Effects of Great Recession on Income Poverty

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1 Study Aim

The aim of this study is to analyze how households with a working age adult with disability compare with households with no adult with disability, during the *great recession*, using "Income Poverty" as a measure of economic wellbeing, when controlling for demographic factors such as gender, marital status, education, race and origin.

2 Sample

For this analysis data from US Census Bureau's SIPP 2008 panel survey was used. [1]. Questions on whether the households had a working age adult with disability were asked in wave-6 of the survey, which ended in August, 2010. Households that participated in wave-6 were included in our sample. There were a total of 34,850 households in wave six. Survey data upto wave-15 were used in our sample. Survey results from July, 2008 through June, 2013 were included in the analysis. Households whose reference person remained the same throughout the 2008 panel were kept in the sample. The reference persons of the households were also required to be 18 years or older throughout the 2008 panel. The final sample had 33,547 households that satisfied all the inclusion criteria.

[1] For more information on the SIPP 2008 panel schedule, please refer to this US Census Bureau website

3 Methods

Total monthly household income was divided by monthly federal poverty level (FPL) and then averaged over quarters to estimate FPL100-ratio. An FPL100-ratio lower than one in any quarter indicated the household was below 100% Federal poverty level in that quarter. Averaging monthly values over a quarter reduced the noise in the response variable by eliminating the month-by-month variability in the income data. In the sample, the monthly income data ranged from -$27,180 to $108,900, the average being $5240 and median $3,874. The negative incomes were associated with households owning business that incurred lossed in those months. The FPL100-ratio ranged from -17.95 to 89.48, with the average being 3.817 and the median 2.924. In the sample, 7,865 out of 33,547 households (23.44%) had at least one working age adult with disability during the observed time period, as identified in wave-6 of the survey. Data from July 2008 (2008-Q3) through May 2013 (2013-Q1) were analyzed. This period overlapped with twelve of the eighteen months [2] of the "Great recession" and its long wake.

3.1 Mixed-effects model for income poverty

A mixed (fixed and random) effects model was fit to estimate the impact of the presence of a working-age adult with disability in a household on its FPL100-ratio. Let Y denote the vector or responses (FPL100-ratio). Let Θ denote the vector of fixed effect factors like gender, marital status, education level, race, origin of household head, along with their interactions. Let β denote another fixed effect of time, represented as quarters, starting from 2008-Q3 and ending in 2013-Q1. Let b denote the household level random effect (random intercept). Then, the mixed-effects ([3]) model for the responses, for each household i can

[2] NBER Recession Cycles

be written as

$$Y_{ij} = \beta_0 + \beta t_j + X_i\Theta + b_i + \epsilon_{ij} \tag{1}$$

where, ϵ_{ij} are regarded as measurement errors, i goes from 1 to H, the number of households, j goes from 1 to T, the total number of quarterly observations for every household. In this model, the response from the i^{th} household at time t_j is assumed to differ from the population mean $X_i\Theta + \beta t_j$ by a household effect b_i and a within household measurement error ϵ_{ij}. The within household and between household errors are assumed to be normal and independent ($b_i \sim \mathcal{N}(0, \sigma_b^2)$, $\epsilon_{ij} \sim \mathcal{N}(0, \sigma^2)$, $b_i \perp\!\!\!\perp \epsilon_{ij}, \forall i, j$). The effect of "time" is a fixed effect and it could be considered part of the fixed effect design matrix X. However, the problem of interest is to test a linear hypothesis about the disability-by-time interaction, to detect the effect of disability on the mean response over the period of the study. Hence, the "time" covariate is denoted separately. During estimation it will be estimated as a fixed effect. Below is the model that will be fit:

$$Y_{ij} = \beta_0 + \beta t_j + \delta \mathbb{1}_{D_i} + \gamma(\mathbb{1}_{D_i} * t_j) + X_i\Theta + b_i + \epsilon_{ij} \tag{2}$$

where, $\mathbb{1}_{D_i} = 1$, if household i has a working age adult with disability, else $\mathbb{1}_{D_i} = 0$. The hypotheses of interests are:

$H_0 : \beta = 0,$ vs $H_a : \beta \neq 0$ tested if FPL100-ratio changed over time

$H_0 : \delta = 0,$ vs $H_a : \delta \neq 0$ tested if disability had any effect on FPL100-ratio

$H_0 : \Theta = 0,$ vs $H_a : \Theta \neq 0$ tested if demographic factors had any effect on FPL100-ratio.

In addition, interactions between demographic factors, and between disability and demograhic factors were also tested.

Demographic factors

The demographic factors were considered as fixed effects. The factors included in this analysis were *gender*, *marital status*, *education*, and *race/origin* of household head. The

Race/Origin factor included "non-hispanic white", "non-hispanic black", "hispanic" and "others". For simplicity, "white" and "black" would indicate categories "non-hispanic white" and "non-hispanic black". Gender of household head had two categories: "male" and "female". Education of household head has three categories: "high-school or less", "some college, diploma, associated degrees" and "bachelors or higher". Marital status of household heads has two categories: "married" and "not married". Divorced or widowed household heads were considered in the "not married" category.

Computational software

All analysis were conducted using the statistical software R ([7]), version 3.3.1. The mixed effects models were fit using the R-package "lme4" ([1]) and all hypothesis tests were done using the R package "lmerTest" ([5]). The final model was fit with some of the fixed effect factors along with their interactions after performing "backward elimination" on the full model. Elimination of the fixed effects were done by the principle of marginality, that is: the highest order interactions are tested first: if they are significant, the lower order effects were included in the model without testing for significance. The p-values for the fixed effects are estimated from the F statistics, with "Satterthwaite" approximation ([8]) denominator degrees of freedom. The p-values for the random effect were computed from likelihood ratio tests ([6]).

3.2 Model for income poverty, with baseline correction

In order to isolate the effect of the *great recession* on income poverty (response), measured by FPL100-ratio, the values of the response at the beginning of study period (2008-Q3) were subtracted from each household's responses. Consequently, all FPL100-ratios of all households at 2008-Q3 were zero. The same model as in eq 1 was fit to this baseline-corrected responses. The problem of interest was to test a linear hypothesis about the

disability-by-time interaction.

3.3 Post-hoc tests

Post-hoc tests were conducted between categories of all demographic factors and their interactions, by calculating differences of "Least Squares Means" using R package "lmerTest" ([5]), with "Satterthwaite" approximation ([8]) of the denominator degrees of freedom.

Multiple testing correction

When conducting post-hoc tests for demographic factors and their interactions, due to multiple categories of these factors the size of the tests might be inflated. Sequentially rejective *Bonferroni procedure* ([4]) and *Benjamini-Hochberg procedure* ([2]) remain the two most popular multiple testing correction procedures. Holm's sequentially rejective Bonferroni procedure controls the family-wise type-I error rate (FWER) and is more powerful than the classical Bonferroni procedure. Benjamini-Hochberg controls the false discovery rate (FDR) which is the expected value of false discovery proportion. Controlling FWER usually proves to be too conservative. Hence, we used the Benjamini-Hochberg procedure , which is less conservative, but more powerful than Bonferroni correction. All post-hoc test p-values reported are Benjamini-Hochberg corrected.

4 Results

Table 1 shows the coefficients of time (measured in year-quarters), and disability and the interaction between them. The first model includes the baseline FPL100-ratio and the second model does not. The rationale for the second model is explained in section 3.2. Both these models include the demographic factors. ANOVA tables of these demographic factors are in tables 2 and 3 respectively, for the two models. The coefficients in the two

models are comparable. For example, $\beta_{\text{time}} = -0.0515, p < 0.01$ in model 1, indicating, FPL100-ratio decreased by 0.05 every quarter, during the study period. The coefficient of *Disability* is $\beta_D = -30.8394, p < 0.01$ in model 1 indicate that households with a working age adult with disability had their FPL100-ratios 30.84 lower, on an average, compared to households without any working age adult with disability. Next, we observe that the coefficient of interaction between time and disability ($\beta_{t*D} = 0.0151, p < 0.05$) is positive. This implies that the slope of FPL100-ratio with time for households with disability is $-0.0364(-0.0515 + 0.0151)$, which is less negative than the households without disability. This apparent contradictory finding leads us to conclude that households with disability although had significantly worse FPL100-ratio throughout the study period, the households without disability experienced more severe declines in their FPL100-ratios. This could throw some light on the impact of different supplementary coverage programs on households with disability.

Although the coefficients of the two different models (without and with baseline correction) were similar, we feel Model 2 is more appropriate for reasons explained in 3.2. For all the demographic factors and for interactions between them, post-hoc tests were conducted to identify the pairwise differences in mean FPL100-ratios of different subgroups.

Gender of household head

Marital status of household head

Race/Origin of household head

In table 5 we can see that regardless of disability, in Model1, households with a "black" ($\mu_{\text{diff}} = -0.53, p = 0.0000$) or "hispanic" ($\mu_{\text{diff}} = -0.46, p = 0.0000$) race/origin as household head is worse off compared to those with "others" race/origin. The discrepancy is higher

between "black" and "white" household heads ($\mu_{\text{diff}} = -0.90, p = 0.0000$). When corrected for baseline, the relationships reverse in sign, indicating that during the study period, "black" and "hispanic" households fared marginally better than "white" and "others". When considering only the households with disability (table 10), there is no significant difference between the different races.

Education of household head

In table 6, we see that regardless of disability, in Model1, households in "high school or less" is worse off than "some college, diploma" ($\mu_{\text{diff}} = -0.47, p = 0.0000$), which is in turn worse off than "bachelors or higher" ($\mu_{\text{diff}} = -1.29, p = 0.0000$). In Model 2, only the difference between "some college, diploma" and "bachelors or higher" groups are significant ($\mu_{\text{diff}} = -0.08, p = 0.014$. When considering only the households with disability (table 11), there is no significant difference between the different education groups.

Interaction of Gender and Marital status

In table 7, we see that in Model 1 "female, not married" households are worse off than "male, married" ($\mu_{\text{diff}} = -0.92, p = 0.0000$), than "female, married" ($\mu_{\text{diff}} = -0.75, p = 0.0000$) and "male, not married" ($\mu_{\text{diff}} = -0.65, p = 0.0000$). In Model 2, similar relationships hold, with smaller mean difference. Even when considering only the households with disability (table 12), the same relationships hold between the groups. We conclude that "female, not married" households fared the most poorly through our study period.

Interaction of Gender and Education

Focusing on the households In table 9, we see that in Model 1,

Interaction of Race/Origin and Marital status

In table

Interaction of Marital status and Education

In table

Interaction of Race/Origin and Education

In table

5 Limitations

1. Although a linear mixed effects regression model discovered some conventional and some interesting patterns in the relationships between response and demographic factors, along with disability, the trajectory of income poverty over the study period for some households were not linear. This modeling approach does not capture trajectory shapes of individual households. A non-parametric fitting of the income poverty trajectories could be tried as a pre-processing step before testing for differences in behavior between different groups of households.

6 Tables

	Model1 (with Baseline)	Model2 (with No Baseline)
Year-Quarter (time)	-0.0515^{***}	-0.0527^{***}
	(0.0021)	(0.0021)
Disability	-30.8394^{***}	-29.6874^{***}
	(8.7393)	(8.7195)
Year-Quarter*Disability	0.0151^{**}	0.0147^{**}
	(0.0043)	(0.0043)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 1: Coefficients of Fixed effects in regression models

Factor	Sum Sq	Mean Sq	NumDF	F.value	p.value
race_origin	5752.68	2876.34	3	238.71	0.0000
education	29404.45	14702.22	2	1220.14	0.0000
gender:ms	1813.16	1813.16	1	150.47	0.0000
ms:race_origin	2070.73	690.24	3	57.28	0.0000
gender:adult_disb	237.05	237.05	1	19.67	0.0000
yearqtrNum	145.47	145.47	1	12.07	0.0005
yearqtrNum:adult_disb	145.47	145.47	1	12.07	0.0005
adult_disb:education	109.34	54.67	2	4.54	0.0107
gender:ms:adult_disb	56.78	56.78	1	4.71	0.0299
gender:race_origin	104.06	34.69	3	2.88	0.0345
race_origin:adult_disb	26.90	8.97	3	0.74	0.5255
ms:adult_disb	0.12	0.12	1	0.01	0.9222

Table 2: Model 1: FPL100 vs demographic factors, time and disability

Factor	Sum Sq	Mean Sq	NumDF	F.value	p.value
gender:ms	721.70	721.70	1	60.04	0.0000
ms:race_origin	556.33	185.44	3	15.43	0.0000
yearqtrNum	138.47	138.47	1	11.52	0.0007
yearqtrNum:adult_disb	138.47	138.47	1	11.52	0.0007
gender:race_origin	181.68	60.56	3	5.04	0.0017
race_origin	151.47	75.73	3	6.30	0.0018
education	72.76	36.38	2	3.03	0.0485
ms:adult_disb	31.83	31.83	1	2.65	0.1037
gender:adult_disb	19.75	19.75	1	1.64	0.1999
adult_disb:education	35.49	17.75	2	1.48	0.2285
gender:ms:adult_disb	14.38	14.38	1	1.20	0.2740
race_origin:adult_disb	21.56	7.19	3	0.60	0.6163

Table 3: Model 2: FPL100 vs demographic factors, time and disability with baseline differences in FPL100 eliminated

Factor	Sum Sq	Mean Sq	NumDF	F.value	p.value
yearqtrNum	1190.80	1190.80	1	132.39	0.0000
ms	218.99	218.99	1	24.35	0.0000
ms:race_origin	279.40	93.13	3	10.35	0.0000
gender:ms	161.88	161.88	1	18.00	0.0000
gender	38.03	38.03	1	4.23	0.0398
race_origin	60.03	20.01	3	2.22	0.0831
gender:race_origin	42.92	14.31	3	1.59	0.1893
education	19.70	9.85	2	1.10	0.3345

Table 4: Model 3: FPL100 vs demographic factors, time and disability, disability only

Factor categories	Est 1	Std Err 1	p-value 1	Est 2	Std Err 2	p-value 2
Black - Others	-0.53	0.07	0.0000	0.22	0.07	0.0007
Black - White	-0.90	0.05	0.0000	0.14	0.04	0.0022
Hispanic - Others	-0.46	0.07	0.0000	0.16	0.07	0.0184
Hispanic - White	-0.83	0.05	0.0000	0.07	0.05	0.1144
Others - White	-0.37	0.06	0.0000	-0.08	0.05	0.1159
Black - Hispanic	-0.07	0.07	0.2663	0.06	0.06	0.2924

Table 5: Post-hoc test of Race/Origin

Factor categories	Est 1	Std Err 1	p-value 1	Est 2	Std Err 2	p-value 2
Some college, diploma, assoc - Bachelors or higher	-1.29	0.03	0.0000	-0.08	0.03	0.0140
High School or less - Bachelors or higher	-1.76	0.04	0.0000	-0.06	0.03	0.0849
High School or less - Some college, diploma, assoc	-0.47	0.03	0.0000	0.02	0.03	0.4373

Table 6: Post-hoc test of education

Factor categories	Est 1	Std Err 1	p-value 1	Est 2	Std Err 2	p-value 2
Female Married - Female Not married	0.74	0.03	0.0000	0.36	0.03	0.0000
Male Married - Female Not married	0.92	0.04	0.0000	0.37	0.04	0.0000
Male Not married - Female Not married	0.65	0.04	0.0000	0.29	0.04	0.0000
Male Married - Male Not married	0.27	0.03	0.0000	0.08	0.03	0.0110
Female Married - Male Not married	0.09	0.04	0.0436	0.07	0.04	0.0950
Male Married - Female Married	0.18	0.04	0.0000	0.01	0.04	0.8001

Table 7: Post-hoc test of gender and marital status

Factor categories	Est 1	Std Err 1	p-value 1	Est 2	Std Err 2	p-value 2
Married White - Not married White	0.75	0.02	0.0000	0.37	0.02	0.0000
Married Black - Not married White	-0.27	0.06	0.0000	0.44	0.06	0.0000
Married Hispanic - Not married White	-0.37	0.06	0.0000	0.30	0.05	0.0000
Married Black - Not married Black	0.52	0.05	0.0000	0.24	0.05	0.0000
Not married Black - Not married White	-0.78	0.05	0.0000	0.20	0.05	0.0000
Not married Others - Married White	-1.03	0.07	0.0000	-0.36	0.06	0.0000
Married Black - Not married Others	0.01	0.09	0.8911	0.43	0.08	0.0000
Not married Hispanic - Not married White	-0.54	0.06	0.0000	0.21	0.05	0.0001
Married Hispanic - Not married Others	-0.09	0.09	0.3030	0.29	0.08	0.0001
Not married Black - Married White	-1.54	0.05	0.0000	-0.17	0.05	0.0004
Married Black - Married Others	-0.56	0.09	0.0000	0.25	0.08	0.0013
Married Black - Not married Hispanic	0.27	0.08	0.0006	0.23	0.07	0.0013
Married Others - Not married White	0.29	0.07	0.0000	0.19	0.06	0.0026
Not married Hispanic - Married White	-1.29	0.06	0.0000	-0.16	0.05	0.0029
Married Others - Married White	-0.46	0.07	0.0000	-0.18	0.06	0.0041
Married Others - Not married Others	0.57	0.07	0.0000	0.18	0.06	0.0048
Not married Hispanic - Not married Others	-0.26	0.09	0.0026	0.20	0.08	0.0095
Not married Black - Not married Others	-0.51	0.08	0.0000	0.19	0.07	0.0103
Married Hispanic - Not married Hispanic	0.17	0.04	0.0001	0.09	0.04	0.0271
Married Black - Married Hispanic	0.10	0.08	0.1926	0.14	0.07	0.0476
Not married Black - Married Hispanic	-0.42	0.07	0.0000	-0.10	0.06	0.1051
Married Hispanic - Married Others	-0.66	0.08	0.0000	0.11	0.08	0.1352
Married Hispanic - Married White	-1.12	0.06	0.0000	-0.07	0.05	0.1894
Married Black - Married White	-1.02	0.06	0.0000	0.07	0.05	0.1899
Not married Hispanic - Married Others	-0.83	0.09	0.0000	0.02	0.08	0.7908
Not married Black - Not married Hispanic	-0.25	0.07	0.0006	-0.01	0.07	0.8662
Not married Others - Not married White	-0.28	0.07	0.0001	0.01	0.06	0.8850
Not married Black - Married Others	-1.07	0.08	0.0000	0.01	0.07	0.8958

Table 8: Post-hoc test of marital status and race/origin

Factor categories	Est 1	Std Err 1	p-value 1	Est 2	Std Err 2	p-value 2
Male White - Female White	0.40	0.03	0.0000	0.14	0.03	0.0000
Female Black - Female Others	-0.38	0.09	0.0000	0.41	0.08	0.0000
Female Black - Female White	-0.85	0.06	0.0000	0.22	0.05	0.0000
Male Others - Female Others	0.60	0.09	0.0000	0.35	0.08	0.0000
Female Others - Male White	-0.87	0.08	0.0000	-0.33	0.07	0.0000
Male Black - Female Others	-0.08	0.09	0.3988	0.38	0.08	0.0000
Male Hispanic - Female Others	0.02	0.09	0.8198	0.40	0.08	0.0000
Male Hispanic - Female White	-0.45	0.06	0.0000	0.21	0.06	0.0003
Male Black - Female White	-0.56	0.07	0.0000	0.19	0.06	0.0012
Female Hispanic - Female Others	-0.33	0.09	0.0003	0.26	0.08	0.0013
Female Others - Female White	-0.48	0.08	0.0000	-0.19	0.07	0.0055
Male Hispanic - Female Hispanic	0.35	0.06	0.0000	0.14	0.06	0.0162
Male Others - Female White	0.13	0.08	0.0901	0.16	0.07	0.0190
Female Black - Female Hispanic	-0.05	0.08	0.5194	0.15	0.07	0.0323
Male Black - Female Hispanic	0.25	0.08	0.0027	0.12	0.07	0.1164
Female Black - Male White	-1.25	0.06	0.0000	0.08	0.05	0.1262
Female Hispanic - Female White	-0.81	0.06	0.0000	0.07	0.05	0.1650
Male Hispanic - Male White	-0.85	0.06	0.0000	0.07	0.06	0.2074
Female Hispanic - Male White	-1.20	0.06	0.0000	-0.07	0.06	0.2291
Female Hispanic - Male Others	-0.93	0.09	0.0000	-0.09	0.08	0.2903
Male Black - Male White	-0.95	0.07	0.0000	0.05	0.06	0.3831
Female Black - Male Others	-0.98	0.09	0.0000	0.06	0.08	0.4639
Male Hispanic - Male Others	-0.58	0.09	0.0000	0.05	0.08	0.5439
Male Black - Female Black	0.30	0.06	0.0000	-0.03	0.06	0.6399
Male Black - Male Others	-0.68	0.09	0.0000	0.03	0.08	0.7174
Male Others - Male White	-0.27	0.08	0.0004	0.02	0.07	0.7651
Male Black - Male Hispanic	-0.10	0.08	0.2292	-0.02	0.08	0.7893
Female Black - Male Hispanic	-0.40	0.08	0.0000	0.01	0.07	0.9142

Table 9: Post-hoc test of gender with race/origin

The following tables are only for households with a working-age adult with disability.

Factor categories	Estimate	Standard Error	t-value	p-value
Black - White	0.14	0.07	2.09	0.0366
Black - Others	0.17	0.10	1.74	0.0825
Hispanic - White	0.11	0.07	1.56	0.1199
Hispanic - Others	0.14	0.10	1.38	0.1681
Others - White	-0.03	0.08	-0.36	0.7214
Black - Hispanic	0.03	0.09	0.32	0.7471

Table 10: Post-hoc test of race/origin

Factor categories	Estimate	Standard Error	t-value	p-value
High School or less - Bachelors or higher	-0.07	0.05	-1.48	0.1395
Some college, diploma, assoc - Bachelors or higher	-0.05	0.05	-1.08	0.2819
High School or less - Some college, diploma, assoc	-0.02	0.04	-0.57	0.5690

Table 11: Post-hoc test of education

Factor categories	Estimate	Standard Error	t-value	p-value
Male Married - Female Not married	0.29	0.06	4.92	0.0000
Female Married - Female Not married	0.31	0.05	6.69	0.0000
Male Not married - Female Not married	0.22	0.06	3.93	0.0001
Male Married - Male Not married	0.07	0.05	1.44	0.1509
Female Married - Male Not married	0.09	0.06	1.40	0.1629
Male Married - Female Married	-0.02	0.06	-0.35	0.7251

Table 12: Post-hoc test of gender and marital status

Factor categories	Estimate	Standard Error	t-value	p-value
Married Black - Not married Black	0.37	0.07	5.04	0.0000
Married Black - Not married White	0.49	0.08	5.94	0.0000
Married White - Not married White	0.34	0.03	10.06	0.0000
Not married Hispanic - Not married White	0.31	0.08	3.74	0.0002
Married Black - Not married Others	0.40	0.12	3.34	0.0008
Married Hispanic - Not married White	0.25	0.08	3.16	0.0016
Not married Black - Married White	-0.22	0.07	-3.06	0.0022
Married Black - Married Others	0.30	0.12	2.58	0.0100
Not married Others - Married White	-0.25	0.10	-2.53	0.0113
Married Black - Married Hispanic	0.25	0.11	2.34	0.0190
Married Others - Not married White	0.20	0.10	2.05	0.0401
Not married Black - Not married Hispanic	-0.19	0.10	-1.88	0.0603
Married Black - Married White	0.15	0.08	1.85	0.0643
Not married Hispanic - Not married Others	0.22	0.12	1.84	0.0662
Not married Black - Not married White	0.12	0.07	1.72	0.0863
Married Black - Not married Hispanic	0.18	0.11	1.66	0.0975
Married Others - Married White	-0.15	0.09	-1.56	0.1186
Married Hispanic - Not married Others	0.16	0.12	1.32	0.1855
Not married Black - Married Hispanic	-0.12	0.10	-1.27	0.2028
Married Hispanic - Married White	-0.09	0.08	-1.23	0.2184
Married Others - Not married Others	0.11	0.10	1.00	0.3162
Not married Hispanic - Married Others	0.12	0.12	1.00	0.3182
Married Hispanic - Not married Hispanic	-0.07	0.07	-0.92	0.3560
Not married Others - Not married White	0.09	0.10	0.90	0.3678
Not married Black - Married Others	-0.07	0.11	-0.65	0.5154
Married Hispanic - Married Others	0.05	0.11	0.45	0.6497
Not married Hispanic - Married White	-0.03	0.08	-0.35	0.7267
Not married Black - Not married Others	0.03	0.11	0.30	0.7670

Table 13: Post-hoc test of marital status with race/origin

Factor categories	Estimate	Standard Error	t-value	p-value
Female Black - Female White	0.24	0.07	3.17	0.0015
Male White - Female White	0.13	0.04	3.01	0.0026
Female Black - Female Others	0.32	0.12	2.76	0.0057
Male Hispanic - Female White	0.22	0.09	2.37	0.0180
Male Hispanic - Female Others	0.30	0.13	2.35	0.0188
Female Others - Male White	-0.21	0.10	-2.10	0.0359
Male Black - Female Others	0.25	0.13	1.98	0.0477
Male Others - Female Others	0.24	0.12	1.92	0.0544
Male Black - Female White	0.17	0.09	1.83	0.0680
Female Hispanic - Female Others	0.21	0.12	1.71	0.0866
Female Hispanic - Female White	0.13	0.08	1.52	0.1283
Male Others - Female White	0.16	0.11	1.48	0.1384
Female Black - Male White	0.11	0.08	1.42	0.1568
Female Black - Female Hispanic	0.11	0.10	1.07	0.2845
Male Hispanic - Male White	0.09	0.09	0.98	0.3286
Male Hispanic - Female Hispanic	0.09	0.10	0.94	0.3494
Female Others - Female White	-0.08	0.10	-0.82	0.4099
Male Black - Female Black	-0.07	0.10	-0.72	0.4742
Female Black - Male Others	0.08	0.12	0.67	0.5026
Male Hispanic - Male Others	0.06	0.13	0.49	0.6272
Male Black - Male Hispanic	-0.05	0.12	-0.43	0.6694
Male Black - Male White	0.04	0.09	0.41	0.6788
Male Black - Female Hispanic	0.04	0.12	0.35	0.7233
Male Others - Male White	0.03	0.11	0.25	0.8022
Female Hispanic - Male Others	-0.03	0.13	-0.23	0.8175
Female Black - Male Hispanic	0.02	0.11	0.15	0.8805
Male Black - Male Others	0.01	0.13	0.09	0.9274
Female Hispanic - Male White	-0.00	0.08	-0.03	0.9762

Table 14: Post-hoc test of gender with race/origin

References

[1] Douglas Bates, Martin Maechler, Ben Bolker, Steven Walker, et al. lme4: Linear mixed-effects models using eigen and s4. *R package version*, 1(7), 2014.

[2] Yoav Benjamini and Yosef Hochberg. Controlling the false discovery rate: a practical and powerful approach to multiple testing. *Journal of the royal statistical society. Series B (Methodological)*, pages 289–300, 1995.

[3] Garrett M Fitzmaurice, Nan M Laird, and James H Ware. *Applied longitudinal analysis*, volume 998. John Wiley & Sons, 2012.

[4] Sture Holm. A simple sequentially rejective multiple test procedure. *Scandinavian journal of statistics*, pages 65–70, 1979.

[5] Alexandra Kuznetsova, Per Bruun Brockhoff, and Rune Haubo Bojesen Christensen. Package lmertest. *R package version*, 2, 2015.

[6] Christopher H Morrell. Likelihood ratio testing of variance components in the linear mixed-effects model using restricted maximum likelihood. *Biometrics*, pages 1560–1568, 1998.

[7] R Core Team. *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, Austria, 2016.

[8] Franklin E Satterthwaite. An approximate distribution of estimates of variance components. *Biometrics bulletin*, 2(6):110–114, 1946.