



WOMEN-OWNED SMALL BUSINESS NAICS ANALYSIS

Final Report

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Acronym List

Acronym	Term
Census ABS	Census Annual Business Survey
DUNS	Data Universal Numbering System
D&B	Dun and Bradstreet Hoovers
EDWOSB	Economically Disadvantaged Women-Owned Small Business
ECWA	Equity in Contracting for Women
FAR	Federal Acquisition Regulations
FASA	Federal Acquisition Streamlining Act
FPDS	Federal Procurement Data System
FY	Fiscal Year (October through September)
LBD	Longitudinal Business Database
NAICS	North American Industry Classification System
SAM	System for Award Management
SBA	U.S. Small Business Administration
WOSB	Women-Owned Small Business

Glossary

TERM	DEFINITION
Disparity study	A disparity study examines the extent to which firms of a given type (e.g., women-owned) are underutilized in public procurement in a particular industry. A disparity study reviews and analyzes the utilization and availability of disadvantaged, minority- and women-owned businesses in a particular market area to determine if disparity exists in the awarding of contracts to minority and women business enterprises by a public entity. A disparity study is typically conducted to determine whether a legally-defensible program is justified or needed to provide remedial relief given exclusionary behavior.
Women-Owned Small Business (WOSB)	SBA defines a WOSB as business that is small pursuant 13 C.F.R. part 121, and that is owned and controlled by women who are U.S. citizens, as described in 13 C.F.R. part 127.
Economically Disadvantaged Women-Owned Small Business (EDWOSB)	In addition to the above WOSB requirements, an EDWOSB is a small business that is owned and controlled by one or more women who are economically-disadvantaged based. Economically disadvantaged is determined by SBA and described in 13 C.F.R. part 127.
Contracts	Represents contracts identified for WOSBs in FPDS-ng.
Contract Obligations	Represents the contract obligation amount identified for WOSB contracts in FPDS-ng
NAICS code	North American Industry Classification System (NAICS) six-digits codes were developed for use by Federal Statistical Agencies for the collection, analysis and publication of statistical data related to the US Economy. The first two digits of the NAICS code designate the economic sector, the third digit designates the subsector, the fourth designates the industry group, the fifth designates the NAICS industry, and the sixth digit designates the national industry (specific to the US, Canada, and Mexico).
Disparity ratio	A disparity ratio measures the degree to which firms of a given type (e.g., women-owned) are represented in federal contracting in proportion to their prevalence in the population (e.g., industry). The disparity ratio is the ratio of two ratios: (1) the utilization ratio divided by (2) the availability ratio.
Utilization ratio	The ratio of the number (or obligations) of contracts awarded to WOSBs divided by the contracts (or obligations) awarded overall.
Availability ratio	The ratio of the number of WOSBs to the total number of firms in the industry (NAICS code).
Stable disparity ratio	Disparity ratios are consistent over a period relative to the selected 0.5 or 0.8 thresholds.
Unstable disparity ratio	Disparity ratios are inconsistent over a period relative to the selected 0.5 or 0.8 thresholds.

EXECUTIVE SUMMARY

Introduction

Women face a wider variety and a greater severity of challenges in starting and growing their business ventures than men. Difficulties obtaining government contracts represent one of the largest hurdles faced by women-owned firms. The literature suggests that women-owned businesses are underrepresented in federal contracting due to a number of barriers, including potential discrimination, lack of knowledge about or disinterest in government contracting, difficulties with federal certifications, smaller size, reduced capacities, limited government and business networks, and other unfavorable social, policy, and regulatory environments.

Another factor accounting for the lower access to federal contracting among women is that they tend to own businesses in more crowded, competitive, and higher failure rates industry sectors. Furthermore, government agencies are prone to bundle contracts, purchase from larger firms, and procure from industries outside of sectors in which women tend to concentrate.

Thus, policymakers have designed and implemented policies and programs intended to facilitate women-owned businesses in accessing the government procurement market.

The Women-Owned Small Business Federal Contracting Program

The Women-Owned Small Business (WOSB) Federal Contracting Program is

one of several programs that Congress has approved to provide greater opportunities for small businesses to win federal contracts. One of the functions of the program is to restrict competition to qualified WOSBs and Economically Disadvantaged Women-Owned Small Businesses (EDWOSBs) to increase “their success to compete for and win federal contracts” and ensure “a level playing field on which such small businesses can compete for Federal contracting opportunities.” Under this program, federal contracting officers may set aside federal contracts (or orders) for WOSBs (including EDWOSBs) in industries in which the SBA determines WOSBs are “substantially underrepresented” in federal procurement and for EDWOSBs exclusively in industries in which the SBA determines WOSBs are “underrepresented” in federal procurement.

Description of the Evaluation

The Small Business Reauthorization Act of 2000 required the SBA to conduct a study to identify the industries in which WOSBs are underrepresented with respect to Federal procurement contracting. The evaluation used the disparity ratio approach to estimate the underrepresentation of WOSBs in federal procurement. The disparity ratio measures the degree to which WOSBs are represented in proportion to their prevalence in the population of “ready, willing, and able” businesses.

The disparity ratio is the ratio of two ratios:

Calculating the Disparity Ratio (Method 1)			
Utilization Ratio (U):		Availability Ratio (A):	
$\frac{\text{\# of Contracts Awarded to WOSBs in an Industry}}{\text{Total \# of Contracts Awarded in an Industry}}$		\div	$\frac{\text{\# of WOSBs in an Industry}}{\text{Total \# of Firms in an Industry}}$

Calculating the Disparity Ratio (Method 2)			
Utilization Ratio (U):		Availability Ratio (A):	
$\frac{\text{Contract Obligations to WOSBs in an Industry}}{\text{Total Contract Obligations in an Industry}}$		\div	$\frac{\text{\# of WOSBs in an Industry}}{\text{Total \# of Firms in an Industry}}$

If the disparity ratio is equal to 1.0, WOSBs are awarded contracts in the same proportion as their representation in the industry, and there is a parity. If the ratio is greater than 1.0 or parity, WOSBs are overrepresented relative to their share of “ready, willing, and able” businesses in the population. If the ratio is less than 1.0,

there is a disparity and WOSBs are underrepresented as government contractors relative to their share of “ready, willing, and able” businesses. The study classified WOSBs’ disparity (i.e., “substantially below parity” and “materially below parity” classifications) as follows (Table ES-1).^{1,2,3,4}

Table ES-1. Disparity ratio thresholds

Disparity ratio from	Disparity ratio to	Description of the value
0	0.5	WOSBs are “substantially below parity”
0.5	0.8	WOSBs are “materially below parity”
0.8	1.2	WOSBs are “close to or at parity”
1.2		WOSBs are “substantially above parity”

Note: The SBA may update these thresholds in the future.

The evaluation calculated disparity ratios for two measures of WOSBs’ representation in federal procurement: 1) the number of contracts, and 2) the obligations of contracts. This accounted for the fact that WOSBs can be materially below parity when they receive a relatively large number of contracts, but the awards are relatively low value, as well as when WOSBs receive a relatively small number of high-value contract awards.

The evaluation used the following secondary data sources to calculate the disparity ratios: 1) Federal Procurement Data System (FPDS) 2016-2019 that provided information on federal contract awards; 2) System for Award Management (SAM) 2016-2019 that contained information for the number and

characteristics of federal contractors and their businesses; and 3) 2017 Census Annual Business Survey (ABS) that contained data for the number of women-owned firms and all firms in the U.S.

Summary of WOSBs’ Disparity Results

The evaluation provided the disparity ratios and “materially below parity”, “substantially below parity”, “close to or at parity”, and “substantially above parity” classifications at the two-, three-, four-, and six-digit North American Industry Classification System (NAICS) codes for the population of firms registered in SAM that are “ready, willing, and able” to conduct business with the federal government.^{i,ii}

The rationale for estimating WOSBs’ representation at more detailed NAICS

ⁱ The first two digits of the NAICS code designate the economic sector, the third — the subsector, the fourth — the industry group, the fifth — the NAICS industry, and the sixth digit designates the national industry specific to the United States, Canada, and Mexico.

ⁱⁱ The primary focus of the study is on identifying NAICS codes with “substantially below parity” and “materially below parity” classifications.

codes (e.g., six-digit) is that dissimilar businesses are more likely to be grouped together at higher levels (e.g., two-digit). The following provides the results for WOSB federal procurement representation classifications for all NAICS codes applicable for federal awards.ⁱⁱⁱ

For the number of awards in the population of firms registered in SAM, the materially below parity or substantially below parity NAICS codes included: all two-digit industries; 88 percent of three-digit industries; 85 percent of four-digit industries; and 82 percent of six-digit industries (Table ES-2).

Table ES-2. WOSB federal procurement representation classification based on the number of awards among firms registered in SAM, by NAICS code level 2016-2019

WOSB Underrepresentation (Number of Contracts)	Industries Applicable for Federal Awards (all disparity ratios)			
	six-digit	four-digit	three-digit	two-digit
Substantially above parity (disparity ratio ≥ 1.2)	50	7	1	0
	5.6%	2.8%	1.3%	0.0%
Close to or at parity (disparity ratio ≥ 0.8 and < 1.2)	108	30	8	0
	12.2%	11.8%	10.7%	0.0%
Materially below parity (disparity ratio < 0.8 and ≥ 0.5)	160	47	12	2
	18.1%	18.5%	16.0%	10.5%
Substantially below parity (disparity ratio < 0.5)	568	170	54	17
	64.1%	66.9%	72.0%	89.5%
TOTAL	886	254	75	19
	100.0%	100.0%	100.0%	100.0%

For the obligations of awards relative to the population of firms registered in SAM, the materially below parity or substantially below parity NAICS codes included: all

two-digit industries; 89 percent of three-digit industries; 91 percent of four-digit industries; and 87 percent of six-digit industries (Table ES-3).

ⁱⁱⁱ The disparity ratio results were omitted for NAICS codes that are not eligible for federal contracts, including “5211 Monetary Authorities-Central Bank,” “8141 Private

Households,” “55 Management of Companies and Enterprises,” “92 Public Administration,” “42 Wholesale Trade,” “44 Retail Trade,” and “45 Retail Trade.”

Table ES-3. WOSB federal procurement representation classification based on the obligations of awards among firms registered in SAM, by NAICS code level 2016-2019

WOSB Under-Representation (Obligations of Contracts)	Industries Applicable for Federal Awards (all disparity ratios)			
	six-digit	four-digit	three-digit	two-digit
Not calculated *	1	0	0	0
	0.1%	0.0%	0.0%	0.0%
Substantially above parity (disparity ratio ≥ 1.2)	56	11	5	0
	6.3%	4.3%	6.7%	0.0%
Close to or at parity (disparity ratio ≥ 0.8 and < 1.2)	56	13	3	0
	6.3%	5.1%	4.0%	0.0%
Materially below parity (disparity ratio < 0.8 and ≥ 0.5)	121	28	8	2
	13.7%	11.0%	10.7%	10.5%
Substantially below parity (disparity ratio < 0.5)	652	202	59	17
	73.6%	79.5%	78.7%	89.5%
TOTAL	886	254	75	19
	100.0%	100.0%	100.0%	100.0%

Note *: Not calculated ratio involved the FPDS data indicating no WOSB awards and the SAM data indicating no WOSB firms.

Limitations of Findings and Sensitivity Analyses

The study conducted two main types of sensitivity analyses for the WOSB federal procurement representation classification. First, it is possible that conclusions regarding the WOSBs' underrepresentation classifications for the NAICS codes with a small number of awards in which the disparity ratio is close to the threshold (i.e., 0.50 or 0.80) should be interpreted with caution. Some of these industries might not have stable disparity ratios and, in any given year, the disparity ratio could be above or below the established threshold. In such industries, the stability of the disparity ratio over years may be quite low (Appendix B).⁵

To address this issue, we conducted the power analyses to determine which industries have sufficiently stable disparity ratios. The study found that about a quarter of six-digit NAICS codes and about 10 percent of four-digit NAICS codes had

disparity ratios that were unstable over the 2016-2019 period. These results suggested that the findings of NAICS codes in which WOSBs were materially below parity or substantially below parity should be interpreted with caution as some of these industries might not have stable disparity ratios and, in any given year, the disparity ratio could be above or below the established threshold.

The study also examined the disparity ratio results for an alternative approach to estimate the availability of "ready, willing, and able" WOSBs. The most often used method to estimate the share of WOSBs in federal procurement is to rely on the SAM data for the firms registered to conduct business with federal government. However, the use of procurement lists is not considered to be the most valid approach by courts or experts. The main argument is that these lists can improperly exclude "ready, willing, and able" firms that are not on the list but should be when considering all available firms. Therefore,

the study also examined the disparity ratio results for the availability ratios calculated based on the Census data for all firms in the United States.

Data limitations of the Census data prevented a comprehensive analysis of the WOSBs' underrepresentation across the comparable set of industry levels and years.^{iv} The results of these limited Census data revealed that WOSBs were more underrepresented in reference to the overall population of firms in the United States than in the population of "ready, willing, and able" firms registered in SAM to conduct business with federal government. This supported the approach of examining the disparity ratios using both types of populations.

Conclusions and Recommendations

Overall, the study suggested that results regarding WOSBs' disparity in federal procurement depend on whether it was measured for: 1) the overall population of firms in the United States; 2) the firms registered in SAM to conduct business with federal government; 3) the number of awards; 4) the obligations of awards, or 5) the NAICS codes in which the disparity ratios were found to be stable by the power analyses.

The study found the WOSBs' underrepresentation to be greater when the disparity ratio was measured with respect to the obligations of awards than the number of awards. The WOSBs' underrepresentation was also greater

when the study measured the disparity ratio based on the overall population of firms in the United States than among firms registered in SAM.

Furthermore, it is possible that some of the findings regarding the WOSBs' underrepresentation may not accurately capture the true underrepresentation of WOSBs for the detailed NAICS codes with a small number of awards and the disparity ratio being close to the threshold.

Overall, the results suggested that the disparity ratios should be examined using both types of reference populations, using both the number and obligations of contracts methods, as well as for all NAICS codes and for industries in which the disparity ratios are stable.

Based on the results, the study provided the following recommendations for the future studies of the WOSBs' disparity. First, the future evaluations should continue using the two measures of the WOSBs' disparity, the number of awards and the obligations of awards. Furthermore, the issue of the stability of the disparity ratios should be further explored, especially among industries with a small number of available firms and awarded contracts.

Future studies should also explore the use of the restricted Census data for the broader definition of the availability ratio based on the overall population of firms in the United States. However, these data are

^{iv} The Census data had the following deficiencies: 1) data were available for one (2017) of the four years during the analysis period (2016-2019); 2) the small business and

WOSB indicators were not available; and 3) data were not available at the three-, four-, and six-digit NAICS levels.

restricted for confidentiality reasons, and Census collaboration is required to produce the results. Future studies should collaborate with the Census Bureau to conduct analyses of the microdata that will provide detailed results for the six-digit NAICS levels for WOSBs.

Future studies should also develop interactive, near real-time decision support tools to provide detailed results for disparity metrics.

INTRODUCTION

Women business owners and entrepreneurs face a wider variety and a greater severity of challenges in starting and growing their businesses than men.^{6,7} Financial barriers represent one of the largest hurdles faced by women-owned firms as they have less startup capital, more difficulty securing loans through formal financial institutions, and less credit history.⁸ Historically, they also have difficulties obtaining government contracts.^{9,10} Fiscal Year (FY) 2019 was the second time in the last seven years that the federal government met the procurement goal of awarding at least 5 percent of contracts to women-owned small businesses (WOSBs), awarding 5.2 percent or \$26 billion in federal contracts to WOSBs.¹¹

A finding that women-owned businesses are underrepresented in federal contracting could result from a number of barriers. These include potential discrimination in federal contracting, lack of knowledge about or disinterest in government contracting, difficulties with certifications, smaller business size, limited capacities, and other unfavorable social, policy, and regulatory environments.¹² As women-owned firms are, on average, smaller than other types of firms, they retain fewer resources and capabilities with which to offset high administrative entrance costs associated with getting on federal bid lists, bidding for federal contracts, and supplying to the government.¹³ The lack of access to information and limited contacts within the government and business networks

also impact women-owned firms' access to industry and contracting opportunities.¹⁴ Another factor accounting for the lower access to federal contracting among women is that they tend to own businesses in more crowded, competitive, less revenue-generating industry sectors that have higher failure rates such as health care and social assistance, or professional, scientific, and technical services.^{15,16,17} Furthermore, government agencies are prone to bundle contracts, purchase from larger firms, and procure from industries (defense, manufacturing, advanced technologies) outside those sectors in which women tend to concentrate.¹⁸

Government procurement in the United States accounts for 10 percent of gross domestic product and is an important component of the entrepreneurial ecosystem and efforts to address gender-related barriers to business formation, growth, and entrepreneurship.¹⁹ The federal government is the largest purchaser of goods and services in the U.S., buying over \$550 billion worth of goods and services in FY 2019.^{20,21} Federal procurement policy can be a key element in the business ecosystem in which small businesses operate, including WOSBs, and can improve their survival and growth. Thus, policymakers have designed and implemented policies intended to reduce possible disparate treatment of businesses based on gender and race in accessing the government procurement market. There are numerous federal programs that assist small businesses, including WOSBs,

particularly by providing assistance with federal contracting opportunities.

Women-Owned Small Business Federal Contracting Program

The WOSB Program is one of several certification programs Congress has approved to provide greater opportunities for small businesses to compete in the federal marketplace. The impetus for the WOSB Program began in 1994 when Congress passed the Federal Acquisition Streamlining Act (FASA), which created a 5 percent government-wide goal of contracting with women-owned small businesses. Legislative language authorizing the WOSB Federal Contracting Program was initially in H.R. 4897, the Equity in Contracting for Women Act (ECWA) of 2000.^{22,23} Congressional interest in the WOSB Program has increased in recent years.²⁴

The WOSB Program is intended to redress what appears to be ongoing disparities

between WOSBs and other types of firms in access to federal procurement opportunities.²⁵ The purpose of the WOSB Program is to restrict competition to qualified WOSBs to increase “their success to compete for and win federal contracts” and ensure “a level playing field on which such small businesses can compete for Federal contracting opportunities.”²⁶ The WOSB Program also helps attain the federal government’s goal of awarding 5 percent of its prime contract dollars to WOSBs. The WOSB Program allows procurement officials to select an acquisition and to restrict competition to two types of firms, Economically Disadvantaged Women-Owned Small Businesses (EDWOSBs) and WOSBs. A procurement official can set aside an acquisition for restricted competition in a North American Industry Classification System (NAICS) industry code in which WOSBs and EDWOSBs were found to be “underrepresented” or “substantially underrepresented.”^{27,28,29,30,31}

DESCRIPTION OF THE EVALUATION

The Small Business Reauthorization Act of 2000 required the SBA to conduct a study to identify the industries characterized by underrepresentation or substantial underrepresentation of WOSBs in federal procurement.

The research objectives for the study required it to:

- Identify datasets and the data analyses methods.
- Obtain available datasets and perform data management and preparation.

- Analyze data to determine which industries include underrepresented and substantially underrepresented WOSBs.
- Separate the level of industry detail to the extent the data could support.
- Produce a report that details the methodology and results of the study.

The following describes the methods used to quantify the degree of WOSB underrepresentation in federal government contracting.

Disparity Ratios

The evaluation used the disparity ratio approach to estimate the representation of WOSBs in obtaining federal contracts. A disparity ratio measures the degree to which firms of a given type (e.g., women-owned) are represented in federal contracting in proportion to their

prevalence in the reference population. This measure of differences in access to federal contracts is the established, validated, and often used approach for disparity studies.^{32,33,34}

The disparity ratio is the ratio of two ratios:

Calculating the Disparity Ratio (Method 1)			
Utilization Ratio (U): $\frac{\text{\# of Contracts Awarded to WOSBs in an Industry}}{\text{Total \# of Contracts Awarded in an Industry}}$		Availability Ratio (A): $\frac{\text{\# of WOSBs in an Industry}}{\text{Total \# of Firms in an Industry}}$	
		÷	
Calculating the Disparity Ratio (Method 2)			
Utilization Ratio (U): $\frac{\text{Contract Obligations to WOSBs in an Industry}}{\text{Total Contract Obligations in an Industry}}$		Availability Ratio (A): $\frac{\text{\# of WOSBs in an Industry}}{\text{Total \# of Firms in an Industry}}$	
		÷	

If the disparity ratio is equal to 1.0, WOSBs are awarded contracts in the same proportion as their representation in the industry, and there is parity. If the ratio is greater than 1.0 or parity, WOSBs are overrepresented relative to their share of total businesses. If the ratio is less than 1.0, there is a disparity and WOSBs are

underrepresented as government contractors relative to their share of total businesses in the reference population. The study classified WOSBs' disparity (i.e., "substantially below parity" and "materially below parity" classifications) as follows (Table 1).^{35,36,37, 38}

Table 1. Disparity ratio thresholds

Disparity ratio from	Disparity ratio to	Description of the value
0	0.5	WOSBs are “substantially below parity” in federal procurement for the NAICS code
0.5	0.8	WOSBs are “materially below parity” in federal procurement for the NAICS code
0.8	1.2	WOSBs are “close to or at parity” in federal procurement for the NAICS code
1.2		WOSBs are “substantially above parity” for the NAICS code

Note: The SBA may update these thresholds in the future.

Issues with Estimating Availability Ratios

There are two approaches for calculating the availability ratio (i.e., the ratio of the number of WOSBs to the total number of firms in the population): 1) the first method calculates the share of WOSBs among the set of firms registered in the System for Award Management (SAM), and 2) the secondary method that calculates the share of WOSBs in the overall population of businesses in the United States.

The legal precedents for the use of “ready, willing, and able” in estimates of the availability of firms to use in measuring disparities arose from legal challenges to affirmative action programs.³⁹ These legal cases introduced the concept of firms that are “ready, willing, and able” to bid on and perform contracts when disparities are being evaluated.⁴⁰ The “ready, willing, and able” statement describes a party that is fully prepared to perform the services required under a contract. This characterization entails an analysis that goes beyond assuming that every firm in a particular market should be included in the availability determination and focuses on firms that could engage in contracting (i.e., registered in the SAM database).

However, the use of procurement lists as the defining measure of available firms is not considered to be the most reliable data by courts or experts. The main argument is that these lists can improperly exclude “ready, willing, and able” firms that are not on the list but should be when considering all available firms.⁴¹ This assumes barriers among certain types of businesses (e.g., women-owned) to apply for federal contracts. The disparity ratio might reflect that women business owners are less likely to bid on contracts, a factor which the study cannot detect if the pool of available firms consists only of firms that have demonstrated their interest to bid on contracts.⁴² Therefore, disparity studies often rely on an additional approach for calculating the availability ratio that involves using Census data or third-party data sources for firm counts in the overall population of businesses in the U.S.

This approach is based on the assumption that all businesses in the United States should be considered in calculating availability, regardless of whether or not the business chooses to compete for federal contracts. This approach provides an additional measure of availability that accounts for the differences in proportions of firms applying to bid on contracts and all available firms in particular industries

for certain types of firms such as WOSBs. Given these considerations, the evaluation conducted sensitivity analyses of the disparity results for both approaches to estimate the availability -- the population of businesses registered in SAM to conduct business with federal government and the overall population of businesses in the United States (see the Appendix C).

Issues with Estimating Utilization Ratios

The study measured the utilization ratio (the ratio of the contracts awarded to WOSBs to the contracts awarded overall) by using the Federal Procurement Data System (FPDS). However, there is evidence that FPDS has data quality and completeness issues. Previous studies and government audits noted the presence of outliers or extreme values in FPDS for the number and obligations of contracts, as well as invalid or missing NAICS codes.^{43,44,45,46}

These data issues could potentially affect the disparity results if there is a substantial difference in the completeness or accuracy of data among WOSBs relative to all other firms. For instance, if WOSBs have a higher rate of outliers for the obligations of awards than other firms, then the utilization ratio will be artificially increased resulting in reduced disparity findings. Thus, the evaluation conducted sensitivity analyses to detect the effect of data issues on the disparity results (Appendix C). The results suggested that the outliers did not substantially affect the disparity ratio results.

The study produced the disparity results for two measures of WOSBs' utilization of

federal procurement: 1) the number of contracts, and 2) the obligations of contracts. This accounted for the fact that underrepresentation can occur when WOSBs receive a relatively large number of contracts, but the awards are proportionally low value, as well as when WOSBs receive a relatively small number of high-value contract awards.

Issues with the Detailed Level of Industry

The study provided the disparity ratio results at the two-, three-, four-, and 6-digit NAICS codes for the population of firms registered in SAM to conduct business with federal government. The first two digits of the NAICS code designate the economic sector, the third digit designates the subsector, the fourth designates the industry group, the fifth designates the NAICS industry, and the sixth digit designates the national industry (specific to the United States, Canada, and Mexico). The rationale for estimating WOSBs' underrepresentation at the more detailed NAICS codes is that dissimilar businesses are more likely to be grouped together at higher levels (e.g., two-digit).

However, there is an issue with using the detailed NAICS codes. It is possible that conclusions regarding the WOSBs' underrepresentation might be unstable over time. In such industries, the disparity ratio may be unstable across multiple years because in any given year there may be no federal contract awards and in subsequent years there are awards. When calculating disparity ratios across multiple years, in this case 2016-2019, the average disparity ratio masks the variance or instability. To address this issue, we

conducted the power analyses to determine which industry disparity ratios are unstable (Appendix B). Based on the power analyses, the study identified industries with sufficiently stable disparity ratios and industries that had unstable disparity ratios. The study then conducted the sensitivity analyses comparing the result for the WOSB classifications based on the disparity ratios calculated for all NAICS codes vs. those in which the disparity ratios were stable (see the Appendix C).

Data Sources

The evaluation used the following secondary data sources to calculate the disparity ratios.

- *Federal Procurement Data System (FPDS) 2016-2019*. This is a single source for U.S. government-wide procurement data run by the U.S. General Services Administration. The relevant data elements included the date, number, and obligations of federal contracts awarded, as well as types of awards (e.g., set-aside, multiyear). We used these data to calculate the utilization ratios for the “ready, willing, and able” population.
- *System for Award Management (SAM) 2016-2019*. This is a government-wide data source that contains information for the characteristics of federal contractors and their businesses. The relevant data elements included the firm characteristics (e.g., six-digit NAICS codes), and the SBA certifications (e.g., WOSB). We used these data to calculate the availability ratios for the “ready, willing, and able” population.
- *Dun and Bradstreet Hoovers (D&B) 2020*. This database is notable for its Data Universal Numbering System (DUNS numbers); which are used as business identifiers to generate business information reports for more than 100 million companies around the globe. The relevant data elements included the owner’s gender, six-digit primary and secondary NAICS codes, the number of employees, and revenue/sales. We used these data to calculate the availability ratios for the overall population of firms in the United States.
- *Census Annual Business Survey (ABS) 2017*. This dataset is publicly available from the Census Bureau and contains data for the number of women-owned firms and all firms in the United States at the two-digit primary NAICS code.

We used these data to calculate the availability ratios for the overall population of firms in the United States.

RESULTS

The disparity ratio results identified the industries in which WOSBs were materially below parity or substantially below parity. The study classified industries as materially below parity when the WOSBs’ disparity ratio was between 0.5 and less than 0.8 and substantially below parity when the disparity ratio was less than 0.5. These thresholds could be revised in the future by the SBA.

The disparity ratios presented in the report also have the following specifications.

- We calculated the disparity ratios using FPDS data over four years (2016-2019) period to reduce the effect of annual fluctuations in the number and obligations of awards.
- For the population of “ready, willing, and able” firms registered in SAM, we based availability ratios on all NAICS codes for a firm to reflect the fact that firms can win awards in all of their selected NAICS codes and not just a primary NAICS code.
- We based the disparity ratios for the total population of firms in the U.S. by using 2017 Census ABS data for primary NAICS codes and 2020 D&B data for primary and secondary NAICS codes.
- The study omitted disparity ratio results for NAICS codes that are not eligible for federal contracts based on Federal Acquisition Regulations (FAR), including “5211 Monetary Authorities-Central Bank,” “8141 Private Households,” “55 Management of Companies and Enterprises,” “92 Public Administration,” “42 Wholesale Trade,” “44 Retail Trade,” and “45 Retail Trade.”

The report presents the disparity ratios results for all NAICS codes eligible for

federal procurement for both the number of awards and the obligations of awards, relative to the population of firms registered in SAM to conduct business with federal government in the 2016-2019 period.

WOSBs’ Representation for the Number of Awards

The disparity ratios for the number of awards in the 2016-2019 period at the two-digit NAICS code indicated 10.5 percent of industries in which WOSBs were materially below parity and an additional 89.5 percent of industries in which WOSBs were substantially below parity in 2016-2019 (Table 2). At the three-digit level, 16.0 percent of industries had WOSBs materially below parity and an additional 72.0 percent of industries had WOSBs substantially below parity for the number of awards. At the four-digit level, 18.5 percent of industries had WOSBs materially below parity and additional 66.9 percent of industries had WOSBs substantially below parity. At the six-digit level, 18.1 percent of industries had WOSBs materially below parity and additional 64.1 percent had WOSBs substantially below parity.

Table 2. WOSB federal procurement underrepresentation classification based on the number of awards among firms registered in SAM, by NAICS code level 2016-2019

WOSB Under-Representation (Number of Contracts)	Industries Applicable for Federal Awards (all disparity ratios)			
	six-digit	four-digit	three-digit	two-digit
Substantially above parity (disparity ratio ≥ 1.2)	50 5.6%	7 2.8%	1 1.3%	0 0.0%
Close to or at parity (disparity ratio ≥ 0.8 and < 1.2)	108 12.2%	30 11.8%	8 10.7%	0 0.0%
Materially below parity (disparity ratio < 0.8 and ≥ 0.5)	160 18.1%	47 18.5%	12 16.0%	2 10.5%
Substantially below parity (disparity ratio < 0.5)	568 64.1%	170 66.9%	54 72.0%	17 89.5%
TOTAL	886 100.0%	254 100.0%	75 100.0%	19 100.0%

Note: Disparity ratios were calculated for all NAICS codes eligible for federal procurement.

WOSBs' Representation for the Obligations of Awards

The disparity ratios for the obligations of awards in the 2016-2019 period at the two-digit NAICS code indicated 10.5 percent of industries (2 of 19) in which WOSBs were materially below parity and an additional 89.5 percent of industries (17 of 19) in which WOSBs were substantially below parity (Table 3). At the three-digit level,

10.7 percent of industries had WOSBs materially below parity and an additional 78.7 percent of industries had WOSBs substantially below parity. At the four-digit level, 11.0 percent of industries had WOSBs materially below parity and 79.5 percent of industries had WOSBs substantially below parity. At the six-digit level, 13.7 percent of industries had WOSBs materially below parity and 73.6 percent had WOSBs substantially below parity.

Table 3. WOSB federal procurement underrepresentation classification based on the obligations of awards among firms registered in SAM, by NAICS code level 2016-2019

WOSB Under-Representation (Obligations of Contracts)	Industries Applicable for Federal Awards (all disparity ratios)			
	six-digit	four-digit	three-digit	two-digit
Not calculated *	1 0.1%	0 0.0%	0 0.0%	0 0.0%
Substantially above parity (disparity ratio ≥ 1.2)	56 6.3%	11 4.3%	5 6.7%	0 0.0%
Close to or at parity (disparity ratio ≥ 0.8 and < 1.2)	56 6.3%	13 5.1%	3 4.0%	0 0.0%
Materially below parity (disparity ratio < 0.8 and ≥ 0.5)	121 13.7%	28 11.0%	8 10.7%	2 10.5%
Substantially below parity (disparity ratio < 0.5)	652 73.6%	202 79.5%	59 78.7%	17 89.5%
TOTAL	886 100.0%	254 100.0%	75 100.0%	19 100.0%

Note: Disparity ratios were calculated for all NAICS codes eligible for federal procurement.

Note *: Not calculated ratio involved the FPDS data indicating no WOSB awards and the SAM data indicating no WOSB firms.

Industry Case Studies

This section presents the descriptive results for some examples of the industries belonging to the five groups of WOSB representation in federal procurement based on the disparity ratio thresholds (See Appendix E). These industry case studies also include industries with unstable disparity ratios (Appendix B).

Industries in which WOSBs were "Substantially Below Parity"

Two examples of industries where WOSBs are substantially below parity: 1) Services for Elderly and Persons with Disabilities (624120); and 2) Satellite Telecommunications (517410).

Industries in which WOSBs were "Materially Below Parity"

Two examples of industries where WOSBs are materially below parity: 1) Support Activities for Forestry (115310); and 2) Convention and Trade Show Organizers (561920).

Industries in which WOSBs were "Close to or at Parity"

Four examples of industries where WOSBs are close to or at parity: 1) Commercial and Institutional Building Construction (236220); 2) Telephone Apparatus Manufacturing (334210); 3) Media Representatives (541840); and 4) Public Relations Agencies (541820).

Industries in which WOSBs were "Substantially Above Parity"

Two examples of industries where WOSBs are substantially above parity: 1) Freestanding Ambulatory Surgical and Emergency Centers (621493); and 2)

Hazardous Waste Treatment and Disposal (562211).

Industries with Unstable Disparity Ratios

Two examples of industries where industries have unstable disparity ratios: 1) Continuing Care Retirement Communities, (623311); and 2) Emergency and Other Relief Services (624230).

Sensitivity Analyses

The study conducted three types of sensitivity analyses: 1) for the disparity ratios relative to the overall population of firms in the United States, 2) for the disparity ratios that the power analyses indicated to be stable with respect to the annual fluctuations in the number or obligations of awards, and 3) for the extreme values in award obligations reported in the FPDS data (Appendix C).

Disparity Ratios Relative to the Overall Population of Firms in the United States

The main goal of the sensitivity analyses for the disparity ratios relative to the overall population of firms in the United States was to explore how the disparity ratios are being affected by changing the reference population for the availability ratios. The study used two data sources for the overall population of forms in the United States, the D&B database and the Census data.

Data issues with the D&B database prevented the accurate calculation of the disparity ratio results. The data limitations included the lack of annual data, the lack of a small business indicator, and data issues with the women-owned indicator and the business size (number of

employees and revenue) for calculating the small business status. The sensitivity analyses revealed that the D&B data severely underestimated the number of women-owned and small firms in the United States (Appendix C).⁵ The previous studies that used third-party data sources, including the D&B database, also noted issues with the information about business size and the ownership (e.g., women-owned businesses), sufficient to affect the estimates of availability of small and disadvantaged businesses.⁴⁷ As a result of the smaller WOSBs' availability ratios, the disparity ratios were severely inflated by the D&B data showing no WOSBs' underrepresentation in almost all of NAICS codes.

The 2017 Census data also had some limitations including the lack of the small business indicator, the information about business size (number of employees and revenue) for calculating the small business status, annual data, NAICS codes for firms' secondary and other industries, and detailed NAICS codes at more than a two-digit level. Thus, the study calculated the availability ratios based on the 2017 Census ABS data for women-owned businesses (small and other-than-small), whereas the utilization ratios were calculated for the WOSBs' awards.

Therefore, the disparity results based on Census data should be interpreted with caution due to Census data providing results for the women-owned firms, thus overestimating the population of WOSBs,

increasing the availability ratios, and indicating greater underrepresentation of WOSBs when compared to disparity ratios based on SAM data for WOSBs. The results of the analyses of Census data revealed that WOSBs were more underrepresented in reference to the overall population of firms in the United States than in reference to the population of firms registered in SAM to conduct business with the federal government in 2017.

Stable Disparity Ratios

As previously discussed, there is an issue with using the detailed NAICS codes. It is possible that conclusions regarding the WOSBs' underrepresentation might be unstable. To address this issue, we conducted the sensitivity analyses by comparing the results for the WOSB underrepresentation obtained for all NAICS codes to the results for the NAICS codes that the power analyses indicated to be stable (Appendix B). The results revealed that for six-digit NAICS codes, 200 (22.6 percent) were unstable for the obligation of awards and 257 (29.0 percent) were unstable for the number of awards (Appendix C). Among the 773 six-digit NAICS codes in which WOSBs were materially below parity or substantially below parity for the obligations of awards, the study found 153 (19.8 percent) to be unstable by the power analyses. Among the 728 six-digit NAICS codes in which WOSBs were materially below parity or substantially below parity for the number of awards, the study found 183 (25.1

⁵ The D&B data have no requirements for the firms to update their business size or report the women-owned status.

percent) to be unstable by the power analyses.

Extreme Values in the FPDS Data

The study conducted additional sensitivity analyses to explore how FPDS data quality and completeness issues with respect to the presence of outliers or extreme values for the value of contracts affected the disparity results. Another data issue involved the extreme value in the SAM for the small business revenue. Therefore, the study conducted the sensitivity of the disparity ratios to extreme values, by comparing the disparity results for the actual values of contracts and the trimmed values for the top and bottom 5 percent of contract awards obligations. Another sensitivity analysis deleted the firms if they reported annual revenue of more than \$1 billion in the SAM. The results of these sensitivity analyses revealed that the disparity and utilization ratios for the NAICS codes eligible for federal contracts were highly correlated for the raw and trimmed contract obligations values, as well as with and without firms that reported extreme revenues, suggesting that the disparity results were not greatly affected by the extreme values in the FPDS or SAM data.

CONCLUSIONS

Overall, the evaluation suggested that results regarding WOSBs' disparity in federal procurement depend on whether it was measured for: 1) the overall population of firms in the United States; 2) the firms registered in SAM to conduct business with federal government; 3) the number of awards; 4) the obligations of awards, or 5) the NAICS codes in which the

disparity ratios were found to be stable by the power analyses.

Among the firms registered in SAM to conduct business with federal government, most of the industries at the six-digit NAICS codes had WOSBs materially below parity or substantially below parity designations. The proportion of NAICS codes with WOSBs materially below parity or substantially below parity steadily increased at the higher aggregation of NAICS codes, with all NAICS codes being materially or substantially below parity at the two-digit level. However, the SAM database for the registered firms does not include firms that have been discouraged from, experience barriers, or have other reservations applying for government contracts.^{48,49} This underestimates the number of WOSBs in the "ready, willing, and able" population, reducing WOSBs' underrepresentation in federal contracting. Therefore, we measured the disparity ratios in reference to the overall population of firms to account for the issue of some WOSBs being less likely to register to bid on contracts. The findings that the WOSBs' underrepresentation was greater in reference to the overall population than for the registered firms was expected and suggested that the disparity ratios should be examined using both types of populations.

Unfortunately, data limitations of the secondary data sources prevented the comprehensive analyses of the WOSBs' underrepresentation in reference to the overall population. The D&B database had issues identifying WOSBs and could not be

used for the accurate calculation of the disparity ratios. The publicly available Census data also had limitations affecting the disparity results. It identified industries only at the two-digit industry-code level, and it is currently available for 2017 only.

Consistent with the previous studies, the study calculated the disparity ratios by using both obligations and number of awards approaches. This accounted for the fact that WOSBs' underrepresentation can occur when they receive a relatively large number of contracts, but the awards are proportionally low value, as well as when WOSBs receive a relatively small number of high-value awards. The results of the current evaluation revealed that WOSBs' underrepresentation was greater when the disparity was measured with respect to the obligations of awards than for the number of awards. These results supported the importance of using both measures of the disparity.

The study also conducted the sensitivity analyses by comparing the results for the WOSB underrepresentation obtained for NAICS codes to the results for the NAICS codes that the power analyses indicated to be stable. The results revealed that a proportion of NAICS codes in which WOSBs were materially below parity or substantially below parity were found to be unstable. The study found that about a quarter of six-digit NAICS codes had disparity ratios that were identified as unstable by the power analyses (Appendix C). These results suggest that the findings of NAICS codes in which WOSBs were materially below parity or substantially below parity should be interpreted with

caution, as some of these industries might not have stable disparity ratios over time and, in any given year, the disparity ratio could be above or below the established threshold.

Based on the results, the study provides the following recommendations for the future studies of the WOSBs' disparity. First, future studies should continue using the two measures of the WOSBs' disparity, the number of awards and the obligations of awards. Furthermore, the issue of the stability of the disparity ratios should be further explored, especially among industries with few or inconsistent number of contract awards. Future studies should also explore the use of the restricted Census data for the broader definition of the availability ratio based on the overall population of firms in the United States. However, these data are restricted for confidentiality reasons, and Census collaboration is required to produce the results. We recommend that future studies should use the Census Longitudinal Business Database (LBD) that includes microdata that would provide data at the three-, four-, and six-digit NAICS levels and could identify WOSBs.

This study includes public use data files and interactive Excel spreadsheets that provide both summary and detailed information on disparity results -- availability, utilization, and disparity ratios. These interactive Excel spreadsheets can be adjusted to alter the default threshold for materially below parity and substantially below parity industry designations.

Appendix A. Literature Review

Introduction

The number of women-owned businesses in the U.S. has been increasing over time and female entrepreneurs are important creators of jobs, innovation, and productivity to the national and local economy. From 1997 to 2017, the number of women-owned businesses has grown 114 percent compared to the overall national growth rate of 44 percent for all businesses. In 2017, women-owned businesses accounted for 39 percent of all U.S. firms, employed 8 percent of the total private sector workforce, and contributed 4 percent of total business revenues. As of January 2017, there are an estimated 11.6 million women-owned firms in the United States that employ nearly 9 million people and generate more than \$1.7 trillion in revenues.⁵⁰ Women-owned businesses alone were expected to contribute more than 5 million new jobs from 2010 to 2020.⁵¹

Although women-owned businesses have contributed significantly to the national economy, they still achieve far less than other types of businesses. Women-owned firms tend to be smaller than other types of firms, whether measured by the number of employees or the amount of revenue.⁵² They are also less likely to grow and are more likely to fail.⁵³⁻⁵⁴ Systemic gender-related barriers in business formation, growth, and entrepreneurship are well-documented in the literature. Women entrepreneurs face a wider variety and a greater severity of challenges in starting and growing their business ventures than men.⁵⁵⁻⁵⁶ Financial barriers represent one of the largest hurdles faced by women-

owned firms as they have less start-up capital, more difficulty securing loans through formal financial institutions, and less credit history.⁵⁷ Historically, they also have difficulties obtaining government contracts.⁵⁸ Between October 1, 2015 and September 30, 2016, only 4.8 percent of all federal prime contract spending had gone to certified WOSBs.⁵⁹

A finding that women-owned businesses are underrepresented in federal contracting could result from a number of barriers, including potential discrimination in federal contracting, lack of knowledge about or disinterest in government contracting, difficulties with federal certifications, smaller size, reduced capacities, and other unfavorable social, policy, and regulatory environments.⁶⁰ As women-owned firms are, on average, smaller than other types of firms, they retain fewer resources and capabilities with which to offset high administrative entrance costs associated with getting on federal bid lists, bidding for federal contracts, and to engage in supplying to government.⁶¹ The lack of access to information and limited contacts within government and business networks also impact women-owned firm's access to industry and contracting opportunities.⁶² Another factor accounting for the lower access to federal contracting among women is that women own more businesses in more crowded, competitive, and higher failure rates industry sectors such as other services.⁶³⁻⁶⁴ Furthermore, government agencies are prone to bundle contracts, purchase from larger firms, and procure from industries (manufacturing, defense, advanced technologies) outside

those sectors in which women tend to concentrate.⁶⁵

Government procurement in the United States accounts for 10 percent of gross domestic product and is therefore an important component of the entrepreneurial ecosystem and efforts to address gender-related barriers to business formation, growth, and entrepreneurship.⁶⁶ The federal government is the largest purchaser of goods and services in the United States, buying over \$425 billion worth of goods and services every year.⁶⁷ As such, federal procurement policy can be a key element in the ecosystem in which small businesses, including WOSBs, operate, and can improve business survival and growth of WOSBs.

The objective of this literature review is to assist in developing the design plan for the evaluation of the WOSB Program by describing the issues and mitigation strategies involved in measuring underrepresentation of WOSBs in access to federal contracts. The review first describes the Women-Owned Small Business Federal Contracting Program (WOSB Program) and its operations and eligibility criteria based on industries with underrepresentation of WOSBs. Then, it describes the methods used to identify WOSBs underrepresentation in access to federal contracts, issues and limitations of these methods, and mitigation strategies to address the issues. Finally, the review discusses how the previous studies approached measurement and interpretation of the results regarding

WOSBs underrepresentation in access to federal contracts.

Identifying Industries with Underrepresentation of WOSBs

The Small Business Reauthorization Act of 2000 required the SBA to conduct a study to identify the industries characterized by underrepresentation or substantial underrepresentation of WOSBs in federal procurement. However, it was only when the SBA issued the WOSB Program final rule on October 7, 2010, that the SBA completed the steps required of it by the ECWA. In the 2010 final rule, the SBA identified 83 eligible NAICS codes for WOSBs and 28 for EDWOSBs.⁶⁸ As of February 2019, there were a total of 113 NAICS codes eligible under the WOSB Program—92 eligible NAICS codes for WOSBs and 21 for EDWOSBs. According to SBA, as of early October 2018, there were 13,224 WOSBs and 4,488 EDWOSBs registered in SBA's online certification database.⁶⁹

There is a variety of measures used by the studies and program evaluations examining the gender, race/ethnicity, and other groups' differences in health, illness, socioeconomic, and other outcomes.⁷⁰⁻⁷¹ The most commonly used measures to quantify the degree of inequality in federal government contracting and business outcomes are disparity ratios and regressions.⁷²⁻⁷³ The regressions are often used to study discrimination and identify the correlates and reasons for disparities in the marketplace with respect to business formation, revenue, employment, financing, and other business outcomes.⁷⁴

(subcontracting plan, set-aside, multiyear, Indefinite Delivery Vehicle).

However, there is evidence that FPDS-NG has data quality and completeness issues. The previous study noted the presence of outliers or extreme values in both FPDS-NG and SAM for the number of employees, annual revenue, the number and value of contracts, as well as invalid or missing NAICS codes--necessitating data management and cleaning procedures.⁷⁵ Federal government audits also noted data issues with these sources. Federal Offices of Inspectors General (OIGs) audits that examined accuracy error rates based on testing of agency transactions found that most (48 of 51) OIGs reported an error rate for the accuracy of the agencies' submitted data. The data elements with errors included Period of Performance Start Date, for which six OIGs reported error rates greater than 40 percent; Potential Total Value of Award, for which 12 OIGs reported error rates greater than 20 percent; and Current Total Value of Award and Legal Entity Address, for which 10 or more OIGs reported error rates greater than 20 percent.⁷⁶ Similar findings were reported by the audit conducted by U.S. Department of Commerce Office of Inspector General for the first quarter of FY 2019. Data elements with completeness or accuracy error rates of over 20 percent were reported for such key data elements as period of performance start and end dates, potential total value of award, and current total value of award. NAICS codes had 7 percent accuracy errors.⁷⁷ Another audit conducted by the Treasury Inspector General for Tax Administration found the percentage of inaccuracies of at least 28

percent for primary place of performance address, potential total value of award, current total value of award, period of performance start and end dates, and action date.⁷⁸

These data issues could potentially affect the disparity results if there is a substantial difference in the completeness or accuracy error rates among WOSBs relative to all other firms. For instance, if WOSBs have a higher rate of missing data for the dollar amount of awards than other firms, then the utilization ratio will be artificially reduced resulting in larger disparity findings. Unfortunately, results for the accuracy of the data elements by business characteristics are unavailable. Thus, the disparity studies should examine the relative presence of outliers and missing data issues by gender to provide some inferences for the effect of data issues on the disparity results.

Issues with Measuring WOSBs

To calculate the disparity ratio, it is necessary to accurately identify WOSBs in multiple data sources. The SBA requires WOSBs to register in the SAM database before being eligible to compete for set-asides. Firms must also get certified as WOSBs or EDWOSBs to participate in SBA's program. To do so, "businesses must provide documents supporting their status..." including "copies of citizenship papers," and, depending on the type of business, "copies of partnership agreements or articles of incorporation."⁷⁹ WOSBs can also choose to receive certification through an authorized third-party certifier. In 2011, SBA approved four organizations to act as third-party

certifiers: (1) El Paso Hispanic Chamber of Commerce, (2) NWBOC (previously known as the National Women Business Owners Corporation), (3) U.S. Women's Chamber of Commerce, and (4) Women's Business Enterprise National Council. To become an SBA-approved third-party certifier, interested organizations submitted an application to SBA that contained information on the organization's structure and staff, policies and procedures for certification, and attestations that they will adhere to program requirements.⁸⁰ The initial costs associated with third-party assessment as an eligible women-owned enterprise ranges from \$250 to \$1,000 with annual renewal fees of \$100 to \$1,000.⁸¹

However, prior to 2020, WOBs were able to self-certify as a small business during their registration with the SBA and in the SAM database.⁸² There is evidence that self-certification led to fraudulent misrepresentation for businesses that are other than small, mistakes, costly bid protests, and millions of misappropriated spending dollars.⁸³⁻⁸⁴ Some contracts were awarded to ineligible businesses because, at the time, no statute required the SBA or COs to substantiate small business certifications before making an award. The U.S. Government Accountability Office (GAO) has reported that in 2012 and 2013, the "SBA found that more than 40 percent of businesses (that previously received contracts) it examined for program eligibility should not have attested they were WOSBs. Similarly, an SBA Inspector General report on WOSB set asides in 2015 found that from a sample of 34 set-aside awards, "[9] of these [34] were awarded to

firms that did not provide required documentation to prove they were eligible for WOSBP." Additionally, the report found that "[12] firms did not provide sufficient documentation to prove that a woman or women controlled the day-to-day operations of the firm". Furthermore, in a 2013 report, NASA's Office of Inspector General (OIG) found that, out of 20 contracts awarded to WOSBs, seven, or 35 percent, "were awarded to [six] different firms that may not have met the criteria for a woman-owned small business."⁸⁵

Research Findings: Disparities

The two previous SBA evaluations produced the disparity results and conclusions that were different due to the methodological distinctions. The SBA 2007 disparity study found that using the disparity ratio for the number of federal awards among all firms with paid employees operating in the United States, WOSBs were substantially underrepresented in utilities, manufacturing, transportation, information services, finance, real estate, professional services, education, health, accommodations, and other services. WOSBs were underrepresented in retail and administrative services. However, using the disparity ratios based on contract dollars among all U.S. firms resulted in WOSBs being underrepresented only in forestry and real estate and substantially underrepresented in transportation and other services. Thus, using dollars rather than number of contracts leads to a different conclusion about industries in which WOSBs were underrepresented, except in transportation and other services, results

for which were consistent across the various measures.⁸⁶

In contrast to the disparity results among all firms, among the population of firms that are ready, willing, and able to perform federal contracts, there was a widespread underrepresentation of WOSBs in government contracting, except in forestry and manufacturing. WOSBs were underrepresented in construction, wholesale trade, one retail trade subsector, real estate, health, arts, and accommodations. They were substantially underrepresented in utilities, one transportation subsector, information, finance, and educational services. WOSBs were at least underrepresented in one manufacturing subsector, one retail trade subsector, one transportation subsector, professional services, administrative services, and other services. However, disparity ratios based on contract dollars indicated no underrepresentation among ready, willing, and able firms.

In addition to the differences in disparity results due to the type of availability measure used, the results of the disparity studies are also affected by the small size of some detailed NAICS codes. The first two digits of the NAICS code designate the economic sector, the third digit designates the subsector, the fourth designates the industry group, the fifth designates the NAICS industry, and the sixth digit designates the national industry. The rationale for estimating disparity at the more detailed, more digits NAICS codes is that dissimilar businesses are more likely to be grouped together at higher levels of aggregation. However, even at the four-

digit level, some dissimilar firms are grouped together (e.g., cosmetology schools and flight-instruction schools).⁸⁷

The SBA 2007 disparity study suggested that there should be enough firms in the NAICS code to analyze and be reasonably sure that random chance did not explain the result.⁸⁸ For example, the disparity ratio may suggest no underrepresentation due to just one large WOSB contract; conversely, WOSBs may be legitimately underrepresented in some small size industries, but based on the small number of firms, it would be difficult to conclude that true representation was accurately captured. The 2007 study used power analysis calculations to determine which three- and four-digit industries had enough observations to be able to detect small mean differences between WOSBs and other firms. Based on the power analysis calculations the study suppressed disparity results for small industries. Results for the analysis of three-digit and four-digit NAICS codes revealed many more industries with underrepresentation when disparity is measured using number of contracts awarded rather than contract dollars awarded. However, only five industries showed underrepresentation of WOSBs when the disparity ratios based on contract dollars was used.⁸⁹

Another difference in disparity results emerged due to the differences in methodologies used. The SBA 2015 study used the regressions and significance testing to determine the industries with significant women-owned businesses underrepresentation, rather than calculating the disparity ratios.⁹⁰ The 2015 study examined the odds of women-owned businesses winning any federal

contract among ready, willing, and able firms by using the regression approach that controlled for size, type, ownership, number of employees, revenue, past performance ratings, and other business characteristics. This study produced a different set of disparity results for the analysis of four-digit NAICS codes than the SBA 2017 study that used the disparity ratios. The 2015 study found that overall, women-owned businesses were less likely to win contracts. Furthermore, women-owned businesses were smaller and younger than other businesses, but this accounted for only part of the disparity in the likelihood of winning contracts; even when controlling for firm characteristics, including firm size and age, women-owned businesses were less likely to win contracts than otherwise similar businesses not owned by women. There were 109 industries (36 percent of the total) in which women-owned businesses had statistically significant lower odds of winning contracts, covering 62 percent of contracts and nearly two-thirds of dollars obligated under contracts awarded in FY 2013 or FY 2014.⁹¹

However, conducting the large number of significance tests leads to at least several industries in which underrepresentation occurs just by chance. Furthermore, the use of statistical testing leads to industries with a large number of firms to have significant disparities with a small magnitude for the ratios (e.g., a ratio of 0.88); conversely, substantial disparities would not be significant for industries with a small number of firms. There is also an issue with suppressing disparity results for small industries, as this means that these

results will not be used by the SBA to promote contracting even though such industries may legitimately have disparities. This suggests that it might be more of a programmatic rather than statistical issue of whether small size industries with disparities should be counted or not.

Overall, these results of the disparity studies suggest that different results and conclusions will be obtained depending on whether the disparity is measured (1) for the overall population of firms; (2) for the firms that are ready, willing, and able; (3) with respect to the presence, the number, or amount of awards; and (4) using the ratio or regression methodologies. The SBA chose to measure disparity using both a dollars and a numbers approach because underrepresentation can occur when WOSBs receive a significant number of contracts, but the awards are proportionally *low-value*, as well as when WOSBs receive a relatively *small number* of contracts because a few large WOSBs receive high-value awards.⁹² Furthermore, both the overall population and the ready, willing, and able population were used by the disparity studies to address the issue of access barriers to federal contracting among WOSBs. The future disparity studies might also consider reporting the disparities for small-size industries but providing caveats to interpretation of these results. Providing detailed and comprehensive disparity results using different outcomes and both reference populations would be useful for the efforts to improve effectiveness of the WOSB Program and promote other efforts and interventions to address

underrepresentation of WOSBs in federal contracting.

Appendix B. Calculating Disparity Ratios

Data Management Procedures

The award start and end dates in the Federal Procurement Data System (FPDS) were used to identify awards by year for the study's time period of 2016-2019. The FPDS data from individual contract actions were aggregated into unique contracts based on the contract numbers in the file, excluding observations with invalid or missing NAICS codes. A unique contract award is defined in this study as a standalone contract award not associated with an Indefinite Delivery Vehicle (IDV). Individual task order awards under a single IDV or different IDVs are also counted as unique contract awards. The definition of unique contracts was operationalized differently for the different versions of the FPDS dataset.

- *FPDS-Next Generation:* concatenated the variables PIID, IDV_PIID, and IDV_REF_IDV_PIID in the Small Business Goaling Report (SBGR) version of the Federal Procurement Data System – Next Generation (FPDS-NG) dataset (to create Master_PIID) and applying the two filters:
TOTAL_SB_ACT_ELIGIBLE_DOLLARS is not equal to zero and
MODIFICATION_NUMBER is equal to zero.
- *Composite version of FPDS:* concatenated the variables ns1: PIID and ns1: PIID3 to create Master_PIID and applying the two filters: Obligated Dollars Amount is

not equal to zero and
MODIFICATION_NUMBER is equal to zero. Please note the dataset includes all dollars obligated.

To identify Woman Owned Small Business (WOSB) in the SAM data, a combination of two fields was used.

1. Woman-owned Status
'BUS_TYPE_STRING' which contains a string of keywords ('8A', '8W', '8E', '8C', '8D') for identifying women-owned businesses.
2. Small-business Status
'NAICS_CODE_STRING', which contains a "Y/N" flag for identifying small businesses.

Another data management issue involved removing duplicate records from SAM data. For firms that maintained entries for multiple establishments, only one entry was kept based on identifying the records that were identical (i.e., employment, revenue, start date) except for the location. Furthermore, fully duplicate records were removed. The firms that only competed for grants were also be removed. For the calculation of the disparity ratios, the NAICS codes with zero number of WOSBs in SAM were removed from the analyses, replicating the approach of the previous studies. For the calculation of the disparity ratios, the NAICS codes with negative dollar values of awards were also removed.

An additional data management procedure involved removing industries that are not eligible for federal contracts or

not used by SBA in determining the business size standards. The RAND study Department of Commerce study omitted the results for the 92 NAICS sector. Both studies omitted “5211 Monetary Authorities-Central Bank”, “8141 Private Households”, and “55 Management of Companies and Enterprises”. This study omitted “5211 Monetary Authorities-Central Bank”, “8141 Private Households”, “55 Management of Companies and Enterprises”, and “92 the Public Administration” NAICS industries. Furthermore, the study removed disparity ratios for “42 Wholesale Trade”, “44 Retail Trade”, and “45 Retail Trade” NAICS codes from the report. The SBA Table of Standards stated that these NAICS codes shall not be used to classify Government acquisitions for supplies. They also shall not be used by Federal government contractors when subcontracting for the acquisition for supplies. The applicable manufacturing NAICS code shall be used to classify acquisitions for supplies.

reported the disparity results for the 92 four-digit NAICS sector, whereas the 2016

Disparity Ratios

The study used the disparity ratio approach to estimate the representation of WOSBs in obtaining federal contracts. A disparity ratio measures the degree to which firms of a given type (e.g., women-owned) are represented in federal contracting in proportion to their prevalence in the reference population. This measure of differences in access to federal contracts is the established, validated, and often used methodology for disparity studies.⁶⁻⁷⁻⁸

The disparity ratio is calculated as the ratio of two ratios:

- (1) the utilization ratio (the number or the obligations of contracts awarded WOSBs divided by the contracts or the obligations awarded overall),
divided by
- (2) the availability ratio (the number of WOSBs divided by the total number of firms in the population).

⁶National Cancer Institute, National Institutes of Health. (2010). *Selected Comparisons of Measures of Health Disparities: A Review Using Databases Relevant to Healthy People 2010 Cancer-Related Objectives*. <https://seer.cancer.gov/publications/disparities2/>.

⁷Minnesota Department of Health, Center for Health Statistics, Division of Health Policy. (2009). *Health Disparities by Racial/Ethnic Populations in Minnesota*.

<https://www.health.state.mn.us/data/mchs/pubs/raceethn/rankingbyratio20032007.pdf>.

⁸National Research Council, Division of Behavioral and Social Sciences and Education, Committee on National Statistics, Steering Committee for the Workshop on Women-Owned Small Businesses in Federal Contracting. (2005). *Analyzing Information on Women-Owned Small Businesses in Federal Contracting*. Washington, DC: National Academies Press.

If the disparity ratio is equal to 1.0, WOSBs are awarded contracts in the same proportion as their representation in the industry, and there is parity. If the ratio is greater than 1.0 or parity, WOSBs are over-represented relative to their share of total businesses. If the ratio is less than 1.0, there is a disparity and WOSBs are underrepresented as government

contractors relative to their share of total businesses in the reference population. Based on the thresholds established and used by the SBA, the previous studies, and the Equal Employment Opportunity Commission's disparate impact guidelines, WOSBs's disparity was classified as follows (Table B-1).⁹⁻¹⁰⁻¹¹

Table B-1. Disparity ratio thresholds

Disparity Ratio From	Disparity Ratio To	Description of the value
0	0.5	WOSBs are "substantially below parity" in federal procurement
0.5	0.8	WOSBs are "materially below parity" in federal procurement
0.8	1.2	WOSBs are "close to or parity" in federal procurement
1.2		WOSBs are "substantially above parity"

Note: the SBA may update these thresholds in the future.

Power Analyses

It is possible that conclusions regarding the WOSBs' underrepresentation might be statistically unreliable or unstable over time. In such industries, the disparity ratio may be unreliable or unstable across multiple years because in any given year there may be no federal contract awards and in subsequent years there are awards. When calculating disparity ratios across multiple years, in this case 2016-2019, the average disparity ratio may mask the variance or instability. To address this issue, we conducted the power analyses to determine which industry disparity ratios are statistically unreliable or unstable. Based on the power analyses, the study

identified industries with sufficiently stable disparity ratios and industries that had unstable disparity ratios.

The SBA classifies the disparity ratio as: *materially below parity* when the WOSBs disparity ratio was between 0.5 and less than 0.8; and *substantially below parity* when the disparity ratio was less than 0.5. The power analyses assessed the disparity ratios' reliability relative to two default thresholds: 0.5 and 0.8. Thus, the power analyses approach provided inferences for the stability of a disparity ratio to being *materially below parity* or *substantially below parity*.

⁹Reardon, E., Nicosia, N., and Moore, N.Y. (2007). *The Utilization of Women-Owned Small Businesses in Federal Contracting*. Report prepared for the Small Business Administration. Santa Monica, CA: RAND Corporation.

¹⁰ National Research Council. 2005. *Analyzing Information on Women-Owned Small Businesses in Federal*

Contracting. Washington, DC: The National Academies Press. <https://doi.org/10.17226/11245>.

¹¹Reardon, E., Nicosia, N., and Moore, N.Y. (2007). *The Utilization of Women-Owned Small Businesses in Federal Contracting*. Report prepared for the Small Business Administration. Santa Monica, CA: RAND Corporation.

This involved the following steps for each two-, three-, four-, and six-digit NAICS codes.

1. Calculating the change in the utilization ratio that would make the disparity to be statistically reliably 0.80 ((0.8 x availability ratio) - utilization ratio)).
2. Calculating the change in the utilization ratio that would make the disparity to be statistically reliably 0.50 ((0.5 x availability ratio) - utilization ratio).
3. Calculating the new utilization ratio that would make the disparity to be statistically reliably between 0.80 and 0.50.
4. Creating an “unstable” flag for disparity ratios when the disparity ratio is not statistically reliable.
5. Creating an “stable” flag for disparity ratios when the disparity ratio is statistically reliable.

The previous study of WOSBs representativeness in federal contracting conducted the power analyses test for the two-sample equality of means to determine the minimum effect size that could be detected for each industry given the number of WOSBs and all other businesses in the population (SAM, D&B, and Census Annual Business Survey data sources), for a significance level of 0.05, and the power of 0.80. The t-test approach for the power analyses was chosen because the outcomes were conceptualized to be the number of awards and the dollar value of awards.¹²

Based on this power analyses, if the effect size produced by the power analyses for the given industry size was more than 0.20, the disparity ratio for this industry was deemed unreliable. In the social science literature, an effect size of 0.2 standard deviations is considered “small,” 0.5 is considered “medium,” and 0.8 is considered “large.” A practically significant effect entails a standardized effect size of 0.20. Thus, the effect size of 0.20 was used as a benchmark for the reliability of the disparity ratios.

However, we believe that there is an issue with conducting this power analyses for the two independent sample t-test. WOSBs and non-WOSBs should be conceptualized as one group, because if an award is not given to a WOSB, then it is given to a non-WOSB. This makes these groups dependent, and thus they are not actually two groups but rather one group (WOSBs and non-WOSBs) with an award success, effectively creating a 1x2 matrix. Therefore, we conducted the power analyses for the one proportion test. This approach to the power analyses examined the disparity ratios as the outcome and determined the extent to which the utilization ratio needs to change for the disparity ratio to become 0.80 or 0.50. This approach tests the reliability of the disparity ratio against the established thresholds, rather than examining the reliability of the difference in the number of awards among WOSBs and all other businesses in the population. Therefore, industries with relatively small sizes could be deemed to have reliable

¹² The utilization of women-owned small businesses in federal contracting (2007). Elaine Reardon, Nancy Nicosia, and Nancy Moore. The RAND Corporation.

disparity ratios if these ratios are very low and unlikely to reach the 0.80 threshold for underrepresentation or 0.50 threshold for substantial underrepresentation. We believe this approach provides a more valid representation of the WOSBs disparity than the approach that labels disparity ratios as unreliable based on an overall industry size.

The study also explored how the annual fluctuations in the disparity ratios differed for all NAICS codes and those in which the disparity ratios were found to be stable by the power analyses. The disparity ratios were calculated by year 2014-2016 and then the results were explored with respect to the reliability of the annual

Table B-2. Intercorrelations of all disparity ratios by year

	2014	2015	2016	2017	2018
2015	0.58	1.00			
2016	0.47	0.63	1.00		
2017	0.42	0.62	0.58	1.00	
2018	0.35	0.45	0.61	0.51	1.00
2019	0.26	0.33	0.44	0.45	0.72

The analyses also explored intercorrelations by year of the unreliable disparity ratios identified by the power analyses. The results supported the validity of the power analyses, as the unreliable disparity ratios were moderately correlated for one-year time period and became uncorrelated for the time period of more than two year (Table B-3). The results of these sensitivity analyses supported the importance of identifying the NAICS codes with unreliable disparity ratios.

results. There were moderately high intercorrelations among all of the disparity ratios (Table B-2). The magnitude of the correlations among years reduced drastically as the number of years increased, suggesting that the disparity ratios begin to change substantially as the time period increases. For the four- and five-years' time periods, the correlations decreased to being moderately small or small. These results supported the decision to use 2016-2019 time period for the calculation of the combined disparity ratios, which increased the statistical reliability and stability of the disparity findings.

Table B-3. Intercorrelations of unreliable disparity ratios by year

	2014	2015	2016	2017	2018
2015	0.30	1.00			
2016	0.22	0.49	1.00		
2017	-0.14	0.32	0.30	1.00	
2018	0.05	0.14	0.03	-0.03	1.00
2019	0.18	-0.02	-0.17	-0.17	0.62

The analyses explored intercorrelations by year of the reliable disparity ratios identified by the power analyses. The results further supported the validity of the power analyses as intercorrelations of reliable disparity ratios were much greater than intercorrelations of unreliable disparity ratios (Table B-4 vs Table B-3).

Table B-4. Intercorrelations of reliable disparity ratios by year

	2014	2015	2016	2017	2018
2015	0.64	1.00			
2016	0.59	0.59	1.00		
2017	0.52	0.52	0.65	1.00	
2018	0.46	0.48	0.54	0.61	1.00
2019	0.45	0.48	0.49	0.54	0.66

Appendix C. Technical Appendix – Sensitivity Analyses

The study conducted the sensitivity analyses to address the following issues.

- The use of the Census and D&B Data to calculate the availability ratios for the overall population of businesses in the U.S.
- The disparity ratio results for the firms registered to conduct business with the federal government vs. for all firms in the United States.
- The disparity ratio results for all NAICS Codes vs. those that were found to be stable by the power analyses.
- The effect of extreme values for the award obligations in FPDS data and revenues in SAM data on the disparity ratio results.

The Census and D&B Data for the Overall Population of Businesses

To calculate the disparity ratios in reference to the overall population of businesses in the U.S., the Census ABS and third-party (D&B) data source were used to calculate the availability ratio (the number

of WOSBs to the total number of firms in the population). The sensitivity analyses were conducted to explore the effect of the use of these data sources on the disparity ratio results.

The 2017 Census data had some limitations including the lack of the small business indicator, the information about business size (number of employees and revenue) for calculating the small business status, annual data, NAICS codes for firms' secondary and other industries, and detailed NAICS codes at more than a 2-digit level. Thus, the availability ratios based on the 2017 Census data were based on women-owned businesses (small and other-than-small), whereas the utilization ratios were calculated for the WOSBs awards. Therefore, the disparity results based on Census data should be interpreted with caution due to Census data providing results for the women-owned firms, thus over-estimating the population of WOSBs, increasing the availability ratios, and indicating greater underrepresentation of WOSBs when compared to disparity ratios based on SAM data for WOSBs. The availability ratios for the population using SAM were smaller than for the availability ratio based on the total population of firms in the United States using Census ABS data (Table C-1).

Table C-1. The WOSBs availability ratios in 2017 among SAM registered firms and the overall population of businesses in the United States.

NAICS	NAICS label	Total # of firms		Availability Ratio	
		SAM	Census	SAM	Census
11	Agriculture, Forestry, Fishing and Hunting	15,622	26,485	0.12	0.30
21	Mining, Quarrying, and Oil and Gas Extraction	8,478	18,087	0.13	0.27
22	Utilities	15,366	2,408	0.13	0.24
23	Construction	102,077	598,120	0.15	0.21
31-33	Manufacturing	146,202	257,081	0.14	0.26
48-49	Transportation and Warehousing	36,631	139,007	0.17	0.27
51	Information	43,828	66,132	0.20	0.25
52	Finance and Insurance	6,447	204,250	0.19	0.26
53	Real Estate and Rental and Leasing	36,694	271,888	0.12	0.36
54	Professional, Scientific, and Technical Services	170,237	753,336	0.22	0.30
56	Administrative and Support and Waste Management and Remediation Services	86,631	281,362	0.24	0.31
61	Educational Services	45,890	53,878	0.26	0.49
62	Health Care and Social Assistance	43,746	468,310	0.15	0.38
71	Arts, Entertainment, and Recreation	12,295	86,341	0.26	0.33
72	Accommodation and Food Services	14,290	415,757	0.12	0.33
81	Other Services (except Public Administration)	50,739	302,651	0.14	0.37

NOTE 1: Census data had 13,700 cases with not classified industry.

NOTE 2: The smaller Census population than SAM population for “Utilities” is due to SAM results being based on all NAICS and Census based on primary NAICS.

The D&B data also lacked the WOSBs flag but provided data for revenue and employment to calculate the small business status based on the SBA Table of Small Business Size Standards. The study relied on these data elements to identify WOSBs by using the SBA Table of Standards to determine the small size status of women-owned firms. The SBA determines if a business is small by comparing that business’s economic qualities (number of employees or average annual receipts) to size standards listed in the SBA’s Table of Small Business Size Standards.¹³ Businesses that exceed the applicable size standard for their primary industry do not meet the requirement of being small. However, the availability and

data quality for the revenues and employment at the firm level affected the results.

The study conducted the sensitivity analyses comparing the disparity results based on the Census ABS and D&B data sources. The results revealed substantial issues with the D&B data for identifying women-owned and small businesses. The number of WOSBs and the total population of firms were much greater in the D&B than in the Census data, however, the availability ratios were much smaller in the D&B (Table C-2). As a result of the smaller availability ratios, the WOSBs disparity ratios were much greater in the D&B.

¹³Small Business Runway Extension Act of 2018. P.L. 115-324, 132 Stat. 4444. 2018.

Table C-2. Comparison of Census and D&B data sources

NAICS	Availability Ratio		Number of WOSBs		Number of all firms		Disparity Ratio	
	Census	D&B	Census	D&B	Census	D&B	Census	D&B
72	0.33	0.04	138,333	58,089	415,757	1,326,515	0.29	2.17
56	0.31	0.05	88,120	148,395	281,362	2,965,700	0.56	3.50
11	0.30	0.04	7,846	25,115	26,485	665,836	0.31	2.43
71	0.33	0.04	28,691	25,619	86,341	588,722	0.46	3.52
23	0.21	0.03	127,439	77,763	598,120	2,468,202	0.71	4.77
61	0.49	0.05	26,195	28,983	53,878	621,147	0.24	2.53
52	0.26	0.02	52,869	31,930	204,250	1,415,663	0.10	1.17
62	0.38	0.06	175,640	134,467	468,310	2,352,211	0.20	1.31
51	0.25	0.04	16,720	23,715	66,132	632,831	0.12	0.81
31	0.26	0.07	67,440	72,615	257,081	1,035,858	0.34	1.28
21	0.27	0.03	4,873	1,325	18,087	48,571	0.35	3.46
81	0.37	0.05	111,359	143,690	302,651	3,058,886	0.20	1.60
54	0.30	0.07	223,257	248,556	753,336	3,536,123	0.36	1.51
53	0.36	0.03	98,679	52,090	271,888	1,690,246	0.21	2.44
44	0.33	0.06	187,821	170,021	561,381	2,763,065	0.03	0.16
48	0.27	0.03	36,965	32,295	139,007	984,957	0.15	1.19
22	0.24	0.01	578	1,176	2,408	80,084	0.13	2.10
42	0.26	0.04	68,752	66,519	266,877	1,799,891	0.13	0.90
TOTAL	0.31	0.04	1,461,577	1,342,363	4,773,351	28,034,508	0.27	2.05

Similar data issues were found comparing D&B and SAM data sources. The number of WOSBs and the total population of firms were much greater in the D&B than in the SAM data, however, the availability ratios were much smaller in the D&B (Table C-3). As a result of the smaller availability ratios,

the WOSBs disparity ratios were much greater in the D&B and most of the NAICS codes had no underrepresentation of WOSBs for the number of awards (74.2 percent for the six-digit and 81.8 percent for the two-digit).

Table C-3. Comparison of SAM and D&B data sources, across 6-digit NAICS

	SAM	D&B
Number of WOSBs	491,275	1,108,061
Number of all firms	2,331,764	23,813,292
Average of Availability Ratios	0.20	0.07
Average of Disparity Ratios	0.72	4.45

These findings suggest that the D&B data have issues with accurate identification of women-owned, small, and WOSBs. The business and owner characteristics are self-reported fields in the D&B data with no requirements for annual updates or data validation procedures. As a result, it seems that the women-own flag and revenue and employment fields were omitted or

misreported resulting in severe underreporting of small and women-owned businesses in the population. The previous studies that used third-party data including the D&B database also noted error in the information about business size (number of employees and revenue) and the ownership, sufficient to affect the results of computations of availability of

small and disadvantaged businesses.¹⁴ Given these issues, the disparity ratios were severely inflated by the D&B data, resulting in no WOSBs unrepresentativeness in most of NAICS

WOSBs Representation Among All Firms in the United States

The disparity ratios results were calculated for the number and the obligations of awards relative to the overall population of firms in the U.S. using the Census data. The main goal of these analyses was to explore how the disparity ratios are being affected by changing the reference population for the availability ratios. The results of the analyses of Census data revealed that WOSBs were more under-represented in reference to the overall population of firms in the United States than in reference to

codes. Thus, the study relied on the Census ABS data for presenting the disparity results for the overall population of firms in the U.S. The following section presents these results.

the population of firms registered in SAM to conduct business with federal government in 2017.

For the number of awards among the businesses registered in SAM population, 93.8 percent of industries had WOSBs materially or substantially below parity, while a 100 percent of industries had WOSBs materially or substantially below parity in reference to the overall population of firms in the U.S. (Table C-4).

Table C-4. The WOSBs disparity ratios for the number of awards in 2017 among firms registered in SAM and Census data for the overall population of businesses in the U.S.

NAICS code	Industry Name	Number of WOSB awards	Total # of awards	Disparity Ratio Number of Awards	
				SAM	Census
23	Construction	5,998	42,802	0.94	0.66
21	Mining, Quarrying, and Oil and Gas Extraction	144	1,798	0.64	0.30
54	Professional, Scientific, and Technical Services	14,016	109,621	0.57	0.43
56	Administrative and Support and Waste Management and Remediation Services	7,615	56,774	0.56	0.43
11	Agriculture, Forestry, Fishing and Hunting	1,003	16,219	0.51	0.21
72	Accommodation and Food Services	773	12,742	0.51	0.18
53	Real Estate and Rental and Leasing	952	18,316	0.45	0.14
61	Educational Services	1,651	14,152	0.45	0.24
81	Other Services (except Public Administration)	1,623	29,719	0.40	0.15
62	Health Care and Social Assistance	1,586	26,298	0.39	0.16
31-33	Manufacturing	107,907	2,098,718	0.36	0.20
71	Arts, Entertainment, and Recreation	193	2,037	0.36	0.29
48-49	Transportation and Warehousing	1,505	25,810	0.35	0.22
22	Utilities	132	3,836	0.27	0.14

¹⁴ Premier Quantitative Consulting, Inc. (2016). Contracting Barriers and Factors Affecting Minority Business Enterprises: A Review of Existing Disparity

Studies. Report prepared for Minority Business Development Agency.

NAICS code	Industry Name	Number of WOSB awards	Total # of awards	Disparity Ratio Number of Awards	
				SAM	Census
51	Information	1,317	38,749	0.17	0.13
52	Finance and Insurance	37	1,723	0.11	0.08
Materially below parity (disparity ratio < 0.8 and >= .5)				31.3%	6.3%
Substantially below parity (disparity ratio < 0.5)				62.5%	93.8%
Total below parity				93.8%	100.0%

For the obligations of awards, WOSBs were materially below parity in 18.8 percent of industries and substantially below parity in 81.3 percent of industries among the businesses registered in SAM (Table C-5).

Whereas, a 100 percent of industries had WOSBs materially or substantially below parity in reference to the U.S. population of firms.

Table C-5. The WOSBs disparity ratios for the obligations of awards in 2017 among firms registered in SAM and Census data for the overall population of businesses in the U.S.

NAICS code	Industry Name	Obligations of WOSB awards	Total obligations of all awards	Disparity Ratio Obligations of Awards	
				SAM	Census
11	Agriculture, Forestry, Fishing and Hunting	\$64,391,536	\$738,572,414	0.72	0.29
53	Real Estate and Rental and Leasing	\$138,113,577	\$1,722,955,679	0.69	0.22
23	Construction	\$2,414,436,630	\$32,715,658,763	0.49 ^A	0.35
21	Mining, Quarrying, and Oil and Gas Extraction	\$10,831,629	\$242,670,857	0.36	0.17
71	Arts, Entertainment, and Recreation	\$15,458,459	\$165,930,706	0.36	0.28
61	Educational Services	\$427,682,488	\$5,244,618,356	0.31	0.17
72	Accommodation and Food Services	\$55,270,120	\$1,544,867,833	0.30	0.11
62	Health Care and Social Assistance	\$485,855,672	\$12,671,292,631	0.25	0.10
81	Other Services (except Public Administration)	\$120,484,098	\$3,564,048,926	0.25	0.09
54	Professional, Scientific, and Technical Services	\$7,577,800,546	\$154,839,166,144	0.22	0.17
48-49	Transportation and Warehousing	\$581,249,259	\$20,261,440,212	0.17	0.11
51	Information	\$357,540,650	\$13,857,058,098	0.13	0.10
56	Administrative and Support and Waste Management and Remediation Services	\$1,459,700,306	\$48,548,691,880	0.12	0.10
31-33	Manufacturing	\$2,640,605,064	\$214,632,947,179	0.08	0.05
22	Utilities	\$13,535,250	\$2,170,185,714	0.05	0.03
52	Finance and Insurance	\$38,471,007	\$15,876,128,334	0.01	0.01
Materially below parity (disparity ratio < 0.8 and >= .5)				18.8%	0.0%
Substantially below parity (disparity ratio < 0.5)				81.3%	100.0%
Total below parity				100.0%	100.0%

NOTE: Yellow highlights industries with disparity ratios less than 0.8 and equal to or greater than 0.5 that are materially below parity; red highlights industries with disparity ratios less than 0.5 that are substantially below parity.

NOTE A: the disparity ratio was determined to be unstable, suggesting that small fluctuations in the obligations of WOSB awards could make the disparity ratio reach the threshold.

WOSBs Representation Among Stable NAICS Codes

It is possible that conclusions regarding the WOSBs underrepresentation might be unstable and may not accurately capture the true representation of WOSBs (Appendix B). To address this issue, we conducted the sensitivity analyses by comparing the results for the WOSB underrepresentation obtained for NAICS codes to the results for the NAICS codes that the power analyses indicated to be stable. The results revealed that for all six-digit NAICS codes, 200 (22.6 percent) were unstable for the obligation of awards and 257 (29.0 percent) were unstable for the number of awards. Among the 773 six-digit NAICS codes in which WOSBs were materially below parity or substantially below parity for the obligations of awards, 153 (19.8 percent) were found to be unstable by the power analyses. Among

the 728 six-digit NAICS codes in which WOSBs were materially below parity or substantially below parity for the number of awards, 183 (25.1 percent) were found to be unstable by the power analyses.

The following presents the results of the disparity ratios for the NAICS codes that were determined to be stable by the power analyses.

The disparity ratios for the number of awards in the 2016-2019 period at the 2-digit NAICS code indicated 31.6 percent of industries (6 of 19) in which WOSBs were materially below parity and additional 63.2 percent of industries (12 of 19) in which WOSBs were substantially below parity of WOSBs (Table C-6). The results also present the relative size of the industries with respect to the number of awards and the number of firms in the population registered to conduct business with federal government.

Table C-6. The WOSBs disparity ratios for the number of awards among firms registered in SAM for the 2-digit NAICS codes, 2016-2019

NAICS code	Industry Name	Number of WOSB awards	Total number of all awards	Number of WOSBs in SAM	Number of all firms in SAM	Disparity Ratio
23	Construction	23,392	167,026	24,192	149,649	0.87
11	Agriculture, Forestry, Fishing and Hunting	4,320	49,915	3,053	22,493	0.64
21	Mining	530	6,377	1,616	11,773	0.61
33	Manufacturing	319,053	3,930,872	18,970	132,457	0.57
56	Administrative and Support and Waste Management and Remediation Services	29,042	204,815	32,708	126,727	0.55
54	Professional, Scientific, and Technical Services	55,273	426,834	57,994	241,809	0.54
72	Accommodation and Food Services	3,532	47,963	3,156	22,507	0.53
53	Real Estate Rental and Leasing	4,108	64,994	6,700	50,141	0.47
61	Educational Services	5,536	49,021	18,934	67,736	0.40
71	Arts, Entertainment, and Recreation	777	7,516	5,358	19,257	0.37
62	Health Care and Social Assistance	6,302	95,162	11,728	64,578	0.36
81	Other Services (except Public Administration)	5,521	98,380	12,207	78,064	0.36
48	Transportation and Warehousing	4,783	85,892	7,742	41,588	0.30

NAICS code	Industry Name	Number of WOSB awards	Total number of all awards	Number of WOSBs in SAM	Number of all firms in SAM	Disparity Ratio
22	Utilities	505	15,441	2,923	21,412	0.24
32	Manufacturing	79,628	1,955,650	8,124	45,848	0.23
51	Information	4,601	139,981	13,197	62,584	0.16
52	Finance and Insurance	143	6,534	2,132	9,817	0.10
31	Manufacturing	25,904	1,208,314	4,602	19,141	0.09
49	Transportation and Warehousing	351	29,319	2,557	12,748	0.06

NOTE: Yellow highlights industries with disparity ratios less than 0.8 and equal to or greater than 0.5 that are materially below parity; red highlights industries with disparity ratios less than 0.5 that are substantially below parity.

At the three-digit level, 22.7 percent of industries had WOSBs materially below parity and an additional 60.0 percent of industries had WOSBs substantially below parity for the number of awards in 2016-2019 (Table C-7). At the four-digit level, 23.2 percent of industries had WOSBs materially below parity and additional 52.8

percent of industries had WOSBs substantially below parity. At the six-digit level, 22.7 percent of industries had WOSBs materially below parity and additional 38.8 percent had WOSBs substantially below parity.

Table C-7. WOSB federal procurement underrepresentation based on the number of awards among firms registered in SAM, by NAICS codes level 2016-2019

WOSB Underrepresentation (Number of Contracts)	Industries Applicable for Federal Awards (stable disparity ratios)			
	6-Digit	4-Digit	3-Digit	2-Digit
Unstable	257	38	8	0
	29.0%	15.0%	10.7%	0.0%
Close to, at, or above parity (disparity ratio ≥ 0.8)	84	23	5	1
	9.5%	9.1%	6.7%	5.3%
Materially below parity (disparity ratio < 0.8 and ≥ 0.5)	201	59	17	6
	22.7%	23.2%	22.7%	31.6%
Substantially below parity (disparity ratio < 0.5)	344	134	45	12
	38.8%	52.8%	60.0%	63.2%
TOTAL	886	254	75	19
	100.0%	100.0%	100.0%	100.0%

The disparity ratios for the obligations of awards in the 2016-2019 period at the two-digit NAICS code indicated 10.5 percent of industries (2 of 19) in which WOSBs were

materially below parity and an additional 89.5 percent of industries (17 of 19) in which WOSBs were substantially below parity (Table C-8).

Table C-8. The WOSBs disparity ratio for the obligations of awards among firms registered in SAM for the 2-digit NAICS codes, 2016-2019

NAICS code	Industry Name	Obligations of WOSB awards	Total obligations of all awards	Number of WOSBs in SAM	Number of all firms in SAM	Disparity Ratio
11	Agriculture, Forestry, Fishing and Hunting	\$280,957,123	\$2,725,837,389	3,053	22,493	0.76
53	Real Estate Rental and Leasing	\$531,260,620	\$5,906,887,558	6,700	50,141	0.67
23	Construction	\$10,866,270,006	\$147,171,000,000	24,192	149,649	0.46
71	Arts, Entertainment, and Recreation	\$97,695,684	\$813,023,557	5,358	19,257	0.43
21	Mining	\$59,230,150	\$1,035,793,272	1,616	11,773	0.42
72	Accommodation and Food Services	\$283,895,721	\$6,276,397,348	3,156	22,507	0.32
61	Educational Services	\$1,551,239,296	\$20,708,681,546	18,934	67,736	0.27
62	Health Care and Social Assistance	\$2,098,747,553	\$44,349,558,694	11,728	64,578	0.26
54	Professional, Scientific, and Technical Services	\$33,463,928,560	\$675,725,000,000	57,994	241,809	0.21
49	Transportation and Warehousing	\$247,117,225	\$6,090,581,474	2,557	12,748	0.20
81	Other Services (except Public Administration)	\$484,492,356	\$15,680,697,495	12,207	78,064	0.20
31	Manufacturing	\$995,512,689	\$27,317,184,868	4,602	19,141	0.15
51	Information	\$1,505,912,597	\$55,740,739,687	13,197	62,584	0.13
56	Administrative and Support and Waste Management and Remediation Services	\$6,439,281,471	\$208,609,000,000	32,708	126,727	0.12
48	Transportation and Warehousing	\$1,599,282,365	\$76,402,450,894	7,742	41,588	0.11
33	Manufacturing	\$8,393,358,880	\$728,127,000,000	18,970	132,457	0.08
32	Manufacturing	\$884,959,580	\$89,524,051,566	8,124	45,848	0.06
22	Utilities	\$58,086,510	\$8,759,310,008	2,923	21,412	0.05
52	Finance and Insurance	\$134,567,525	\$64,229,584,330	2,132	9,817	0.01

NOTE: Yellow highlights industries with disparity ratios less than 0.8 and equal to or greater than 0.5 that are materially below parity; red highlights industries with disparity ratios less than 0.5 that are substantially below parity.

At the three-digit level, 16.0 percent of industries had WOSBs materially below parity and an additional 70.7 percent of industries had WOSBs substantially below parity (Table C-9). At the four-digit level, 16.5 percent of industries had WOSBs materially below parity and 67.7 percent of

industries had WOSBs substantially below parity. At the six-digit level, 17.3 percent of industries had WOSBs materially below parity and 52.7 percent had WOSBs substantially below parity.

Table C-9. WOSB federal procurement underrepresentation based on the obligations of awards among firms registered in SAM, by NAICS codes level 2016-2019

WOSB Underrepresentation (Obligations of Contracts)	Industries Applicable for Federal Awards (stable disparity ratios)			
	6-Digit	4-Digit	3-Digit	2-Digit
Not calculated *	1	0	0	0
	0.1%	0.0%	0.0%	0.0%
Unstable	200	20	2	0
	22.6%	7.9%	2.7%	0.0%
Close to, at, or above parity (disparity ratio ≥ 0.8)	65	20	8	0
	7.3%	7.9%	10.7%	0.0%
Materially below parity (disparity ratio < 0.8 and ≥ 0.5)	153	42	12	2
	17.3%	16.5%	16.0%	10.5%
Substantially below parity (disparity ratio < 0.5)	467	172	53	17
	52.7%	67.7%	70.7%	89.5%
TOTAL	886	254	75	19
	100.0%	100.0%	100.0%	100.0%

Note *: Not calculated ratio involved the FPDS data indicating no WOSB awards and the SAM data indicating no WOSB firms.

Sensitivity Analyses for FPDS and SAM Extreme Values

Additional sensitivity analyses were conducted to further explore how FPDS data quality and completeness issues with respect to the presence of outliers or extreme values for the value of contracts. Furthermore, based on the approach for identifying unique contracts, there was a potential issue with the contract actions for each contract. In some cases, individual actions referred to multiyear contracts or revisions to earlier contracts. This might have led to errors in summing to the contract level, such as negative dollar amounts, zeros, or very large contract values. Therefore, the study conducted the sensitivity of the disparity ratios to extreme values, by comparing the disparity results for the actual values of contracts and the trimmed values for the top and

bottom 5 percent of contract awards dollar values. Another data issue involved the extreme value in the SAM for revenue. The firms were deleted from the analyses if they reported in the SAM annual revenue of more than \$1 billion.

The study conducted the sensitivity analyses to extreme values at the six-digit NAICS codes, by comparing the disparity and utilization ratios based on the following: 1) the actual dollar values of contracts (raw), and 2) the trimmed extreme values for the top and bottom 5 percent of contract awards dollar values (relative), 3) the removal of firms with more than \$1 billion revenue (absolute). The results revealed that the disparity and utilization ratios for the NAICS codes eligible for federal contracts were highly correlated for the raw and trimmed values.

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