

# Housing Market Institutions Drive Race and Ethnicity Differences in Energy Consumption

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## Abstract

When socio-demographic factors are considered in any kind of analysis of household electric and gas utility data, it is common to observe differences in energy use between households with different self-reported race and ethnicity compositions. These differences persist controlling for structure type, e.g., single family dwelling, age and size of housing units, and, other common control variables. Without the information necessary to better explain these differences, they are commonly summarized simply as cultural differences. This paper demonstrates that these differences can be partially explained by differential sorting by structure and ownership, i.e., endogenizing housing choice and rental decisions. We will show that these differences in energy consumption may be because of housing market institutions and restrictions.

## 1 Introduction

[12]

Figure 1: Annual kWh by Rent/Own and Race

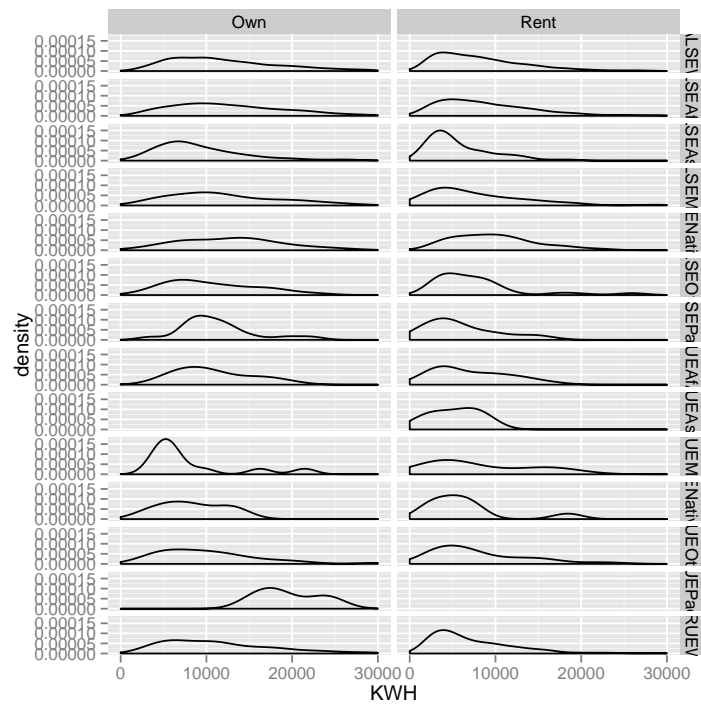
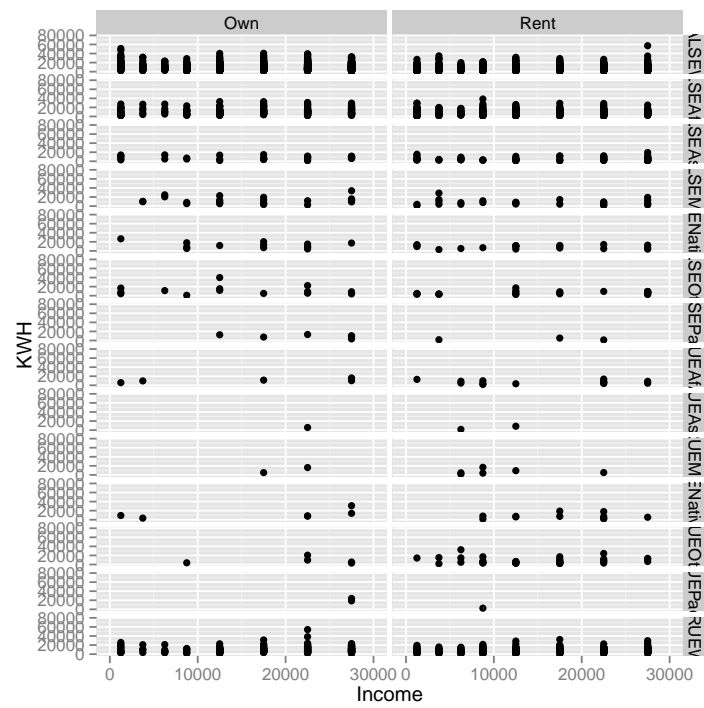


Figure 2: Annual kWh by Income



|             | FALSEWt | FALSEAfAm | FALSEAsian | FALSEMulti | FALSENativeAm | FALSEOther |
|-------------|---------|-----------|------------|------------|---------------|------------|
| Mobile      | 371     | 24        | 1          | 6          | 7             | 5          |
| SFDetached  | 5694    | 754       | 231        | 87         | 35            | 5          |
| SFAttached  | 544     | 121       | 48         | 14         | 9             | 1          |
| SmApartment | 430     | 174       | 52         | 12         | 7             | 1          |
| LgApartment | 951     | 382       | 113        | 27         | 15            | 2          |

Table 1: Count of Observations by Race and Structure Type

### 1.1 Race and Ethnicity in Conditional Demand

### 1.2 How Race and Ethnicity are Interpreted

## 2 RECS

### 2.1 Race and Ethnicity Differences in Equipment and Structure

### 2.2 Differences in Reported Behavior

### 2.3 HUD Complaints

## 3 Conditional Demand Estimation

### 3.1 Orthodox Results

```
# weights: 290 (252 variable)
initial value 27412.275532
iter 10 value 18277.849872
iter 20 value 16456.709264
iter 30 value 15328.790711
iter 40 value 14953.228502
iter 50 value 14605.498292
iter 60 value 14072.205160
iter 70 value 13614.076441
iter 80 value 13476.010708
iter 90 value 13353.307788
iter 100 value 13165.327630
final value 13165.327630
stopped after 100 iterations
```

Call:

```
multinom(formula = StrTenure ~ RENTHELP + TOTSQFT_EN + Income +
  NHSLDMEM + reporttot + EDUCATION + reporttot + reporttot:EthRace +
  UR, data = RECS)
```

Coefficients:

|                 | (Intercept)                | RENTHELPTTRUE               | TOTSQFT_EN    | Income        |
|-----------------|----------------------------|-----------------------------|---------------|---------------|
| OwnLgApartment  | -1.4012045                 | 2.1454443                   | -0.0019509345 | 3.459254e-06  |
| OwnMobile       | 1.8481044                  | -0.3335909                  | -0.0024782727 | -1.036208e-05 |
| OwnSFAttached   | -3.6710529                 | 0.2236006                   | -0.0004030778 | 7.180833e-07  |
| OwnSmApartment  | -3.1672555                 | 4.6166536                   | -0.0010380324 | 2.974365e-06  |
| RentLgApartment | 1.7899438                  | 5.1034563                   | -0.0030038175 | -1.046446e-05 |
| RentMobile      | 1.9786892                  | 5.8969739                   | -0.0038888400 | -3.639383e-05 |
| RentSFAttached  | -2.3878420                 | 4.7618232                   | -0.0012446232 | -1.021858e-05 |
| RentSFDetached  | -1.5726891                 | 2.8200895                   | -0.0005734065 | -1.226262e-05 |
| RentSmApartment | 0.1807821                  | 5.1008582                   | -0.0026323099 | -1.619186e-05 |
|                 | NHSLDMEM                   | reporttot                   | EDUCATIONNoHS | EDUCATIONHS   |
| OwnLgApartment  | -0.34797258                | 0.015013718                 | 0.477269446   | 0.37401861    |
| OwnMobile       | 0.15128116                 | -0.004738898                | 0.485162185   | 0.11640843    |
| OwnSFAttached   | -0.25038723                | 0.008050993                 | 0.226793906   | 0.85684652    |
| OwnSmApartment  | -0.28237646                | -0.009663942                | -0.688673023  | -0.03748283   |
| RentLgApartment | -0.03500606                | 0.011237582                 | 0.004987983   | -0.04286051   |
| RentMobile      | 0.40934677                 | -0.051218671                | 0.390739477   | 0.14594218    |
| RentSFAttached  | 0.12059529                 | 0.034419469                 | -0.030921130  | -0.23572032   |
| RentSFDetached  | 0.30723498                 | 0.001014244                 | 0.102122854   | -0.01403466   |
| RentSmApartment | 0.05205921                 | -0.014265982                | 0.263488737   | 0.02949444    |
|                 | EDUCATIONSomeCol           | EDUCATIONAA                 | EDUCATIONBA   | EDUCATIONMA   |
| OwnLgApartment  | 0.6929779                  | 0.65737452                  | 0.95739291    | 1.4417718     |
| OwnMobile       | 0.7905695                  | 0.21659624                  | -0.35389397   | -1.6492500    |
| OwnSFAttached   | 0.8985078                  | 0.87238180                  | 1.52406591    | 1.2864582     |
| OwnSmApartment  | -0.3374229                 | -0.16358571                 | 0.11573260    | -0.4165630    |
| RentLgApartment | 0.2805560                  | 0.27019330                  | 0.66607255    | 0.7373567     |
| RentMobile      | -0.2202073                 | 0.00850999                  | -1.06151061   | -5.7933615    |
| RentSFAttached  | 0.2031599                  | -0.13171082                 | 0.02641089    | -0.1009914    |
| RentSFDetached  | 0.2157358                  | 0.11563920                  | -0.10035484   | -0.4337383    |
| RentSmApartment | 0.3623767                  | 0.41090394                  | 0.47854431    | 0.1297479     |
|                 | EDUCATIONProf              | EDUCATIONPHD                | URUrban       |               |
| OwnLgApartment  | 1.8736513                  | 1.2372782                   | 1.4520879     |               |
| OwnMobile       | -2.1151470                 | -2.4556028                  | -1.1014520    |               |
| OwnSFAttached   | 1.5983874                  | 1.5419624                   | 1.6277862     |               |
| OwnSmApartment  | 0.3985125                  | 0.5267079                   | 2.3226177     |               |
| RentLgApartment | 0.9433553                  | 0.9234813                   | 1.5801513     |               |
| RentMobile      | 1.7018720                  | 2.9972013                   | -1.0603773    |               |
| RentSFAttached  | -0.8478266                 | 0.4381929                   | 1.9708629     |               |
| RentSFDetached  | -0.1725402                 | -0.0787602                  | 0.5626279     |               |
| RentSmApartment | 0.3681771                  | 0.6908721                   | 1.9187057     |               |
|                 | reporttot:EthRaceFALSEAfAm | reporttot:EthRaceFALSEAsian |               |               |
| OwnLgApartment  | -0.061129933               |                             | 0.07766379    |               |
| OwnMobile       | -0.253501612               |                             | -0.71539058   |               |
| OwnSFAttached   | 0.073028129                |                             | 0.06828815    |               |
| OwnSmApartment  | -0.003398508               |                             | -0.07136701   |               |
| RentLgApartment | 0.135654877                |                             | 0.06161987    |               |

|                 |                              |                                 |
|-----------------|------------------------------|---------------------------------|
| RentMobile      | -0.584744072                 | -1.76876817                     |
| RentSFAttached  | 0.135991827                  | -0.04106818                     |
| RentSFDetached  | 0.075353177                  | -0.00935299                     |
| RentSmApartment | 0.190626173                  | 0.12929070                      |
|                 | reportttot:EthRaceFALSEMulti | reportttot:EthRaceFALSENativeAm |
| OwnLgApartment  | -0.218513213                 | -0.542488392                    |
| OwnMobile       | 0.009344288                  | 0.026094924                     |
| OwnSFAttached   | -0.024491876                 | 0.079630580                     |
| OwnSmApartment  | -0.260290488                 | -0.551033411                    |
| RentLgApartment | 0.097746978                  | 0.029581017                     |
| RentMobile      | -0.615016447                 | -0.036504716                    |
| RentSFAttached  | 0.014477356                  | 0.092926422                     |
| RentSFDetached  | 0.093122527                  | -0.017882116                    |
| RentSmApartment | 0.037601924                  | -0.002009332                    |
|                 | reportttot:EthRaceFALSEOther | reportttot:EthRaceFALSEPacific  |
| OwnLgApartment  | -0.02561634                  | -0.68676247                     |
| OwnMobile       | -0.55227399                  | -0.04961086                     |
| OwnSFAttached   | -0.02252647                  | -5.15650607                     |
| OwnSmApartment  | -0.13826734                  | -1.70662972                     |
| RentLgApartment | 0.05565783                   | 0.10232812                      |
| RentMobile      | -0.01394297                  | -2.42342974                     |
| RentSFAttached  | 0.11273668                   | -1.10930205                     |
| RentSFDetached  | 0.05107721                   | 0.01030506                      |
| RentSmApartment | 0.07408486                   | -0.25631938                     |
|                 | reportttot:EthRaceTRUEAfAm   | reportttot:EthRaceTRUEAsian     |
| OwnLgApartment  | -0.994558317                 | -0.33037417                     |
| OwnMobile       | -0.008599062                 | -0.49712877                     |
| OwnSFAttached   | 0.901421947                  | -1.07591077                     |
| OwnSmApartment  | 0.720621562                  | -0.42752187                     |
| RentLgApartment | 0.702580769                  | -0.08253460                     |
| RentMobile      | 0.823029357                  | -0.71191633                     |
| RentSFAttached  | 0.706637515                  | -1.72623591                     |
| RentSFDetached  | 0.653334007                  | 0.04942301                      |
| RentSmApartment | 0.779288301                  | -2.09522007                     |
|                 | reportttot:EthRaceTRUEMulti  | reportttot:EthRaceTRUENativeAm  |
| OwnLgApartment  | -0.19864986                  | 0.4914334                       |
| OwnMobile       | 0.03562188                   | 0.2623866                       |
| OwnSFAttached   | -1.13148003                  | 0.3121788                       |
| OwnSmApartment  | 0.17970443                   | 0.4218565                       |
| RentLgApartment | 0.14034061                   | 0.3174522                       |
| RentMobile      | 0.21249252                   | -0.5517922                      |
| RentSFAttached  | -0.81366313                  | 0.4200183                       |
| RentSFDetached  | 0.03562691                   | 0.1682046                       |
| RentSmApartment | 0.31811515                   | 0.3544462                       |
|                 | reportttot:EthRaceTRUEOther  | reportttot:EthRaceTRUEPacific   |
| OwnLgApartment  | 0.02180558                   | -0.397523801                    |

|                 |             |              |
|-----------------|-------------|--------------|
| OwnMobile       | -0.06062417 | -0.180497351 |
| OwnSFAttached   | 0.03002728  | 0.281796703  |
| OwnSmApartment  | 0.18705769  | 0.142528296  |
| RentLgApartment | 0.07142922  | -1.524863739 |
| RentMobile      | 0.21052647  | -1.033877065 |
| RentSFAttached  | 0.07825611  | -0.689753196 |
| RentSFDetached  | -0.06288220 | -3.109386196 |
| RentSmApartment | 0.08111029  | -0.004257285 |

reporttot:EthRaceTRUEWt

|                 |             |
|-----------------|-------------|
| OwnLgApartment  | -0.07852315 |
| OwnMobile       | -0.03453491 |
| OwnSFAttached   | -0.02259886 |
| OwnSmApartment  | -0.05248278 |
| RentLgApartment | 0.04717723  |
| RentMobile      | -0.01815809 |
| RentSFAttached  | 0.01876969  |
| RentSFDetached  | 0.03145875  |
| RentSmApartment | 0.08247824  |

Std. Errors:

|                 | (Intercept)      | RENTHELPTTRUE | TOTSQFT_EN    | Income       |
|-----------------|------------------|---------------|---------------|--------------|
| OwnLgApartment  | 4.351724e-08     | 1.361833e-10  | 8.042083e-05  | 1.486828e-06 |
| OwnMobile       | 4.801794e-08     | 2.878315e-11  | 7.351840e-05  | 2.004093e-06 |
| OwnSFAttached   | 1.093224e-08     | 2.331910e-11  | 3.658997e-05  | 1.015700e-06 |
| OwnSmApartment  | 3.405954e-08     | 1.684418e-09  | 8.323208e-05  | 1.893700e-06 |
| RentLgApartment | 3.217775e-08     | 1.259582e-08  | 4.426271e-05  | 1.009244e-06 |
| RentMobile      | 1.680366e-07     | 2.380603e-08  | 1.954323e-04  | 6.852449e-06 |
| RentSFAttached  | 2.662972e-08     | 3.695408e-09  | 5.604870e-05  | 1.623214e-06 |
| RentSFDetached  | 2.296883e-08     | 1.271973e-09  | 3.053730e-05  | 1.052931e-06 |
| RentSmApartment | 4.160313e-08     | 6.682058e-09  | 5.994973e-05  | 1.579855e-06 |
|                 | NHSLDMEM         | reporttot     | EDUCATIONNoHS | EDUCATIONHS  |
| OwnLgApartment  | 8.500718e-08     | 3.075767e-07  | 4.870920e-09  | 1.386252e-08 |
| OwnMobile       | 1.299624e-07     | 3.006569e-07  | 1.355709e-08  | 1.767290e-08 |
| OwnSFAttached   | 2.393908e-08     | 7.985562e-08  | 9.307634e-10  | 3.961343e-09 |
| OwnSmApartment  | 7.270828e-08     | 2.359306e-07  | 3.187754e-09  | 1.477896e-08 |
| RentLgApartment | 8.193668e-08     | 2.062674e-07  | 1.301925e-08  | 1.208165e-08 |
| RentMobile      | 5.537054e-07     | 9.511767e-07  | 7.046973e-08  | 6.631369e-08 |
| RentSFAttached  | 7.665648e-08     | 2.069790e-07  | 6.389055e-09  | 9.143159e-09 |
| RentSFDetached  | 1.007340e-07     | 1.130154e-07  | 1.170572e-08  | 7.680150e-09 |
| RentSmApartment | 1.102293e-07     | 2.587058e-07  | 1.173288e-08  | 1.497742e-08 |
|                 | EDUCATIONSOMEcol | EDUCATIONAA   | EDUCATIONBA   | EDUCATIONMA  |
| OwnLgApartment  | 1.158332e-08     | 4.914648e-09  | 5.566968e-09  | 2.329809e-09 |
| OwnMobile       | 1.491993e-08     | 2.521968e-09  | 4.256616e-10  | 3.059156e-11 |
| OwnSFAttached   | 2.523770e-09     | 1.061512e-09  | 2.194114e-09  | 4.833421e-10 |
| OwnSmApartment  | 6.977600e-09     | 3.697818e-09  | 4.241222e-09  | 6.433379e-10 |
| RentLgApartment | 7.959396e-09     | 2.991435e-09  | 3.372193e-09  | 3.581167e-10 |

|                 |                             |                                |              |              |
|-----------------|-----------------------------|--------------------------------|--------------|--------------|
| RentMobile      | 1.813836e-08                | 5.950328e-09                   | 7.252824e-11 | 9.122272e-13 |
| RentSFAttached  | 7.476959e-09                | 1.936084e-09                   | 1.891315e-09 | 2.454978e-10 |
| RentSFDetached  | 3.744902e-09                | 9.586280e-10                   | 1.326644e-09 | 3.522232e-10 |
| RentSmApartment | 1.017352e-08                | 3.547218e-09                   | 2.200330e-09 | 1.212453e-10 |
|                 | EDUCATIONProf               | EDUCATIONPHD                   | URUrban      |              |
| OwnLgApartment  | 1.264854e-10                | 1.966242e-10                   | 3.914011e-08 |              |
| OwnMobile       | 1.174724e-11                | 1.327710e-11                   | 2.054870e-08 |              |
| OwnSFAttached   | 1.626516e-10                | 6.605900e-11                   | 9.742949e-09 |              |
| OwnSmApartment  | 1.079404e-10                | 1.247334e-10                   | 3.236071e-08 |              |
| RentLgApartment | 2.764815e-10                | 7.535749e-10                   | 2.760945e-08 |              |
| RentMobile      | 5.514256e-10                | 1.506763e-09                   | 9.058000e-08 |              |
| RentSFAttached  | 1.052140e-11                | 9.127383e-11                   | 2.471527e-08 |              |
| RentSFDetached  | 6.977103e-11                | 2.535682e-11                   | 1.538717e-08 |              |
| RentSmApartment | 4.023520e-11                | 1.231473e-10                   | 3.864537e-08 |              |
|                 | reporttot:EthRaceFALSEAfAm  | reporttot:EthRaceFALSEAsian    |              |              |
| OwnLgApartment  | 1.963367e-08                | 5.606453e-09                   |              |              |
| OwnMobile       | 1.362978e-08                | 1.615299e-11                   |              |              |
| OwnSFAttached   | 9.815614e-09                | 1.350058e-09                   |              |              |
| OwnSmApartment  | 1.921235e-08                | 2.132416e-10                   |              |              |
| RentLgApartment | 4.541580e-08                | 2.210217e-09                   |              |              |
| RentMobile      | 1.942309e-08                | 7.827963e-12                   |              |              |
| RentSFAttached  | 4.187071e-08                | 9.156847e-10                   |              |              |
| RentSFDetached  | 1.910479e-08                | 2.239577e-09                   |              |              |
| RentSmApartment | 7.118139e-08                | 4.919406e-09                   |              |              |
|                 | reporttot:EthRaceFALSEMulti | reporttot:EthRaceFALSENativeAm |              |              |
| OwnLgApartment  | 2.615273e-10                | 9.367484e-11                   |              |              |
| OwnMobile       | 4.200240e-09                | 6.379168e-09                   |              |              |
| OwnSFAttached   | 2.550073e-10                | 1.109178e-09                   |              |              |
| OwnSmApartment  | 1.935621e-10                | 5.739529e-11                   |              |              |
| RentLgApartment | 4.251619e-09                | 2.523858e-09                   |              |              |
| RentMobile      | 1.011654e-09                | 1.426604e-08                   |              |              |
| RentSFAttached  | 1.781757e-09                | 4.230313e-09                   |              |              |
| RentSFDetached  | 2.187221e-09                | 1.898748e-09                   |              |              |
| RentSmApartment | 2.506901e-09                | 1.606973e-09                   |              |              |
|                 | reporttot:EthRaceFALSEOther | reporttot:EthRaceFALSEPacific  |              |              |
| OwnLgApartment  | 1.090309e-09                | 2.227915e-11                   |              |              |
| OwnMobile       | 8.697048e-11                | 1.698262e-09                   |              |              |
| OwnSFAttached   | 2.490790e-10                | 2.558331e-16                   |              |              |
| OwnSmApartment  | 1.256503e-10                | 6.267601e-13                   |              |              |
| RentLgApartment | 1.880471e-09                | 9.010899e-10                   |              |              |
| RentMobile      | 3.482380e-09                | 2.806748e-13                   |              |              |
| RentSFAttached  | 6.042252e-09                | 2.639569e-12                   |              |              |
| RentSFDetached  | 2.204181e-09                | 3.601196e-10                   |              |              |
| RentSmApartment | 2.452424e-09                | 1.655045e-11                   |              |              |
|                 | reporttot:EthRaceTRUEAfAm   | reporttot:EthRaceTRUEAsian     |              |              |
| OwnLgApartment  | 1.200681e-12                | 3.770832e-11                   |              |              |



|                 |                            |                               |
|-----------------|----------------------------|-------------------------------|
| OwnMobile       | 8.285815e-10               | 4.408003e-11                  |
| OwnSFAttached   | 2.950472e-10               | 4.674004e-13                  |
| OwnSmApartment  | 7.533099e-10               | 1.311664e-11                  |
| RentLgApartment | 7.302695e-09               | 1.623169e-10                  |
| RentMobile      | 2.160392e-08               | 2.622579e-10                  |
| RentSFAttached  | 2.013095e-09               | 3.157614e-13                  |
| RentSFDetached  | 5.062913e-09               | 1.471258e-10                  |
| RentSmApartment | 5.034675e-09               | 3.440708e-13                  |
|                 | reporttot:EthRaceTRUEMulti | reporttot:EthRaceTRUENativeAm |
| OwnLgApartment  | 7.673547e-11               | 7.795320e-10                  |
| OwnMobile       | 1.673434e-10               | 8.459745e-10                  |
| OwnSFAttached   | 6.945296e-13               | 1.942390e-10                  |
| OwnSmApartment  | 4.258973e-09               | 3.941367e-10                  |
| RentLgApartment | 1.115209e-09               | 8.417261e-10                  |
| RentMobile      | 2.474460e-09               | 2.379009e-10                  |
| RentSFAttached  | 1.180096e-12               | 8.788977e-10                  |
| RentSFDetached  | 2.050147e-09               | 3.858355e-10                  |
| RentSmApartment | 6.918216e-09               | 1.286191e-09                  |
|                 | reporttot:EthRaceTRUEOther | reporttot:EthRaceTRUEPacific  |
| OwnLgApartment  | 1.562151e-09               | 2.575334e-12                  |
| OwnMobile       | 1.582095e-09               | 2.668836e-10                  |
| OwnSFAttached   | 1.052125e-09               | 1.270903e-10                  |
| OwnSmApartment  | 2.413554e-08               | 9.823655e-11                  |
| RentLgApartment | 5.490875e-08               | 2.399506e-14                  |
| RentMobile      | 1.566813e-07               | 1.182834e-12                  |
| RentSFAttached  | 3.278555e-08               | 1.156016e-12                  |
| RentSFDetached  | 4.937909e-09               | 5.975457e-15                  |
| RentSmApartment | 2.918801e-08               | 1.839679e-10                  |
|                 | reporttot:EthRaceTRUEWt    |                               |
| OwnLgApartment  | 1.438646e-08               |                               |
| OwnMobile       | 3.358932e-08               |                               |
| OwnSFAttached   | 3.806993e-09               |                               |
| OwnSmApartment  | 1.043395e-08               |                               |
| RentLgApartment | 3.496748e-08               |                               |
| RentMobile      | 1.828711e-07               |                               |
| RentSFAttached  | 2.182158e-08               |                               |
| RentSFDetached  | 4.080229e-08               |                               |
| RentSmApartment | 4.782485e-08               |                               |

Residual Deviance: 26330.66  
AIC: 26834.66

### 3.2 Single Equation Methods

### 3.3 Multiple Equation Methods

## 4 Summary and Conclusions

## References

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|    | State                | Population | Reports (per 100,000) |
|----|----------------------|------------|-----------------------|
| 1  | Alabama              | 4,677,464  | 7.50                  |
| 2  | Alaska               | 688,125    | 13.01                 |
| 3  | Arizona              | 6,499,377  | 3.68                  |
| 4  | Arkansas             | 2,867,764  | 9.26                  |
| 5  | California           | 36,580,371 | 3.03                  |
| 6  | Colorado             | 4,935,213  | 1.97                  |
| 7  | Connecticut          | 3,502,932  | 20.50                 |
| 8  | Delaware             | 876,211    | 14.00                 |
| 9  | District of Columbia | 590,074    | 14.00                 |
| 10 | Florida              | 18,423,878 | 3.93                  |
| 11 | Georgia              | 9,697,838  | 2.06                  |
| 12 | Hawaii               | 1,287,481  | 13.01                 |
| 13 | Idaho                | 1,527,506  | 9.94                  |
| 14 | Illinois             | 12,842,954 | 2.88                  |
| 15 | Indiana              | 6,388,309  | 9.14                  |
| 16 | Iowa                 | 2,993,987  | 19.92                 |
| 17 | Kansas               | 2,797,375  | 10.31                 |
| 18 | Kentucky             | 4,287,931  | 7.50                  |
| 19 | Louisiana            | 4,451,513  | 9.26                  |
| 20 | Maine                | 1,319,691  | 20.50                 |
| 21 | Maryland             | 5,658,655  | 14.00                 |
| 22 | Massachusetts        | 6,543,595  | 4.51                  |
| 23 | Michigan             | 10,002,486 | 4.97                  |
| 24 | Minnesota            | 5,230,567  | 19.92                 |
| 25 | Mississippi          | 2,940,212  | 7.50                  |
| 26 | Missouri             | 5,956,335  | 4.99                  |
| 27 | Montana              | 968,035    | 9.94                  |
| 28 | Nebraska             | 1,781,949  | 10.31                 |
| 29 | Nevada               | 2,615,772  | 5.08                  |
| 30 | New Hampshire        | 1,321,872  | 20.50                 |
| 31 | New Jersey           | 8,663,398  | 2.34                  |
| 32 | New Mexico           | 1,986,763  | 5.08                  |
| 33 | New York             | 19,467,789 | 4.60                  |
| 34 | North Carolina       | 9,247,134  | 4.22                  |
| 35 | North Dakota         | 641,421    | 19.92                 |
| 36 | Ohio                 | 11,528,072 | 9.14                  |
| 37 | Oklahoma             | 3,644,025  | 9.26                  |
| 38 | Oregon               | 3,782,991  | 13.01                 |
| 39 | Pennsylvania         | 12,566,368 | 1.87                  |
| 40 | Rhode Island         | 1,053,502  | 20.50                 |
| 41 | South Carolina       | 4,503,280  | 4.22                  |
| 42 | South Dakota         | 804,532    | 19.92                 |
| 43 | Tennessee            | 6,240,456  | 2.61                  |
| 44 | Texas                | 24,304,290 | 4.18                  |
| 45 | Utah                 | 2,727,343  | 9.94                  |
| 46 | Vermont              | 621,049    | 20.50                 |
| 47 | Virginia             | 7,795,424  | 2.03                  |
| 48 | Washington           | 6,566,073  | 13.01                 |
| 49 | West Virginia        | 1,814,873  | 14.00                 |
| 50 | Wisconsin            | 5,627,610  | 1.81                  |
| 51 | Wyoming              | 532,981    | 9.94                  |

Table 2: HUD Complaints per 100,000 Population

|                                      | Estimate   | Std. Error | t value | Pr(> t ) |
|--------------------------------------|------------|------------|---------|----------|
| (Intercept)                          | 2181.1197  | 1792.3947  | 1.22    | 0.2237   |
| ElecMealsThreeDay                    | 1338.6588  | 297.7217   | 4.50    | 0.0000   |
| ElecMealsTwoDay                      | 1644.3185  | 185.0764   | 8.88    | 0.0000   |
| ElecMealsOneDay                      | 1685.3404  | 159.1570   | 10.59   | 0.0000   |
| ElecMealsFewWeek                     | 1451.1356  | 183.7584   | 7.90    | 0.0000   |
| ElecMealsOneWeek                     | 1726.8842  | 406.3322   | 4.25    | 0.0000   |
| ElecMealsLessWeek                    | 992.8116   | 424.8594   | 2.34    | 0.0195   |
| NUMFRIG                              | 1574.9574  | 120.8432   | 13.03   | 0.0000   |
| AgeFridge2to4Years                   | 49.6457    | 195.1174   | 0.25    | 0.7992   |
| AgeFridge5to9Years                   | 312.9075   | 183.1243   | 1.71    | 0.0875   |
| AgeFridge20PlusYears                 | 282.4503   | 328.6753   | 0.86    | 0.3902   |
| AgeFridge10to14Years                 | 392.2705   | 207.4396   | 1.89    | 0.0587   |
| AgeFridge15to19Years                 | 3.4299     | 283.6629   | 0.01    | 0.9904   |
| NUMPC                                | 345.0370   | 64.3126    | 5.37    | 0.0000   |
| TIMEON1OneTo3Hrs                     | -142.2026  | 160.6198   | -0.89   | 0.3760   |
| TIMEON1ThreeTo6Hrs                   | -5.9463    | 186.4186   | -0.03   | 0.9746   |
| TIMEON1SixTo10Hrs                    | 224.2810   | 239.0840   | 0.94    | 0.3482   |
| TIMEON1Gr10                          | 823.2281   | 214.7291   | 3.83    | 0.0001   |
| WELLPUMPTRUE                         | 1501.4018  | 183.5027   | 8.18    | 0.0000   |
| ElecWaterSmall                       | 4421.9192  | 256.3522   | 17.25   | 0.0000   |
| ElecWaterMed                         | 4658.3555  | 163.9114   | 28.42   | 0.0000   |
| ElecWaterLrg                         | 5809.5827  | 189.7584   | 30.62   | 0.0000   |
| ElecWaterTankless                    | 3251.7517  | 755.3718   | 4.30    | 0.0000   |
| SWIMPOOLTRUE                         | 3228.7285  | 222.3292   | 14.52   | 0.0000   |
| ElecPoolTRUE                         | 4604.1557  | 837.0574   | 5.50    | 0.0000   |
| RECBATHTRUE                          | 1013.4653  | 426.3413   | 2.38    | 0.0175   |
| ElecTubTRUE                          | 1218.8041  | 486.6005   | 2.50    | 0.0123   |
| NHSLDMEM                             | 952.0720   | 42.5506    | 22.38   | 0.0000   |
| Income                               | 0.0086     | 0.0016     | 5.37    | 0.0000   |
| TVONWD1LessHour:TVTYPE1Standard      | -3266.1101 | 1800.2730  | -1.81   | 0.0697   |
| TVONWD1OneTo3Hrs:TVTYPE1Standard     | -3010.1255 | 1775.5111  | -1.70   | 0.0900   |
| TVONWD1ThreeTo6Hrs:TVTYPE1Standard   | -2516.9211 | 1772.6818  | -1.42   | 0.1557   |
| TVONWD1SixTo10Hrs:TVTYPE1Standard    | -1794.7156 | 1778.9345  | -1.01   | 0.3131   |
| TVONWD1Gr10:TVTYPE1Standard          | -1290.6207 | 1784.9518  | -0.72   | 0.4697   |
| TVONWD1LessHour:TVTYPE1LCD           | -2896.8097 | 1807.2466  | -1.60   | 0.1090   |
| TVONWD1OneTo3Hrs:TVTYPE1LCD          | -2313.1891 | 1773.9814  | -1.30   | 0.1923   |
| TVONWD1ThreeTo6Hrs:TVTYPE1LCD        | -1955.8036 | 1770.9445  | -1.10   | 0.2695   |
| TVONWD1SixTo10Hrs:TVTYPE1LCD         | -1593.9919 | 1777.1898  | -0.90   | 0.3698   |
| TVONWD1Gr10:TVTYPE1LCD               | -485.7205  | 1785.6404  | -0.27   | 0.7856   |
| TVONWD1LessHour:TVTYPE1Plasma        | -1497.7500 | 1988.0024  | -0.75   | 0.4512   |
| TVONWD1OneTo3Hrs:TVTYPE1Plasma       | -1664.7504 | 1800.8346  | -0.92   | 0.3553   |
| TVONWD1ThreeTo6Hrs:TVTYPE1Plasma     | -2001.8306 | 1788.6852  | -1.12   | 0.2631   |
| TVONWD1SixTo10Hrs:TVTYPE1Plasma      | -940.8541  | 1815.7684  | -0.52   | 0.6044   |
| TVONWD1Gr10:TVTYPE1Plasma            | 418.9083   | 1846.1024  | 0.23    | 0.8205   |
| TVONWD1LessHour:TVTYPE1Projection    | -2094.9059 | 2146.9297  | -0.98   | 0.3292   |
| TVONWD1OneTo3Hrs:TVTYPE1Projection   | -1639.6049 | 1851.1064  | -0.89   | 0.3758   |
| TVONWD1ThreeTo6Hrs:TVTYPE1Projection | -2152.3377 | 1812.9470  | -1.19   | 0.2352   |
| TVONWD1SixTo10Hrs:TVTYPE1Projection  | -925.1902  | 1837.7040  | -0.50   | 0.6147   |
| TVONWD1Gr10:TVTYPE1Projection        | 1530.2305  | 1911.2140  | 0.80    | 0.4234   |
| TVONWD1LessHour:TVTYPE1LED           | -4513.1128 | 2901.1001  | -1.56   | 0.1198   |
| TVONWD1OneTo3Hrs:TVTYPE1LED          | -1678.7884 | 2013.2805  | -0.83   | 0.4044   |
| TVONWD1ThreeTo6Hrs:TVTYPE1LED        | -2106.7446 | 1923.5912  | -1.10   | 0.2735   |
| TVONWD1SixTo10Hrs:TVTYPE1LED         | -3418.0720 | 2390.7609  | -1.43   | 0.1528   |
| TOTSQFT_EN:TYPEGLASSSinglePane       | -0.1921    | 0.1586     | -1.21   | 0.2259   |
| TOTSQFT_EN:TYPEGLASSDoublePane       | -0.0336    | 0.1540     | -0.22   | 0.8271   |

|                                | Estimate   | Std. Error | t value | Pr(> t ) |
|--------------------------------|------------|------------|---------|----------|
| (Intercept)                    | 1948.2943  | 80.2307    | 24.28   | 0.0000   |
| RENTHELPTTRUE                  | 206.7350   | 84.1076    | 2.46    | 0.0140   |
| StrTenureOwnLgApartment        | -1392.2772 | 72.2081    | -19.28  | 0.0000   |
| StrTenureOwnMobile             | -1134.4416 | 53.9823    | -21.02  | 0.0000   |
| StrTenureOwnSFAttached         | -549.6952  | 49.0434    | -11.21  | 0.0000   |
| StrTenureOwnSmApartment        | -779.1076  | 89.4444    | -8.71   | 0.0000   |
| StrTenureRentLgApartment       | -1393.4070 | 31.1855    | -44.68  | 0.0000   |
| StrTenureRentMobile            | -1213.4556 | 108.7993   | -11.15  | 0.0000   |
| StrTenureRentSFAttached        | -856.9121  | 57.0870    | -15.01  | 0.0000   |
| StrTenureRentSFDetached        | -553.5699  | 38.5786    | -14.35  | 0.0000   |
| StrTenureRentSmApartment       | -1161.1082 | 42.1556    | -27.54  | 0.0000   |
| Income                         | 0.0078     | 0.0003     | 29.57   | 0.0000   |
| reporttot                      | 14.8827    | 1.8850     | 7.90    | 0.0000   |
| EDUCATIONNoHS                  | 98.3357    | 82.3383    | 1.19    | 0.2324   |
| EDUCATIONHS                    | 109.9418   | 77.9684    | 1.41    | 0.1585   |
| EDUCATIONSomeCol               | 168.9859   | 78.5995    | 2.15    | 0.0316   |
| EDUCATIONAA                    | 171.7528   | 82.0919    | 2.09    | 0.0364   |
| EDUCATIONBA                    | 352.1423   | 79.7827    | 4.41    | 0.0000   |
| EDUCATIONMA                    | 369.0524   | 84.7068    | 4.36    | 0.0000   |
| EDUCATIONProf                  | 623.5784   | 105.4315   | 5.91    | 0.0000   |
| EDUCATIONPHD                   | 499.0001   | 115.4102   | 4.32    | 0.0000   |
| URUrban                        | -279.5002  | 25.5669    | -10.93  | 0.0000   |
| reporttot:EthRaceFALSEAfAm     | -4.9338    | 4.5597     | -1.08   | 0.2793   |
| reporttot:EthRaceFALSEAsian    | -8.7364    | 7.7372     | -1.13   | 0.2589   |
| reporttot:EthRaceFALSEMulti    | -18.8675   | 9.8690     | -1.91   | 0.0559   |
| reporttot:EthRaceFALSENativeAm | -14.2408   | 12.0000    | -1.19   | 0.2354   |
| reporttot:EthRaceFALSEOther    | 0.6991     | 12.7324    | 0.05    | 0.9562   |
| reporttot:EthRaceFALSEPacific  | -37.5385   | 18.1475    | -2.07   | 0.0386   |
| reporttot:EthRaceTRUEAfAm      | -13.9581   | 28.5075    | -0.49   | 0.6244   |
| reporttot:EthRaceTRUEAsian     | -16.9656   | 33.5615    | -0.51   | 0.6132   |
| reporttot:EthRaceTRUEMulti     | 2.8707     | 16.5903    | 0.17    | 0.8626   |
| reporttot:EthRaceTRUENativeAm  | -22.4893   | 35.3740    | -0.64   | 0.5249   |
| reporttot:EthRaceTRUEOther     | 5.1444     | 11.5405    | 0.45    | 0.6558   |
| reporttot:EthRaceTRUEPacific   | -34.7671   | 55.4693    | -0.63   | 0.5308   |
| reporttot:EthRaceTRUEWt        | -23.1538   | 5.5814     | -4.15   | 0.0000   |

Table 4: Orthodox Square Foot Model