups receiving this classification are deemed socially and economically disadvantaged because of historic discrimination in capital and credit opportunities.

Robb (2002) notes that small businesses with ownership from SDB categories have significantly higher mortality rates. Blanchflower (2009) further notes that black owned businesses are significantly underrepresented in virtually every industry and only notes a growth in construction - and this following roughly a decade of contraction in construction. He reports substantial differences in access to capital sources, with minority owners facing systematically lower opportunities for funding. These findings are consistent with other evidence that black entrepreneurs face higher denial rates than white counterparts (Cavalluzzo, Cavalluzzo, & Wolken, 2002).

Unlike some other programs (e.g. SBIR), SDB's are allowed to enter into partnerships and joint ventures with non-disadvantaged owners in a mentor-protégé relationship (Abramowicz & Sparks, 2007). The program sets a 10% funding goal for any federal agency awarding contracts in excess of $250,000. While this establishes favorable evaluation of disadvantaged and 8(a) disadvantaged firms, judicial requirements mandate that distribution of awards must be race neutral in order to minimize discrimination against white owned small businesses and other non-disadvantaged businesses (Myers Jr & Ha, 2009). The 8(a) program additionally extends to sub-contracting relationships. Under this program, large primary contractors receive bonus payments if they subcontract with 8(a) disadvantaged firms (Abramowicz & Sparks, 2007).

Small Business Innovation Research (SBIR) Program

Initially created by the Small Business Innovation Development Act of 1982, the SBIR program was initially targeted for 1.25% of extramural research funding (Held et al., 2006). Since its inception, the program has raised its targets to 2.5% for projects meeting SBIR characteristics. The program initially expired in 2008, but has been extended through a series of short-term packages involving elements of the stimulus program (Seong, Horn, & Held, 2008). Requirements for participation in SBIR research include independent ownership (at least 51%) by a U.S. citizen or lawful resident with the firm located within the United States. The goals of SBIR are to increase use of small

businesses R&D, enhance commercialization of federal R&D, and improve access for minority and disadvantaged businesses (Held et al., 2006).

The motivation for the SBIR is reflected upon the advantages small firms have in generating innovation (Audretsch, 2003) and extends the legitimacy benefits for small businesses with government contracts (Connell, 2009) ultimately leading to increased creation of innovative new ventures (Cooper, 2003). Research examining the performance of SBIR firms finds that recipients of SBIR contracts create more jobs (Connell, 2009) and grow sales faster than similar sized counterparts (Lerner, 1999).

The growth advantages of SBIR firms may represent inherently greater innovative productivity for the award winners, rather than innovation created as a result of federal funding (Wallsten, 2000). Wallsten suggests SBIR funding simply functions as a supplement to firm R&D investment. Whether SBIR causes innovation or innovative firms receive more SBIR funds, a positive correlation exists between SBIR funding and innovative firms. Audresch (2003) observes that "some of the most innovative American companies received early stage finance from SBIR, including Apple Computer, Chiron, Compaq and Intel" (p. 133).

SBIR participation occurs in three funding stages, progressing from phase-1 merit, to phase-2 primary R&D, and, occasionally, phase-3 follow-up (Held et al., 2006). The program is highly selective with only 17% of applicants receiving phase-1 funding and merely 50% of those moving on to phase-2 funding (Cooper, 2003). The total federal SBIR program generates roughly 4000 contracts per year going to some 1500 firms, many of whom win multiple contracts (Connell, 2009). Firms winning SBIR contracts also move on to receive other non-SBIR federal contracts, prompting Held and colleagues (2006) to suggest SBIR functions as a recruiting tool bringing firms into a federal participation network.

Some criticism has been made of the SBIR program. Held and colleagues (2006) observe that the SBIR program, while significant, remains a small part of the overall small business program. Further, SBIR initiatives targeted at women-owned businesses and SDB's may be less effective than distinct programs targeted at those two groups. Additionally, Seong and colleagues (2008) find that SBIR administrative costs are quite high, running 4-5 times the cost of similar small business targeting programs. They caution, however, that these administrative costs may be driven by the nature of the innovation research. Held and colleagues (2006) further observe that the commercialization goals for SBIR are generally only met by a handful of firms. This conclusion echoes arguments by Lerner (1999) suggesting that the high performance outcomes for SBIR firms may be an artifact produced by a handful of firms in venture-capital dense geographic communities (e.g. Silicon Valley).

Research Questions

In the preceding sections, we have defined and characterized small business categories specifically highlighted in federal

procurement programs. These small business categories reflect demographic groups who are underrepresented in entrepreneurship, have higher failure rates for their ventures, and are composed of entrepreneurs who are systematically restrained in access to institutional capital. If this were a sample of small businesses without partnership connections to the federal government, we might expect performance below that of non-minority small businesses and large businesses. However, given decades of attention by federal procurement, including special programs, incentives, and within network mentoring, it is quite possible that these historically underrepresented firms will fare similarly to their non-minority small and large business counterparts.

ANALYSIS

Our study involves the examination of all contracts awarded between the years of 2005 and 2007 by Johnson Space Center (JSC), a NASA directorate located in Houston, TX. JSC engages in a number of public-private partnerships with both large and small firms. This includes funding for ongoing projects, such as Space Station Freedom, emerging R&D, and general facilities development and management. In addition to relationships with direct contractors, larger recipients, such as Boeing, often sub-contract out parcels of their awards, creating an interdependent network of small to large businesses focusing on a variety of projects.

Primary contractual data is available online through the NASA Acquisition Internet Service (NAIS). This website allows for ad-hoc queries on all direct relationships between NASA (and its directorates) and the various organizations it awards funding. This includes for-profits, not for-profits, NGO's, educational institutions, as well as state and municipal governments. For the purposes of our study, we omit contracts awarded to educational and governmental institutions. Further, in our examination of small business performance, we also omit not-for profits and NGO's.

Table 1 depicts the number of contracts and dollar value awarded for large businesses, small businesses and not-for-profits (including NGO's). We specifically emphasize the dollar value awarded, rather than the total amount paid to the awardee. While this may at times overstate the amount each entity ultimately receives, it maintains a uniform presentation for all awards. In some cases, awards were still being disbursed for contracts with lengthy durations, and emphasis on payments received would have underrepresented the actual commitment in the award. We were able to identify 5,676 contracts amounting to roughly $157 billion awarded over the three years of our sample. Not surprisingly, large businesses received the majority of the funded awards, taking in nearly 97% of all funds. However, small businesses received the overwhelming number of contracts, receiving approximately 63% of all contracts.

Table 1-Contracts Awarded Based on Size and Type of Business

Category	Contracts Awarded	Dollars Awarded
Large Business	1759 (31%)	$151Bn (96.6%)
Small Business	3567 (63%)	$4.9Bn (3.1%)
NFP	350 (6%)	$.5Bn (.3%)
	5676	$157Bn

NAIS also provides categorization data for small businesses. Prior to 2005, this information is generally restricted to the size of the business and whether it is a strategically disadvantaged business. However, beginning in 2005, this information was uniformly reported to include designations for women-owned businesses, disadvantaged businesses, 8(a) disadvantaged businesses, and SBIR firms, thereby allowing examination of various combinations of categories (e.g. women-owned, disadvantaged businesses). Below, Table 2 documents the number of firms, dollars received, and contracts received for all small business categories receiving awards in our sample period. Small businesses make up the largest number of firms in the sample (n = 958). This category represents firms which do not meet the definitions for any other small business category.

Table 2-Number of Firms, Dollar Amount Received, and Contracts Received

Category	Firms		Dollars Awarded		Contracts Awarded	
Small Business	958	73.6%	$ 1,624,624,022.76	33.4%	2514	70.5%
Women-Owned	149	11.4%	$ 562,639,152.00	11.6%	380	10.7%
Disadvantaged	47	3.6%	$ 2,085,069,152.00	42.9%	155	4.3%
8(a) Disadvantaged	11	.8%	$ 168,530,354.00	3.5%	79	2.2%
SBIR	93	7.1%	$ 90,851,524.00	1.9%	256	7.2%
WOB Disadvantaged	22	1.7%	$ 271,320,938.00	5.6%	121	3.4%
WOB 8(a)	7	.5%	$ 43,675,446.00	0.9%	34	1.0%
WOB SBIR	10	.8%	$ 8,494,100.00	0.2%	21	0.6%
DIS SBIR	5	.4%	$ 2,064,673.00	0.0%	7	0.2%

While such businesses make up the majority of sampled small firms (74%), and receive a similar majority of the awarded contracts (71%), they receive the second largest level of awards (33%) behind that awarded to disadvantaged firms (43%) who represent a substantially smaller number of firms (4%). This cursory examination suggests that certain categories of small businesses perform better (or worse) than the general small business category.

NAIS also contains information on the NAICS category associated with the contract award. While this information is omitted in some cases, most of the contracts awarded to for-profit ventures contain this information. An examination of the most frequently cited NAICS codes, the percentage for each category, and the rank order for that frequency within each category of business is shown in Table 3 below. NAIS reports this information at the six-digit NAICS code, and we retain that information in our documentation and subsequent analysis. The most frequently occurring NAICS codes appear to come from NAICS 54, Professional, Scientific and Technical Services. Indeed, six of the ten most frequent NAICS codes (roughly 33%) come from this area. In general, the most common NAICS codes are fairly well represented across all categories of business. The two primary exceptions appear, at first glance, to come from 8(a) disadvantaged firms and SBIR firms for whom five and seven of the ten most common NAICS codes respectively do not appear.

An examination of the top-ten NAICS codes by category and their relative weight within each category appears in Table 4 below. This information offers insights into the nature of the differences observed initially in Table 3. While SBIR firms only comprised three of the ten most common NAICS codes, the difference appears largely driven by the weight of the most frequent NAICS category for SBIR contracts. NAICS 541710, R&D in Physical, Engineering and Life Sciences, makes up over 86% of the SBIR contracts awarded by JSC in this period. To this end, SBIR firms mirror all other business categories in the fact that most awards come from NAICS 54. The 8(a) disadvantaged businesses, however, differ significantly in the types of firms receiving contracts. Here, we find four of the ten most frequent awards coming from NAICS 23, Construction. Further, these awards make up roughly 43% of the total contracts awarded to 8(a) firms.

Our examination of contracts and dollars awarded suggested that different categories of small businesses perform differently in their receipt of awards. However, our examination of the industries represented suggests differences only in the 8(a) disadvantaged category. Other than 8(a) firms, the various categories of small business seem relatively equivalently spread across the same types of industries represented by large and non-minority small businesses.

Table 3-NAICS Codes, Industry Category, and the Rank Order of Each Category

NAICS	Category	Percent	LB	SB	WOB	DIS	8(A)	SBIR	WOBDIS
541710	R&D Phys, Eng, and Life	14.1%	2	3	1	36	8	1	9
541330	Engineering Services	7.2%	1	2	17	4	6	2	N/A
334111	Electronic Computer Mfg	5.0%	4	1	5	26	N/A	N/A	2
443120	Computer and Software Stores	3.8%	3	4	N/A	N/A	N/A	N/A	5
541519	Other Computer Related Svc	3.8%	6	7	6	6	4	N/A	1
541611	Adm Mgmt Consulting	3.3%	10	5	4	8	17	N/A	16
541511	Custom Computer Programming	2.8%	15	8	45	35	1	6	14
511210	Software Publishers	2.4%	5	10	10	33	N/A	N/A	8
541512	Computer Systems Design SVC	2.0%	8	19	46	10	N/A	N/A	15
337214	Office Furniture Mfg	1.8%	11	18	3	30	N/A	N/A	N/A

Table 4-NAICS Codes and Relative Weight Within Each Category

Large Business		Small Business		Disadvantaged Business		8(a) Disadvantaged		Women-Owned		SBIR		Disadvantaged Women-owned	
541330	10.0%	334111	7.4%	238160	13.3%	541511	20.2%	541710	10.4%	541710	86.1%	541519	25.5%
541710	6.6%	541330	7.2%	236210	8.9%	236210	19.1%	611430	10.4%	541330	2.9%	334111	23.6%
443120	6.3%	541710	5.3%	238210	8.9%	238160	11.7%	337214	9.6%	334413	1.6%	423430	9.1%
334111	4.0%	443120	4.3%	541330	8.1%	541519	8.5%	541611	5.2%	333999	1.2%	323115	5.5%
511210	4.0%	541611	4.3%	236220	7.4%	237110	6.4%	334111	4.3%	336415	1.2%	443120	5.5%
541519	3.6%	334112	3.6%	541519	6.7%	541330	6.4%	541519	3.5%	541511	1.2%	561612	5.5%
335999	3.4%	541519	3.1%	541310	4.4%	237310	5.3%	611420	3.5%	927110	1.2%	237110	3.6%
541512	3.3%	541511	3.0%	541611	3.7%	541710	3.2%	334515	2.6%	325411	0.8%	511210	3.6%
541310	2.9%	334515	2.5%	423430	3.0%	561410	3.2%	421430	2.6%	334419	0.8%	541710	3.6%
541611	2.9%	511210	2.2%	541512	3.0%	562910	3.2%	511210	2.6%	334510	0.8%	236220	1.8%
All Other	53.1%		57.3%		32.6%		12.8%		45.2%		2.0%		12.7%

The remainder of our analysis examines receipt of federal contracts, dollars awarded, and degree of specialization and generalization. Here we conducted regression models using three dependent variables: number of contracts awarded, log-dollar values of contracts awarded, and number of NAICS codes covered in contract awards. We used three subsets of our data to conduct this analysis. The first analysis examined differences across all for-profit and not-for-profit firms (n = 1925). Our second analysis examined performance characteristics of all for-profit firms (n = 1913). Our final analysis examined differences across only small businesses (n = 1299). These analyses are presented in Table 5 below.

Table 5-Comparison of For-Profit and Small Business Firms

All for-profit firms					**Small Business Only**					
	Model 1		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
DV	## Contracts		##NAICS		Log_Dollars		## Contracts		##NAICS	
Predictor	β	p	β	p	β	p	β	p	β	p
SB	-.06	*	-.09	**						
WOB	-.00		.02		-.02		-.01		.03	
DIS	.02		.09	**	.12	**	.02		.11	**
8(A)	.03		.09	**	.10	**	.04		.12	**
SBIR	-.04	†	.13	**	.24	**	-.05	†	.16	**
NFP	0									
Diversified	.30	**			.20	**	.30	**		
R2	.10	**	.03	**	.15	**	.09	**	.05	**
n	1925		1813		1299		1299		1299	
Base Case	Large Business		Large Business		Small Business		Small Business		Small Business	
†	0.1	*	0.05	**	0.01	**	0.001			

In each regression, our predictors are categorical variables separating the base case from our categories of interest. The base case is large businesses in model 1 and 2 and general small businesses in models 3-5. Categorical predictors exist for general small businesses (in models 1 and 2) along with firms meeting government procurement program definitions for women-owned business, SDB's, SDB's meeting 8(a) requirements, and SBIR contracting firms. In regression models examining contracts and dollars awarded, we additionally track the number of NAICS codes a firm operated in, thus estimating effects from diversification (multiple NAICS codes) and specialization (one NAICS code).

Small Businesses and their Receipt of JSC Contracts

Our first research question examines whether small businesses (and related subcategories) differ in their receipt of federal contracts. We focus on contracts awarded, rather than dollars awarded, as the very definition of small under SBA rules suggests that small firms will receive inherently smaller contracts than large businesses. We thus examine the number of contracts awarded as a function of the business category type, with large businesses representing the base case. Regression results are reported as Model 1 in Table 5. Our regression model is significant (R^2 =.10; p<.001) and predictors for diversification (β=.30) and small business (β=-.06) are significant with the predictor for SBIR (β=-.04) approaching significance. From this, we conclude that firms operating across multiple NAICS codes receive more contracts than specialist firms functioning in a single (or few) NAICS codes. Further, individual small businesses receive fewer federal contracts and SBIR firms receive somewhat fewer federal contracts than do large businesses. None of the firms representing small businesses in disadvantaged minority groups differ substantially in their contract award characteristics.

Small Business Specialization Within the JSC Contract Network

Our second research question examines the extent to which small businesses, and categories of small businesses, differ in their extent of diversification or specialization. Here, we use the number of NAICS codes a firm operates in as a dependent variable in a regression against the various categories of organizations, with large businesses functioning as a base case. Results for this regression are reported as Model 2 in Table 5.

The regression model is significant (R^2 = .03; p <.001), although the variance explained is quite low. We find significant positive relationships for disadvantaged (β = .09), 8(a) qualifying firms (β = .09) and SBIR recipients (β = .13) along with a negative significant relationship for general small businesses (β = -.09). From this, we conclude that SDB and SBIR program recipients tend to operate across more NAICS codes than do large businesses. Taking model 1 and 2 together, small businesses receive fewer contracts from JSC and tend to operate across fewer NAICS codes.

Small Business Categories and their Receipt of JSC Contracts

Where our initial models compared the performance of small businesses and specific categories of small businesses relative to large businesses, we turn our attention now to the comparative performance within the small business subset itself. Here our sample is reduced to firms meeting small business characteristics (n = 1299) and we examine results using both the number of contracts and dollars awarded. Our predictor variables in this stage include the various categories of small business (with general small business functioning as the base case) along with a predictor for the number of NAICS codes the firm operates in. The regression runs are presented as Model 3 and Model 4 in Table 5.

Model 4 uses the log dollars of the contract awards as a dependent variable against the categorical predictors. The model is significant (R^2 = .15; p<.001) and we find a number of the predictors significant. Consistent with our examination across all organizations, more diversified firms receive higher dollar awards than do specialists (β = .20). Additionally, both types of SDB's, disadvantaged firms (β = .12) and 8(a) classified firms (β = .10) receive higher dollar awards than general small businesses. SBIR recipients (β = .24) also receive higher dollar awards than non-SBIR small business recipients.

Model 5 uses the number of contracts awarded as a dependent variable against the same range of predictors. Once again the model is significant (R^2 = .09), although few predictors reach significance. Consistent with earlier analysis, diversified firms receive more contracts (β = .30) than do specialists. SBIR recipients (β = -.05) receive marginally fewer contracts than do non-SBIR small businesses - although the preceding results suggest these fewer contracts are more lucrative.

Specialization of Small Businesses Awarded JSC Contracts

Our final analysis examines the tendencies towards diversification or specialization for small business recipients of JSC contracts. Here, our dependent variable is the number of NAICS codes a firm operates in regressed against the various categories of small businesses, with general small businesses functioning as the base case. Results of this regression are depicted in Model 5 on Table 5, once again the model is significant (R^2 = .05).

We find significant, positive coefficients for both categories of SDB's with both disadvantaged firms (β = .11) and 8(a) firms (β = .12) functioning in more NAICS codes than do general small businesses. Additionally, SBIR firms (β = .16) tend to operate in more NAICS codes than do their non-SBIR general small business counterparts.

DISCUSSION

The Federal government expends some effort understanding the impact of small business on the economy as well as understanding institutional biases which undermine the potential effectiveness of many categories of small business. While small business have historically functioned as job and innovation incubators for the

United States (Audretsch, 2003) and while entrepreneurship generally produces better earnings and lifestyle opportunities for many individuals (Daniel, 2004), these benefits do not come without pitfalls. Small businesses retain a very high failure rate (Robb, 2002) and outcomes for small business are not equivocal across demographic groups. We discuss our findings categorically, looking at findings for general small business, women-owned business, SDB's, and SBIR businesses.

General small business includes all firms meeting SBA definitions who did not fall into any other category. While these firms receive the largest number of total contracts (70.5%), they receive the second largest total awards (33.4%). Considering that general small businesses comprise the largest number of firms in the small business category (73.6%), these initial outcomes suggested that the individual firm performance lags behind that of other small business categories. This phenomenon is, in fact, born out in our regression models. Individual general small businesses receive fewer contracts and smaller awards per contract than do all other firms, except for women-owned small businesses.

However, it does not appear that this is through any specific penalty in awards as much as in self-selection by the general small businesses themselves. General small businesses tend to operate across fewer NAICS codes than do any other firms in our sample, except for women-owned businesses. Additionally, general small businesses seem concentrated in NAICS 54 (science and technology) and NAICS 33 (manufacturing) which appear to be the most competitive contracts in the JSC data set. In the three models where we examined contract award characteristics, the number of NAICS codes a firm operates in routinely emerged as the strongest performance predictor. A tendency towards specialization in more competitive arenas likely limits potential contracting opportunities for general small businesses.

While we find general small businesses to underperform nearly all other business categories, the same cannot be said for women-owned businesses. Businesses owned by female entrepreneurs do not under or over-perform general small and large businesses in their receipt of contracts. Similarly, they do not outperform, nor do they underperform, general small businesses in the dollar amounts of contracts received. Additionally, they do not appear to be any more or less specialized than general small or large businesses. While Reardon et al. (2007) report that federal procurement targets, as a whole, have never been met for women-owned businesses, we find little evidence that women-owned businesses are underperforming in their role as contractors for JSC. Our findings that WOB are not underperforming in terms of number or dollar of contracts echoes the findings of Reardon et al., although their study pertains to contracts only. Given the general underperformance of women-owned businesses, as a whole, in the federal procurement system, our findings suggest actions and policies in place at JSC are producing desired results.

While our findings for women-owned businesses suggest performance that is

neither higher nor lower than the performance of small businesses, the same cannot be said for SDB's. SDB's outperform general small businesses, receiving higher contract awards on average. Additionally, SDB's neither under, nor over, perform large or small businesses in the numbers of contracts awarded. Held et al. (2006) observes that SBIR programs targeted at SDB's may be less effective than direct programs targeted at SDB's. While we cannot test the comparative suggested by Held and colleagues in this data set, we confirm their endorsement of targeted SDB programs. Within the JSC procurement program, SDB's are receiving opportunities for their firms to flourish.

Robb (2002) notes that SDB's tend to be underrepresented across industry categories and that SDB owners tend to concentrate in specific industries. Our findings suggest that, within JSC procurements, SDB's tend to be less specialized than other firms and are more likely to operate across multiple NAICS codes than general small businesses. We notice a concentration of SDB contracts awarded in NAICS 23 (construction) which is consistent with Robb's analysis. However, we also find NAICS 54 (science and technology) is also well represented for SDB's in the JSC network.

Our examination of SBIR contracts suggests that the vast majority of SBIR awards go to firms operating in NAICS 54, which is unsurprising given the nature of SBIR work. We further observe some SBIR contracts going to firms in NAICS 33 (manufacturing). Additionally, we find that SBIR firms are more likely to operate across multiple NAICS codes than do general small businesses. Taken together, this suggests that JSC-SBIR contracts may be making strides to address the commercialization of R&D goals of the SBIR program (Held et al., 2006).

Our performance evaluation for SBIR firms produces mixed, but generally positive, findings. We find very weak evidence that SBIR firms receive fewer contracts, on average, than do general small and large businesses. However, the statistical results for these findings are notably weak. Taken in conjunction with our finding that SBIR firms function across multiple NAICS codes, which substantially correlates with number of contracts awarded, this suggests that the negative finding is a statistical artifact. Our evidence suggests that SBIR contracts provide substantially higher award dollars than do general small business contracts. Our finding here is consistent with Connell's (2009) examination of SBIR awards for all federal agencies.

On the whole, our examination of JSC contracts produces a number of important findings. Specifically, JSC appears to perform admirably with regard to their mandate to stimulate business opportunities across historically underrepresented small businesses. While other research suggests that the federal contracting performance lags behind policy goals (Held et al., 2006; Reardon et al., 2007), this NASA directorate offers evidence of programs producing desired outcomes. To date, the examination of public-private partnerships - specifically those involving small business and underrepresented businesses - has largely emphasized macro-policy outcomes.

Our examination of a single directorate within one agency of the federal government finds that macro-policy outcomes are not always emblematic of directorate performance.

Even though our research documents important positive outcomes for SDB's, our findings themselves suggest three important questions for future research. These questions involve potential interaction effects, causal arguments, and network evolution. We address each of these separately.

In general, our investigation of procurement program categories focused on direct effects. To this end, we examined outcomes for women-owned businesses as well as SDB's. We find no significant over, nor underperformance for the former and indication of substantial positive performance for the latter. We did not explore effects for businesses who occupy more than one category simultaneously (e.g. women-owned SDB's or SDB SBIR firms). In this, our research mirrors the general tenor of research examining public-private partnerships with the Federal government. Within our sample, few firms (less than 3.5% of all small businesses) were flagged for multiple characteristics, offering little ability to explore these interactions. It is interesting, given our findings, to inquire whether all women-owned businesses performed equally with their general small business competitors or, alternately, whether separation of SDB women-owned businesses would substantially alter these findings. We believe this is an important question to pursue in the future.

Our second research question addresses that of causality. Research examining the general performance of SDB's (Robb, 2002) finds them underrepresented and underperforming in most industries. To this end, a number of federal programs seek to remedy this historical underrepresentation, yet as a whole performance lags behind policy goals (Reardon et al., 2007). In our study of JSC, we find SDB's well represented and performing at or above levels of general small businesses. While this is a significant and admirable outcome, it is unclear, given the nature of our data, whether this outcome is policy driven.

We do not know, given this data, whether specialized procurement programs, mentoring opportunities within the JSC network, or other JSC driven initiatives led to this outcome or whether the outcome is associated with other factors. Further, because our data is panel data, taken within the same time period, all of our outcomes are thus correlations only. We make no claims of causality, merely inferences of causation. Given that our findings are atypical of general business and federal procurement (overall), further research should explore causal outcomes. To what extent are the results we observe outcomes of concentrated efforts at JSC? Which programs (assuming a causal link exists) produce these positive outcomes? Can such programs (should they exist) be modeled and replicated elsewhere? While we advise cautious optimism, future research should explore causal factors directly.

Finally, do the correlations we find carry forwards? Held and colleagues (2006) argue that programs like SBIR can function

as gateway programs bringing new firms into the federal participation networks. Audretsch (2003) suggests that participation in these programs can lead to higher innovation outputs in future periods. Connell (2009) suggests that public-private partnerships with the Federal government provide legitimacy benefits yielding greater opportunities for performance and growth in future periods.

Do these benefits accrue? Are firms in the JSC procurement system likely to remain in the network? Assuming the firms will remain, is it equivocally true or are some types of firms more (or less) likely to remain in the network? Do firms entering the federal network through one agency expand their connections across multiple agencies or do they tend to stay with one agency partner? Do these partnerships materialize in firm performance benefits and, if so, are these benefits located entirely within the government network? Given the nature of our data, we are unable to address these questions. However, considering our findings in conjunction with existing research suggests that greater knowledge is needed about the antecedents and consequences of participation in public-private partnerships with the federal government.

We began this study with the intent of imPproving our understanding of correlates to participation within the JSC procurement network. We couched our analysis in a macro-economic understanding of the historical underrepresentation of SDB's and how that informs federal procurement initiatives. Our findings suggest that, at the directorate level, positive outcomes exist for historically underrepresented businesses.

Federal agencies often operate with dual strategic mandates, an operational mandate tied directly to their identity (e.g. space exploration) and a policy mandate to enact their operational mandate in conjunction with broader federal initiatives (e.g. promoting small business and disadvantaged business opportunities). While federal guidelines subordinate the policy mandate to the operational mandate, the interaction of the two should always be considered.

Specifically, JSC appears to have realized at least some of the policy goals the federal government has established for small, underrepresented businesses. However, our analysis is restricted to contracts awarded within one Presidential administration. Current discussion regarding the future of NASA and potential changes to the mandate for several directorates may result in changes in funding levels and targets. To the extent that current funding and targets realize policy goals for small and underrepresented businesses, substantial changes in mandates and funding should be carefully implemented to avoid losing any current benefits.

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