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CHAPTER 7: REGRESSION AND PRIVATE SECTOR ANALYSIS

I. INTRODUCTION

Private sector business practices which are not subject to government minority and woman-owned business enterprise (M/WBE) or disadvantaged business enterprise (DBE) requirements are indicators of marketplace conditions that could adversely affect the formation and growth of M/WBEs, thereby depressing the current availability of M/WBEs. *Concrete Works of Colorado v. City of Denver (Concrete Works II)*[1] sets forth a framework for considering a passive participant model for an analysis of discrimination in private sector business practices. In accordance with *Concrete Works II*, regression analyses were conducted to examine three outcome variables—business ownership rates, business earnings, and business loan approval. Each regression analysis compared minority group members[2] and Caucasian females to Caucasian males by controlling for race and gender-neutral explanatory variables such as age, education, marital status, and access to capital. The impact of the explanatory variables on the outcome variables is described in this chapter. These findings elucidate the socio-economic conditions in Metro's market area that should be considered when measuring the relative availability of M/WBEs and Caucasian male-owned businesses.

The U.S. Census Public Use Microdata Sample (PUMS) data was used to compare minority and Caucasian females' probability of owning a business to the probability of Caucasian males owning a business. Logistic regression was used to determine if race and gender have a statistically significant effect on the probability of business ownership. The PUMS data was also used to compare the business earnings of M/WBEs to Caucasian male-owned businesses. An Ordinary Least Squares (OLS) regression was utilized to analyze the PUMS data for disparities in business earnings after controlling for race and gender-neutral factors. The Federal Reserve Board's National Survey of Small Business Finances (NSSBF) dataset was used to compare M/WBEs' business loan approval probabilities to Caucasian male-owned businesses' loan approval probabilities, while controlling for other business explanatory variables.

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[1]   Concrete Works of Colo., Inc. v. City of Denver, *86 F. Supp. 2d 1042, 1073 (D. Colo. 2000), rev'd on other grounds, 321 F.3d 950 (10th Cir. 2003), cert. denied, 540 U.S. 1027 (2003).*

[2]   *Minority group members include both males and females.*

The applicable limits of the private sector discrimination findings are set forth in *Builders Association of Greater Chicago v. City of Chicago*[3] *(City of Chicago)*, where the court established that even when there is evidence of private sector discrimination, the findings cannot be used as the factual predicate for a government-sponsored, race-conscious M/WBE or DBE program unless there is a nexus between the private sector data and the public agency actions. The private sector findings, however, can be used to develop race-neutral programs to address barriers to the formation and development of M/WBEs. The findings can be applied in the Step Two phase of DBE goal setting. Given the case law, caution must be exercised in the interpretation and application of the regression findings. Case law regarding the application of private sector discrimination is discussed below in detail.

II. LEGAL ANALYSIS

A. Passive Discrimination

The controlling legal precedent set forth in the 1989 *City of Richmond v. J.A. Croson Co.*[4] decision authorized state and local governments to remedy discrimination in the award of subcontracts by its prime contractors on the grounds that the government cannot be a "passive participant" in such discrimination. In January 2003 *Concrete Works II* and *City of Chicago* extended the private sector analysis to the investigation of discriminatory barriers that M/WBEs encountered in the formation and development of businesses and their consequence for state and local remedial programs. *Concrete Works II* set forth a framework for considering such private sector discrimination as a passive participant model for analysis. However, the obligation of presenting an appropriate nexus between the government remedy and the private sector discrimination was first addressed in *City of Chicago*.

The Tenth Circuit Court decided in *Concrete Works II* that business activities conducted in the private sector, if within the government's market area, are also appropriate areas to explore the issue of passive participation. However, the appropriateness of the City's remedy, given the finding of private sector discrimination, was not at issue before the court. The question before the court was whether sufficient facts existed to determine if the private sector business practices under consideration constituted discrimination. For technical legal reasons,[5] the court did not examine whether a consequent public sector remedy, i.e., one involving a goal requirement on the City of Denver's contracts, was "narrowly tailored" or otherwise supported by the City's private sector findings of discrimination.

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[3]   Builders Association of Greater Chicago v. City of Chicago, *298 F.Supp.2d 725 (N.D. Ill. 2003).*

[4]   *488 U.S. 469 (1989).*

[5]   *Plaintiff had not preserved the issue on appeal. Therefore, it was no longer part of the case.*

B.   Narrow Tailoring

The question of whether a particular public sector remedy is narrowly tailored when it is based solely on business practices within the private sector was at issue in *City of Chicago*. *City of Chicago*, decided ten months after *Concrete Works II*, found that certain private sector business practices constituted discrimination against minorities in the Chicago market area. However, the District Court did not find the City of Chicago's M/WBE subcontracting goal to be a remedy "narrowly tailored" to address the documented private sector discriminatory business practices that had been discovered within the City's market area. The court explicitly stated that certain discriminatory business practices documented by regression analyses constituted private sector discrimination. It is also notable that the documented discriminatory business practices reviewed by the court in the *City of Chicago* were similar to those reviewed in *Concrete Works II*. Notwithstanding the fact that discrimination in the City of Chicago's market area was documented, the court determined that the evidence was insufficient to support the City's race-based subcontracting goals. The court ordered an injunction to invalidate the City of Chicago's race-based program.

We note the following statements from that opinion:

> Racial preferences are, by their nature, highly suspect, and they cannot be used to benefit one group that, by definition, is not either individually or collectively the present victim of discrimination. There may well also be (and the evidence suggests that there are) minorities and women who do not enter the industry because they perceive barriers to entry. If there is none, and their perception is in error, that false perception cannot be used to provide additional opportunities to M/WBEs already in the market to the detriment of other firms who, again by definition, neither individually nor collectively are engaged in discriminatory practices.[6]

> Given these distortions of the market and these barriers, is the City's program narrowly tailored as a remedy? It is here that I believe the program fails.There is no "meaningful individualized review" of M/WBEs, *Gratz v. Bollinger*, 539 U.S. 244, 156 L. Ed. 2d 257, 123 S.Ct. 2411, 2431 (2003) (Justice O'Connor concurring). Chicago's program is more expansive and more rigid than plans that have been sustained by the courts. It has no termination date, nor has it any means for determining a termination date. The 'graduation' revenue amount is very high, $27,500,000, and very few have graduated. There is no net worth threshold. A third-generation Japanese-American from a wealthy family, with a graduate degree from MIT, qualifies (and an Iraqi immigrant does not). Waivers are rarely or never granted on construction contracts, but "regarding the availability of waivers is of particular importance... a 'rigid

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[6]   Builders Association of Greater Chicago v. City of Chicago, *298 F.Supp.2d 725 (N.D. Ill. 2003).*

numerical quota' particularly disserves the cause of narrow tailoring" *Adarand Constructors v. Slater*, *supra*, at 1177. The City's program is "rigid numerical quota," a quota not related to the number of available, willing and able firms but to concepts of how many of those firms there should be. Formalistic points did not survive strict scrutiny in *Gratz v. Bollinger*, *supra*, and formalistic percentages cannot survive scrutiny.[7]

C.   Capacity to Perform Contracts

The federal circuit appellate decision in *Rothe Development Corp. v. U.S. Department of Defense*[8] involved the issue of capacity. There were two earlier appeals prior to the appellate court's holding in November 2008 that the Department of Defense's (DOD) small disadvantaged business program was unconstitutional on its face.

One of the arguments proffered by *Rothe* on appeal was that the district court erred by relying on six disparity studies that failed to establish that the DOD played any role in the discriminatory exclusion of minority-owned contractors.

The court acknowledged that two of the studies relied upon by Congress attempted to deal with capacity. The New York City study limited prime contracts to those valued at $1 million and under, and the firms in the Dallas study had a "demonstrated capacity to win large competitively bid contracts." Thus, the court concluded that several studies that were relied upon demonstrated that the firms had the capacity to perform a contract. The court expressed an additional concern as to whether the firms could do *more than one contract a time* and deduced that a regression analysis was recommended as the corrective for going forward.[9]

Caution should also be exercised when determining which minority or gender group is appropriate for race-conscious or gender-conscious remedies. For a local government's M/WBE program to be narrowly tailored there must be a statistical finding that available minority subcontractors are underutilized. Where the underutilization of a minority group is not found to be statistically significant, the minority group should not be included in race-conscious remedies.[10]

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[7]   Id.

[8]   *545 F.3d 1023 (Fed. Cir. 2008).*

[9]   Id.

[10]   H.B. Rowe Company v. Tippett, *615 F.3d 233, Court of Appeals, Fourth Circuit (N.C.), July 22, 2010 (NO. 09-1050). The* Rowe *Court also ruled that statistical evidence of overutilization of women business enterprises that is not statistically significant is sufficient factual predicate for gender-based remedies.*

D.   Conclusion

As established in *City of Chicago*, private sector discrimination cannot be used as the factual basis for a government sponsored, race-based M/WBE program without a nexus to the government's actions. Therefore, the discrimination that might be revealed in the regression analysis is not a sufficient factual predicate for a Metro race-based M/WBE Program unless a nexus is established between Metro and the private sector data. These economic indicators, albeit not a measure of passive discrimination, are illustrative of private sector discrimination and can support Metro-sponsored, race-neutral programs.

III. REGRESSION ANALYSIS METHODOLOGY

A regression analysis is the methodology employed to ascertain whether there are private sector economic indicators of discrimination in Metro's market area that could impact the formation and development of M/WBEs. The three regression analyses focus on the construction, goods and services, miscellaneous and other professional services, and architecture and engineering industries. The data sets used for the regression analyses did not allow for an exact match of the industries used in Metro's Disparity Study. Therefore, the four industries were selected to most closely mirror the industries used in Metro's Study.

As noted, three separate regression analyses are used. They are the Business Ownership Analysis, the Earnings Disparity Analysis, and the Business Loan Approval Analysis. All analyses takes into consideration race and gender-neutral factors, such as age, education, and creditworthiness in assessing whether the explanatory factors examined are disproportionately affecting minorities and females when compared to similarly situated Caucasian males.

IV. DATASETS ANALYZED

The 2008, 2009, and 2010 PUMS datasets produced by the United States Census Bureau were compiled and used to analyze business ownership and earnings disparities within the Greater Los Angeles Area. The counties encompassing the Greater Los Angeles Area, which are the same as the Census's Los Angeles Metropolitan Statistical Area, are Los Angeles, Ventura, San Bernardino, Orange, and Riverside. It is important to note that the Greater Los Angeles Area is different from the Disparity Study's market area, which is limited to just Los Angeles County, because it was necessary to increase data size to conduct valid regression analyses. The data for each county was identified using Public Use Microdata Areas (PUMA), a variable within the PUMS dataset that reports data for counties within states. The dataset includes information on personal profile, industry, work characteristics, and family structure. The PUMS data allowed for an analysis by an individual's race and gender.

The 2003 NSSBF was utilized to examine business loan approval rates in the Business Loan Approval Analysis. The NSSBF data set contains observations for business and owner characteristics, including the business owner's credit and resources and the business's credit and financial health. The NSSBF records the geographic location of the business by Census Division, instead of city, county, or state. While the NSSBF data is available by Census Division, the Pacific subdivision containing the State of California lacked sufficient data to perform an accurate regression analysis by minority status, gender, and industry. Therefore, the sampling region was expanded to the West Region, which includes Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

The 2003 NSSBF contains the most recent available data on access to credit for the West Region. The data set allowed for an analysis of all minority groups combined by industry within the 13 state region.

V. REGRESSION MODELS DEFINED

A.   Business Ownership Analysis

The Business Ownership Analysis examines the relationship between the probability of being a business owner and independent socio-economic variables. Business ownership, the dependent variable, includes business owners of incorporated and non-incorporated firms. The business ownership variable utilizes two values. A value of "1" indicates that a person is a business owner, whereas a value of "0" indicates that a person is not a business owner. When the dependent variable is defined this way, it is called a binary variable.[11] In this case a logistic regression model is utilized to predict the probability of business ownership using independent socio-economic variables. Four logistic models are run to predict the probability of business ownership in each of the four industries examined in Metro's Disparity Study. Categories of the independent variables analyzed include educational level, citizenship status, personal characteristics, and race/gender.

In the table below a finding of disparity is denoted by an asterisk (*) when the independent variable is significant at or above the 95 percent level. A finding of disparity indicates that there is a non-random relationship between the probability of owning a business and the independent variable. Tables of regression results indicate the sine of each variable's coefficient from the regression output. If the coefficient sine is positive, it indicates that there is a positive relationship between the dependent variable and that independent variable. For example, having an advanced degree is positively related to the probability of being a business owner, holding all other variables constant. If the

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[11] *In this case, the standard Ordinary Least Squares (OLS) Regression model cannot be employed and a Logistic model is utilized to predict the probability of business ownership.*

coefficient sine for the independent variable is negative, this implies an inverse relationship between the dependent variable and that independent variable. For instance, an individual with children under the age of six has a lower probability of owning a business, holding all other variables constant.

For each of the four industries the Logistic regression is used to identify the probability that an individual owns a business given his or her background including race, gender, and race and gender-neutral factors. The dependent variables in all regressions are binary variables coded as "1" for individuals who are self-employed and "0" for individuals who are not self-employed.[12] Table 7.01 presents the independent variables used for the Business Ownership Analysis.

Table 7.01: Independent Variables Used in the Business Ownership Analysis

Personal Characteristics	Educational Attainment	Race	Gender
Age Home Ownership and Value Marital Status Speaking English at Home Number of Children under the Age of Six in the Household Marital Status	Bachelor's Degree Advanced Degree	African American Asian Pacific American Subcontinent Asian American Hispanic American Native American Other Minority Group[13]	Female

B.   The Earnings Disparity Analysis

The Earnings Disparity Analysis examines the relationship between the annual self-employment income and independent socio-economic variables. "Wages" are defined as the individual's total dollar income earned in the previous twelve months. Categories of independent socio-economic variables analyzed include educational level, citizenship status, personal characteristics, business characteristics, and race/gender.

All of the independent variables are regressed against wages in an Ordinary Least Squares (OLS) regression model. The OLS model estimates a linear relationship between the independent variables and the dependent variable. This multivariate regression model estimates a line similar to the standard $y = mx + b$ format but with additional independent variables. The mathematical purpose of a regression analysis is to estimate a best-fit line for the model and assess which findings are statistically significant.

In the table below a finding of disparity is denoted by an asterisk (*) when an independent variable is significant at or above the 95 percent level. A finding of disparity indicates that there is a non-random relationship between wages and the independent variable. Tables of regression results indicate the sine of each variable's coefficient from

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[12]   Note: The terms "business owner" and "self-employed" are used interchangeably throughout the chapter.

[13]   Other Minority includes individuals who belong to two or more racial groups.

the regression output. If the coefficient sine is positive, it means there is a positive relationship between the dependent variable and that independent variable. For example, if age is positively related to wages, this implies that older business owners tend to have higher business earnings, holding all other variables constant. If the coefficient sine for the independent variable is negative, this implies an inverse relationship between the dependent variable and that independent variable. For example, if having a child under the age of six is negatively related to wages, this implies that business owners with children under the age of six tend to have lower business earnings.

An OLS regression analysis is used to assess the presence of business earning disparities. OLS regressions have been conducted separately for each industry. Table 7.02 presents the independent variables used for the Earnings Disparity Analysis.[14]

Table 7.02: Independent Variables Used for the Earnings Disparity Analysis

Personal Characteristics	Educational Attainment	Race	Gender
Age Age Squared Incorporated Business Home Ownership and Value Marital Status Not Speaking English at Home Number of Children under Age Six in the Household	Bachelor's Degree Advanced Degree	African American Asian Pacific American Subcontinent Asian American Native American Hispanic American Other Minority Groups	Female

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[14]   *If an independent variable is a binary variable, it will be coded as "1" if the individual has that variable present and "0" if otherwise (i.e. for the Hispanic American variable, it is coded as "1" if the individual is Hispanic American and "0" if otherwise). If an independent variable is a continuous variable, a value will be used (i.e. one's age can be labeled as 35).*

C.   The Business Loan Approval Analysis

The Business Loan Approval Analysis examines the relationship between the probability of obtaining a business loan and variables related to socio-economic factors and business characteristics. The model is an Ordered Logistic model where the dependent variable is the reported probability of obtaining a business loan.

The NSSBF data was collected by the U.S. Federal Reserve. The NSSBF collects information on small businesses (fewer than 500 employees) in the United States, such as owner characteristics, firm size, use of financial services, and the income and balance sheets of the firm. The 2003 NSSBF dataset is the most recently released data set.

In the table below a finding of disparity is denoted by an asterisk (*) when the independent variable is significant at or above the 95 percent level. A finding of disparity indicates that there is a non-random relationship between obtaining a business loan and each independent variable. The tables containing the regression results also indicate the sine of each variable's coefficient from the regression output. If the coefficient sine is positive, it means there is a positive relationship between the independent and dependent variables. For example, if having a bachelor's degree has a positive coefficient, then business owners with a bachelor's degree are more probable to obtain a business loan, holding all other variables constant. If the sine of the coefficient for the independent variable is negative, this implies an inverse relationship between the independent and dependent variables. For instance, if having equipment loans has a negative coefficient, this implies an indirect relationship between having an equipment loan and obtaining a business loan. Therefore, a firm that has equipment loans has a decreased probability of obtaining a business loan (or a higher probability of being denied a business loan).

An Ordered Logistic regression is used to examine the factors that might explain loan approvals for the business owners. The dependent variable is a categorical variable where "2" denotes never being denied a business loan, "1" denotes sometimes being denied a business loan, and "0" signifies always being denied a business loan.[15] The independent variables describe three sets of factors:

- Business owner's minority and gender group classification
- Business owner's credit and resources
- Business' credit and financial health

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[15]   *An Ordered Logistic model could be used differently for this model by assessing the numbers: 1= always denied a loan, 2= sometimes denied a loan, and 3= never denied a loan.*

Table 7.03 presents the independent variables used for the Business Loan Approval Analysis. [16]

Table 7.03: Independent Variables Used for Business Loan Approval Analysis

Owners Credit and Resources	Firm's Credit and Financial Health	Race	Gender
Bachelor's Degree Advanced Degree Use of Personal Credit Card for Business	Age of Business Capital Leases Equipment Loans Stockholder Loans Location Credit Score Organization Type Total Mortgage Principal Owned	African American Asian Pacific American Subcontinent Asian American Native American Hispanic American Other Minority Groups	Female

VI. FINDINGS

A. Business Ownership Analysis

The business ownership variable is defined by the number of self-employed individuals in each of the four industries. The analysis considered incorporated and non-incorporated businesses. The data in this section comes from the Los Angeles, Ventura, San Bernardino, Orange, and Riverside counties. The counties were specified using PUMA, a variable within the PUMS dataset that can specify the different counties within states.[17] As noted in *Section IV*, because each PUMA is determined by the U.S. Census, the region analyzed in the regression analyses could be limited to the Greater Los Angeles Area.

Previous studies have shown that many non-discriminatory factors, such as education, age, and marital status, are associated with self-employment. In this analysis race and gender-neutral factors are combined with race and gender-specific factors in a logistic regression model to determine whether observed race or gender disparities are independent of the race and gender-neutral factors known to be associated with self-employment. It must be noted that many of these variables, such as having an advanced degree, while seeming to be race and gender-neutral, may in fact be correlated with race and gender. For example, if Caucasian females are less probable to have advanced

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[16] *If an independent variable is a binary variable, it will be coded as "1" if the individual has that variable present and "0" if otherwise (i.e. for the Hispanic American variable, it is coded as "1" if the individual is Hispanic American and "0" if otherwise). If an independent variable is a continuous variable, a value will be used (i.e. one's age can be labeled as 35).*

[17] *The PUMS data were collected by the U.S. Census Bureau from a five percent sample of U.S. households. The observations were weighted to preserve the representative nature of the sample in relation to the population as a whole.*

degrees and the regression results show that individuals with advanced degrees are significantly more probable to own a business, Caucasian females may be disadvantaged in multiple ways. First, Caucasian females may have statistically significant lower business ownership rates, so they face a direct disadvantage as a group. Second, they are indirectly disadvantaged as they tend to have less advanced degrees, which significantly increase one's chances of owning a business.

1. Logistic Model Results for Construction Business Ownership Probabilities

Table 7.04 presents the logistic regression results for the probability of owning a business in the construction industry based on the 20 variables analyzed in this model.

Table 7.04: Construction Industry Logistic Model

Business Ownership Model	Coefficient	Significance	Standard Error	z-score	z>|P-value|
Age	0.068	*	0.009	7.410	0.000
Age squared	0.000	*	0.000	-3.750	0.000
Bachelor degree(a)	-0.142		0.121	-1.170	0.240
Advanced degree	-0.061		0.053	-1.160	0.244
Home owner	-0.072		0.048	-1.510	0.131
Home value	0.000	*	0.000	5.370	0.000
Interest and dividend income	0.000		0.000	2.150	0.032
Monthly mortgage payment	0.000	*	0.000	3.480	0.001
Speaks English at home	-0.304	*	0.062	-4.870	0.000
Having a child under the age of six	-0.531	*	0.230	-2.310	0.021
Married	-0.015		0.042	-0.360	0.720
Caucasian Female	-0.748	*	0.098	-7.640	0.000
African American	-0.326	*	0.123	-2.640	0.008
Asian-Pacific American	-0.011		0.097	-0.110	0.909
Subcontinent Asian American	-1.911	*	0.503	-3.800	0.000
Hispanic American	-0.583	*	0.067	-8.700	0.000
Native American	-0.429	*	0.177	-2.420	0.015
Other Minority	-0.076		0.126	-0.600	0.546
Year 2009(b)	0.005		0.047	0.110	0.915
Year 2010	0.083		0.047	1.770	0.077
Constant	-2.806	*	0.220	-12.750	0.000

(a) For the variables Bachelor's degree and advanced degree, the baseline variable is High School.

(b) For the year variables, the baseline variable is year 2008.

Note: z > |p-value| of less than 0.05 denote findings of statistical significance.

* identifies statistically significant variables

The construction industry logistic regression results indicate the following:[18]

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[18] For the Business Ownership Analysis, the results are presented for age, education, race, and gender variables only.

- The probability of construction business ownership is positively associated with increased age; older individuals are significantly[19] more probable to be business owners in the construction industry.

- Caucasian females are significantly less probable to be business owners in the construction industry than Caucasian males.

- African American, Subcontinent Asian Americans, Hispanic Americans, and Native Americans are significantly less probable to be business owners in the construction industry than Caucasian males.

- Asian-Pacific Americans and Other Minority groups are less probable than Caucasian males to be business owners in the construction industry but not at a significant level.

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[19] *Throughout this chapter, significance refers to statistical significance.*

2. Logistic Model Results for Goods and Services Business Ownership Probabilities

Table 7.05 presents the logistic regression results for the probability of owning a business in the goods and services industry using the 20 variables analyzed in this model.

Table 7.05: Goods and Services Logistic Model

Business Ownership Model	Coefficient	Significance	Standard Error	z-score	z>|P-value|
Age	0.108	*	0.004	25.460	0.000
Age squared	-0.001	*	0.000	-16.330	0.000
Bachelor degree	0.173		0.091	1.890	0.058
Advanced degree	0.233	*	0.039	5.950	0.000
Home owner	0.028		0.026	1.060	0.290
Home value	0.000	*	0.000	14.580	0.000
Interest and dividends	0.000	*	0.000	10.510	0.000
Monthly mortgage payment	0.000	*	0.000	16.560	0.000
Speaks English at home	-0.468	*	0.031	-14.930	0.000
Having a child under the age of six	0.190	*	0.051	3.700	0.000
Married	0.131	*	0.024	5.460	0.000
Caucasian Female	-0.189	*	0.031	-6.130	0.000
African American	-0.557	*	0.058	-9.640	0.000
Asian Pacific American	-0.400	*	0.039	-10.330	0.000
Subcontinent Asian American	-0.353	*	0.095	-3.700	0.000
Hispanic American	-0.959	*	0.039	-24.630	0.000
Native American	-1.022	*	0.165	-6.190	0.000
Other Minority	-0.366	*	0.067	-5.490	0.000
Year 2009	0.056	*	0.026	2.190	0.029
Year 2010	0.008		0.026	0.310	0.758
Constant	-5.377	*	0.113	-47.470	0.000

Note: z > |p-value| of less than 0.05 denote findings of statistical significance.

* identifies statistically significant variables.

The goods and services industry logistic regression results indicate the following:

- The probability of business ownership is positively associated with an increase in age; older individuals are significantly more probable to be business owners in the goods and services industry.

- Having an advanced degree significantly increases the probability of being a business owner in the goods and services industry.

- Caucasian females are significantly less probable to be business owners in the goods and services industry than Caucasian males.

- African Americans, Asian Pacific Americans, Subcontinent Asian Americans, Hispanic Americans, Native Americans, and Other Minority groups are significantly less probable to be business owners in the goods and services industry than Caucasian males.

3. Logistic Model Results for Miscellaneous and Other Professional Services Business Ownership Probabilities

Table 7.06 presents the logistic regression results for the probability of owning a business in the miscellaneous and other professional services industry using the 20 variables analyzed in this model.

Table 7.06: Miscellaneous and Other Professional Services Logistic Model

Business Ownership Model	Coefficient	Significance	Standard Error	z-score	z>|P-value|
Age	0.088	*	0.006	14.070	0.000
Age squared	-0.001	*	0.000	-7.930	0.000
Bachelor degree	-0.065		0.206	-0.310	0.753
Advanced degree	-0.164		0.085	-1.920	0.054
Home owner	-0.208	*	0.039	-5.380	0.000
Home value	0.000	*	0.000	8.220	0.000
Interest and dividends	0.000	*	0.000	6.680	0.000
Monthly mortgage payment	0.000	*	0.000	10.660	0.000
Speaks English at home	0.049		0.043	1.140	0.252
Having a child under the age of six	-0.032		0.066	-0.490	0.627
Married	0.055		0.033	1.670	0.096
Caucasian Female	-0.599	*	0.038	-15.650	0.000
African American	-0.664	*	0.080	-8.260	0.000
Asian-Pacific American	-0.762	*	0.056	-13.560	0.000
Subcontinent Asian American	-0.737	*	0.113	-6.520	0.000
Hispanic American	-0.913	*	0.055	-16.520	0.000
Native American	-0.999	*	0.247	-4.040	0.000
Other Minority	-0.545	*	0.098	-5.570	0.000
Year 2009	0.031		0.037	0.850	0.397
Year 2010	0.065		0.036	1.790	0.074
Constant	-3.684	*	0.179	-20.540	0.000

Note: z > |p-value| of less than 0.05 denote findings of statistical significance.

* identifies statistically significant variables.

The miscellaneous and other professional services industry logistic regression results indicate the following:

- The probability of business ownership is positively associated with increased age; older individuals are significantly more probable to be business owners in the miscellaneous and other professional services industry.

- Caucasian females are significantly less probable to be business owners in the miscellaneous and other professional services industry than Caucasian males.

- African Americans, Asian-Pacific Americans, Subcontinent Asian Americans, Hispanic Americans, Native Americans, and Other Minority groups are significantly less probable to be business owners in the miscellaneous and other professional services industry than Caucasian males.

4. Logistic Model Results for Architecture and Engineering Business Ownership Probabilities

Table 7.07 presents the logistic regression results for the probability of owning a business in the architecture and engineering industry using the 19 variables analyzed in this model.

Table 7.07: Architecture and Engineering Logistic Model

Business Ownership Model	Coefficient	Significance	Standard Error	z-score	z>|P-value|
Age	0.090	*	0.026	3.500	0.000
Age squared	0.000		0.000	-1.300	0.192
Bachelor degree	(omitted)[20]				
Advanced degree	2.276	*	1.065	2.140	0.033
Home owner	-0.525	*	0.170	-3.080	0.002
Home value	0.000	*	0.000	2.600	0.009
Interest and dividends	0.000		0.000	1.860	0.062
Monthly mortgage payment	0.000		0.000	1.760	0.078
Speaks English at home	0.182		0.154	1.180	0.239
Having a child under the age of six	0.525		0.328	1.600	0.109
Married	0.022		0.137	0.160	0.875
Caucasian Female	-0.617	*	0.175	-3.520	0.000
African American	-0.886	*	0.438	-2.020	0.043
Asian Pacific American	-0.164		0.188	-0.870	0.383
Subcontinent Asian American	-0.477		0.388	-1.230	0.218
Hispanic American	-0.296		0.221	-1.340	0.181
Native American	0.650		0.690	0.940	0.346
Other Minority	-0.757		0.445	-1.700	0.089
Year 2009	0.090		0.138	0.650	0.513
Year 2010	-0.013		0.146	-0.090	0.928
Constant	-7.531	*	1.274	-5.910	0.000

Note: z > |p-value| of less than 0.05 denote findings of statistical significance.

* identifies statistically significant variables.

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[20] *Bachelor Degree is omitted because the variables predict failure to be a business owner perfectly, therefore biasing the data.*

The architecture and engineering industry logistic regression results indicate the following:[21]

- The probability of business ownership is positively associated with an increase in age; older individuals are significantly more probable to be business owners in the architecture and engineering industry.

- Having an advanced degree significantly increases the probability of being a business owner in the architecture and engineering industry.

- Caucasian females are significantly less probable to be business owners in the architecture and engineering industry than Caucasian males.

- African Americans are significantly less probable to be business owners in the architecture and engineering industry than Caucasian males.

- Asian-Pacific Americans, Subcontinent Asian Americans, Hispanic Americans, and Other Minority groups are less probable than Caucasian males to be business owners in the architecture and engineering industry but not at a significant level.

B.   Business Ownership Analysis Conclusion

The Business Ownership Analysis examined the different explanatory variables' impact on an individual's probability of owning a business in the construction, goods and services, miscellaneous and other professional services, and architecture and engineering industries. Controlling for race and gender-neutral factors, the Business Ownership Analysis results show that statistically significant disparities in the probability of owning a business exist for minorities and females when compared to similarly situated Caucasian males. Caucasian females and African Americans experience the greatest disparity, as they are significantly less probable to own a business in the construction, miscellaneous and other professional services, goods and services, and architecture and engineering industries as similarly situated Caucasian males. Asian-Pacific Americans are also significantly less probable to own a business in the goods and services and miscellaneous and other professional services industries. In addition, they are less probable to own a business in the construction and architecture and engineering industries, but not at a statistically significant level.

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[21]   For the Business Ownership Analysis, the results are presented for age, education, race, and gender variables only.

Subcontinent Asian Americans, Hispanic Americans, and Native Americans are all significantly less probable to own a business in the construction, goods and services, and miscellaneous and other professional services industries compared to similarly situated Caucasian males. In the architecture and engineering industry Subcontinent Asian Americans and Hispanic Americans are less probable to own a business, but not at a statistically significant level. Other minority groups have a statistically significant business ownership disparity in the goods and services and miscellaneous and other professional services industries. They also have lower business ownership probabilities in the construction and architecture and engineering industries, but this relationship is not statistically significant.

Table 7.08 depicts the business ownership regression analysis results by race, gender, and industry.

Table 7.08: Statistically Significant Business Ownership Disparities

Race / Gender	Construction	Goods and Services	Miscellaneous and Other Professional Services	Architecture and Engineering
Caucasian Female	Yes	Yes	Yes	Yes
African American	Yes	Yes	Yes	Yes
Asian-Pacific American	No	Yes	Yes	No
Subcontinent Asian American	Yes	Yes	Yes	No
Hispanic American	Yes	Yes	Yes	No
Native American	Yes	Yes	Yes	No
Other Minority	No	Yes	Yes	No

Cells shaded gray denote no statistically significant disparity present.

C.   *Business Earnings Analysis*

The business earnings variable is identified by self-employment income[22] between the years 2008 to 2010 for the four industries: construction, goods and services, miscellaneous and other professional services, and architecture and engineering. The analysis considered incorporated and non-incorporated businesses.

Previous studies have shown that many non-discriminatory factors, such as education, age, and marital status, are associated with self-employment income. In this analysis race and gender-neutral factors are combined with race and gender groups in an OLS regression model to determine whether observed race or gender disparities were independent of the race and gender-neutral factors known to be associated with self-employment income.

1.   OLS Regression Results for Business Earnings in the Construction Industry

Table 7.09 depicts the results of the OLS regression for business earnings in the construction industry based on the 21 variables analyzed in this model.

Table 7.09: Construction Industry OLS Regression

Earnings Disparity Model	Coefficient	Significance	Standard Error	t-value	t>|P-value|
Age	1828.543	*	178.187	10.260	0.000
Age squared	-19.596	*	1.964	-9.980	0.000
Incorporated business	-30072.300	*	1302.187	-23.090	0.000
Bachelor degree	5695.307	*	2750.739	2.070	0.038
Advanced degree	6079.015	*	1236.405	4.920	0.000
Home owner	321.774		1455.373	0.220	0.825
Home value	0.005	*	0.003	1.970	0.049
Interest and sividends	0.192	*	0.072	2.650	0.008
Monthly mortgage payment	4.524	*	0.811	5.580	0.000
Speaks English at home	-78.277		2562.377	-0.030	0.976
Having a child under the age of six	-6056.642		3854.703	-1.570	0.116
Married	4830.465	*	1198.192	4.030	0.000
Caucasian Female	-8655.223	*	2330.723	-3.710	0.000
African American	-9213.387	*	2294.623	-4.020	0.000
Asian-Pacific American	-7583.229	*	2650.862	-2.860	0.004

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[22]   *The terms "business earnings" and "self-employment income" are used interchangeably.*

Earnings Disparity Model	Coefficient	Significance	Standard Error	t-value	t>|P-value|
Subcontinent Asian American	-6847.729		4995.103	-1.370	0.170
Hispanic American	-4891.910		2817.800	-1.740	0.083
Native American	-5541.392		3629.149	-1.530	0.127
Other Minority	-4152.145		3287.457	-1.260	0.207
Year 2009	-1521.200		1472.058	-1.030	0.301
Year 2010	-4290.018	*	1260.085	-3.400	0.001
Constant	-21567.990	*	5043.774	-4.280	0.000

Note: t > |p-value| of less than 0.05 denote findings of statistical significance.

* identifies statistically significant variables.

The OLS regression results for business earnings in the construction industry indicate the following:[23]

- Older business owners are significantly more probable to have higher business earnings in the construction industry.

- Business owners with a bachelor's degree or advanced degree are significantly more probable to have higher business earnings in the construction industry.

- Caucasian female business owners are significantly more probable to have lower business earnings in the construction industry than Caucasian males.

- African American and Asian-Pacific American business owners are significantly more probable to have lower business earnings in the construction industry than Caucasian males.

- Subcontinent Asian American, Hispanic American, Native American, and Other Minority business owners are more probable to have lower business earnings in the construction industry than Caucasian males, but not at a statistically significant level.

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[23] *For the Earnings Disparity Model, the results are presented for age, education, race, and gender variables only.*

2. OLS Regression Results for Business Earnings in the Goods and Services Industry

Table 7.10 depicts the results of the OLS regression for business earnings in the goods and services industry based on the 21 variables analyzed in this model.

Table 7.10: Goods and Services OLS Regression

Earnings Disparity Model	Coefficient	Significance	Standard Error	t-value	t>|P-value|
Age	1563.510	*	163.022	9.590	0.000
Age squared	-16.492	*	1.619	-10.190	0.000
Incorporated business	-36125.530	*	928.576	-38.900	0.000
Bachelor degree	171.684		3122.155	0.050	0.956
Advanced degree	6692.055	*	1175.208	5.690	0.000
Home owner	-288.903		1154.810	-0.250	0.802
Home value	0.007	*	0.002	4.700	0.000
Interest and sividends	0.075	*	0.028	2.680	0.007
Monthly mortgage Payment	3.311	*	5638559.000	5.870	0.000
Speaks English at home	-377.765		1229.554	-0.310	0.759
Having a child under the age of six	-7758.022	*	1504.483	-5.160	0.000
Married	1784.612		1015.123	1.760	0.079
Caucasian Female	-12722.720	*	1328.168	-9.580	0.000
African American	-8934.088	*	2520.187	-3.550	0.000
Asian-Pacific American	-10545.290	*	1748.505	-6.030	0.000
Subcontinent Asian American	-4162.131		4419.135	-0.940	0.346
Hispanic American	-11490.990	*	1410.805	-8.140	0.000
Native American	-8101.493		5346.088	-1.520	0.130
Other Minority	-8453.455	*	2793.171	-3.030	0.002
Year 2009	-2391.289	*	1123.961	-2.130	0.033
Year 2010	-2436.181	*	1098.402	-2.220	0.027
Constant	-4022.700		4089.784	0.980	0.325

Note: z > |p-value| of less than 0.05 denote findings of statistical significance.

* identifies statistically significant variables.

The OLS regression results for business earnings in the goods and services industry indicate the following:[24]

- Older business owners are significantly more probable to have higher business earnings in the goods and services industry.

- Business owners with an advanced degree are significantly more probable to have higher business earnings in the goods and services industry.

- Caucasian female business owners are significantly more probable to have lower business earnings in the goods and services industry than Caucasian males.

- African American, Asian-Pacific American, Hispanic American, and Other Minority business owners are significantly more probable to have lower business earnings in the goods and services industry than Caucasian males.

- Subcontinent Asian American and Native American business owners are more probable to have lower business earnings in the goods and services industry than Caucasian males, but not at a statistically significant level.

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[24] *For the Earnings Disparity Model, the results are presented for age, education, race, and gender variables only.*

3. OLS Regression Results for Business Earnings in the Miscellaneous and Other Professional Services Industry

Table 7.11 depicts the results of the OLS regression for business earnings in the miscellaneous and other professional services industry based on the 21 variables analyzed in this model.

Table 7.11: Miscellaneous and Other Professional Services OLS Regression

Earnings Disparity Model	Coefficient	Significance	Standard Error	t-value	t>|P-value|
Age	3014.515	*	274.493	10.980	0.000
Age squared	-29.877	*	2.690	-11.110	0.000
Incorporated business	-53696.330	*	1596.991	-33.620	0.000
Bachelor degree	6122.239		4350.198	1.410	0.159
Advanced degree	14080.180	*	2876.018	4.900	0.000
Home owner	5443.427	*	1770.334	3.070	0.002
Home value	0.007	*	0.001	4.840	0.000
Interest and dividends	0.078	*	0.039	8.300	0.046
Monthly mortgage payment	6.036	*	0.727	1.990	0.000
Speaks English at home	3140.728		1858.113	1.690	0.091
Having a child under the age of six	-2434.841		3517.158	-0.690	0.489
Married	3552.510	*	1644.228	2.160	0.031
Caucasian Female	-24993.540	*	1845.523	-13.540	0.000
African American	-7232.982	*	3038.805	-6.290	0.000
Asian-Pacific American	-19111.200	*	2833.692	-2.550	0.011
Subcontinent Asian American	1792.425		2460.410	0.250	0.802
Hispanic American	-18453.880	*	7140.044	-7.500	0.000
Native American	-25853.000	*	7399.316	-3.490	0.000
Other Minority	-13531.750	*	4950.215	-2.730	0.006
Year 2009	-3708.159	*	1872.191	-1.980	0.048
Year 2010	-4126.399	*	1787.568	-2.310	0.021
Constant	-40589.860	*	7557.521	-5.370	0.000

Note: z > |p-value| of less than 0.05 denote findings of statistical significance.

* identifies statistically significant variables.

The OLS regression results for business earnings in the miscellaneous and other professional services industry indicate the following:[25]

- Older business owners are significantly more probable to have higher business earnings in the miscellaneous and other professional services industry.

- Business owners with an advanced degree are significantly more probable to have higher business earnings in the miscellaneous and other professional services industry.

- Caucasian female business owners are significantly more probable to have lower business earnings in the miscellaneous and other professional services industry than Caucasian males.

- African American, Asian-Pacific American, Hispanic American, Native American, and Other Minority business owners are significantly more probable to have lower business earnings in the miscellaneous and other professional services industry than Caucasian males.

- Subcontinent Asian American business owners are more probable to have lower business earnings in the miscellaneous and other professional services industry than Caucasian males, but not at a statistically significant level.

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[25] *For the Earnings Disparity Model, the results are presented for age, education, race, and gender variables only.*

4. OLS Regression Results for Business Earnings in the Architecture and Engineering Industry

Table 7.12 depicts the results of the OLS regression for business earnings in the architecture and engineering industry based on the 20 variables analyzed in this model.

Table 7.12: Architecture and Engineering OLS Regression

Earnings Disparity Model	Coefficient	Significance	Standard Error	t-value	t>|P-value|
Age	3193.065	*	1009.286	3.160	0.002
Age squared	-31.785	*	9.742	-3.260	0.001
Incorporated business	-44062.780	*	5870.348	-7.510	0.000
Bachelor degree	(omitted)				
Advanced degree	19325.710		13602.020	1.420	0.156
Home owner	4805.730		5702.638	0.840	0.400
Home value	-0.004		0.003	-1.290	0.197
Interest and dividends	-0.001		0.065	-0.020	0.982
Monthly mortgage payment	4.296		2.474	1.740	0.083
Speaks English at home	-4919.862		8495.418	-0.580	0.563
Having a child under the age of six	-24323.340	*	10898.610	-2.230	0.026
Married	13186.020	*	5697.715	2.310	0.021
Caucasian Female	-8005.348		9038.301	-0.890	0.376
African American	-14292.020		7962.848	-1.790	0.073
Asian-Pacific American	-6523.386		9638.593	-0.680	0.499
Subcontinent Asian American	-21696.350		13607.050	-1.590	0.111
Hispanic American	10695.220		14547.590	0.740	0.463
Native American	-22957.820	*	6331.241	-3.630	0.002
Other Minority	-28764.560	*	9206.650	-3.120	0.000
Year 2009	-12884.580		7097.897	-1.820	0.070
Year 2010	-10106.620		7411.635	-1.360	0.173
Constant	-50019.760		32233.580	-1.550	0.121

Note: z > |p-value| of less than 0.05 denote findings of statistical significance.

* identifies statistically significant variables.

The OLS regression results for business earnings in the architecture and engineering industry indicate the following:[26]

- Older business owners are significantly more probable to have higher business earnings in the architecture and engineering industry.

- Caucasian female business owners are more probable to have lower business earnings in the architecture and engineering industry than Caucasian males, but not at a statistically significant level.

- Native American and Other Minority group business owners are significantly more probable to have lower business earnings in the architecture and engineering industry than Caucasian males.

- African American, Asian-Pacific American, and Subcontinent Asian American business owners are more probable to have lower business earnings in the architecture and engineering industry than Caucasian males, but not at a statistically significant level.

D.   Business Earnings Analysis Conclusion

Controlling for race and gender-neutral factors, the Business Earnings Analysis documented statistically significant disparities in business earnings for minorities and females when compared to similarly situated Caucasian males. Caucasian females, African Americans, and Asian-Pacific Americans have lower business earnings at a statistically significant level in the construction, goods and services, and miscellaneous and other professional services industries. These three ethnicities also have lower business earnings in the architecture and engineering industry, but not at a statistically significant level. While Subcontinent Asian Americans have lower business earnings in the construction, goods and services, miscellaneous and other professional services, and architecture and engineering industries, these disparities are not statistically significant.

Hispanic Americans have statistically significant lower business earnings in two of the four industries—goods and services and miscellaneous and other professional services—when compared to similarly situated Caucasian males. They also are more probable to have lower business earnings in the construction industry, but not at a statistically significant level. Native Americans face statistically significant business earnings disparities in the miscellaneous and other professional services and architecture and engineering industries. However, their lower earnings in construction and goods and services industries are not statistically significant. Lastly, other minority groups have significantly lower earnings in the goods and services, miscellaneous and other

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[26]   *For the Earnings Disparity Model, the results are presented for age, education, race, and gender variables only.*

professional services, and architecture and engineering industries. Other minority groups do not have statistically significant lower business earnings in the construction industry.

Table 7.13 depicts the earnings disparity regression results by race, gender, and industry.

Table 7.13: Statistically Significant Business Earnings Disparities

Race / Gender	Construction	Goods and Services	Miscellaneous and Other Professional Services	Architecture and Engineering
Caucasian Female	Yes	Yes	Yes	No
African American	Yes	Yes	Yes	No
Asian-Pacific American	Yes	Yes	Yes	No
Subcontinent Asian American	No	No	No	No
Hispanic American	No	Yes	Yes	No
Native American	No	No	Yes	Yes
Other Minority Group	No	Yes	Yes	Yes

Cells shaded gray denote no statistically significant disparity present.

E. Business Loan Approval Analysis

Access to business capital in the form of loans is measured by the Business Loan Approval Analysis. The probability of business loan approval variable is a score that reflects the reported probability of experiencing loan approval. The data in this section comes from the 2003 NSSBF data set. Previous studies have shown that many non-discriminatory factors such as education, experience of the business owner, and firm characteristics could lead to differences in a business owner's loan approval rate. In this analysis race and gender-neutral factors are combined with race and gender groups in an ordered logistic regression model to determine whether observed race or gender disparities were independent of the race and gender-neutral factors known to be associated with business loan approval.

Access to business capital in the form of loans is measured by the probability of obtaining a business loan among the 5,415 business owners in three industries. It should be noted that only three industries are analyzed because the architecture and engineering industry was collapsed into the miscellaneous and other professional services industry due to insufficient data. Furthermore, the dataset does not contain sufficient information on all ethnic groups to allow for a separate examination of each group. Therefore, results are provided for all minority males and females combined and for Caucasian females, referred to as minority business enterprises (MBEs) and woman-owned business enterprises (WBEs), or collectively as M/WBEs. The NSSBF records the geographic location of the firm by Census Division instead of city, county, or state. Due to insufficient data in the construction, goods and services, and miscellaneous and other professional services industries, the sampling region was expanded to the West Region defined by the Census. This region includes: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

The results of the ordered logistic regression for each set of factors are presented in the tables below.

1. Ordered Logistic Regression Results for Business Loan Approval in the Construction Industry

The ordered logistic regression results for business loan approval in the construction industry based on the 13 variables analyzed in this model are depicted in Table 7.14.

Table 7.14: Ordered Logistic Model for the Business Loan Approval Analysis in the Construction Industry

Loan Approval Model	Coefficient	Significance	Standard Error	z-score	z>|P-value|
Business Owner's Minority Group					
Caucasian Female	-3.087	*	0.977	-3.160	0.002
Minority	-1.240		0.916	-1.350	0.176
Business Owner's Credit and Resources					
Bachelor's degree (a)	-0.813		0.656	-1.240	0.215
Advanced degree	15.618	*	0.877	17.800	0.000
Use of owner's personal credit card for business	-0.484		0.463	-1.040	0.296
Firm's Credit and Financial Health					
Age	0.015		0.030	0.500	0.616
Firm has existing capital leases	20.898	*	0.789	26.500	0.000
Firm has vehicle loans	0.950		0.821	1.160	0.247
Firm has stockholder loans	-4.519	*	0.794	-5.690	0.000
Located in MSA(b)	(omitted)[27]				
Low D&B credit score	-2.421	*	0.817	-2.960	0.003
Corporation	-3.041	*	1.148	-2.650	0.008
Total mortgage principal owned (in millions)	11.226		6.330	1.770	0.076

(a) The baseline variable for Bachelor's degree and Advanced degree is High School or below.
(b) MSA denotes Metropolitan Statistical Area, rather than one living in a rural area.
Note: z > |p-value| of less than 0.05 denote findings of statistical significance.
* identifies statistically significant variables.

[27] *Omitted due to too few data points.*

Statistically significant ordered logistic regression results for the construction industry Business Loan Approval Analysis indicate the following:

a. Business Owner's Minority Group and Gender Classification

- Caucasian females have a significantly lower probability of obtaining a business loan in the construction industry than Caucasian males.

- Minority groups have a lower probability of obtaining a business loan in the construction industry than Caucasian males, but not at a significant level.

b. Business Owner's Credit and Resources

- Business owners with an advanced degree have a higher probability of obtaining a business loan in the construction industry.

c. Firm's Credit and Financial Health

- Firms with existing capital leases have a significantly higher probability of obtaining a business loan in the construction industry.

- Firms with stockholder loans have a significantly lower probability of obtaining a business loan in the construction industry.

- Firms with a low Dunn and Bradstreet credit score have a significantly lower probability of obtaining a business loan in the construction industry.

- Firms established as a corporation have a significantly lower probability of obtaining a business loan in the construction industry.

2. **Ordered Logistic Regression Results for Business Loan Approval in the Goods and Services Industry**

The Ordered Logistic regression results for business loan approval in the goods and services industry based on the 13 variables analyzed in this model are depicted in Table 7.15.

Table 7.15: Ordered Logistic Model for the Business Loan Approval Analysis in the Goods and Services Industry

Loan Approval Model	Coefficient	Significance	Standard Error	z-score	z>|P-value|
Business Owner's Minority Group					
Caucasian Female	0.261		0.205	1.270	0.204
Minority	-0.286		0.230	-1.240	0.215
Business Owner's Credit and Resources					
Bachelor's degree	0.327		0.196	1.670	0.095
Advanced degree	0.865	*	0.268	3.230	0.001
Use of owner's personal credit card for business	-0.571	*	0.162	-3.520	0.000
Firm's Credit and Financial Health					
Age	0.027	*	0.011	2.470	0.013
Firm has existing capital leases	-0.299		0.164	-1.830	0.068
Firm has vehicle loans	0.235		0.175	1.340	0.179
Firm has stockholder loans	-0.725	*	0.177	-4.100	0.000
Located in MSA	0.075		0.184	0.400	0.686
Low D&B credit score	-0.861	*	0.169	-5.090	0.000
Corporation	-0.435	*	0.205	-2.120	0.034
Total mortgage principal owned (in millions)	0.044		0.047	0.940	0.350

Note: z > |p-value| of less than 0.05 denote findings of statistical significance.
* identifies statistically significant variables.

Statistically significant ordered logistic regression results for the goods and services industry Business Loan Approval Analysis indicate the following:

a. Business Owner's Minority Group and Gender Classification

- Minority groups have a lower probability of obtaining a business loan in the goods and services industry than Caucasian males, but not at a significant level.

b. Business Owner's Credit and Resources

- Business owners with an advanced degree have a significantly higher probability of obtaining a business loan in the goods and services industry.

- Business owners who use their own personal credit card for business have a statistically lower probability of obtaining a business loan in the goods and services industry.

c. Firm's Credit and Financial Health

- Firms with more years of business operations have a significantly higher probability of obtaining a business loan in the goods and services industry.

- Firms with stockholder loans have a significantly lower probability of obtaining a business loan in the goods and services industry.

- Firms with a low Dunn and Bradstreet credit score have a significantly lower probability of obtaining a business loan in the goods and services industry.

- Firms established as a corporation have a significantly lower probability of obtaining a business loan in the goods and services industry.

3. Ordered Logistic Regression Results for Business Loan Approval in the Miscellaneous and Other Professional Services Industry

The ordered logistic regression results for business loan approval in the miscellaneous and other professional services industry based on the 13 variables analyzed in this model are depicted in Table 7.16.

Table 7.16: Ordered Logistic Model for the Business Loan Approval Analysis in the Miscellaneous and Other Professional Services Industry

Loan Approval Model	Coefficient	Significance	Standard Error	z-score	z>|P-value|
Business Owner's Minority Group					
Caucasian Female	15.364	*	0.816	18.830	0.000
Minority	0.173		0.514	0.340	0.737
Business Owner's Credit and Resources					
Bachelor's degree	-1.472	*	0.688	-2.140	0.032
Advanced degree	0.705		0.530	1.330	0.184
Use of owner's personal credit card for business	0.437		0.342	1.280	0.201
Firm's Credit and Financial Health					
Age	0.069	*	0.027	2.560	0.010
Firm has existing capital leases	-0.191		0.637	-0.300	0.764
Firm has vehicle loans	0.874		0.912	0.960	0.338
Firm has stockholder loans	-0.814		0.494	-1.650	0.100
Located in MSA	0.772		0.543	1.420	0.155
Low D&B credit score	-0.935	*	0.450	-2.080	0.038
Corporation	1.575		1.192	1.320	0.186
Total mortgage principal owned (in millions)	6.567	*	2.560	2.560	0.010

Note: z > |p-value| of less than 0.05 denote findings of statistical significance.
* identifies statistically significant variables.

Statistically significant ordered logistic regression results for the miscellaneous and other professional services industry Business Loan Approval Analysis indicate the following:

a.   Business Owner's Minority Group and Gender Classification

- Caucasian females have a significantly higher probability of obtaining a business loan in the miscellaneous and other professional services industry than Caucasian males.

b.   Business Owner's Credit and Resources

- Business owners with a bachelor's degree have a significantly lower probability of obtaining a business loan in the miscellaneous and other professional services industry.

c.   Firm's Credit and Financial Health

- Firms with more years of business operations have a significantly higher probability of obtaining a business loan in the miscellaneous and other professional services industry.

- Firms with a low Dunn and Bradstreet credit score have a significantly lower probability of obtaining a business loan in the miscellaneous and other professional services industry.

- Firms with a higher total mortgage principal have a significantly higher probability of obtaining a business loan in the miscellaneous and other professional services industry.

F.   Business Loan Approval Analysis Conclusions

Controlling for race and gender-neutral factors, the Business Loan Approval Analysis reveals statistically significant disparities for M/WBEs when compared to similarly situated Caucasian males. Caucasian females have a statistically significant disparity in obtaining a business loan in the construction industry. Minority groups have a disparity in obtaining a business loan in the construction and goods and services industries, but not at a statistically significant level. The data also shows overutilization for Caucasian females in the miscellaneous and other professional services industry.

The statistically significant disparity documented for M/WBEs when compared to similarly situated Caucasian males, points to the presence of race and gender disparity as a factor in access to business capital. Access to business capital in the private sector constitutes a major factor in business development, continuity, and growth. The documented disparity in M/WBE access to business capital may have adversely impacted the number of these businesses in the construction, miscellaneous and other professional services, and goods and services industries available to perform on Metro contracts during the Study period.

Table 7.17 depicts the Business Loan Approval Analysis regression results by race, gender, and industry.

Table 7.17: Statistically Significant Business Loan Approval Disparities

Race / Gender	Construction	Goods and Services	Miscellaneous and Other Professional Services
Caucasian Females	Yes	No	No
Minority Groups	No	No	No

Cells shaded gray denote no statistically significant disparity present.

VII. CONCLUSION

Three regression analyses were conducted to determine whether there were factors in the private sector that might help explain the current levels of M/WBE availability and any statistical disparities between M/WBE availability and utilization identified in the Disparity Study. The three analyses examined the following outcome variables—business ownership, business earnings, and business loan approval.

These analyses were performed for the four industries—construction, goods and services, miscellaneous and other professional services, and architecture and engineering—included in Metro's Disparity Study. The regression analyses examined the effect of race and gender on the three outcome variables. The Business Ownership Analysis and the Earnings Disparity Analysis used data from the 2008, 2009, and 2010 PUMS datasets for Los Angeles, Ventura, San Bernardino, Orange, and Riverside counties and compared business ownership rates and earnings for M/WBEs to those of similarly situated Caucasian males. The Business Loan Approval Analysis used the 2003 NSSBF dataset for the West Region and compared business loan approval rates for M/WBEs to those of similarly situated Caucasian males.

A. Regression Findings

The analyses of the three outcome variables in five county areas document disparities that could adversely affect the formation and growth of M/WBEs within the construction, goods and services, miscellaneous and other professional services, and architecture and engineering industries. In the absence of a race and gender-neutral explanation for the disparities, the regression findings point to racial and gender discrimination that depressed business ownership, business earnings, and business loan approval rates. Such discrimination is a manifestation of economic conditions in the private sector that impede minorities and females' efforts to create, grow, and sustain businesses. It can reasonably be inferred that these private sector conditions are manifested in the current M/WBEs' experiences.

It is important to note there are limitations to the application of the regression findings in accessing disparity between the utilization and availability of businesses. No matter how discriminatory the private sector may be, the findings cannot be used as the factual basis for a government-sponsored, race-conscious M/WBE or DBE program. Therefore, caution must be exercised in the interpretation and application of the regression findings in a disparity study. Nevertheless, the findings can be a formula for developing race-neutral programs to eliminate identified statistically significant disparities in Metro's use of available M/WBEs.