

APPENDIX F.

Business Ownership in the Oregon Construction and Engineering Industries

Focusing on construction and engineering, Keen Independent examined business ownership for different racial, ethnic and gender groups in Oregon using Public Use Microdata Samples (PUMS) from the 2000 Census and from the 2008–2012 American Community Survey (ACS). (Appendix F uses “self-employment” and “business ownership” interchangeably.)

As discussed in Appendix E, Keen Independent considers Clark and Skamania counties in Washington as part of the Oregon marketplace due to their inclusion in the Portland-Vancouver-Hillsboro, OR-WA Metropolitan Statistical Area. Any discussion of the Oregon marketplace or Oregon construction and engineering industries in the following analysis also includes firms and individuals located in these two Washington counties.

A. Business Ownership Rates

Many studies have explored differences between minority and non-minority business ownership at the national level.¹ Although self-employment rates have increased for minorities and women over time, a number of studies indicate that race, ethnicity and gender continue to affect opportunities for business ownership. The extent to which such individual characteristics may limit business ownership opportunities differs across industries and from state to state.

Construction industry. Keen Independent classified workers as self-employed if they reported that they worked in their own unincorporated or incorporated business. In 2008–2012, 27 percent of workers in the Oregon construction industry were self-employed compared with 12 percent of workers across all industries.

Rates of self-employment in the Oregon construction industry vary by race, ethnicity and gender. Figure F-1 shows the percentage of workers who were self-employed in the construction industry by group for 2000 and 2008–2012 in Oregon.

¹ See, for example, Aldrich, H. E., & Waldinger, R. (1990). Ethnicity and Entrepreneurship. *Annual Review of Sociology*, 16, 111–135; Fairlie, R. W., & Meyer, B. D. (1996). Ethnic and Racial Self-Employment Differences and Possible Explanations. *The Journal of Human Resources*, 31(4), 757–793; Fairlie, R. W., & Robb, A. M. (2007). Why are Black-Owned Businesses Less Successful than White-Owned Businesses? The Role of Families, Inheritances and Business Human Capital. *Journal of Labor Economics*, 25(2), 289–323; Fairlie, R. W., & Robb, A. M. (2006). Race, Families and Business Success: A Comparison of African-American-, Asian-, and White-Owned Businesses. *Russell Sage Foundation*; and Chatterji, A. K., Chay, K. Y., & Fairlie, R. W. (2013). The Impact of City Contracting Set-Asides on Black Self-Employment and Employment. Working paper. Retrieved from <http://www.nber.org/papers/w18884>

Figure F-1.
 Percentage of workers in the construction industry who were self-employed, 2008–2012 and 2000

Oregon	2008-2012	2000
Race/ethnicity		
African American	24.7 %	12.7 % **
Asian American	28.8	15.5 **
Hispanic American	11.6 **	11.2 **
Native American or other	18.5 **	19.9 **
Non-Hispanic white	29.3	27.8
Gender		
Female	21.5 % **	19.5 % **
Male	27.4	27.0
All individuals	26.8 %	26.2 %

Note: **, ** Denote that the difference in proportions between the minority and non-Hispanic white groups (or female and male groups) for the given Census/ACS year is statistically significant at the 90% or 95% confidence level, respectively.

Source: Keen Independent Research from 2000 U.S. Census 5% sample and 2008–2012 ACS Public Use Microdata samples. The 2000 Census and 2008–2012 ACS raw data extracts were obtained through the IPUMS program of the MN Population Center: <http://usa.ipums.org/usa/>.

Business ownership rates in 2000. In 2000, 28 percent of non-Hispanic whites were self-employed. Business ownership rates were approximately half of that rate for African Americans, Hispanic Americans and Asian Americans (statistically significant differences).

- About 13 percent of African Americans working in the Oregon construction industry owned businesses, less than half the rate of non-Hispanic whites.
- About 16 percent of Asian Americans working in the Oregon construction industry owned businesses.
- About 11 percent of Hispanic Americans in the construction industry owned businesses, also less than half the rate of non-Hispanic whites.
- The ownership rate of Native Americans and other minorities in the construction industry was 20 percent.

In 2000, there were also differences in business ownership rates between men and women working in the industry: 27 percent of men in the Oregon construction industry owned businesses and about 20 percent of women owned businesses in 2000, a statistically significant difference.

Business ownership in 2008–2012. Between 2000 and 2008–2012, business ownership rates in the Oregon construction industry grew for non-Hispanic whites and most minority groups, and for women. Business ownership rates increased for African Americans and Asian Americans working in the industry to the point where there were no longer any statistically significant differences in self-employment rates compared with non-Hispanic whites.

In 2008–2012, disparities in business ownership rates persisted between non-Hispanic whites (25%) and other minority groups:

- Although business ownership among Hispanic Americans in the construction industry increased to 12 percent in 2008–2012; the difference in ownership rates from non-Hispanic whites remained statistically significant.
- About 19 percent of Native Americans in the construction industry in 2008–2012 were self-employed. The business ownership rate for this group remained less than the rate for non-Hispanic whites (statistically significant difference).

The business ownership rate among women increased to about 22 percent for 2008–2012, still less than that for men (a statistically significant difference).

Engineering industry. Keen Independent also examined business ownership rates in the Oregon engineering industry. Figure F-2 presents the percentage of workers who were self-employed in the engineering industry in 2000 and 2008–2012. (Note that the 0 percent results for African American owners of engineering firms are only for the Census data sample for those years; Keen Independent did identify African American-owned engineering-related firms from other sources.)

Figure F-2.
Percentage of workers in the engineering industry who were self-employed, 2000 and 2008–2012

Oregon	2008-2012	2000
Race/ethnicity		
African American	0.0 % **	0.0 % **
Asian American	10.6	7.7 **
Hispanic American	9.3	11.8
Native American or other minority	6.8 *	24.4
Non-Hispanic white	19.0	19.3
Gender		
Female	10.6 % **	10.6 % **
Male	20.5	21.5
All individuals	17.9 %	18.5 %

Note: **, * Denote that the difference in proportions between the minority and non-Hispanic white groups (or female and male groups) for the given Census/ACS year is statistically significant at the 90% or 95% confidence level, respectively.

Source: Keen Independent Research from 2000 U.S. Census 5% sample and 2008–2012 ACS Public Use Microdata samples. The 2000 Census and 2008–2012 ACS raw data extracts were obtained through the IPUMS program of the MN Population Center: <http://usa.ipums.org/usa/>.

Business ownership rates in 2000. In 2000, 19 percent of non-Hispanic whites working in the Oregon engineering industry were self-employed. Business ownership rates were considerably lower for African Americans, Asian Americans and Hispanic Americans working in the industry (statistically significant differences for African Americans and Asian Americans). The Census data did not contain any African American owners of engineering businesses in the sample data for that year. Figure F-2 shows these results.

In 2000, the rate of self-employment for women working in the engineering industry was about one-half that of men (statistically significant difference). The right-hand column of Figure F-2 provides results for self-employment rates in 2000.

Business ownership rates in 2008–2012. As shown in Figure F-2, there was little change in business ownership for workers in the engineering industry from 2000 to 2008–2012. Business ownership rates decreased for some minority groups as well as non-Hispanic whites. Asian Americans were the only group to see an increase in business ownership rates, while there was no change for African Americans (0%) and women (11%).

In the Oregon engineering industry in 2008–2012, there were large differences in business ownership rates for minority groups compared with non-Hispanic whites, as discussed below:

- There were no self-employed African Americans in the sample data for the engineering industry in 2008–2012, so the calculated business ownership rate for that group was 0 percent (statistically significant difference).
- Among those working in the engineering industry, about one-half as many Asian Americans and Hispanic Americans were self-employed as found for non-Hispanic whites. These differences were not statistically significant, in large part because of the small sample size of these groups in the Oregon engineering industry.
- The rate for Native Americans was about 7 percent in 2008–2012. Native Americans were self-employed at less than half the rate of non-Hispanic whites (statistically significant difference).

Figure F-2 also compares business ownership rates for women and men working in the Oregon engineering industry. For 2008 to 2012, about 11 percent of women in the engineering industry were self-employed compared with 21 percent of men. The difference between the two groups was statistically significant.

Potential causes of differences in business ownership rates. Nationally, researchers have examined whether there are disparities in business ownership rates after considering personal characteristics such as education and age. Several studies have found that disparities in business ownership still exist even after accounting for such factors.

- **Financial capital.** Some studies have concluded that access to financial capital is a strong determinant of business ownership. Researchers have consistently found correlation between startup capital and business formation, expansion and survival.² In addition, one study found that housing appreciation measured at the Metropolitan Statistical Area level is a positive determinant of becoming self-employed.³ However, unexplained differences still exist when statistically controlling for those factors.⁴ Access to capital is discussed in more detail in Appendix G.
- **Education.** Education has a positive effect on the probability of business ownership in most industries. However, results of multiple studies indicate that minorities are still less likely to own a business than non-minorities with similar levels of education.⁵ Recent research confirms a significant relationship between education and ability to obtain startup capital.⁶
- **Intergenerational links.** Intergenerational links affect one's likelihood of self-employment. One study found that experience working for a self-employed family member increases the likelihood of business ownership for minorities.⁷
- **Immigration to the United States.** Time since immigration and assimilation into American society are also important determinants of self-employment, but unexplained differences in business ownership between minorities and non-minorities still exist when accounting for those factors.⁸

² See Lofstrom, M., & Wang, C. (2006). Hispanic Self-Employment: A Dynamic Analysis of Business Ownership. Working paper, Institute for the Study of Labor. Retrieved from <http://ftp.iza.org/dp2101.pdf>; Fairlie, R. W., & Robb, A. M. (2006). Race, Families and Business Success: A Comparison of African-American-, Asian-, and White-Owned Businesses. *Russell Sage Foundation*; Chatterji, A. K., Chay, K. Y., & Fairlie, R. W. (2013). The Impact of City Contracting Set-Asides on Black Self-Employment and Employment. Working paper. Retrieved from <http://www.nber.org/papers/w18884>

³ Fairlie, R. W., & Krashinsky, H. A. (2006). Liquidity Constraints, Household Wealth and Entrepreneurship Revisited. IZA Discussion Paper No. 2201.

⁴ Lofstrom, M., & Wang, C. (2006). Hispanic Self-Employment: A Dynamic Analysis of Business Ownership. Working paper, Institute for the Study of Labor. Retrieved from <http://ftp.iza.org/dp2101.pdf>

⁵ See Fairlie, R. W., & Meyer, B. D. (1996). Ethnic and Racial Self-Employment Differences and Possible Explanations. *The Journal of Human Resources*, 31(4), 757–793; and Butler, J. S., & Herring, C. (1991). Ethnicity and Entrepreneurship in America: Toward an Explanation of Racial and Ethnic Group Variations in Self-Employment. *Sociological Perspectives*, 79–94.

⁶ Fairlie, R. W., Robb, A. M., & Robinson, D. T. (2009). Capital Injections among New Black and White Business Ventures: Evidence from the Kauffman Firm Survey. Working paper, Federal Reserve Bank of Cleveland.

⁷ See Fairlie, R. W., & Robb, A. M. (2006). Race, Families and Business Success: A Comparison of African-American-, Asian-, and White-Owned Businesses. *Russell Sage Foundation*; and Fairlie, R. W., & Robb, A. M. (2007). Why are Black-Owned Businesses Less Successful than White-Owned Businesses? The Role of Families, Inheritances and Business Human Capital. *Journal of Labor Economics*, 25(2), 289–323.

⁸ See Fairlie, R. W., & Meyer, B. D. (1996). Ethnic and Racial Self-Employment Differences and Possible Explanations. *The Journal of Human Resources*, 31(4), 757–793; and Butler, J. S., & Herring, C. (1991). Ethnicity and Entrepreneurship in America: Toward an Explanation of Racial and Ethnic Group Variations in Self-Employment. *Sociological Perspectives*, 79–94.

B. Business Ownership Regression Analysis

Race, ethnicity and gender can affect opportunities for business ownership, even when accounting for personal characteristics such as education, age and familial status. Recent research using data from 2007 through 2010 indicates that minorities (including African Americans and Hispanic Americans) face greater credit constraints at business startup and throughout business ownership than non-Hispanic whites, even after controlling for other factors including credit score.⁹

To further examine business ownership, Keen Independent developed multivariate regression models to explore patterns of business ownership in Oregon. Those models estimate the effect of race, ethnicity and gender on the probability of business ownership while statistically controlling for other personal and family characteristics.

An extensive body of literature examines whether race- and gender-neutral personal factors such as access to financial capital, education, age, and family characteristics (e.g., marital status) help explain differences in business ownership. That subject has also been examined in other disparity studies. For example, prior studies in Minnesota and Illinois have used econometric analyses to investigate whether disparities in business ownership for minorities and women working in the construction and engineering industries persist after statistically controlling for race- and gender-neutral personal characteristics.^{10, 11} Those studies have incorporated probit econometric models using PUMS data from the 2000 Census, and have been among the materials that agencies have submitted to courts in subsequent litigation concerning the implementation of the Federal DBE Program.

Keen Independent used similar probit regression models to predict business ownership from multiple independent or “explanatory” variables,¹² such as:

- Personal characteristics that are potentially linked to the likelihood of business ownership — age, age-squared, disability, marital status, number of children in the household, number of elderly people in the household, and English-speaking ability;
- 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
- Race, ethnicity and gender.

⁹ Robb, A. M. (2012). Access to Capital among Young Firms, Minority-owned Firms, Women-owned Firms and High-Tech Firms. *Small Business Administration*; Chatterji, A. K., Chay, K. Y., & Fairlie, R. W. (2013). The Impact of City Contracting Set-Asides on Black Self-Employment and Employment. Working paper. Retrieved from <http://www.nber.org/papers/w18884>

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.

¹² Probit models are often used in the literature that examines business ownership rates. A probit model estimates the effects of multiple independent or “predictor” variables in terms of a single, dichotomous dependent or “outcome” variable — in this case, business ownership. The dependent variable is binary, coded as “1” for individuals in a particular industry who are self-employed and “0” for individuals who are not self-employed. The model enables estimation of the probability that workers in a given sample are self-employed, based on their individual characteristics. Keen Independent excluded observations where the Census Bureau had imputed values for the dependent variable (business ownership).

Keen Independent developed two probit regression models using PUMS data from the 2008–2012 ACS:

- A model for the Oregon construction industry that included 5,862 observations; and
- A model for the Oregon engineering industry that included 982 observations.

Oregon construction industry in 2008–2012. Figure F-3 presents the coefficients for the probit regression model for individuals working in the Oregon construction industry in 2008–2012. Several factors were important and statistically significant in predicting the probability of business ownership:

- Older workers were associated with a *higher* probability of business ownership, and this effect diminished for the oldest workers;
- Workers who owned a home were associated with a *higher* probability of business ownership;
- Higher home values were associated with a *higher* probability of business ownership; and
- Higher mortgage payments were associated with a *higher* probability of business ownership.

After statistically controlling for factors other than race, ethnicity and gender, there were statistically significant disparities in business ownership rates for Hispanic Americans, Native Americans and women working in the Oregon construction industry. Members of these minority groups and women working in the Oregon construction industry were less likely to own construction businesses than similarly-situated non-minorities or men.

Figure F-3.
Oregon construction industry
business ownership model, 2008–
2012

Note:

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

Source:

Keen Independent Research from 2008–2012
ACS Public Use Microdata samples. The 2008–
2012 ACS raw data extract was obtained
through the IPUMS program of the MN
Population Center: <http://usa.ipums.org/usa/>.

Variable	Coefficient
Constant	-3.0050 **
Age	0.0681 **
Age-squared	-0.0005 **
Married	-0.0050
Disabled	-0.0810
Number of children in household	0.0053
Number of people over 65 in household	-0.0166
Owns home	0.1270 *
Home value (\$0,000s)	0.0007 **
Monthly mortgage payment (\$0,000s)	0.0511 *
Interest and dividend income (\$0,000s)	0.0009
Income of spouse or partner (\$0,000s)	-0.0005
Speaks English well	0.2930
Less than high school education	-0.0196
Some college	0.0191
Four-year degree	0.1160
Advanced degree	0.1490
African American	0.1400
Asian American	0.0193
Hispanic American	-0.2760 **
Native American	-0.3550 **
Other Minority	0.3790
Female	-0.3010 **

Simulations of business ownership rates. Probit modeling allows for further analysis of the disparities identified in business ownership rates for Hispanic Americans, Native Americans and women. Keen Independent modeled business ownership rates for these groups as if they had the same probability of business ownership as similarly situated non-Hispanic white males.

1. Keen Independent performed a probit regression analysis predicting business ownership using only non-Hispanic white male construction workers in the dataset.¹³
2. After obtaining the results from the non-Hispanic white male regression model, the study team used coefficients from that model along with the mean personal, financial and educational characteristics of Hispanic American, Native American and non-Hispanic white women working in the Oregon construction industry (i.e., indicators of educational attainment as well as indicators of personal financial resources and constraints) to estimate the probability of business ownership of each group. Similar simulation approaches have been used in other disparity studies that courts have reviewed.

¹³ That version of the model excluded the race, ethnicity and gender indicator variables, because the value of all of those variables would be the same (i.e., 0).

Figure F-4 presents the simulated business ownership rate (i.e., “benchmark” rate) for Hispanic Americans, Native Americans and non-Hispanic white women, and compares it to the actual, observed mean probabilities of business ownership for that group. The disparity index was calculated by taking the actual business ownership rate for each group, dividing it by that group’s benchmark rate, and then multiplying the result by 100. The disparity index expresses the presence of an ownership disparity, or lack thereof, in terms of what would be expected based on the simulated business ownership rates of similarly-situated non-Hispanic white male construction workers. Note that the “actual” self-employment rates are for the dataset used for these regression analyses and do not always exactly match results from the entire 2008–2012 data.

Results from these analyses show lower actual self-employment rates for Hispanic Americans, Native Americans and non-Hispanic white women than the simulated ownership rates for these groups:

- **Hispanic Americans.** The actual ownership rate for Hispanic American workers in the construction industry was 11.9 percent, which is less than the benchmark rate of 22.2 percent. Dividing 11.9 percent by 22.2 percent (and then multiplying by 100) gives a disparity index of 53 for Hispanic American business ownership. Because the index is less than 100, the results indicate a disparity. Because it is less than 80, it indicates a “substantial” disparity (Appendix B has a discussion of the use of substantial disparity in court cases). In other words, Hispanic Americans owned businesses at about one-half the rate that would be expected based on simulated ownership rates of non-Hispanic white male construction workers.
- **Native Americans.** The actual business ownership rate for Native Americans was 16 percent, which is less than the benchmark rate of 26.4 percent. The corresponding disparity index was 61, indicating that Native Americans owned construction businesses at 61 percent of the rate that would be expected based on simulated ownership rates of non-Hispanic white males. This indicates a substantial disparity in the business ownership rates for Native Americans working in the Oregon construction industry.
- **Women.** The benchmark ownership rate for non-Hispanic white women was 32.6 percent, and the corresponding disparity index was 67, indicating that business ownership for non-Hispanic white women in the construction industry was about two-thirds of the rate that would be expected based on simulated rates of non-Hispanic white males.

Figure F-4.
Comparison of actual business ownership rates to simulated rates for Oregon construction workers, 2008–2012

Group	Self-employment rate		Disparity index (100 = parity)
	Actual	Benchmark	
Hispanic American	11.9%	22.2%	53
Native American	16.0%	26.4%	61
Non-Hispanic white female	21.9%	32.6%	67

Note: As the benchmark figure can only be estimated for records with an observed (rather than imputed) dependent variable, comparison is made with only this subset of the sample. For this reason, actual self-employment rates may differ slightly from those in Figure F-1.

Source: Keen Independent Research from 2008–2012 ACS Public Use Microdata samples. The 2008–2012 ACS raw data extract was obtained through the IPUMS program of the MN Population Center: <http://usa.ipums.org/usa/>.

Oregon engineering industry in 2008 through 2012. Keen Independent developed a separate business ownership model for the Oregon engineering industry using 2008–2012 ACS data. Figure F-5 presents the coefficients from that probit model.¹⁴ After controlling for personal and family characteristics, there were statistically significant disparities in business ownership rates among people working in the Oregon engineering industry for African Americans, Native Americans and women.

Figure F-5.
Oregon engineering industry business ownership model, 2008–2012

Note:

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

Source:

Keen Independent Research from 2008–2012 ACS Public Use Microdata samples. The 2008–2012 ACS raw data extract was obtained through the IPUMS program of the MN Population Center: <http://usa.ipums.org/usa/>.

Variable	Coefficient
Constant	-1.6130
Age	-0.0013
Age-squared	0.0004
Married	-0.3420 **
Disabled	-0.1710
Number of children in household	0.1200
Number of people over 65 in household	-0.0299
Owns home	0.0967
Home value (\$0,000s)	0.0002
Monthly mortgage payment (\$0,000s)	0.1450
Interest and dividend income (\$0,000s)	-0.0003
Income of spouse or partner (\$0,000s)	0.0007
Less than high school education	-4.7630 **
Some college	-0.1840
Four-year degree	-0.2810
Advanced degree	0.0656
African American	-4.8040 **
Asian American	-0.2960
Hispanic American	-0.2810
Native American	-4.7030 **
Other Minority	0.0312
Female	-0.2970 **

¹⁴ Speaking English well was excluded from the engineering industry model because nearly every individual in the dataset spoke English well.

Simulations of business ownership rates. Using the same approach as for the construction industry, Keen Independent simulated business ownership rates in the Oregon engineering industry. Figure F-6 presents actual and simulated (“benchmark”) business ownership rates for African Americans and Hispanic Americans in the Oregon engineering industry. (The number of other minorities in the construction sample was too small to perform the analysis for that group.)

- **African Americans and Native Americans.** There were no African American or Native American business owners in the 2008–2012 engineering worker sample data. The benchmark business ownership rate for African Americans was about 11 percent based on similarly situated non-Hispanic white males. The benchmark rate for Native Americans was about 15 percent. As actual self-employment for both groups in these data was 0 percent, the resulting disparity index for business ownership was 0 for African Americans and Native Americans working in the Oregon engineering industry
- **Women.** Results of the probit simulation for women were similar to the disparity identified for Hispanic Americans, as shown in Figure F-6. The resulting disparity index for non-Hispanic white women compared with non-Hispanic white men was 70. In other words, non-minority women working in the Oregon engineering industry were about two-thirds as likely to own businesses as non-minority men with similar personal and family characteristics.

Figure F-6.
Comparison of actual business ownership rates to simulated rates for Oregon workers in the engineering industry, 2008–2012

Group	Self-employment rate		Disparity index (100 = parity)
	Actual	Benchmark	
African American	0.0%	11.4%	0
Native American	0.0%	14.6%	0
Non-Hispanic white female	11.6%	16.6%	70

Note: As the benchmark figure can only be estimated for records with an observed (rather than imputed) dependent variable, comparison is made with only this subset of the sample. For this reason, actual self-employment rates may differ slightly from those in Figure F-2.

Source: Keen Independent Research from 2008–2012 ACS Public Use Microdata samples. The 2008–2012 raw data extract was obtained through the IPUMS program of the MN Population Center: <http://usa.ipums.org/usa/>.

C. Summary of Business Ownership in the Construction and Engineering Industries

Disparities in business ownership were present in the Oregon construction industry:

- In both the 2000 and 2008–2012 time periods, business ownership rates for Hispanic Americans, Native Americans and women were substantially lower than that of non-Hispanic whites. Business ownership rates for African Americans and Asian Americans were lower than non-minorities in 2000 (a statistically significant difference).
- After statistically controlling for factors including education, age, family status and homeownership, statistically significant disparities in business ownership rates persisted for Hispanic Americans, Native Americans and women working in the Oregon construction industry in 2008–2012.

There were also disparities in business ownership in the Oregon engineering industry:

- Compared to non-Hispanic whites, business ownership rates were lower for African Americans, Native Americans and women in 2008–2012; those differences were statistically significant. Business ownership rates were also lower for Asian Americans and Hispanic Americans, but the differences were not statistically significant.
- Using regression analysis to account for other personal characteristics, there were substantial disparities for African Americans, Native Americans and women in 2008–2012.