

APPENDIX E.

Business Ownership in the Construction and Engineering Industries

BBC examined rates at which minorities, women and non-minority men owned businesses in San Diego County, Southern California and the United States.

Business Ownership Rates

Many studies have explored differences in rates of business ownership between minorities and non-minorities in the United States. Though self-employment rates have increased for minorities and women, a number of studies indicate that different opportunities for entrepreneurship exist based on gender, ethnicity and race.¹ One study found that the explanatory power of race and ethnicity in self-employment is not substantially diminished by including other neutral factors that also affect self-employment.²

Disparities in the rates of business ownership have been considered by courts when reviewing state DOT implementation of the Federal DBE Program. Any disparities in business ownership rates may be especially important when considering DBE participation goals. For example, research developed for the Illinois Department of Transportation (IDOT) considered disparities in business ownership rates as a factor in adjusting the base figure for the IDOT annual DBE goal.³

BBC used Public Use Micro-sample (PUMS) data (based on data from the 1980 and 2000 U.S. Census) to study rates of self-employment in construction and engineering in Southern California and San Diego County, as well as data from the 2007 American Community Survey (ACS). Self-employment and business ownership are used interchangeably in the following discussion. Rates of business ownership are based on the location of a workers home, which could be different from the business location. However, 2007 ACS data indicates that only 3.3 percent of all workers living in San Diego County work at a location outside of the county.

Construction industry. Figure E-1 shows the percentage of workers in the construction industry who were self-employed in 1980, 2000 and 2007, by race/ethnicity and gender.

¹ See Waldinger, Roger and Howard E. Aldrich. 1990. *Ethnicity and Entrepreneurship*. Annual Review of Sociology. 111-135.; Fairlie, Robert W. and Bruce D. Meyer. 1996. *Ethnic and Racial Self-Employment Differences and Possible Explanations*. The Journal of Human Resources, Volume 31, Issue 4, 757-793.; Fairlie, Robert W. and Alicia M. Robb. 2006. *Why are Black-Owned Businesses Less Successful than White-Owned Businesses? The Role of Families, Inheritances, and Business Human Capital*. Forthcoming Journal of Labor Economics.; and Fairlie, Robert W. and Alicia M. Robb. 2006. *Race, Families and Business Success: A Comparison of African-American-, Asian-, and White-Owned Businesses*. Russell Sage Foundation.

² Fairlie, Robert W. and Bruce D. Meyer. 1996. *Ethnic and Racial Self-Employment Differences and Possible Explanations*. The Journal of Human Resources, Volume 31, Issue 4, 757-793.

³ National Economic Research Associates, Inc. 2004. *Disadvantaged Business Enterprise Availability Study*. Prepared for the Illinois Department of Transportation.

**Figure E-1.
Percentage of workers who
were self-employed in the
construction industry in San
Diego County, Southern
California and the U.S.,
1980, 2000 and 2007**

Note:

In San Diego County, "All other minority groups" includes African Americans, Subcontinent Asian Americans, Native Americans and other minority groups. Sample sizes for these race/ethnicity groups were too small to statistically analyze individually.

** Denotes that the difference in proportions between the minority and non-Hispanic white groups (or female and male gender groups) is statistically significant at the 95% confidence level.

Source:

BBC Research & Consulting from 1980 and 2000 U.S. Census 5% sample and 2007 ACS Public Use Micro-sample data. The raw data extract was obtained through the IPUMS program of the MN Population Center: <http://usa.ipums.org/usa/>.

San Diego County	1980	2000	2007
Race/ethnicity			
Asian-Pacific American	8.7 % **	13.1 % **	32.2 %
Hispanic American	11.8 **	12.3 **	12.5 **
All other minority groups	10.4 **	15.0 **	25.5
Non-Hispanic white	21.0	23.5	27.9
Gender			
Female	13.8 % **	14.4 % **	14.8 % **
Male	19.7	19.9	22.9
All individuals	19.1 %	19.3 %	21.8 %
Southern California	1980	2000	2007
Race/ethnicity			
African American	13.9 % **	17.4 % **	20.9 % **
Asian-Pacific American	17.6	27.0	30.7
Subcontinent Asian American	0.0 **	15.1	40.8
Hispanic American	9.9	13.6 **	16.1 **
Native American	15.1 **	21.1 **	23.3
Other minority group	20.0	34.1 **	33.5
Non-Hispanic white	21.2	26.5	28.5
Gender			
Female	10.0 % **	15.3 % **	14.7 % **
Male	19.5	21.4	22.2
All individuals	18.5 %	20.8 %	21.5 %
Unites States	1980	2000	2007
Race/ethnicity			
African American	9.1 % **	14.8 % **	18.5 % **
Asian-Pacific American	11.2 **	21.3 **	22.7 **
Subcontinent Asian American	5.6 **	19.0 **	25.5
Hispanic American	10.7 **	12.6 **	13.8 **
Native American	9.8 **	18.7 **	22.1 **
Other minority group	17.0	24.1	16.3 **
Non-Hispanic white	18.9	25.1	26.8
Gender			
Female	9.4 % **	17.4 % **	18.5 % **
Male	18.5	23.1	23.6
All individuals	17.6 %	22.5 %	23.1 %

Business ownership rates in 2000. In 2000, about 26 percent of non-Hispanic whites working in the construction industry in Southern California and 23 percent in San Diego County were self-employed (in incorporated or unincorporated businesses). The sample of workers in the San Diego County construction industry included only a small number of African Americans, Subcontinent Asian Americans, Native American and “other minorities”, therefore, these minorities were grouped and analyzed together (“all other minority groups”). Rates of business ownership among each minority group and females working in the construction industry were lower than non-Hispanic whites:

- In 2000, about 12 percent of Hispanic Americans, 13 percent of Asian-Pacific Americans and 15 percent of “all other minority groups” working in the construction industry in San Diego County were self-employed. In each case, the difference from the non-Hispanic white rate is statistically significant at the 95 percent confidence level.
- Women owned businesses in San Diego County at a rate of about 14 percent compared with nearly 20 percent for men, a statistically significant difference.

Due to the larger sample size, a more detailed analysis of self-employment in the construction industry across race/ethnicity and gender was possible for Southern California as a whole. Disparities in rates of business ownership existed for African Americans, Subcontinent Asian Americans, Hispanic Americans, Native Americans and women when examining 2000 data for Southern California. Each of these differences are statistically significant except for Subcontinent Asian Americans. Business ownership rates for Asian-Pacific Americans were about the same as non-Hispanic whites in 2000 for Southern California.

Similar trends of low business ownership rates for African Americans and Hispanic Americans compared to non-Hispanic whites are found in the national construction industry. Women are also self-employed at lower rates than men in the United States construction industry.

Changes in business ownership rates in San Diego County and Southern California since 2000. The 2007 ACS shows increases in business ownership rates since 2000 for most groups in the Southern California and San Diego County construction industry. The increases in business ownership rates for some minority groups were higher than those for non-Hispanic whites in both San Diego and Southern California. However, differences persisted in ownership rates between some minority and non-minority groups:

- In 2007, African American business ownership rates increased to about 21 percent in Southern California. However, this ownership rate was still substantially lower (statistically significant) than the 2007 rates for non-Hispanic whites (29% in Southern California).
- Compared to other minority groups, self-employment rates for Hispanic Americans increased little from 2000 to 2007. In both San Diego County and Southern California there were still large, statistically significant disparities between Hispanic American and non-Hispanic white business ownership rates in 2007.
- From 2000 to 2007, the disparity in business ownership rates in the construction industry between men and women increased in both San Diego County and Southern California as a whole. The difference remained statistically significant.

The business ownership rate for Asian-Pacific Americans in San Diego County increased from about 13 percent in 2000 to over 32 percent in 2007. The rate in 2007 exceeded that of non-Hispanic whites, although the difference is not statistically significant.

Engineering industry. The study team also compared self-employment rates among groups working in the engineering industry in San Diego County, Southern California and the United States. Figure E-2 shows the percentage of engineering workers who were self-employed in 1980, 2000 and 2007 by race/ethnicity and gender.

Business ownership rates in 2000. BBC's analysis of business ownership rates in the engineering industry focuses on Southern California in 2000 because of the larger sample sizes in this dataset. In 2000, 16 percent of non-Hispanic whites working in the Southern California engineering industry owned their own businesses (about 13% in San Diego County). Some minority groups working in the industry in 2000 had substantially lower rates of business ownership:

- Only about 9 percent of Hispanic Americans and 8 percent of African Americans working in the engineering industry in Southern California were self-employed (both differences are statistically significant from non-Hispanic whites);
- About 10 percent of Asian-Pacific Americans in Southern California owned their own businesses (a statistically significant difference from non-Hispanic whites); and
- Subcontinent Asian Americans in the engineering industry were self-employed at a rate of 11 percent in Southern California. (The lack of statistically significant differences compared with non-Hispanic whites may be due to small sample sizes).

Native Americans in Southern California had higher rates of self-employment than non-Hispanic whites in 2000. This figure is based on a relatively small sample size.

About 8 percent of women were self-employed in the Southern California engineering industry in 2000 compared to about 16 percent of men, a statistically significant difference.

The study team also examined 2000 business ownership rates among civil, environmental and geological engineers in Southern California. Although results are not presented here due to small sample sizes, disparities in rates of business ownership generally mirrored those for the industry as a whole.

**Figure E-2.
Percentage of workers who
were self-employed in the
engineering industry in San
Diego County, Southern
California and the U.S.,
1980, 2000 and 2007**

Note:

** Denotes that the difference in proportions between the minority and non-Hispanic white groups (or female and male gender groups) is statistically significant at 95% confidence levels.

In San Diego County, "All other minority groups" includes African Americans, Subcontinent Asian Americans, Native Americans and other minority groups. Sample sizes for these race/ethnicity groups were too small to statistically analyze individually.

The data presented in this table include all business owners in the engineering industry. The study team was unable to restrict the population to the specific occupations defined in Appendix I due to small sample sizes.

Source:

BBC Research & Consulting from 1980 and 2000 U.S. Census 5% Public Use Micro-sample data and 2007 American Community Survey data. The raw data extract was obtained through the IPUMS program of the MN Population Center: <http://usa.ipums.org/usa/>.

San Diego County	1980	2000	2007
Race/ethnicity			
Asian-Pacific American	12.5 %	5.2 % **	0.0 % **
Hispanic American	0.0 **	13.4	9.0
All other minority groups	0.0 **	12.4	7.8
Non-Hispanic white	20.1	13.1	11.8
Gender			
Female	6.7 % **	6.5 %	7.0 %
Male	22.1	14.7	11.1
All individuals	18.1 %	12.2 %	10.0 %
Southern California	1980	2000	2007
Race/ethnicity			
African American	5.6 % **	8.2 % **	5.8 % **
Asian-Pacific American	10.6 **	9.9 **	9.2 **
Subcontinent Asian American	16.7	11.4	6.8
Hispanic American	7.9 **	9.1 **	8.1 **
Native American	15.4	22.3	36.4
Other minority group	0.0 **	25.0	25.3
Non-Hispanic white	19.4	16.0	15.2
Gender			
Female	4.7 % **	8.4 % **	7.2 % **
Male	21.5	16.1	15.1
All individuals	17.3 %	13.9 %	12.8 %
Unites States	1980	2000	2007
Race/ethnicity			
African American	4.7 % **	4.8 % **	4.2 % **
Asian-Pacific American	8.1 **	8.2 **	8.1 **
Subcontinent Asian American	5.9 **	6.4 **	7.9
Hispanic American	9.6 **	8.8 **	8.6 **
Native American	10.3	11.8	10.6
Other minority group	8.3	11.5	6.3
Non-Hispanic white	14.2	13.1	12.1
Gender			
Female	4.1 % **	7.5 % **	7.7 % **
Male	16.4	14.0	12.6
All individuals	13.5 %	12.2 %	11.2 %

Changes in business ownership rates in San Diego County and Southern California since 2000.

Business ownership rates for all individuals in the engineering industry in Southern California in 2007 (ACS data) were lower than the rates found in the 2000 Census. Disparities in business ownership rates persist for African Americans, Asian-Pacific Americans, Subcontinent Asian Americans, Hispanic Americans and women. Differences are statistically significant for each of these groups except Subcontinent Asian Americans.

Figure E-2 also present 2007 results for San Diego County. Due to the small sample size, African Americans, Subcontinent Asian Americans, Native American and “other minorities” were again grouped and analyzed together (“all other minority groups”). The rate of business ownership for non-Hispanic whites was about 11 percent. Each minority group as well as women had a lower rate of business ownership, however, the difference is only statistically significant for Asian-Pacific Americans.

Potential causes of differences in business ownership rates. Researchers have examined whether there are disparities in business ownership rates after considering factors such as education and age. A number of studies have found that disparities in business ownership still exist when accounting for such factors:

- Several studies have found that access to financial capital is a strong determinant of business ownership. One consistent finding is the positive relationship between start-up capital and business formation, expansion and survival.⁴ One study found that housing appreciation measured at the MSA-level is a positive determinant of entry into self-employment.⁵ However, unexplained differences still exist when controlling for these factors.⁶
- Education has positive effects on the probability of business ownership in most industries. However, findings from multiple studies indicate that minorities are still less likely to own a business than their non-minority counterparts with the same levels of education.⁷
- Intergenerational links contribute to the likelihood of self-employment. One study found that experience working for a self-employed family member increases the likelihood of self-employment for minority groups.⁸

⁴ See Lofstrom, Magnus and Chunbei Wang. 2006. *Hispanic Self-Employment: A Dynamic Analysis of Business Ownership*. Working paper, Forschungsinstitut zur Zukunft der Arbeit Institute for the Study of Labor.; and Fairlie, Robert W. and Alicia M. Robb. 2006. *Race, Families and Business Success: A Comparison of African-American-, Asian-, and White-Owned Businesses*. Russell Sage Foundation.

⁵ Fairlie, Robert W. and Harry A. Krashinsky. 2006. *Liquidity Constraints, Household Wealth and Entrepreneurship Revisited*.

⁶ Lofstrom, Magnus and Chunbei Wang. 2006. *Hispanic Self-Employment: A Dynamic Analysis of Business Ownership*. Working paper, Forschungsinstitut zur Zukunft der Arbeit Institute for the Study of Labor.

⁷ See Fairlie, Robert W. and Bruce D. Meyer. 1996. *Ethnic and Racial Self-Employment Differences and Possible Explanations*. *The Journal of Human Resources*, Volume 31, Issue 4, 757-793; and Butler, John Sibley and Cedric Herring. 1991. *Ethnicity and Entrepreneurship in America: Toward an Explanation of Racial and Ethnic Group Variations in Self-Employment*. *Sociological Perspectives*. 79-94.

⁸ See Fairlie, Robert W. and Alicia M. Robb. 2006. *Race, Families and Business Success: A Comparison of African-American-, Asian-, and White-Owned Businesses*. Russell Sage Foundation; and Fairlie, Robert W. and Alicia M. Robb. 2006. *Why are Black-Owned Businesses Less Successful than White-Owned Businesses? The Role of Families, Inheritances, and Business Human Capital*. Forthcoming *Journal of Labor Economics*.

- Studies have found that time since immigration, and assimilation into American society are important determinants of self-employment. However, unexplained differences in minority-business ownership still exist when controlling for these factors.⁹

BBC developed multivariate statistical models to further explore patterns of business ownership in Southern California's construction and engineering industries.

Regression Analysis of Business Ownership

In the discussion above, BBC identified statistically significant disparities in rates of business ownership for some minority groups in the Southern California construction and engineering industries.

There is extensive literature examining whether race- and gender-neutral factors such as access to financial capital, education, age, family characteristics (e.g., marital status) and other factors can help explain differences in rates of business ownership. This issue has also been examined in other disparity studies. Prior studies in Minnesota¹⁰ and Illinois¹¹ have conducted econometric analyses to investigate whether or not disparities in business ownership among race/ethnicity and gender groups in the combined construction and engineering industry remain after controlling for neutral factors. These studies have incorporated probit econometric models using PUMS data from the 2000 Census and have been among the materials submitted to the courts in subsequent litigation concerning states' implementation of the Federal DBE Program.

In line with these previous studies, BBC developed a probit regression model to further examine differences in the rates of business ownership among workers in the San Diego County and Southern California construction and engineering industries and to explore how neutral factors, such as age, education, access to capital and creditworthiness (among others) might account for at least a portion of these differences.

BBC developed a probit model for Southern California using 2000 PUMS data, conducting three separate regressions: one for the combined construction and engineering industries, one for construction workers only and one for engineering workers only. In total, BBC's 2000 Southern California model included 28,621 observations.

BBC developed a similar Southern California model using 2007 ACS data, conducting regressions for the combined construction and engineering industries and the construction industry alone. In total, the 2007 Southern California model included 8,311 observations. Due to the small sample size for engineering, BBC did not perform a regression for engineering workers alone in 2007.

⁹ See Fairlie, Robert W. and Bruce D. Meyer. 1996. *Ethnic and Racial Self-Employment Differences and Possible Explanations*. The Journal of Human Resources, Volume 31, Issue 4, 757-793; and Butler, John Sibley and Cedric Herring. 1991. *Ethnicity and Entrepreneurship in America: Toward an Explanation of Racial and Ethnic Group Variations in Self-Employment*. Sociological Perspectives. 79-94.

¹⁰ National Economic Research Associates, Inc. 2000. *Disadvantaged Business Enterprise Availability Study*. Prepared for the Minnesota Department of Transportation.

¹¹ National Economic Research Associates, Inc. 2004. *Disadvantaged Business Enterprise Availability Study*. Prepared for the Illinois Department of Transportation.

The probit model functional form that BBC used is consistent with other research. The probit model represents the effects of a number of independent variables in terms of a single, dichotomous dependent variable — in this case business ownership. 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 enables estimation of the probability that a worker in an industry is also a business owner. The study team excluded observations where the Census Bureau had imputed self-employment.

The extensive literature on business ownership explains the theoretical basis for business ownership regression models. BBC’s model specification is based on models developed by past researchers at the national level or state level and is very similar to models used in other studies previously reviewed by the courts.¹² 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);
- Indicators of 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 representing the race/ethnicity and gender of the individual.

¹² See, for example, *Northern Contracting, Inc. v. Illinois*, 2005 WL 2230195 at *21, N. 32 (N.D. Ill. Sept. 8, 2005), aff’d 473 F.3d 715 (7th Cir. 2007).

Results for the Southern California construction and engineering industries. BBC performed regression analyses for workers in the combined construction and engineering industries. Separate analyses were performed using 2000 Census data and 2007 ACS data.

Results for the combined construction and engineering industries in 2000. Figure E-3 presents the coefficients and t-statistics for the 2000 probit model that combines individuals working in both the construction and engineering industries.

Figure E-3.
Southern California combined construction and engineering business ownership probit model, 2000

Variable	Coefficient	t-statistic
Constant	-2.903	-22.23 **
Age	0.084	13.34 **
Age-squared	-0.001	-9.47 **
Married	-0.018	-0.73
Disabled	0.002	0.08
Children in household	-0.004	-0.42
Number of people over 65 in household	-0.107	-3.51 **
Owens home	-0.198	-6.99 **
Home value (\$000s)	0.001	13.79 **
Monthly mortgage payment (\$000s)	-0.010	-0.59
Interest and dividend income (\$000s)	0.001	1.57
Income of spouse or partner (\$000s)	0.001	2.65 **
Speaks English well	0.034	0.97
Less than high school education	-0.060	-2.00 *
Some college	0.023	0.89
Four-year degree	-0.107	-3.07 **
Advanced degree	-0.224	-4.50 **
African American	-0.233	-3.95 **
Asian-Pacific American	-0.064	-1.48
Subcontinent Asian American	-0.445	-2.54 **
Hispanic American	-0.186	-7.02 **
Native American	-0.069	-0.82
Other minority group	0.320	3.49 **
Female	-0.441	-13.42 **

Note: *, ** Denote significance at the 90% and 95% confidence levels, respectively.

Source: BBC Research & Consulting based on analysis of 2000 Census 5% Public Use Micro-sample data.

The model indicates that several neutral factors are statistically significant in predicting the probability of business ownership in these industries:

- Older individuals are more likely to be business owners, but this marginal effect declines for the oldest individuals;
- Income from a spouse or partner is positively correlated with being a business owner;
- Having less than a high school diploma, decreases the likelihood of being a business owner;
- A four-year college degree or an advanced degree also decreases the likelihood of being a business owner, compared to individuals with just a high school degree;
- Having people over 65 in the household decreases the likelihood of business ownership; and
- The combination of a negative coefficient for the indicator of homeownership and a positive coefficient for home value implies that homeownership only increases the likelihood of business ownership for individuals with homes valued above approximately \$160,000.

Even after controlling for the neutral factors available in the PUMS data, statistically significant disparities in rates of business ownership remain for African Americans, Subcontinent Asian Americans, Hispanic Americans and women. This model indicates that individuals in the “other minority” category may be more likely to own a business in the combined construction and engineering industries.

Results for the combined construction and engineering industries in 2007. Figure E-4 presents the results for the probit regression for the combined Southern California construction and engineering industries using 2007 ACS data. Many of the same neutral factors as before are statistically significant in predicting the probability of being a business owner. The regression results indicate that age, education level, homeownership and home value affect the probability of an individual becoming a business owner. The model for 2007 also shows some differences in the impact of neutral factors on business ownership:

- Having less than a high school diploma is no longer statistically significant;
- People over 65 in the household do not have a statistically significant impact on the likelihood of business ownership; and
- Having a second form of income from a spouse or partner is not a significant factor in determining the probability of business ownership.

The 2007 model indicates that after controlling for neutral factors, statistically significant disparities in engineering and construction business ownership rates remain for Hispanic Americans and women. African Americans are also less likely to own businesses, although the difference is not statistically significant (possibly due to small sample size).

Figure E-4.
Southern California combined construction and engineering
business ownership probit model, 2007

Variable	Coefficient	t-statistic
Constant	-2.769	-11.46 **
Age	0.085	7.23 **
Age-squared	-0.001	-5.12 **
Married	0.029	0.62
Disabled	-0.022	-0.23
Children in household	-0.028	-1.57
Number of people over 65 in household	0.013	0.24
Owns home	-0.401	-5.59 **
Home value (\$000s)	0.001	6.78 **
Monthly mortgage payment (\$000s)	0.020	1.11
Interest and dividend income (\$000s)	0.001	1.25
Income of spouse or partner (\$000s)	0.000	0.87
Speaks English well	-0.036	-0.59
Less than high school education	-0.083	-1.50
Some college	-0.051	-1.01
Four-year degree	-0.267	-3.99 **
Advanced degree	-0.300	-3.06 **
African American	-0.231	-1.85
Asian-Pacific American	-0.035	-0.41
Subcontinent Asian American	-0.056	-0.16
Hispanic American	-0.221	-4.39 **
Native American	-0.084	-0.44
Other minority group	0.228	0.76
Female	-0.489	-7.86 **

Note: ** Denotes significance at the 95% confidence level.

Source: BBC Research & Consulting based on analysis of 2007 ACS Public Use Micro-sample data.

Results specific to the Southern California construction industry. It is possible that the roles of neutral factors, and perhaps race/ethnicity and gender, on self-employment in the construction industry differ from those in the engineering industry. To examine this possibility, BBC performed separate regression analyses for each industry.

Southern California construction industry in 2000. Figure E-5 presents the results of the probit model of self-employment in the Southern California construction industry in 2000.

Figure E-5.
Southern California construction business ownership
probit model, 2000

Variable	Coefficient	t-statistic
Constant	-2.868	-21.08 **
Age	0.082	12.44 **
Age-squared	-0.001	-8.84 **
Married	-0.013	-0.52
Disabled	-0.005	-0.17
Children in household	-0.007	-0.71
Number of people over 65 in household	-0.110	-3.38 **
Owens home	-0.203	-6.74 **
Home value (\$000s)	0.001	13.12 **
Monthly mortgage payment (\$000s)	-0.008	-0.40
Interest and dividend income (\$000s)	0.001	1.09
Income of spouse or partner (\$000s)	0.001	1.96 *
Speaks English well	0.056	1.59
Less than high school education	-0.051	-1.71
Some college	0.062	2.34 **
Four-year degree	0.003	0.07
Advanced degree	-0.118	-1.73
African American	-0.223	-3.61 **
Asian-Pacific American	0.090	1.74
Subcontinent Asian American	-0.577	-2.28 **
Hispanic American	-0.198	-7.22 **
Native American	-0.125	-1.41
Other minority group	0.304	3.01 **
Female	-0.404	-10.65 **

Note: *,** Denote significance at the 90% and 95% confidence levels, respectively.

Source: BBC Research & Consulting based on analysis of 2000 Census 5% Public Use Micro-sample data.

Results of the model for the construction industry alone are generally similar to the 2000 model for the combined industries, with the following exceptions:

- Having some college education significantly increases the likelihood of being a business owner in construction but neither a four-year degree nor an advanced degree has a statistically significant impact on business ownership rates; and
- Having less than a high school diploma does not have a statistically significant impact on the probability of ownership in the construction industry.

The construction business ownership model for 2000 indicates statistically significant disparities in the rate of business ownership for African Americans, Subcontinent Asian Americans, Hispanic Americans and women after accounting for neutral factors. Similar to the 2000 combined model, results for the construction industry alone indicate individuals in the “other minority” category may be more likely to be business owners.

The probit modeling approach enables estimation of 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 performed a probit model regression for business ownership in the construction industry using only the non-Hispanic white males in the dataset.¹³ BBC then applied the coefficients from this version of the model to the mean characteristics of the minority and female groups in the dataset to calculate the probability of business ownership in the absence of race-related, ethnicity-related and gender-related effects. In this way BBC was able to simulate the rate of business ownership for similarly situated non-Hispanic white males.

Figure E-6 shows these simulated (“benchmark”) business ownership rates and compares them to the actual, observed mean probability of business ownership for African Americans, Subcontinent Asian Americans, Hispanic Americans, individuals classified as ‘other minority’ and women (all statistically significant disparities). This simulation approach has also been incorporated in other disparity studies reviewed by the courts.¹⁴

Figure E-6.
Comparison of actual construction business ownership rates to simulated rates under non-Hispanic white male business environment for groups with statistically significant disparities, 2000

Group	Self-employment rate		Disparity index (100 = parity)
	Actual	Benchmark	
African American	17.8%	24.9%	71
Subcontinent Asian American	15.1%	30.1%	50
Hispanic American	13.7%	21.5%	64
Other minority group	34.1%	26.4%	129
Female	15.4%	27.1%	57

Note: Since imputed observations have been dropped from the data set used to create this model, the actual rates of self-employment presented here may vary from the rates presented in Figure E-1, which included imputed observations.

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

These results suggest that there are only 71 percent as many African American-owned construction businesses in Southern 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 Hispanic Americans, Subcontinent Asian Americans and women.

¹³ This version of the model excludes the race, ethnicity and gender indicator variables since the value for all of those variables would be zero.

¹⁴ See, for example, *Northern Contracting, Inc. v. Illinois*.

On the other hand, individuals classified as “other minority” own businesses in the Southern California construction industry at rates higher than similarly situated non-Hispanic white males.

Southern California construction industry in 2007. The study team repeated the probit regression and disparity analysis for business ownership in the construction industry in Southern California using 2007 ACS data (a smaller data set than the 2000 Census). The results of the probit regression are presented in Figure E-7.

Figure E-7.
Southern California construction business ownership probit model, 2007

Variable	Coefficient	t-statistic
Constant	-2.744	-10.81 **
Age	0.084	6.71 **
Age-squared	-0.001	-4.69 **
Married	0.036	0.71
Disabled	-0.075	-0.72
Children in household	-0.033	-1.77
Number of people over 65 in household	0.015	0.26
Owns home	-0.415	-5.42 **
Home value (\$000s)	0.001	6.31 **
Monthly mortgage payment (\$000s)	0.029	1.43
Interest and dividend income (\$000s)	0.001	0.85
Income of spouse or partner (\$000s)	0.001	1.05
Speaks English well	-0.012	-0.20
Less than high school education	-0.078	-1.42
Some college	-0.033	-0.63
Four-year degree	-0.126	-1.60
Advanced degree	-0.073	-0.48
African American	-0.226	-1.70
Asian-Pacific American	0.073	0.72
Subcontinent Asian American	0.256	0.56
Hispanic American	-0.238	-4.53 **
Native American	-0.211	-1.05
Other minority group	0.198	0.60
Female	-0.488	-6.82 **

Note: ** Denotes significance at the 95% confidence level.

Source: BBC Research & Consulting based on analysis of 2007 ACS Public Use Micro-sample data.

The probit regression results for 2007 are similar to those for 2000 with some differences in the significance of neutral factors and race/ethnicity factors on the probability of business ownership. Notable differences in neutral factors include:

- Having people over 65 in the household and a second form of income from a spouse or partner are not statistically significant indicators of the probability of business ownership; and
- Having some college education is not a statistically significant determinant of ownership in the 2007 model.

In the 2007 model, statistically significant disparities in business ownership rates for Hispanic Americans and females remain. However, the disparity for African Americans, while large, is not statistically significant (which could be due to smaller sample sizes).

The study team also used 2007 ACS data to generate disparity indices, using the same methodology described above. The results of this analysis are presented in Figure E-8.

Figure E-8.
Comparison of actual construction business ownership rates to simulated rates under non-Hispanic white male business environment for groups with statistically significant disparities, 2007

Group	Self-employment rate		Disparity index (100 = parity)
	Actual	Benchmark	
Hispanic American	16.0%	28.4%	56
Female	14.8%	29.5%	50

Note: Since imputed observations have been dropped from the data set used to create this model, the actual rates of self-employment presented here may vary from the rates presented in Figure E-1, which included imputed observations.

Source: BBC Research & consulting from statistical models of 2007 American Community Survey data.

The indices imply that in Southern California in 2007, there are only 56 percent as many Hispanic Americans-owned businesses in the construction industry as would be expected if Hispanic Americans owned businesses at the same rate as similarly situated non-Hispanic white males. Women owned businesses at an even lower rate compared to non-Hispanic white males with similar neutral characteristics. The results from this model indicate a greater disparity for both groups in 2007 than in 2000.

Results specific to the Southern California engineering industry. BBC also developed a probit business ownership model for the Southern California engineering industry alone using 2000 Census data. Due to a small sample size for engineering workers in the 2007 ACS, the study team did not perform a regression for engineering-only workers for 2007. Figure E-9 presents the results of the 2000 engineering-only model.

Figure E-9.
Southern California engineering business ownership probit model, 2000

Variable	Coefficient	t-statistic
Constant	-3.852	-6.86 **
Age	0.110	4.81 **
Age-squared	-0.001	-3.49 **
Married	-0.013	-0.18
Disabled	-0.023	-0.22
Children in household	-0.021	-0.72
Number of people over 65 in household	-0.108	-1.19
Owns home	-0.236	-2.54 **
Home value (\$000s)	0.001	4.60 **
Monthly mortgage payment (\$000s)	-0.041	-1.00
Interest and dividend income (\$000s)	0.001	0.85
Income of spouse or partner (\$000s)	0.002	2.86 **
Speaks English well	-0.276	-1.26
Less than high school education	-0.438	-1.87
Some college	0.022	0.18
Four-year degree	0.222	1.84
Advanced degree	0.252	1.93
African American	-0.294	-1.36
Asian-Pacific American	-0.247	-2.85 **
Subcontinent Asian American	-0.233	-0.94
Hispanic American	0.036	0.36
Native American	0.514	1.77
Other minority group	0.479	2.12 *
Female	-0.332	-4.61 **

Note: **, * Denote significance at the 90% and 95% confidence levels, respectively.

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

Neutral factors associated with business ownership in the 2000 Southern California engineering industry include:

- Older individuals are more likely to be business owners, but this marginal effect declines for the oldest individuals;
- Income from a spouse or partner is positively correlated with being a business owner; and
- The combination of a negative coefficient for the indicator of homeownership and a positive coefficient for home value implies that homeownership only increases the likelihood of business ownership for individuals with homes valued above approximately \$250,000.

After accounting for the neutral factors available in the PUMS data, the engineering business ownership model indicates statistically significant disparities in the business ownership rates for Asian-Pacific Americans and women. Disparities for African Americans and Subcontinent Asian Americans are the same magnitude, but not statistically significant. The engineering regression model indicates individuals classified as “other minority” are more likely to be business owners, similar to the 2000 combined and construction models.

The study team simulated engineering business ownership rates for groups showing statistically significant differences based on the environment for non-Hispanic white males in the Southern California engineering industry. Figure E-10 shows the simulated business ownership rates and compares them to the actual, observed mean probability of engineering business ownership for groups where disparities are statistically significant.

Figure E-10.
Comparison of actual engineering business ownership rates to simulated rates under non-Hispanic white male business environment for groups with significant disparities, 2000

Group	Self-employment rate		Disparity index (100 = parity)
	Actual	Benchmark	
Asian-Pacific American	10.0%	15.2%	66
Other minority group	25.0%	14.3%	175
Female	8.3%	14.3%	58

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

Note: Since imputed observations have been dropped from the data set used to create this model, the actual rates of self-employment presented here may vary from the rates presented in Figure E-2, which included imputed observations.

These results suggest:

- Women experience about the same levels of disparity in business ownership in the Southern California engineering and construction industries;
- Asian-Pacific Americans own businesses in the engineering industry at a rate about two-thirds the rate for similarly situated non-Hispanic white men; and
- Individuals classified as “other minority” own businesses at higher rates than similarly situated non-Hispanic white men in the engineering industry.

Summary of Business Ownership in the Construction and Engineering Industries

At the time of this report, the most extensive data on business ownership comes from the 2000 Census. The analyses of these data provide the highest level of accuracy and detail and are the focus of this summary.

In 2000, disparities in business ownership were present in the construction industry.

- Business ownership rates in the construction industry were lower for African Americans than for non-Hispanic whites in both San Diego County and Southern California — the difference is statistically significant for Southern California.
- Hispanic Americans working in both the San Diego County and Southern California construction industries had ownership rates lower than that of non-Hispanic whites (both statistically significant differences).
- The business ownership rates for women in the San Diego County and Southern California construction industries were lower than ownership rates for men (both statistically significant differences).
- Lower business ownership rates (statistically significant) also existed for Asian-Pacific Americans in the San Diego County construction industry. No statistically significant difference is present between these two groups in Southern California as a whole.

Some disparities were also found in the engineering industry in 2000.

- Compared to non-Hispanic whites, ownership rates in both the San Diego County and Southern California engineering industries for Asian-Pacific Americans were lower and statistically significant.
- The business ownership rates for women in the San Diego County and Southern California engineering industries were lower than ownership rates for men (both statistically significant differences).
- A statistically significant disparity was present for Hispanic Americans in the Southern California engineering industry.

Probit regression models were used to investigate the presence of race/ethnicity and gender disparities in business ownership in Southern California after accounting for the effects of neutral factors.

- Statistically significant disparities in construction business ownership rates were found for African Americans, Subcontinent Asian Americans, Hispanic Americans and women in 2000.
- Statistically significant disparities were found for Asian-Pacific Americans and women in the engineering industry in 2000.