

## **APPENDIX H.**

### **Regression Analysis**

In Section III and Appendix F, the study team noted that there were statistically significant disparities for some minority groups (and non-Hispanic, white women) in rates of business ownership, earnings of business owners, and frequency of business loan denials. BBC considered the possibility that neutral factors, such as age, education, access to capital and creditworthiness (among others) might account for at least a portion of these disparities. The study team further investigated these issues through multivariate regression analyses. This appendix documents the regression analysis.

In the comparison of availability versus utilization of minority and women-owned firms for the disparity analysis, the study team only considers firms to be available for a potential project if they had previously bid on (or been awarded) a project of similar size. If, however, there are significant disparities in “bid capacity” based on minority or female firm ownership, the study team’s approach might underestimate the availability of minority and women-owned firms in the disparity analysis (and perhaps not find disparities when more comprehensive analysis would reveal them). This appendix also further investigates potential disparities in bid capacity for minority and women-owned firms.

#### **Business Ownership**

As discussed in Appendix F, there is an extensive literature on the determinants of business ownership. Prior studies have found that neutral factors such as access to financial capital, education, age, family characteristics (e.g. marital status) and other factors can help explain rates of self-employment.

This issue has also been examined in other disparity studies. Prior studies in Minnesota<sup>1</sup> and Illinois<sup>2</sup> have conducted econometric analyses to investigate whether or not disparities in business ownership among race, ethnic and gender groups in the combined construction and engineering industry remain after controlling for neutral factors. These studies have incorporated probit econometric models using data from the 2000 Census Public Use Microdata Sample (2000 PUMS). These studies have been among the materials submitted to the courts in subsequent litigation concerning states’ implementation of the Federal DBE Program.

To further examine potential disparities in the rates of business ownership among employees in the California construction and engineering industries, the study team developed a probit model using 2000 PUMS data for California residents employed in these industries. The PUMS data is a 5 percent sample of U.S. households and the Census Bureau assigns a weight to each observation so that the weighted sample is representative of the population as a whole.

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<sup>1</sup> National Economic Research Associates, Inc. 2000. *Disadvantaged Business Enterprise Availability Study*. Prepared for the Minnesota Department of Transportation.

<sup>2</sup> National Economic Research Associates, Inc. 2004. *Disadvantaged Business Enterprise Availability Study*. Prepared for the Illinois Department of Transportation.

BBC used a probit model functional form for the regression analysis, consistent with other research. The probit model of business ownership in California includes more than 52,000 individuals working in the construction and engineering industries. The dependent variable is binary – coded as a “1” for individuals who are self-employed and a “0” for individuals who are not self-employed. The model estimates the probabilities of being a business owner among workers in the industry. The study team excluded observations where the Census Bureau had imputed self-employment (the dependent variable).

The extensive literature on business ownership explains the theoretical basis for business ownership regression models. BBC developed a model specification based on models developed by past researchers at the national level or in other states. Independent variables include:

- Personal characteristics potentially linked to the likelihood of business ownership (age, age-squared, marital status, number of children and elderly people in the household, ability to speak English and disability status);
- Variables to control for differences in educational attainment;
- Measures and indicators related to personal financial resources and constraints (home ownership, home value, monthly mortgage payment, dividend and interest income and additional household income from a spouse or unmarried partner); and
- Variables to indicate the race, ethnicity and gender of the individual.

The specification of this model is very similar to models used in other studies previously reviewed by the courts.

**Results for the California transportation and engineering industries.** Figure H-1 presents the coefficients and t-statistics for the initial probit model, which combines individuals working in both the construction and engineering industries. The model indicates that several of the neutral factors are statistically significant in predicting the probability of business ownership;

- Older individuals are more likely to be business owners, but this marginal effect declines for the oldest individuals;
- Interest and dividend income is positively correlated with being a business owner;
- Individuals who speak English “very well” are more likely to be business owners;
- Having some college, but not necessarily a four year college degree, increases the likelihood of being a business owner;
- Having an advanced degree reduces the likelihood of being a business owner;
- Income of a spouse or partner increases the likelihood of a person being a business owner; and
- The combination of the negative coefficient on the binary indicator of home ownership and the positive coefficient on the value of the home imply that homeownership only begins to increase the likelihood of business ownership for individuals with homes valued above approximately \$150,000.

The effects of these neutral factors are generally consistent with previous research on business ownership and entrepreneurship. Even after controlling for the neutral factors that can be identified based on the PUMS data, statistically significant disparities in rates of business ownership remain for African Americans, Asian Pacific Americans, Subcontinent Asian Americans, Hispanic Americans and women.

**Figure H-1.**  
**California Combined Construction and Engineering Business Ownership Probit Model**

Variable	Coefficient	t-statistic
Constant	-3.041131	-28.82 **
Age	0.089546	17.48 **
Age-squared	-0.000784	-12.85 **
Married	0.006204	0.32
Disabled	-0.017051	-0.76
Own children younger than 10	0.003853	0.55
Number of people over 65 in HH	-0.004007	-0.05
Own home	-0.102716	-4.60 **
Home value (\$000s)	0.000001	14.38 **
Monthly mortgage payment	0.000025	1.67 *
Interest and dividend income (\$000s)	0.000002	3.65 **
Income of spouse or partner (\$000s)	0.000001	2.24 *
Speaks English very well	-0.030202	-1.14
Less than high school education	-0.024449	-1.03
Some college	0.115799	6.00 **
Four year degree	0.095091	3.25 **
Advanced degree	-0.034981	-0.72
African American	-0.324188	-6.56 **
Asian Pacific American	-0.004323	-0.11
Subcontinent Asian American	-0.457124	-2.79 **
Hispanic American	-0.288456	-12.20 **
Native American	-0.081738	-1.42
Other minority group	0.074456	0.98
Female	-0.415492	-15.00 **

Note: \*Significant at 90% confidence level.

\*\*Significant at 95% confidence level.

Source BBC Research & Consulting based on analysis of 2000 Census Public Use Microdata Sample.

**Results specific to the construction industry.** It is possible that the influence of neutral factors, and perhaps race and gender, on self-employment in the construction industry differ from those in the engineering industry. To examine this possibility the study team developed separate models by industry.

Figure H-2 presents the results of the probit model of self-employment in the California construction industry.

**Figure H-2.**  
**California Construction Business Ownership Probit Model**

Variable	Coefficient	t-statistic
Constant	-3.58177	-9.67 **
Age	0.086555	5.27 **
Age-squared	-0.000645	-3.48 **
Married	-0.014554	-0.27
Disabled	0.053411	0.70
Own children younger than 10	0.011743	0.56
Number of people over 65 in HH	0.120283	0.81
Own home	-0.254078	-3.85 **
Home value (\$000s)	0.000001	6.86 **
Monthly mortgage payment	0.000014	-0.47
Interest and dividend income (\$000s)	0.000002	1.76 *
Income of spouse or partner (\$000s)	0.0000001	2.55 *
Speaks English very well	-0.069579	-0.80
Less than high school education	-0.053793	-0.32
Some college	0.046507	0.50
Four year degree	0.256621	2.83 **
Advanced degree	0.230272	2.41 *
African American	-0.486443	-2.92 **
Asian Pacific American	-0.266160	-4.04 **
Subcontinent Asian American	-0.180251	-1.02
Hispanic American	-0.078585	-0.99
Native American	0.491396	2.61 **
Other minority group	0.262255	1.51
Female	-0.257010	-5.07 **

Note: \*Significant at 90% confidence level.

\*\*Significant at 95% confidence level.

Source: BBC Research & Consulting based on analysis of 2000 Census Public Use Microdata Sample.

Results of the construction industry only model are generally similar to the model for the combined industries, with the following exceptions:

- Speaking English “very well” is not a significant factor in self-employment in the construction industry;
- Completing either some college or a four year degree significantly increases the likelihood of being a business owner in construction; and
- There is not a significant disparity in the rate of construction business ownership among Asian Pacific Americans in the construction industry after accounting for neutral factors.

The construction business ownership model continues to indicate significant disparities in the rate of business ownership for African Americans, Subcontinent Asian Americans, Hispanic Americans and women after accounting for neutral factors identifiable from the 2000 PUMS data.

The probit modeling approach can then be used to estimate how many business owners there would be among each minority group with significant disparities in self-employment rates if they had the same probability of business ownership as similarly situated non-Hispanic white males. To conduct this next step in the analysis, BBC re-estimated the probit business ownership model for the construction industry based on only the non-Hispanic white males in the PUMS dataset.<sup>3</sup> The study team then applied the coefficients from this version of the model to the characteristics of the minority and female individuals in the dataset to calculate the probability of business ownership in the absence of race, ethnicity and gender-related effects. Figure H-3 depicts these simulated business ownership rates and compares them to the actual, observed mean probability of business ownership for each statistically significant group from the PUMS data. This simulation approach has also been incorporated in other disparity studies reviewed by the courts.

**Figure H-3.**  
**Comparison of Actual Construction Business Ownership Rates to Simulated Rates Under Non-Hispanic, White Male Business Environment for Groups Experiencing Significant Disparities**

Group	Self-employment Rates		Disparity index (100 = parity)
	Actual	Benchmark	
African American	14.5%	23.7%	61
Subcontinent Asian American	16.0%	30.7%	52
Hispanic American	12.1%	22.6%	53
Females	14.8%	27.3%	54

Source: BBC Research & Consulting from statistical models of 2000 Census of Population data.

These results suggest that there are only 61 percent as many African American owned construction businesses in California as one would anticipate if African Americans working in the industry owned businesses at the same rate as similarly situated non-Hispanic, white males. The disparities are somewhat larger for Subcontinent Asian Americans, Hispanic Americans and women.

<sup>3</sup> This version of the model excludes the race, ethnicity and gender indicator variables since the value for all of those variables would be zero.

**Results specific to the engineering industry.** The study team also estimated a probit business ownership model for the California engineering industry. Figure H-4 presents the results of this model.

**Figure H-4.  
California Engineering Business Ownership Probit Model**

Variable	Coefficient	t-statistic
Constant	-3.03479	-30.26 **
Age	0.089098	18.41 **
Age-squared	-0.000768	-13.41 **
Married	-0.000418	-0.02
Disabled	-0.006170	-0.29
Own children younger than 10	0.007628	1.16
Number of people over 65 in HH	0.015675	0.23
Own home	-0.107322	-5.13 **
Home value (\$000s)	0.000001	15.78 **
Monthly mortgage payment	0.000014	1.03
Interest and dividend income (\$000s)	0.000002	4.30 **
Income of spouse or partner (\$000s)	0.000001	2.80 **
Speaks English very well	-0.050141	-1.98 *
Less than high school education	-0.029736	-1.27
Some college	0.079236	4.24 **
Four year degree	-0.021547	-0.86
Advanced degree	-0.173040	-4.98 **
African American	-0.340434	-7.23 **
Asian Pacific American	-0.127010	-3.90 **
Subcontinent Asian American	-0.354839	-2.93 **
Hispanic American	-0.282162	-12.46 **
Native American	-0.035647	-0.65
Other minority group	0.095299	1.37
Female	-0.429396	-18.01 **

Note: \*Significant at 90% confidence level.  
\*\*Significant at 95% confidence level.

Source: BBC Research & Consulting based on analysis of 2000 Census Public Use Microdata Sample.

Many of the neutral factors associated with being a business owner in the engineering industry are similar to those in the construction industry, with some differences. In the engineering industry, more education is required to significantly increase the likelihood of being a business owner than in the construction industry. The combination of the negative coefficient on the binary indicator of home -ownership and the positive coefficient on the value of the home imply that homeownership only begins to increase the likelihood of business ownership in the engineering industry for individuals with homes valued above approximately \$250,000.

The engineering business ownership model continues to indicate significant disparities in the rate of business ownership for African Americans, Asian Pacific Americans and women after accounting for neutral factors identifiable from the 2000 PUMS data. Disparities for Hispanic Americans and Subcontinent Asian Americans are not statistically significant. Native Americans working in this industry are more likely than non-Hispanic whites to own businesses.

The study team simulated engineering business ownership rates for these groups if they faced the same marked environment as white males. Figure H-5 depicts these simulated business ownership rates and compares them to the actual, observed mean probability of engineering business ownership for each statistically significant group.

**Figure H-5.**  
**Comparison of Actual Engineering Business Ownership Rates to Simulated Rates Under Non-Hispanic, White Male Business Environment for Groups Experiencing Significant Disparities**

Group	Self-employment Rates		Disparity index (100 = parity)
	Actual	Benchmark	
African American	6.0%	14.8%	40
Asian-Pacific American	10.2%	15.2%	67
Native American	23.2%	13.6%	171
Females	9.4%	14.7%	64

Source: BBC Research & Consulting from statistical models of 2000 Census of Population data.

These results suggest that the disparity in engineering business ownership among African Americans is even larger than in the construction industry. The disparity in female ownership of engineering firms is less than found in the construction industry.

### Business Earnings

Appendix F includes analysis of business earnings for business owners in the construction and engineering industries in California. Differences in business owner earnings may be at least partially accounted for by race- and gender-neutral factors such as age.

The study team applied regression analysis to the 2000 PUMS data to examine whether disparities in business earnings remained after controlling for neutral factors. Consistent with past court-reviewed research, BBC applied an ordinary least squares regression. The OLS model of construction and engineering business owner earnings in California included 7,546 observations.

Consistent with the model specifications that have been reviewed by the courts, the dependent variable in this model is the natural log of business earnings. Business owners reporting zero or negative business earnings were excluded, as were observations where the Census Bureau had imputed the amount of business earnings. Apart from variables indicating the race, ethnicity and gender of the business owner, the model also contained the available measures from the PUMS data considered likely to affect earnings potential – including age, age-squared, marital status, ability to speak English very well, disability condition and educational attainment. This model is very similar to models reviewed by the courts after other recent disparity studies.<sup>4</sup>

<sup>4</sup> For example, National Economic Research Associates, Inc. 2000. *Disadvantaged Business Enterprise Availability Study*. Prepared for the Minnesota Department of Transportation; and National Economic Research Associates, Inc. 2004. *Disadvantaged Business Enterprise Availability Study*. Prepared for the Illinois Department of Transportation.

**Results for the California construction and engineering industries.** Figure H-6 depicts the results of the OLS model for the combined construction and engineering industries (past studies reviewed by the courts have combined construction and engineering). The model indicates that several of the neutral factors are statistically significant in predicting earnings of business owners in the California construction and engineering industries:

- Older business owners have greater earnings, but this marginal effect declines for the oldest individuals;
- Owners who are married tend to have greater business earnings; and
- Business owners with less than a high school degree tend to have lower business earnings.

After accounting for neutral factors, there are statistically significant disparities for African American and Hispanic American business owners as well as women.

**Figure H-6.**  
**California Combined Construction and Engineering Business Owner Earnings Model**

Variable	Coefficient	t-statistic
Constant	6.671328	23.22 **
Age	0.134376	10.21 **
Age-squared	-0.001459	-9.80 **
Married	0.409922	10.45 **
Speak English Very Well	0.050617	0.89
Disabled	-0.002063	-0.04
Less than HS	-0.245781	-4.28 **
Some College	-0.008317	-0.18
Four Year Degree	0.035475	0.58
Advanced Degree	0.017928	0.19
African American	-0.472129	-2.80 **
Asian Pacific American	-0.075027	-1.00
Subcontinent Asian American	0.340119	1.41
Hispanic American	-0.211683	-3.83 **
Native American	-0.172427	-1.05
Other Minority Group	0.426328	2.98 **
Female	-0.618914	-8.16 **

Note: \*Significant at 90% confidence level.  
\*\*Significant at 95% confidence level.

Source: BBC Research & Consulting, 2007 based on analysis of 2000 Census Public Use Microdata Sample.

**Business owner earnings results specific to the construction industry.** The study team recognized that the influences on business owner earnings might differ between construction firms and engineering firms. Figure H-7 presents the results of the OLS model of business owner earnings specific to the California construction industry.

**Figure H-7.  
California Construction Business Owner Earnings Model**

Variable	Coefficient	t-statistic
Constant	6.729981	22.25 **
Age	0.131912	9.48 **
Age-squared	-0.001448	-9.18 **
Married	0.437137	10.64 **
Speak English Very Well	0.060690	1.02
Disabled	0.007405	0.14
Less than HS	-0.244410	-4.22 **
Some College	0.011002	0.24
Four Year Degree	0.050111	0.73
Advanced Degree	0.032978	0.25
African American	-0.520161	-2.89 **
Asian Pacific American	-0.038796	-0.48
Subcontinent Asian American	0.582479	2.62 **
Hispanic American	-0.216282	-3.73 **
Native American	-0.235089	-1.37
Other Minority Group	0.373642	2.23 *
Female	-0.632175	-6.61 **

Note: \*Significant at 90% confidence level.  
\*\*Significant at 95% confidence level.

Source: BBC Research & Consulting, 2007 based on analysis of 2000 Census Public Use Microdata Sample.

The construction-only model of business owner earnings shows very similar influences from neutral factors as observed in the previous model combining construction and engineering firms. After controlling for these influences, model results indicate the following significant disparities in business earnings for African American, Hispanic American and female business owners in the construction industry:

- African American construction business owners earn about 41 percent less than average;
- Hispanic American construction business owners earn about 19 percent less than average; and
- Female construction business owners earn about 47 percent less than average.

Model results also show that on average, Subcontinent Asian Americans and individuals in the Other Minority Group are likely to earn more than similarly situated non-Hispanic, white male construction business owners.

Similar to the business ownership analysis, BBC simulated business earnings for minority groups and females in the construction industry in the absence of race, ethnicity and gender-related effects.

Figure H-8 depicts these simulated business earnings and compares them to the actual, observed mean probability of business earnings for each statistically significant group.

**Figure H-8.**  
**Comparison of Actual Construction Business Owner Earnings to Simulated Earnings Under Non-Hispanic, White Male Business Environment for Groups Experiencing Significant Disparities**

Group	Business owner earnings		Disparity index (100 = parity)
	Actual	Benchmark	
African American	\$ 11,252	\$ 18,983	59
Subcontinent Asian American	\$ 41,396	\$ 25,519	162
Hispanic American	\$ 13,278	\$ 18,539	72
Other Minority Group	\$ 26,416	\$ 18,838	140
Females	\$ 9,925	\$ 19,869	50

Source: BBC Research & Consulting from statistical models of 2000 Census of Population data.

Results suggest that African American business owners in the construction industry earn about 40 percent less than they would if they earned as much as similarly situated non-Hispanic, white males. Hispanic Americans and women respectively earn about 28 and 50 percent less than similarly situated non-Hispanic, white males.

**Business owner earnings results specific to the engineering industry.** Figure H-9 presents the results of the OLS model of business owner earnings for California engineering firms.

**Figure H-9.**  
**California Engineering Business Owner Earnings Model**

Variable	Coefficient	t-statistic
Constant	5.398966	5.48 **
Age	0.179734	4.30 **
Age-squared	-0.001807	-3.95 **
Married	0.179178	1.44
Speak English Very Well	0.202088	0.83
Disabled	-0.217387	-0.78
Less than HS	-0.440857	-0.94
Some College	-0.338929	-1.14
Four Year Degree	-0.031136	-0.11
Advanced Degree	-0.063143	-0.21
African American	0.253169	0.74
Asian Pacific American	-0.106952	-0.59
Subcontinent Asian American	0.169822	0.47
Hispanic American	-0.153510	-0.79
Native American	1.111466	4.59 **
Other Minority Group	0.579863	2.01 *
Female	-0.470334	-3.55 **

Note: \*Significant at 90% confidence level.

\*\*Significant at 95% confidence level.

Source: BBC Research & Consulting, 2007 based on analysis of 2000 Census Public Use Microdata Sample.

While some of the neutral factors in the model of business owner earnings in the engineering industry operate in the same direction as in the construction industry model, only the combination of age and age-squared are statistically significant. The engineering business owner earnings model indicates that only women business owners appear to be experiencing a significant disparity in earnings. The coefficient for female engineering business owners implies that they earn about 38 percent less than average, after including neutral factors in the model. Model results also show that on average, Native Americans and business owners in the Other Minority Group earn more than their white male counterparts.

The study team simulated business owner earnings for females and other significant minority groups if they faced the same market environment as non-Hispanic, white males. Figure H-10 depicts these simulated business owner earnings and compares them to the actual, observed mean of engineering business owner earnings for each group.

**Figure H-10.**  
**Comparison of Actual Engineering Business Owner Earnings to Simulated Earnings Under Non-Hispanic, White Male Business Environment for Groups Experiencing Significant Disparities**

Group	Self-employment Rates		Disparity index (100 = parity)
	Actual	Benchmark	
Native Americans	\$ 42,983	\$ 13,480	319
Other Minority Group	\$ 34,175	\$ 20,693	165
Females	\$ 10,771	\$ 17,672	61

Source: BBC Research & Consulting from statistical models of 2000 Census of Population data.

Results show that the disparity in female ownership of engineering firms is less than that found in the construction industry. Women engineering business owners earn about 39 percent less than similarly situated non-Hispanic, white males.

### **Likelihood of Business Loan Denial**

As discussed in Appendix F, access to capital is an important factor in small business formation and expansion. Based on data for both the nation and the Pacific region from the 1998 National Survey of Small Business Finances (NSSBF), firms owned by African Americans, Asian Americans and Hispanic Americans are more frequently denied on business loan applications than non-Hispanic, white-owned firms.

There is an extensive literature on business loan denials that provides the theoretical basis for the regression models. Previous studies have used probit econometric analysis in an effort to determine whether higher rates of loan denial for minorities can be explained by neutral factors. The standard model includes four types of variables, that describe:

- The owner's credit and resources;
- The firm's credit and financial health;
- The environment in which the firm and lender operate, and
- Whether or not the owner is a member of a minority group.<sup>5</sup>

To examine whether neutral factors might explain the higher rates of loan denials for some minority groups, the study team developed a probit model using the data from the 1998 NSSBF. Probit regressions are the functional form of the regression analysis typically used in the literature. After excluding a small number of observations where the loan outcome was imputed, the national sample included 932 firms that had applied for a loan during the three years preceding the survey. The Pacific region included 172 such firms.

A large number of variables are required to control for differences in the neutral factors described previously. A total of 58 variables are included to represent the owners credit and resources (10 variables), the firm's credit and financial health (29 variables) and the environment in which the firm and lender operate including the nature of the loan applied for (19 variables). Given the relatively small sample sizes and the large number of variables the model requires, the study team did not attempt to estimate this model for the Pacific region by itself. Instead, we estimate a model that includes observations throughout the country and seek to identify any significant differences between the national credit market and the Pacific region credit market through interaction terms. These interactions include firms located in the Pacific region and firms owned by minorities and women in the region. This approach has been used in previous, peer-reviewed research.<sup>6</sup>

Figure H-11 on the following page presents the coefficients and t-statistics from the probit model of loan denials.

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<sup>5</sup> See, for example, Blanchard, Lloyd; Zao, Bo and John Yinger. 2005. *Do Credit Barriers Exist for Minority and Women Entrepreneurs?* Center for Policy Research, Syracuse University.

<sup>6</sup> Blanchflower, David G.; Levine, Phillip B. and David J. Zimmerman. 2003. "Discrimination in the Small-Business Credit Market." *The Review of Economics and Statistics*. 85(4): 930-943.

**Figure H-11.**  
**Dependent Variable: Loan Denial**

Variable	Coefficient	t-statistic	Variable	Coefficient	t-statistic	Variable	Coefficient	t-statistic
<b>Race/ethnicity/gender</b>			<b>Firm's Credit and Financial Health</b>			<b>Firm and Lender Environment and Loan Characteristics</b>		
Constant	-5.901834	-4.59 **	D&B credit score = moderate risk	0.751698	1.50	Partnership	0.065837	0.19
African American	1.147015	4.41 **	D&B credit score = average risk	0.776498	1.55	S corporation	-0.275278	-1.17
Asian American	0.342745	0.80	D&B credit score = significant risk	0.511792	1.00	C corporation	-0.298310	-1.07
Hispanic American	1.086194	4.68 **	D&B credit score = high risk	0.469423	0.85	Construction industry	0.552832	2.01 **
Female	-0.047219	-0.24	Total employees	-0.001487	-0.48	Manufacturing industry	0.293527	1.11
Pacific Region	0.157391	0.63	Percent of business owned by principal	-0.003396	-0.74	Transportation, communications and utilities industry	0.418079	0.93
African American in Pacific Region	-0.665632	-1.10	Family owned business	0.806781	2.63 **	Finance, insurance and real estate industries	-0.047970	-0.13
Asian American in Pacific Region	0.016462	0.03	Firm purchased	-0.296028	-1.47 *	Engineering industry	0.656266	1.82 *
Hispanic American in Pacific Region	0.119294	0.25	Firm inherited	-0.045901	-0.13	Other industry	0.310062	1.58
Female in Pacific Region	0.218200	0.56	Firm age	-0.013492	-1.23	Herfindahl index = .10 to .18	2.366303	4.52 **
			Firm has checking account	0.291959	0.88	Herfindahl index = .18 or above	2.667912	5.05 **
			Firm has savings account	-0.268816	-1.53	Located in MSA	0.190705	1.04
			Firm has line of credit	-0.935108	-4.95 **	Sales market local only	0.191879	1.20
			Existing capital leases	-0.089363	-0.46	Loan amount	0.000000	0.00
			Existing mortgage for business	-0.334783	-1.57 *	Capital lease application	-0.171244	-0.49
			Existing vehicle loans	-0.540121	-2.91 **	Business mortgage application	-0.846545	-2.97 **
			Existing equipment loans	-0.600107	-2.82 **	Vehicle loan application	-1.112551	-3.72 **
			Existing loans from stockholders	0.587765	2.89 **	Equipment loan application	-0.768501	-2.68 **
			Other existing loans	-0.108275	-0.54	Loan for other purposes	-0.304385	-1.51
			Firm used trade credit in past year	-0.230761	-1.41			
			Log of total sales in prior year	-0.013200	-0.20			
			Negative sales in prior year (indicator)	0.190337	0.23			
			Log of cost of doing business in prior year	0.019601	0.37			
			Log of total assets	0.029251	0.41			
			Negative total assets (indicator)	-0.193784	-0.22			
			Log of total equity	0.095306	1.27			
			Negative total equity (indicator)	0.959581	1.24			
			Firm bankruptcy in past 7 years	0.744926	1.39			
			Firm delinquency in business transactions	1.218895	6.65 **			
<b>Owners Credit and Resources</b>								
Age	0.007337	0.92						
Owner Experience	0.010275	0.93						
Less than high school education	0.090054	0.25						
Some college	-0.147203	-0.71						
Four year degree	-0.554377	-2.52 **						
Advanced degree	-0.436286	-1.75 *						
Bankruptcy in past 7 years	1.496524	2.66 **						
Judgement against in past 3 years	1.057841	3.27 **						
Log of net worth excluding home	-0.027334	-0.48						
Owner has negative net worth (indicator)	-0.451254	-0.64						

Note: \* Significant at 90% confidence level.  
 \*\* Significant at 95% confidence level.

Source: BBC Research & Consulting analysis of 1998 NSSBF data.

The loan denial model indicates that a number of neutral factors are significantly correlated with the probability of loan denial. These include:

- Factors specific to the business owner, including whether or not the owner had been personally bankrupt within the past seven years or had a judgment against them;
- Factors related to the firm’s credit and financial health, including if the firm had existing loans and lines of credit. Family-owned firms and firms with delinquencies in business transactions were more likely to be denied.
- Some of the firm, lender and loan environment characteristics. Firms in the construction industry are more likely to have their loan applications denied than other firms. Firms in highly concentrated industry segments (as measured by the Herfindahl Index) are more likely to be denied. Potentially collateralized loans such as business mortgages, vehicle loans and equipment loans are less likely to be denied.

After accounting for these and the other potential neutral influences, firms owned by African Americans and Hispanic Americans remain significantly more likely to have their loans denied than other firms. The interaction terms for the Pacific region, and for minority- and women-owned firms within the region, are insignificant. This result implies that the probabilities of loan denials for minority- and women-owned firms within the Pacific region are not statistically different from the national probabilities.

The study team simulated loan approval rates for minority groups with statistically significant disparities (note that the approval rate is equal to one minus the denial rate). Figure H-12 shows these simulated loan approval rates and compares them to the actual, observed mean probability of loan approval for each group in the NSSBF data set.

**Exhibit H-12.**  
**Comparison of Actual Loan Approval Rates to Simulated Loan Approval Rates Under Non-Hispanic, White Male Business Environment for Groups Experiencing Significant Disparities**

Group	Loan Approval Rates		Disparity Index (100 = parity)
	Actual	Benchmark	
African Americans	50.1%	78.3%	64
Hispanic Americans	51.6%	83.9%	62

Source: BBC Research & Consulting analysis of 1998 NSSBF data.

Based on the NSSBF data, African American-owned firms that applied for loans were denied at a rate of nearly 50 percent. Model results show that African American-owned firms would be denied loans about 22 percent of the time if they were denied at the same rate as similarly situate firms owned by non-Hispanic, white males. Hispanic American-owned firms would be denied about 16 percent of the time. The actual loan denial rate for Hispanic Americans who applied for loans is 48 percent.

## **Bid Capacity**

One of the requirements for BBC to consider a firm to be “available” for a Caltrans project in BBC’s disparity analysis is that the firm had previously bid on, or been awarded, another contract or subcontract of similar size. The study team considers the largest previous bid (or award) by a firm to be the measure of its “bid capacity.” The following analysis considers whether there is evidence of disparities in bid capacity for minority- and women-owned firms in the California construction and engineering industries.

The study team conducted an extensive survey of California transportation construction and engineering firms, which is described in Appendix C of the report. The team attempted to contact every establishment located in California in the relevant lines of business. After narrowing the sample to firms in pertinent lines of work with appropriate experience and interest for Caltrans projects, and compressing multiple responses from multi-establishment firms in California into single firm observations, the survey effort produced a database of 3,998 firms potentially available for Caltrans work.<sup>7</sup> The following analysis of bid capacity relies on the results of the Availability Survey.

One of the factors that affects bid capacity is the industry specialization of construction and engineering firms. Some industry segments, such as construction of water, sewer and utility lines, apparently involve larger projects. Other segments, such as landscape architecture and surveying and mapmaking involve smaller scale assignments. One way of controlling for variation in bid capacities in different sub-industries is to assess whether or not a firm has a bid capacity above or below the median level for firms in that sub-industry. BBC can then test whether minority- and women-owned firms bid on larger or smaller contracts or subcontracts compared with other firms in their sub-industry.

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<sup>7</sup> See Appendix C, pages 8 and 9 for further description of the survey sample and process.

Figure H-13 indicates the median bid capacity among California-based establishments in each of the 18 industry segments within the construction and engineering industries. Note that the survey questions regarding the largest project that firms had bid on or been awarded captured data in dollar ranges rather than specific dollar amounts.

**Figure H-13.**  
**Median Bid Capacity by Industry Segment**

Industry Segment	Median Bid Capacity
Highway construction and concrete work	Over \$500,000 to \$1 million
Asphalt and concrete supply	Over \$100,000 to \$500,000
Structural steel erection	Over \$100,000 to \$500,000
Wrecking and demolition	Over \$100,000 to \$500,000
Electrical work	Over \$100,000 to \$500,000
Construction sand and gravel	Over \$100,000 to \$500,000
Heavy construction equipment rental	Over \$100,000 to \$500,000
Excavation and drilling	Over \$100,000 to \$500,000
Water, sewer and utility lines	Over \$1 million to \$2 million
Trucking	Over \$100,000 to \$500,000
Testing services	Over \$100,000 to \$500,000
Landscape architecture	\$100,000 or less
Surveying and mapmaking	\$100,000 or less
Engineering	Over \$100,000 to \$500,000
Construction management	Over \$500,000 to \$1 million
Transportation consulting and planning	Over \$100,000 to \$500,000
Environmental research, consulting and remediation	Over \$100,000 to \$500,000
Archeological expeditions	Over \$100,000 to \$500,000

Source: BBC Research & Consulting, 2007.

Firms with bid capacities above the median for their industry segments are counted as available for larger Caltrans projects than most of the firms in their line of business (as well counted as available for smaller assignments). Thus, these firms figure more prominently in the availability analysis than firms with smaller bid capacities. An initial question is whether or not minority and women-owned firms are as likely as majority owned firms to have above average bid capacity for their industry segment. Figure H-14 compares the proportions of firms with above average bid capacity by ownership.

**Figure H-14.**  
**Proportion of Firms with Above Average Bid Capacity by Ownership**

Source:  
 BBC Research & Consulting, 2007.

Firm Ownership	Proportion With Above-Median Bid Capacity	
	Construction	Engineering
African American	29.4%	39.3%
Asian-Pacific American	57.1%	31.6%
Subcontinent Asian American	11.1%	45.9%
Hispanic American	33.2%	47.9%
Native American	38.2%	26.7%
Female	36.1%	28.6%
Majority-owned	41.3%	34.7%
<b>All Firms</b>	<b>39.5%</b>	<b>34.7%</b>

The results shown in Figure H-14 indicate that, in aggregate, the proportion of minority and women-owned businesses with above median bid capacity slightly lower than the proportion of firms owned by non-Hispanic, white males that have above median bid capacity for the construction industry. For the engineering industry, the proportion of firms with above median bid capacity is the same for minority- and women-owned firms (in aggregate) as for majority-owned firms. There are, however, differences in the proportions of firms with above median bid capacity for individual groups, such as African Americans or Hispanic American.

BBC then considered whether neutral factors account for differences among groups in the probability of having above median bid capacity and if there are statistically significant disparities in bid capacity after accounting for neutral factors.

There are a number of variables from the Availability Survey that may be correlated with bid capacity. Annual revenues, number of employees and, potentially, whether or not a firm has multiple establishments in California, are examples. However, the direction of causation for these variables is unclear. Do firms have greater bid capacity because they have more employees, or do they have more employees because they bid on and win larger assignments?

After considering the array of variables from the Availability Survey, the study team determined that the neutral factor that might best explain differences in bid capacity while being truly exogenous to that capacity was age of the firm. Theoretically, the longer firms are in business, the larger the contract or subcontract they may pursue.

To test this hypothesis, the study team conducted separate logistic regression analyses for the construction and engineering industries to determine whether or not bid capacity could be at least partly explained by the age of the firm and whether or not minority- and women-owned firms differ from majority-owned firms of similar ages.

**Bid capacity results for the California construction industry.** Results for the California construction industry are shown in Figure H-12, below. The logistic regression model indicates:

- The age of the firm is a significant predictor of having above average bid capacity;
- Any remaining negative differences in the likelihood of having above average bid capacity for minority and women-owned firms were not statistically significant; and
- Construction firms owned by Asian-Pacific Americans are significantly more likely to have above average bid capacity than other firms in their sub-industries.

**Figure H-15.**  
**California Construction Industry Bid Capacity Model**

Note:

\*Significant at 90% confidence level.

\*\*Significant at 95% confidence level.

Source:

BBC Research and Consulting, 2007.

Variable	Coefficient	Wald-statistic
Constant	-0.904	75.00 **
Age of firm	0.020	40.36 **
African American	-0.362	1.31
Asian-Pacific American	0.963	7.48 **
Subcontinent Asian American	-1.381	1.68
Hispanic American	-0.182	1.27
Native American	0.185	0.26
Female	-0.113	0.63

**Bid capacity results for the California engineering industry.** Results for the California engineering industry are shown in Figure H-16, below. The logistic regression model for this industry indicates:

- The age of the firm is a significant predictor of having above average bid capacity for engineering as well as construction;
- Any remaining negative differences in the likelihood of having above average bid capacity for minority and women-owned firms were not statistically significant; and
- Engineering firms owned by Subcontinent Asian Americans and Hispanic Americans are significantly more likely to have above average bid capacity than other firms in their sub-industries.

**Figure H-16**  
**California Engineering Industry Bid Capacity Model**

Note:

\*Significant at 90% confidence level.

\*\*Significant at 95% confidence level.

Source:

BBC Research and Consulting, 2007.

Variable	Coefficient	Wald-statistic
Constant	-1.285	107.42 **
Age of firm	0.027	42.03 **
African American	0.499	1.56
Asian-Pacific American	0.037	0.02
Subcontinent Asian American	0.698	4.15 **
Hispanic American	0.791	10.11 **
Native American	-0.128	0.05
Female	-0.213	1.46