Consumption, as predicted by the gender of the household head

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1 Introduction

Per-capita food expenditure can serve as a proxy to understand consumption in the household, consumption that correlates to household well-being. Learning about the differences in how male and female household heads spend on consumption, can be useful in determining how best to ensure household wellbeing overall. Some G2P transfers, credit disbursements and other poverty targeted programs are designed to direct their payments towards female members of the household.

Targeting of female household members to receive payments is done under the assumptions that it could increase the agency of the female members and prompt a greater portion of the resources to contribute to the well-being of the entire household.[1] This brief aims to provide additional insights into deciding whether such operational policies can be effective. Using data compiled from the 2009 National Income Dynamics Study (NIDS), we investigate whether there is a *measurable difference in per-capita food expenditure by female and male household heads*. Insights into this question could have policy implications especially for development interventions in their prioritizing/targeting of household heads.

2 Describing the data

The NIDS dataset contains responses from 6865 individual household heads in South Africa of which 54.13% are male and 45.87% are female.[2] Almost 75% of the respondents have identified as belonging to the *African* race, with the rest of respondents identifying as *Coloured*, *Indian* and *White*. The mean age of the respondents is quite high at almost 49 years. This could be due to the dataset containing data only on household heads, who tend to be older.

Table 1: Number of respondents tabulated by gender and race

Race	Female	Male	Total
African	2610	2617	5227
Coloured	377	609	986
Indian	26	81	107
White	136	409	545
Total	3149	3716	6865

The average female respondent is older than the male respondent. On the other hand, the average years of education completed by male respondents is almost 1.5 years more than females. It is notable that, female household heads tend to have larger households on average even when controlling for their race, age and education. Additionally, male household heads tend to earn more income and spend more on average than

[1] Women have traditionally been the target for large social transfer programs (Simon 2019). World Bank recommends depositing payments directly into women's accounts (Bull et al. 2020). Hagen-Zanker et al. (2017) summarizes some of the evidences around gender sensitive cash transfer designs.

[2] This omits 21 null values for race.

female household heads. As a result, it appears that female household heads on average earn less, spend less, are older, have larger households and also have less years of education than male household heads.

Table 2: Summary table of various means grouped by gender

	Female	Male
Mean Age	51.36	46.82
Mean Years Education	6.03	7.45
Mean HH Size	4.10	3.63
Mean PerCap Income (Rands)	1094.10	2193.43
Mean PerCap Food Expenditure (Rands)	261.62	367.90

3 Do female and male household heads spend differently?

Male household heads spend 368 Rands and female household heads 262 Rands on food on average (See Table 2). We find male household heads spend almost 32 percent more on average compared to female household heads. This difference on average expenditure is statistically mesaurable (See Appendix: Model 1).

However we need to note from Section 2 above that compared to male households heads, females tend tend to earn less, spend less, are older, have larger households and have less years of education. It would be prudent to be aware of these factors and try to control for these variables.

When adding more complexity to the model by controlling for individual and household characteristics such as age, education, household size, and cellphone ownership, we find that male household heads tend to spend only 17.6 percent more on average than female household heads (See Appendix: Model 2). This almost halves the previos estimate of the average difference in expenditure.

It should also be noted that there is persistent and widespread difference between the races when it comes to income, education, household size, employment etc. When we control for race, we find that male household heads spend only 11.4 percent more on average that female household heads (See Appendix: Model 3).

Lastly, we have so far omitted considerations for income itself as a factor that could have some influence on the results. When controlling for income we find that male household heads spend only 9.4 percent more on average than female household heads (see Appendix: Model 4).

3.1 Caveats

As conventional wisdom would hold that alcoholism and smoking may lead to decreased spending on household welfare, the model found that this was largely true. However we ended up not controlling for smoking and alcohol consumption as these did not produce a noticeable difference in the fit of the model.

Similarly employment would ensure more income to be spent on household welfare, however this variable did not improve the model by much. Additionally since household per capita income is a proxy for employment which was used thoroughly in the model, making the inclusion of employment was not necessary.

4 Conclusion

It seems that male household heads tend to spend around 9.4% more on food than female household heads. This result is statistically measurable when controlling for individual, household and socio-economic chracteristic such as age, income, education, household size and race. This result needs to be considered in the context of the fact that males tend to earn more, be better educated and preside over smaller households.

This analysis is limited by the fact that we have taken only food expenditure as our response variable. Expenditure on household welfare also includes expenditure on education, health, nutrition etc. A complete understanding of the hypothesis can be achieved by including these expenditures into account.

Looking forward, the study could be further enriched by looking at how expenditure in food changes as income increases for both male and female household heads.

5 References

Bull, Greta L., Caren Grown, Boutheina Guermazi, Michal Rutkowski, and Mahesh Uttamchandani. 2020. "Building Back Better Means Designing Cash Transfers for Women's Empowerment." https://blogs.worldbank.org/voices/building-back-better-means-designing-cash-transfers-womens-empowerment.

Hagen-Zanker, Jessica, Luca Pellerano, Francesca Bastagli, Luke Harman, Valentina Barca, Georgina Sturge, Tanja Schmidt, and Calvin Laing. 2017. "The Impact of Cash Transfers on Women and Girls." *Education* 42 (15): 2.

Simon, Claire A. 2019. *The Effect of Cash-Based Interventions on Gender Outcomes in Development and Humanitarian Settings*. UN.

6 Appendix:

6.1 Regression Model

6.1.1 Log Transformation

The dependent variable for percapita food expenditure is heavily right skewed. As a result natural log transformation is used to make the distribution normal in all the models.

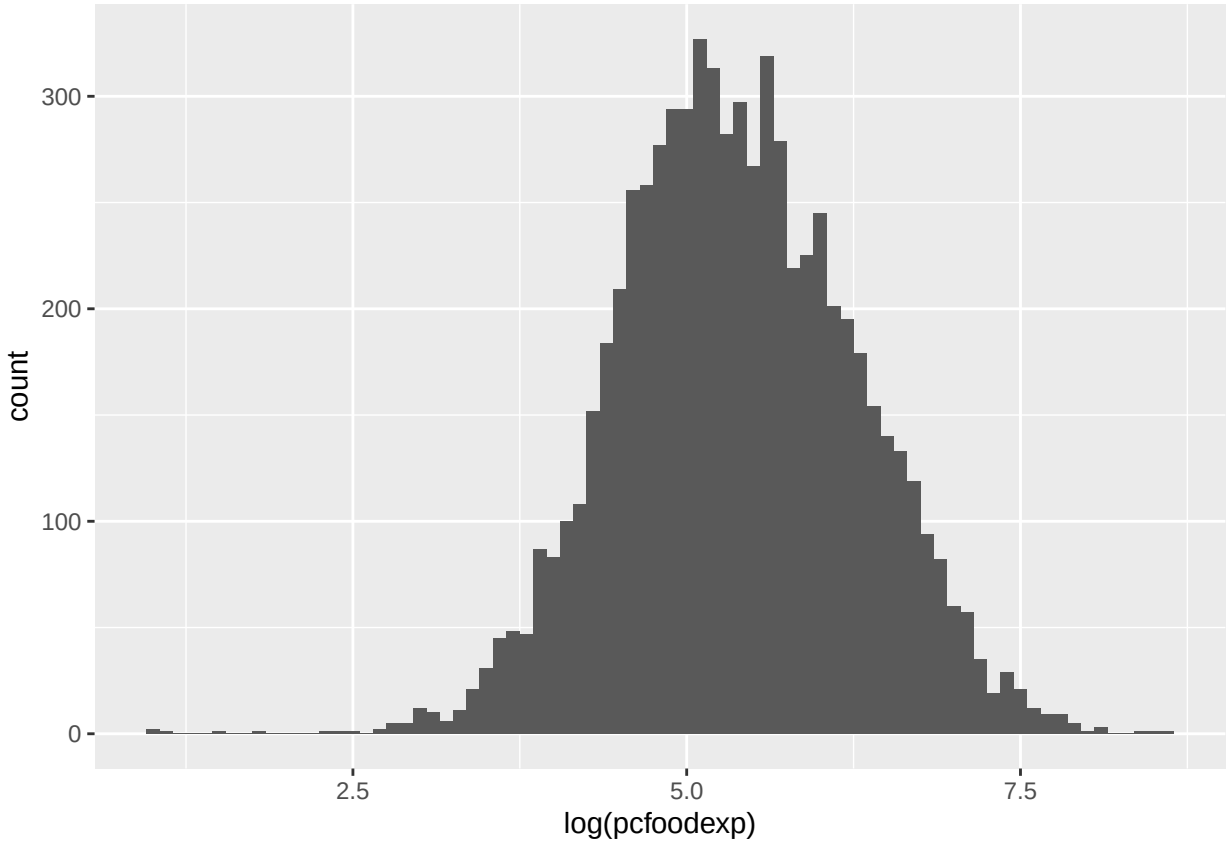


Figure 1: Log transformation allows percapita food expenditure to be normally distributed

6.1.2 Model 1

For the initial model we perform a regression of the dependent variable against gender. This model shows statistically significant differences between male and female household heads when it comes to per capita food expenditure. Male household heads tend to spend almost 32% more on average than female household heads. The initial model can thereby be expressed as below:

$$log(\text{PerCapFoodEx}) \approx \hat{\beta}_0 + \hat{\beta}_1(\text{Gender})$$

This basic model seems to have very weak explanatory powers. However it find a significant positive relationship between food expenditure and being male.

```
##
## Call:
## lm(formula = log(pcfoodexp) ~ Gender, data = nids_dta)
##
## Residuals:
```

```
##     Min      1Q  Median      3Q     Max
## -4.5624 -0.5971 -0.0272  0.5824  3.0635
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  5.20074    0.01549  335.64   <2e-16 ***
## GenderMale   0.31719    0.02106   15.06   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8708 on 6884 degrees of freedom
## Multiple R-squared:  0.0319, Adjusted R-squared:  0.03176
## F-statistic: 226.9 on 1 and 6884 DF,  p-value: < 2.2e-16
```

6.1.3 Model 2

To improve on the initial model, we will now control for individual characteristics such as age, years of education, whether the individual is a highschool grad, and household characteristics such as household size and whether there is a cellphone in the household.

The new model thereby will include variables around individual characteristics and household characteristics:

$$log(\text{PerCapFoodEx}) \approx \hat{\beta}_0 + \hat{\beta}_1(\text{Gender}) + \hat{\beta}_2(\text{Individual and HH Characteristics})$$

Interestingly this model finds a positive relationship between per-capita food expenditure and cellphone ownership in the household. In fact high school grads spend 42% more on food than non high school grads. However, there still exists a 17% premium on food expenditure for being a male household head compared to female.

```
##
## Call:
## lm(formula = log(pcfoodexp) ~ Gender + age + education + hsgradNEW +
##     hhsize + cellphoneNEW, data = nids_dta)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.4268 -0.4120  0.0034  0.4449  2.5476
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.8524006  0.0423909 114.468  < 2e-16 ***
## GenderMale       0.1769583  0.0165158  10.714  < 2e-16 ***
## age              0.0108351  0.0005817  18.626  < 2e-16 ***
## education        0.0483559  0.0024853  19.457  < 2e-16 ***
## hsgradNEWYES     0.4202457  0.0259975  16.165  < 2e-16 ***
## hhsize          -0.1608093  0.0033450 -48.074  < 2e-16 ***
## cellphoneNEWYES  0.1150658  0.0213134   5.399 6.94e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.6624 on 6686 degrees of freedom
##   (193 observations deleted due to missingness)
## Multiple R-squared:  0.4393, Adjusted R-squared:  0.4388
## F-statistic: 873.1 on 6 and 6686 DF,  p-value: < 2.2e-16
```

6.1.4 Model 3

Right now we want to further improve on model 2, by including the variables around race. As discussed in Section 2, we have respondents in the data set who have identified as being *African*,*Coloured*, *Indian* and *White*.

Once we add race, the new model can be expressed as:

$log(\text{PerCapFoodEx}) \approx \hat{\beta}_0 + \hat{\beta}_1(\text{Gender}) + \hat{\beta}_2(\text{Individual and HH Characteristics}) + \hat{\beta}_2(\text{Coloured}) + \hat{\beta}_2(\text{Indian}) + \hat{\beta}_2(\text{White})$

Interstingly, we find that being *African* comes with significant disadvantages as, every other race spends significant more on average on food than *Africans".

```
##
## Call:
## lm(formula = log(pcfoodexp) ~ Gender + age + education + hsgradNEW +
##     hhsize + cellphoneNEW + racefactor, data = nids_dta)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.4070 -0.3751  0.0177  0.4032  2.5428
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)          5.0565935  0.0411430 122.903  < 2e-16 ***
## GenderMale           0.1138849  0.0156958   7.256 4.45e-13 ***
## age                  0.0066852  0.0005709  11.709  < 2e-16 ***
## education            0.0303432  0.0024211  12.533  < 2e-16 ***
## hsgradNEWYES         0.3361058  0.0249912  13.449  < 2e-16 ***
## hhsize              -0.1589935  0.0031766 -50.051  < 2e-16 ***
## cellphoneNEWYES      0.1598888  0.0203277   7.866 4.26e-15 ***
## racefactorColoured   0.3937975  0.0224039  17.577  < 2e-16 ***
## racefactorIndian     0.8903039  0.0620789  14.341  < 2e-16 ***
## racefactorWhite      0.7553655  0.0324314  23.291  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.6228 on 6663 degrees of freedom
##   (213 observations deleted due to missingness)
## Multiple R-squared:  0.5044, Adjusted R-squared:  0.5037
## F-statistic: 753.5 on 9 and 6663 DF,  p-value: < 2.2e-16
```

6.1.5 Model 4

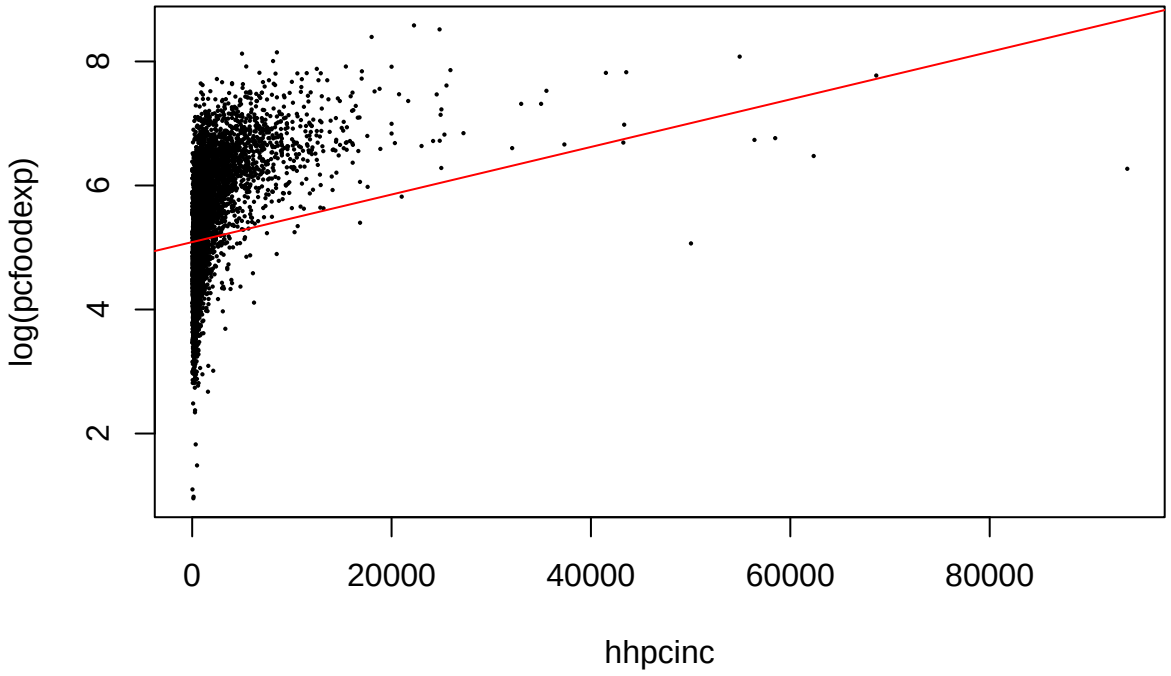
As it stands the, Model 3 seems pretty strong. However, we are yet to include another variable of interest into our model, that is the household per capital income that is recorded as rands per month in the data set.

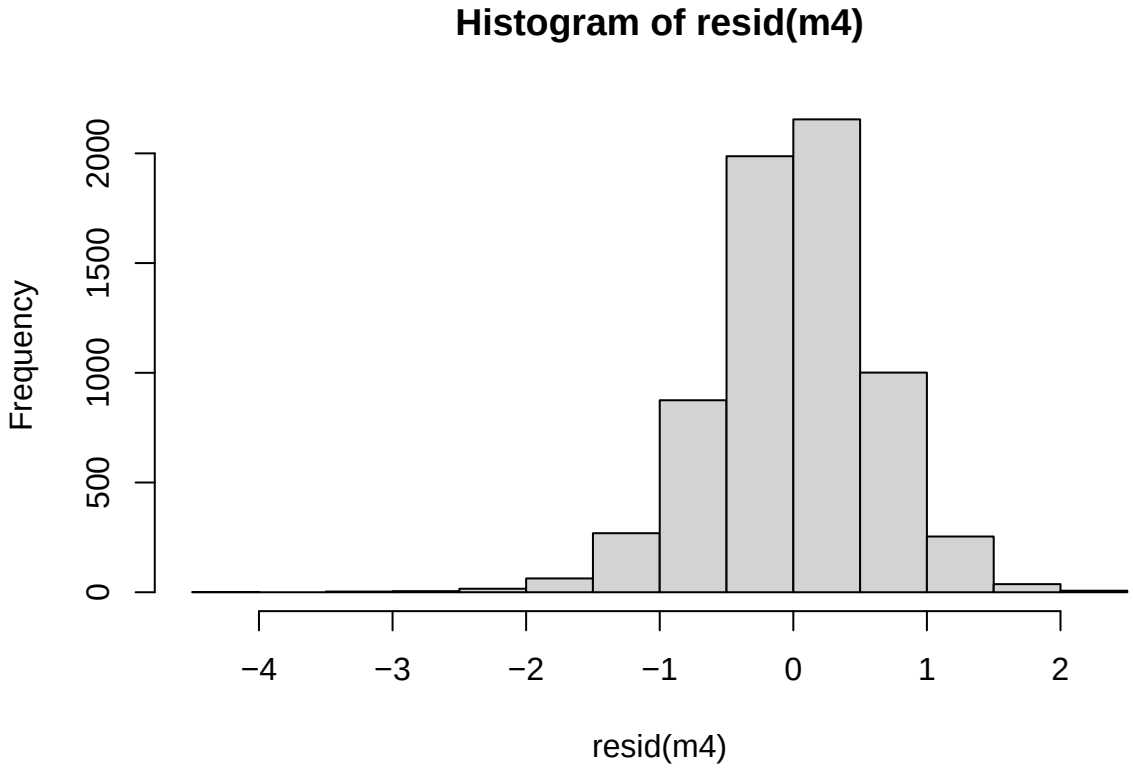
Once we include that into our model our final model stands as:

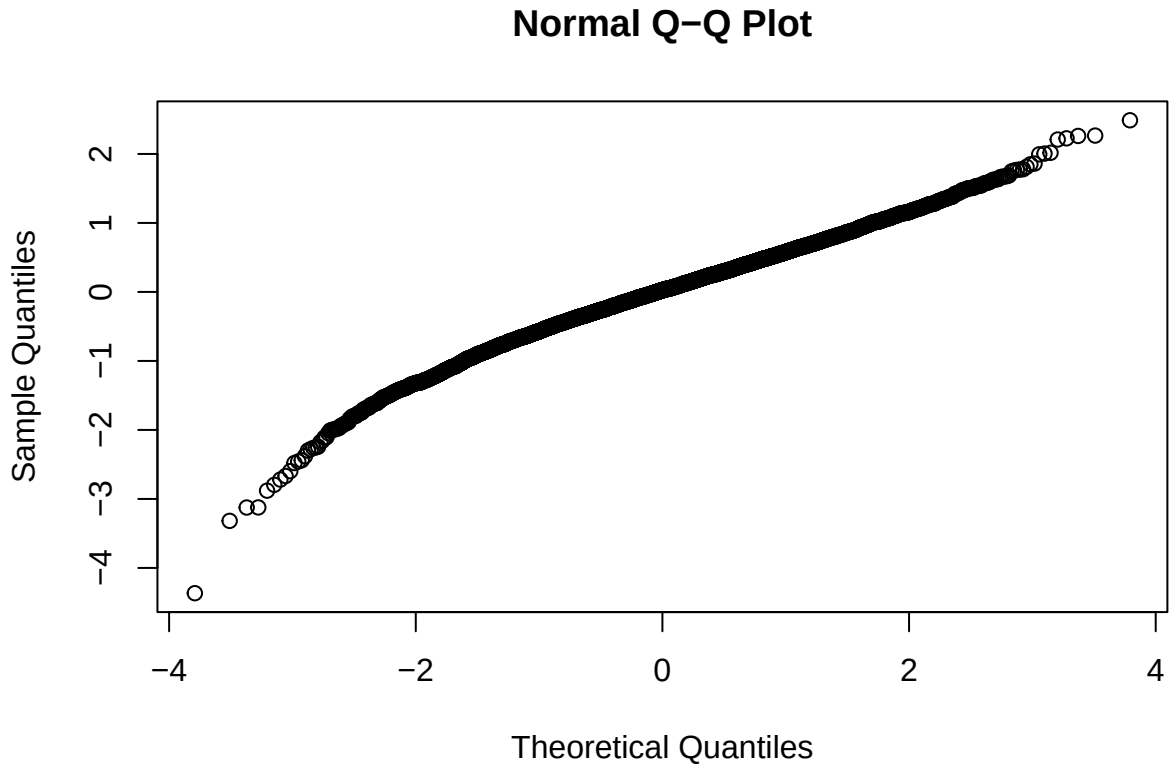
$log(\text{PerCapFoodEx}) \approx \hat{\beta}_0 + \hat{\beta}_1(\text{Gender}) + \hat{\beta}_2(\text{Individual and HH Characteristics}) + \hat{\beta}_C(\text{Coloured}) + \hat{\beta}_I(\text{Indian}) + \hat{\beta}_W(\text{White}) + \hat{\beta}_3$

Including household per-capita income into the model makes it more complete. We find that male household heads spend only 9.5% more on average on food than female household heads. However this needs to be more carefully interpreted and a more nuanced discussion on this can be found in Section 3.

```
##
## Call:
## lm(formula = log(pcfoodexp) ~ Gender + age + education + hsgradNEW +
##     hhsize + cellphoneNEW + racefactor + hhpcinc, data = nids_dta)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.3659 -0.3615  0.0252  0.3964  2.4879
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)          5.087e+00  4.050e-02 125.599  < 2e-16 ***
## GenderMale           9.401e-02  1.549e-02   6.070 1.35e-09 ***
## age                  5.792e-03  5.644e-04  10.262  < 2e-16 ***
## education            2.657e-02  2.393e-03  11.101  < 2e-16 ***
## hsgradNEWYES         2.706e-01  2.495e-02  10.849  < 2e-16 ***
## hhsize              -1.524e-01  3.153e-03 -48.343  < 2e-16 ***
## cellphoneNEWYES      1.452e-01  2.001e-02   7.254 4.50e-13 ***
## racefactorColoured   3.870e-01  2.203e-02  17.566  < 2e-16 ***
## racefactorIndian     8.309e-01  6.116e-02  13.585  < 2e-16 ***
## racefactorWhite      5.938e-01  3.361e-02  17.666  < 2e-16 ***
## hhpcinc              3.836e-05  2.526e-06  15.183  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.6123 on 6662 degrees of freedom
##   (213 observations deleted due to missingness)
## Multiple R-squared:  0.521,  Adjusted R-squared:  0.5203
## F-statistic: 724.5 on 10 and 6662 DF,  p-value: < 2.2e-16
```




Histogram of resid(m4)
Frequency
0
500
1000
1500
2000
−4
−3
−2
−1
0
1
2
resid(m4)


Normal Q−Q Plot
Sample Quantiles
−4
−3
−2
−1
0
1
2
−4
−2
0
2
4
Theoretical Quantiles

6.2 Data Dictionary

variable	label	value_labels
hhid	Household identifier	NULL
pid	Individual identifier	NULL
age	Age in Years	NULL
male	Gender of Respondent	0, 1
race	Population Group	1, 2, 3, 4
education	Education in Years	NULL
hsgrad	HS Graduation (Matric)	0, 1
satisfaction	Current Life Satisfaction 10=most)	NULL
hstatus	Self Perceived Health Status	1, 2, 3, 4, 5
hhsize	Household Size	NULL
hhhead	1=Household Head	NULL
hhpcinc	HH Per/Cap Inc (Rands/Month)	NULL
hhpcinc1000	HH Per/Cap Inc (Thousands of Rands/Month)	NULL
hhpcinc1000sq	HH Per/Cap Inc Squared (Thousands of Rands/Month)	NULL
pcfoodexp	HH Per Capita Food Expenditure	NULL
lnpcfoodexp	Natural Log of HH PC Food Expenditure	NULL
province	Province of Residence	-9, -8, -7, -5, -3, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
smoker	Respondent Smokes Cigarettes	0, 1
pctransport	HH Per Capita Transportation Expenses in Rands per Month	NULL
employed	Employment Status	0, 1
alcohol	Alcohol consumption Per Week	1, 2, 3, 4, 5, 6, 7, 8
cellphone	Cellphone in Household	0, 1
nhcrime	Perceived amount of theft/burglary in the NH	1, 2, 3, 4, 5
religious	Are religious activities important to life?	0, 1
driver	Has a driver's License	0, 1
Gender	NA	NULL