Economic Inequality and its Effect on Household Consumption

How does UK household consumption spending relative to GDP differ with economic inequality?
An econometric study.

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Statement of authenticity
This project is my own work and contains no unreferenced work of others.

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1. Introduction

This project aims to determine whether UK consumer spending as a percentage of GDP increases as a result of increased inequality. It is an econometric multivariate regression analysis of how greater inequality may cause consumers to spend more in order to maintain their relative social standing, resulting in debt creation. The question to be answered is: How does consumer spending relative to GDP differ with economic inequality? The data used are annual UK variables covering the period from 1975 to 2007: consumer spending relative to GDP, inequality as measured by the Gini coefficient, the base interest rate, median income and average house prices. The results of the model will be used to discern the hypothesis that the coefficient for the Gini coefficient independent variable will be significant and positive.

Before looking at the model, we will survey economic theories of consumption and inequality, specifically Veblen's theory of conspicuous consumption and Bourdieu's theory of cultural capital, and how they contrast with neo-classical theories in which consumer's possess exogenous preferences free from social influences. Recent studies of consumption and inequality also take contrasting views on the influence that inequality has consumption patterns, and whether the role of credit is merely useful in maintaining consumption levels or destructive in fuelling Minsky's boom and bust cycles.

However, as we shall see the results of the multivariate regression model indicate that increasing inequality is likely to have a significant and positive effect on consumption

spending relative to GDP. Therefore, it seems that social theories of consumption do have relevance in helping to explain consumer spending decisions beyond a purely 'rational choice', and the resultant debt creation which often enables such spending. Due to the importance placed by many economists on excessive debt creation helping to trigger and deepen the economic crisis of 2007-08, such analysis will undoubtedly add to other research on negative social and economic problems being attributed to inequality. Policy makers may take this as being further evidence to support the implementation of policies designed to limit economic inequality.

2. Literature review and economic theory

Neoclassical economics rests on the presumption that consumers are sovereign and utility maximising. This sovereignty in turn relies on consumers having their own exogenous preferences, not preferences that are created or influenced by forces external to them, whether social or economic (Trigg, 2010). So in this way a consumer's preferences will not be affected by what others consume: if a consumer's preferred car is a reasonably-priced hatchback and his neighbour purchases a luxury saloon car, our consumer's preference for a reasonably-priced hatchback will not be affected.

Social theories of consumption on the other hand argue that our preferences and behaviours can be influenced by social factors. Perhaps inequality causes a neighbour's income to increase relative to our consumer (total income remaining unchanged). Our consumer might feel envious of his neighbour's luxury saloon and change his mind about buying a reasonably-priced hatchback. He might instead look at ways in which he could fund the purchase of a car similar to his neighbour's through borrowing. This sort of behaviour was first formally described in economic terms by Veblen, cited in Trigg (2010), and his theory of conspicuous consumption, in which consumers purchase goods to indicate their wealth, and therefore their place in the social hierarchy, or their status. In incorporating Bourdieu's theory of cultural capital, cited in Trigg (2010), it also becomes possible to understand how preferences for goods which are not displayed or directly indicative of wealth can be seen to have social influences. The purchasing of expensive underwear could be unconscious emulation and the purchasing of artwork an example of 'cultural expertise' and appreciation, and thus status.

As already stated, this project will look at how inequality correlates with consumption levels relative to GDP. Ceteris paribus, were consumers' preferences sovereign we might expect that as inequality increases and purchasing power is transferred from the poorer classes (with a higher propensity to consume) to the richer classes (with a lower propensity to consume) overall consumption decreases (Dynan, Skinner, Zeldes, 2000). However, utilising Veblen's and Bourdieu's social theories of consumption, both cited in Trigg (2010), we might expect the opposite: that as inequality increases consumers must spend more in order to maintain their relative social standing. Many changes have taken place in the UK since inequality started to rapidly increase in the 1980s (see model data), so other variables in the study which may affect consumption levels also need to be considered in light of economic theory. Among these are Galbraith's ideas on 'want creation' through advertising, also cited in Trigg (2010), but also the deregulation of private lending, an increase in house prices

indicating consumer wealth, and the effect of changes in interest rates and inflation. Not to mention an increase in real incomes. For instance, private lending went through deregulation in the 1980s (Davies et al, 2010) so it might be asked whether access to credit is in fact the direct cause of higher debt levels and therefore greater consumption, rather than inequality being the driver behind increased spending. Are most people inherently impatient in valuing current consumption more highly than future consumption (Himmelweit and Stone, 2010) and in possession of an over-confidence bias (Prouza, 2013), and does this explain why consumers might spend more regardless of a perceived change in their relative social standing? Rational choice theory would argue that we can rationally compare the cost of borrowing with the benefit of current spending and therefore greater access to credit should have no significant effect on long term consumption levels (Harford, 2008)) (only maintaining consumption levels throughout short term unforeseen circumstances affecting income or expenditure). But this view is not supported by cognitive psychology research which describes how decisions are shaped by unconscious biases (Kahneman, 2001), the data used for this project showing increased consumption levels and household debt in the *long term* since lending deregulation and research indicating that bankruptcies and incidences of financial distress increase in communities with higher levels of economic inequality (Frank and Levine, 2007).

It could seem as though there should be a bridge between rational choice theory and social choice theories of consumption. Many consumption decisions will undoubtedly be driven by rational choice theory: weighing up only price and quality against a given budget to buy a new washing machine for example. But many consumption decisions will also be influence by social factors: consumers queuing for hours in order to buy a mobile phone that differs to their current phone only in colour in order to differentiate one's social identity and therefore status. As the noble prize winning psychologist, Kahneman (2011) has stated, perhaps we can think fast (unconsciously with biases) or slow (consciously and largely rationally) and our thinking, preferences and consumption decisions are dominated by different systems.

Neo-classical economic models as interpreted by normative theory can be used to show how we should act more rationally in order to be utility maximising, as opposed to positive theory which uses them to predict or describe how we actually behave (Anand, 2010). If spending increases due to increasing inequality because of 'irrational' status seeking, then utilising normative theories to increase our rationality is surely a good thing if unsustainable consumption levels reinforce an economic inequality which does not improve happiness and erodes society (Wilkinson and Pickett, 2009). In this vein, government policy has recently resulted in the inclusion of financial decision making in the school curriculum (Department for Education, 2013). However, as we are unlikely to ever become completely rational (nor perhaps would we want to be) there will continue to be a place for policy that nudges us towards making better decisions day to day, in the manner described by Thaler and Sunstein in their book *Nudge,* cited in Anand (2010). But also, perhaps more importantly, greater regulation of lending and a greater redistribution of wealth and income to counter the growth in inequality and subsequent social consumption patterns as described by Veblen and Bourdieu that lead to unsustainable spending levels. The importance of these outcomes to governments cannot be overstated when economists such as Minsky, and more recent

research, points to such consumption being funded by over-borrowing that potentially leads to bankruptcies and, ultimately, recession (cited in Kapeller and Schütz, 2013).

In summary, this project will attempt to determine whether inequality causes a change in consumption levels, and in doing so suggest that the maintenance of status as described by social theories of consumption can explain why. This could affect how much reliance can be placed in neo-classical economic models to decision making, especially when applied to macro-economic modelling, and potentially, forecasting economic stability.

3. Data

The project will use UK data for the following variables.

Dependent variable:

- CONSUM (Household final consumption expenditure, etc. (% of GDP)), source: World Bank

Key independent variable:

- GINI (Gini coefficient (at disposable income, post taxes and transfers)), source: Institute for Fiscal Studies (IFS)

Other independent variables:

- INT (Bank of England Interest Base Rate), source: Bank of England
- MINC (Median income (weekly) Before Housing Costs (£)), source: Institute for Fiscal Studies
- HOUSE (Real Av. House Price (£)), source: Nationwide

The variables are annual results from 1975 to 2007. This range captures when economic inequality in the UK started to steadily increase from a low of 0.239 (Gini coefficient) in 1977, up to 0.359 in 2007. The data range stops before the financial crisis in 2008 to avoid outliers created by highly unusual economic circumstances, which resulted in income levels falling suddenly for example.

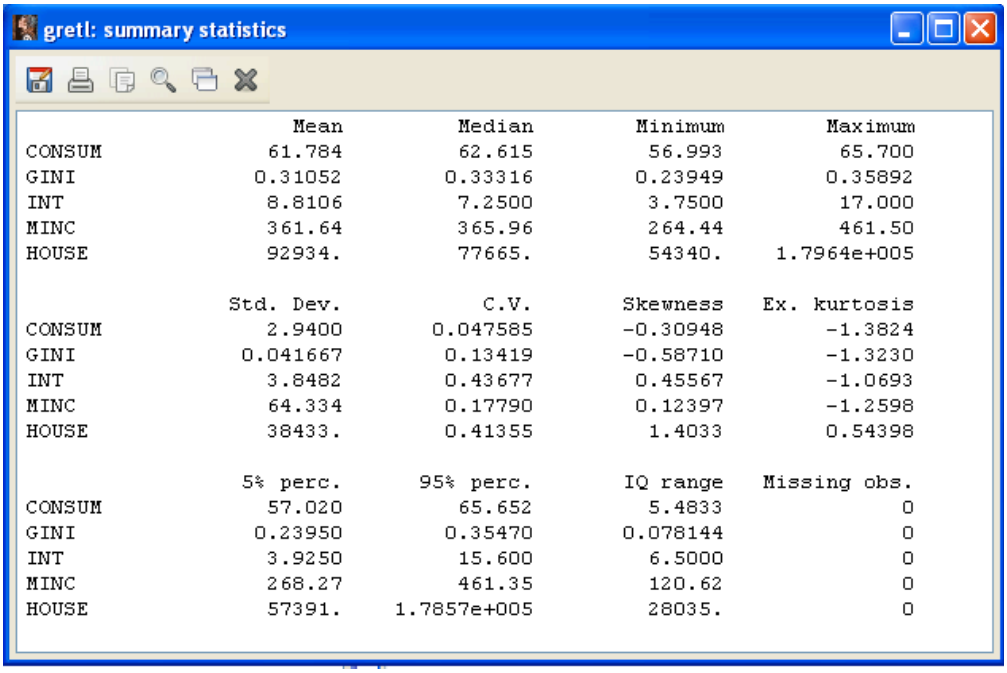
The data will inform a multivariate regression equation which will attempt to model household final consumption expenditure (% of GDP) as a function of the independent variables. How the Gini coefficient, saving rates and indebtedness correlate will be of particular interest.

3.1 Preliminary descriptive statistics

Initial analysis of the variables will help determine the relevancy and characteristics of the data, and crucially whether any transformations should occur before they are used for linear modelling.

On Figure 1 we can see that CONSUM ranges from a minimum of 57% to a maximum of 66% (to two significant figures). Its mean 61.784 is not substantially different to its median 62.615. Of note, GINI's mean is lower than its median (0.31052 to 0.33316) indicating a negative skew in the data; INT's mean is higher than its median (8.8106% to 7.2500%) indicating a positive skew in the data; and HOUSE's mean is lower to a median (£92934 to £77665) also indicating a positive skew in the date. All skews are reflected in the measurements of skewness on Figure 1 and can be seen in the frequency plots for GINI, INT and HOUSE (appendix A).

Figure 1: Initial summary statistics


gretl: summary statistics

	Mean	Median	Minimum	Maximum
CONSUM	61.784	62.615	56.993	65.700
GINI	0.31052	0.33316	0.23949	0.35892
INT	8.8106	7.2500	3.7500	17.000
MINC	361.64	365.96	264.44	461.50
HOUSE	92934.	77665.	54340.	1.7964e+005

	Std. Dev.	C.V.	Skewness	Ex. kurtosis
CONSUM	2.9400	0.047585	-0.30948	-1.3824
GINI	0.041667	0.13419	-0.58710	-1.3230
INT	3.8482	0.43677	0.45567	-1.0693
MINC	64.334	0.17790	0.12397	-1.2598
HOUSE	38433.	0.41355	1.4033	0.54398

	5% perc.	95% perc.	IQ range	Missing obs.
CONSUM	57.020	65.652	5.4833	0
GINI	0.23950	0.35470	0.078144	0
INT	3.9250	15.600	6.5000	0
MINC	268.27	461.35	120.62	0
HOUSE	57391.	1.7857e+005	28035.	0

Because of the skewness in these variables and the high p-value for GINI when running the regression model without any transformations (see appendix B), the variables GINI, INT and HOUSE were transformed to their log values. Thus, l_GINI, l_INT and l_HOUSE will be used in place of the untransformed data.

Summary statistics for all variables used in the regression model (appendix C) demonstrate much less disparity between the means and medians for the variables transformed when compared to Figure 1.

As can be seen from the frequency distribution plots for CONSUM and MINC (appendix A), neither show clear skewness and they are therefore left untransformed.

4. Research methods

4.1 Variables used and econometric model specification

In order to ascertain the effect of inequality on consumption expenditure this project will utilise the following variables in an Ordinary Least Squares multivariate regression model using Gretl:

CONSUM – household final consumption expenditure, etc as a percentage of GDP

l_GINI – Log of Gini coefficient (at disposable income, post taxes and transfers)

MINC – Real median weekly income before housing costs (£)

l_INT – Log of Bank of England base interest rate (%)

l_HOUSE – Log of real average house prices (£)

The question to be answered is how inequality affects consumption expenditure. This gives us CONSUM as the dependent variable and l_GINI as the key independent variable. CONSUM, household final consumption expenditure, etc (% GDP) includes all goods and services (except the purchases of dwellings) and the expenditures of non-profit institutions serving households; whilst l_GINI, the log of the Gini coefficient, is the log of a standard measure of economic inequality which uses measures of wealth and income.

To investigate how other factors effect consumption spending, and improve the econometric model, the variables MINC, l_INT and l_HOUSE have also been included in the analysis. MINC, median weekly income before housing costs, is an important measure of income levels in an economy. In neo-classical economics, if incomes rise relative to prices, we expect consumer demand, and therefore consumption, to increase. Meanwhile, l_INT, the log of the base interest rate, allows us to measure how the cost of borrowing affects access to credit and therefore consumption. Finally, l_HOUSE is included as housing is the greatest form of wealth for the vast majority of the population. If house prices rise, consumers become wealthier and are thus likely to increase their consumption spending.

Originally, I also intended to use the following variables: population (POP), the saving ratio (SAVING), average weekly hours worked (HOURS), unemployment (UNEM), and total outstanding credit loaned to households and non-profit institutions serving households (NPISH) adjusted for inflation. NPISH are organisations which provide goods or services to households free of charge or at economically insignificant prices. However, running the model with these variables included resulted in each of the additional variables having non-statistically significant p-values (appendix D). After whittling down the variables in order to produce statistically significant results it seemed that CREDIT should be kept in the model, as this was a key aspect of the ideas covered in the literary review and theory elements of the project. But still, all the remaining variables in the model were not statistically significant (appendix E). This was likely the result of multicollenarity between CREDIT, MINC and l_HOUSE in particular (appendix F). However, it was concluded that credit is not really a *cause* of consumption, but it can be a *result* if consumers' incomes cannot cover the price of goods or services. What can be a cause of consumption, however, is ease of access to credit, and a key determinant of that in a developed economy is the base interest rate. So finally, removing CREDIT from the model produced the economic regression equation already described in which all variables are statistically significant at the 1% significance level. Satisfactorily, these are also the key variables one would discern to cause consumption levels to alter, apart from the consumer confidence index which I could not find data for. However, over the long term it is assumed that the effect of consumer confidence levels is negligible (only helping to describe short term changes through periods of economic instability).

So the regression model is:

CONSUM = a + (b_1 x l_GINI) + (b_2 x MINC) + (b_3 x l_INT) + (b_4 x l_HOUSE) + *u*

where:

a is a constant representing the intercept of the regression line

b_1 is the slope coefficient of the variable l_GINI

b_2 is the slope coefficient of the variable MINC

b_3 is the slope coefficient of the variable l_INT

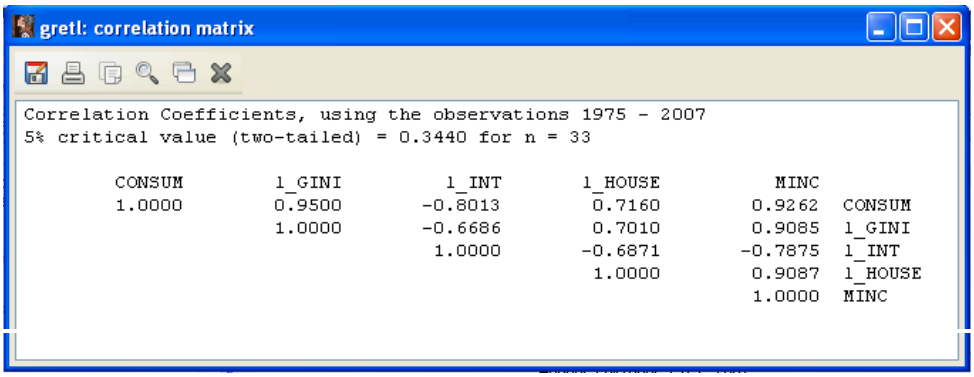
b_4 is the slope coefficient of the variable l_HOUSE

u is the error term

4.2 Evidence of multicollinearirty

We will now look at a correlation matrix of the variables used in the model for this project (Figure 2). This displays the strength of the correlations between the variables and can be helpful in identifying instances of multicollinearity. CONSUM has a very strong positive correlation with l_GINI, which is in line with what the project is intended to highlight, as well as MINC, with a fairly positive correlation with l_HOUSE. l_INT meanwhile has a strong negative correlation with CONSUM, which is again what we would expect given that if interest rates rise we would assume borrowing to decrease, and therefore debt fuelled consumption to decrease.

Figure 2: final correlation matrix



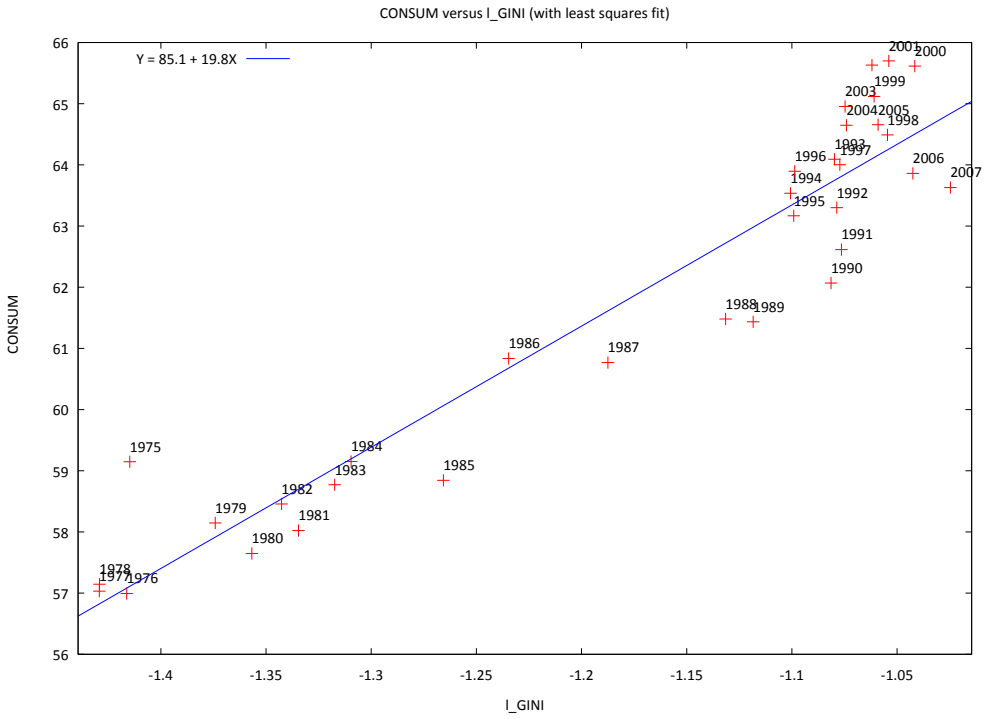
In terms of multicollinearity between the independent variables of note there is a very strong positive correlation 0.9085 between l_GINI and MINC, which is an interesting finding: inequality increases as median income increases. Further analysis of different income quartiles would be necessary to identify at which income levels inequality is most pronounced and whether there is any causality between the two. There is also a very strong positive correlation, 0.9087, between l_HOUSE and MINC, which is stronger than one might have assumed given that house prices in the UK have increased so rapidly. However, a positive correlation is to be expected: with restrictions on the supply side in the UK housing

market, higher incomes and therefore demand will result in higher prices. Overall, increased instances of multicollinearity indicated by fairly high correlations between all the variables (both negative and positive) might be why versions of the model with more variables resulted in low p-values (see Appendix E for the inclusion of CREDIT for example). Because of these instances of multicollinearity it was necessary to reduce the number of variables down to the key variables as already described in order to maintain the statistical significance of the model.

4.3 Visual representation of the key correlations

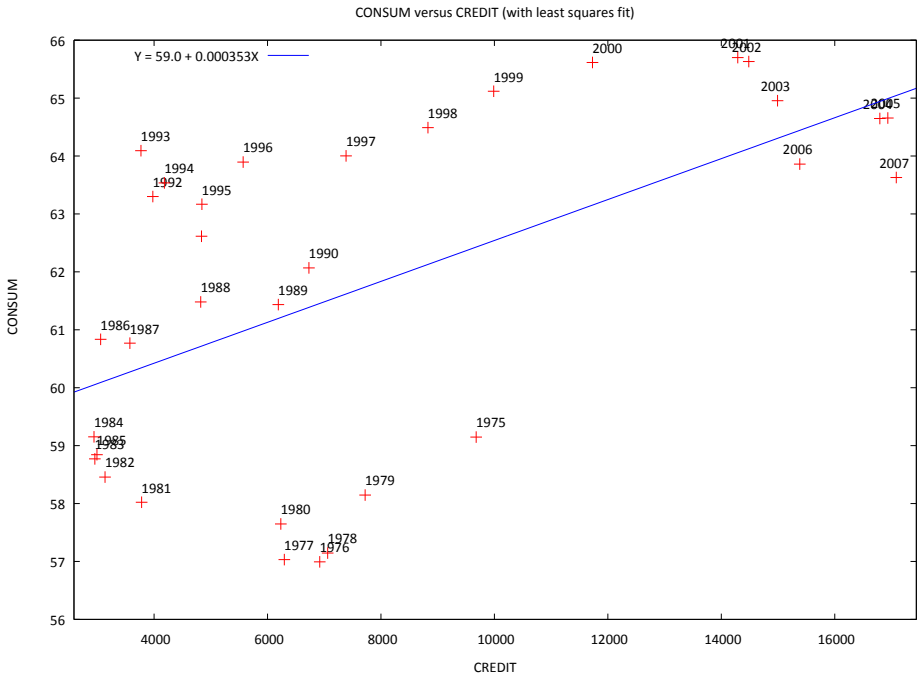
Turning now to scatterplots in order to help outline the key relationships, we have:

Figure 3: Scatterplot of CONSUM and l_GINI



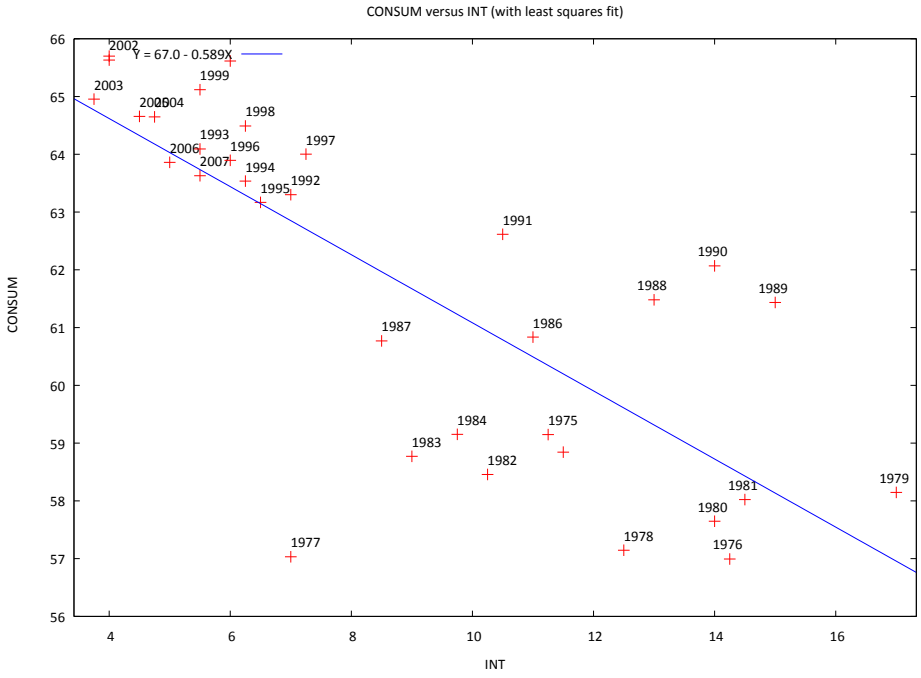
As seen on Figure 3, CONSUM and GINI have a strong positive linear correlation with a period of rapid increase in both consumption relative to GDP and inequality throughout the 1980s and 1990s before stagnating in the 2000s. It is from the mid-1980s that ease of access to credit increased drastically with a variety of credit cards becoming available, and mortgage lending and financial regulation being relaxed. So a significant increase in consumption as a percentage of GDP could have been enabled by consumers increasing their personal debt during this time. Looking at a scatterplot (Figure 4) of the data CREDIT (total outstanding credit to households and non-profit institutions serving households) - sourced for the project but not ultimately including in the regression model – against CONSUM we can see that there is such a positive relationship. From the mid-1980s both CREDIT and CONSUM began a steady increase for the next fifteen years or so until 2001 when CONSUM starts to decrease.

Figure 4: A scatterplot of CREDIT and CONSUM



However, it should be noted that simultaneously the Bank of England's base interest rate was historically high throughout the late 1970s and 1980s, lessening access to credit for many, as we can see on Figure 5 with INT as a level. As INT decreased to moderate rates in 1992, CONSUM increased fairly substantially (along with CREDIT as already noted).

Figure 5: Scatterplot of CONSUM and INT



Looking now at Figure 6, a scatterplot of CONSUM and l_INT (the variable actually used in the model), an even greater negative correlation between the two indicators is apparent, as we would expect.

Figure 6: Scatterplot of CONSUM and l_INT

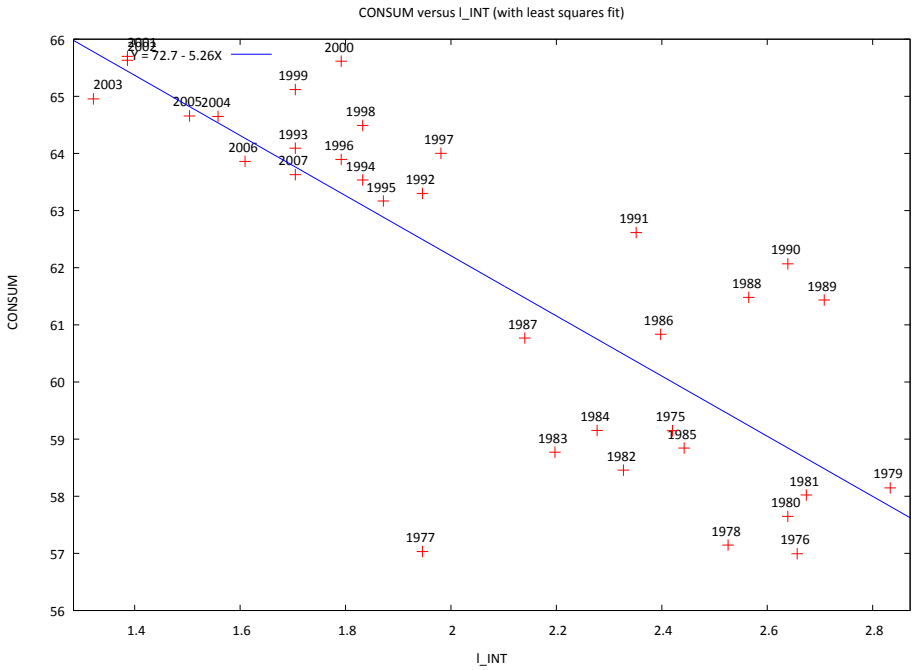


Figure 7 is a scatterplot of CONSUM and l_HOUSE and shows an irregular correlation between CONSUM and l_HOUSE but ultimately one with a positive relationship as expressed by the line of best fit. This irregular relationship, as well as multicollenearity, is likely the reason why the coefficient for l_HOUSE in the model is a negative value (Figure 9), when this is not what we might expect given that house prices are a good indicator of wealth and increased wealth could therefore lead to greater consumption (as already stated). Perhaps a large number of individuals are on the verge of being priced out of the market and are having to spend more on deposits and large mortgages, ultimately lessening their consumption of other goods and services. It should be noted that transforming HOUSE to the square of HOUSE (sq_HOUSE) does not change the coefficient sign, and also lessens the p-value of l_GINI, when running the model (appendix H). For this reason the variable is left as l_HOUSE.

Also, despite the univariate relationship between CONSUM and l_HOUSE being positive (Figure 7), but in the multivariate model, negative (this partial effect given by the negative coefficient), and the ambiguity this might lend the results, it is judged to be important to still include this variable in the model in order to avoid omitted variable bias. Indeed, removing l_HOUSE from the model gives a weaker r-squared value of 0.953 (Appendix I) compared to 0.996 (Figure 9), and results in MINC's coefficient no longer being statistically significant with a p-value of 0.5175 (Appendix I).

Figure 7: Scatterplot of CONSUM and I_HOUSE

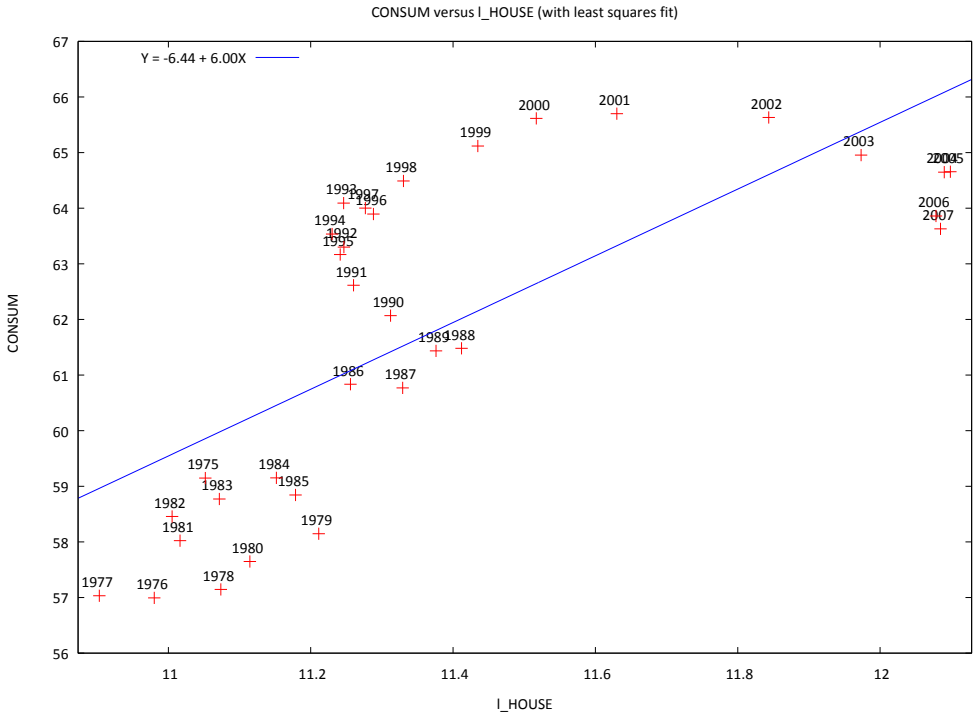
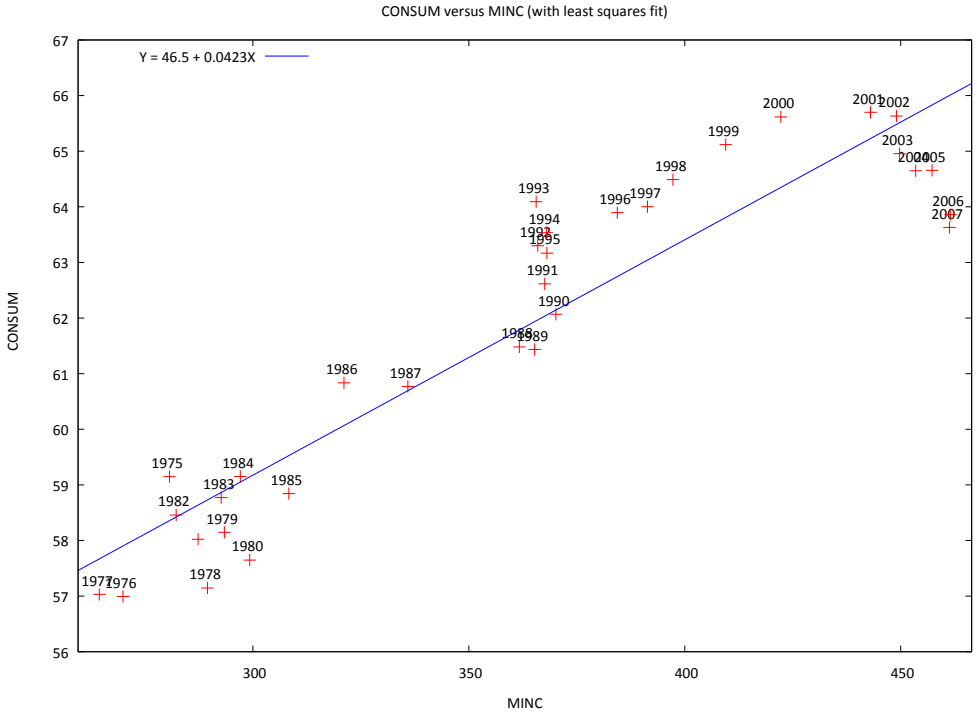


Figure 8: Scatterplot of CONSUM and MINC



Finally, Figure 8 shows a strong positive correlation association between CONSUM and MINC. This is very much as we would expect: as real incomes rise consumers have more money to spend and so consumption increases. However, it should be noted that from 2001

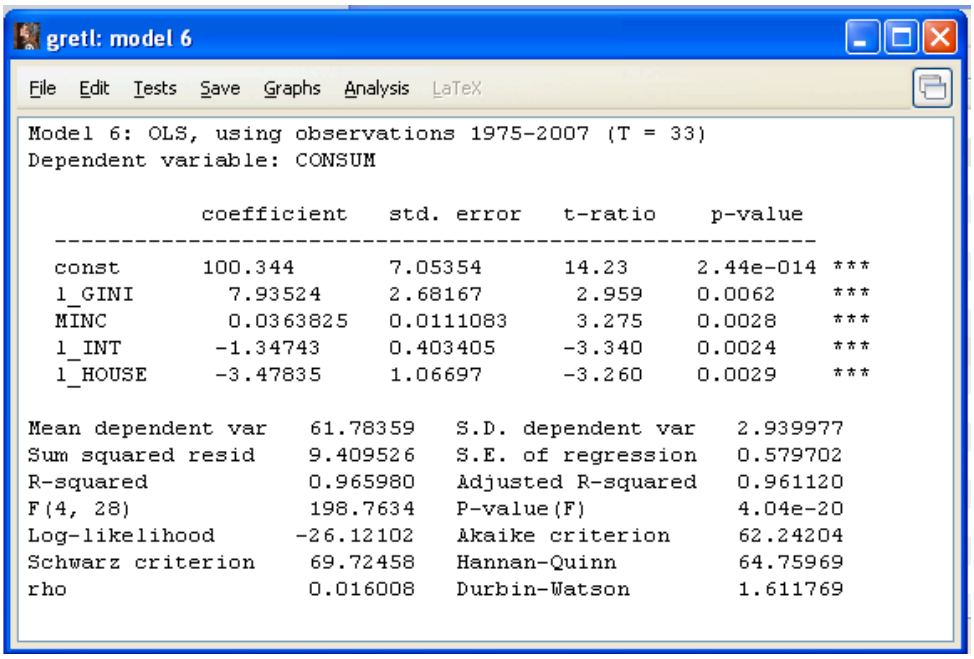
real income growth slows and consumption as a percentage of GDP decreases. Perhaps this is a result of slowing income growth creating a reduction in consumer confidence; or a result of the theory that lower income families have a higher propensity to spend: inequality could have resulted in adverse effect on consumer spending.

5. Findings and discussion of findings

5.1 Using data to address the question

Now that the data and how they can best be used to create a multivariate regression model has been considered, we can look at answering the project's question: how inequality affects consumption expenditure. To do this the Ordinary Least Squares model is used on Gretl to give the following results:

Figure 9: OLS Model



This allows us to state the final model as:

CONSUM = 100.344 + (7.935 x l_GINI) + (0.036 x MINC) – (1.347 x l_INT) – (3.478 x l_HOUSE)

The constant term 100.344 gives the intercept when the independent variables l_GINI, MINC, l_INT and l_HOUSE all equal zero. This value can be thought of as autonomous consumption, as it represents the consumption of what is required in order to survive even when income is zero.

The coefficient for l_GINI is 7.935. As long as all other variables are held constant, this means that CONSUM (consumption as a percentage of GDP) will change by 7.93524

divided by 100, or 0.0793524 units, each time GINI (inequality as measured by the Gini coefficient) changes by 1%. This is in line with the hypothesis of the project.

The coefficient for MINC is 0.036. As long as all other variables are held constant, this means that each time MINC (median income) increases by one unit then CONSUM increases by 0.036. This is in line with standard neo-classical economy theory in which higher incomes lead to higher consumption expenditure due to the assumption of non-satiation (Trigg, 2010).

The coefficient for l_INT is -1.34743. As long as all other variables are held constant, this means that CONSUM will change by -1.34743 divided by 100, or -0.0134743 units, each time INT (the Bank of England's base interest rate) changes by 1%. This is in line with expectations. If the cost of borrowing increases consumers are less likely to borrow in order to fund non-autonomous consumption

The coefficient for l_HOUSE is -3.47835. As long as all other variables are held constant, this means that CONSUM will change by -3.47835 divided by 100, or -0.0347835 units, each time HOUSE (the average house price) changes by 1%. This is not in line with initial expectations as already noted.

5.2 Statistical significance of coefficients

Before drawing final conclusions from the model we must first consider the statistical significance of the coefficients individually, and then the statistical significance of the model as a whole.

To assess the statistical significance of the coefficients for each of the independent variables we can use the t-ratios and p-values given by Gretl on running the OLS model (Figure 9). The test to be conducted is an attempt to prove the null hypothesis ($\mathbf{H_0}$) that the coefficient of an independent variable is actually zero:

$$\mathbf{H_0}: b_n = 0.$$

If we cannot prove this, then we must reject the null hypothesis and support the alternative hypothesis ($\mathbf{H_A}$) that the true coefficient of the independent variable is not zero:

$$\mathbf{H_A}: b_n \neq 0.$$

I.e. the given coefficient is statistically significant.

As the model has less than thirty degrees of freedom (28) the critical value of normal distribution is not assumed to be accurate for t-ratio testing. Therefore, using a t-distribution, Gretl produces a critical value of 2.76326 at the 1% significance level (Appendix J). If a t-ratio of a coefficient falls between -2.76326 and +2.76326 then the null hypothesis ($\mathbf{H_0}$) cannot be rejected. Where the magnitude of a t-ratio is greater than the critical value, $\mathbf{H_0}$ is rejected at the relevant significance level.

As the t-ratios of all the coefficients exceed +/-2.76326 we can reject the null hypothesis for each of them.

Turning now to the p-values, we can see that each of them is less than 0.01, indicating that each coefficient is statistical significant at a 1% level. Gretl also includes stars (*) to indicate the significance level, and each coefficient is listed as *** (indicating 1% significance).

In summary, each independent variable on its own has a statistically significant effect on the dependent variable, CONSUM.

5.3 Statistical quality of model

We now turn to the statistical significance of the model as a whole. To do this we can use two tests that Gretl provides: the R-squared test and the F-test of joint significance.

The model has an R-squared value of 0.965980, which means that the independent variables used account for 96.6% of any variation in CONSUM. This is very significant result which indicates that the model is accurate and relevant.

Now we turn to the F-test of joint significance for the null hypothesis that none of the independent variables in our multivariate model help to explain CONSUM. The p-value for the F-test is 4.04e-20, or <0.00001 to five decimal places, which is below the 1% significance level. Therefore, we can reject the null hypothesis and conclude that as a whole, the model is useful, and that the independent variables largely explain variation in CONSUM.

Both the R-squared and F-test indicate that together the independent variables used in the model meaningfully explain any variation in the dependent variable, CONSUM. The model is statistically relevant.

5.4 Visual inspection – residual plots

As can be seen from the residual plots for each of the independent variables (see appendix K) the data points have a random pattern with no line of best fit. This indicates that the linear model used for this project is a good representation of the data, and that the error term, u, comprises of only random effects on the dependent variable, CONSUM.

However, to formally test for the presence of heteroskedasticity, or dispersion in the error terms which varies with the values of one or more of the independent variables, we will use Gretl to perform White's test (appendix L).

The p-value for the test is 0.196910, or 19.7%. This is greater than the 5% significance level so we cannot reject the null hypothesis that the errors in the model are homoscedastic. This is good evidence that the error terms of the model are not heteroskedasticity, and supports the visual inspection of residuals.

5.5 Results in terms of theory

So what does all this mean? The Gini coefficient in 1975 was 0.2429826, and 0.3589162 in 2007. This suggests that the Gini coefficient increased by about 47.7% between 1975 and 2007.

And as the project's model has determined that CONSUM increases by 0.0793524 units each time GINI increased by 1%, we can expect consumption as a percentage of GDP to

have increased by 3.79% between 1975 and 2007 purely due to an increase in inequality. (47.7 multiplied by 0.0793524 (the coefficient for the l_GINI) equals 3.78510948).

Consumption as a percentage of GDP actually increased by 4.48 units (63.63 (in 2007) minus 59.15 (in 1975) = 4.48).

If our model predicts that inequality accounted for a 3.79 percentage change in CONSUM between 1975 and 2007 (rounded to two decimal places), but it actually increased by 4.48, we can say that inequality is responsible for an 84.5% increase in household consumption spending as a percentage of GDP.

This is quite significantly the most important cause of consumption spending as a percentage of GDP out of all of the independent variables, the others being real median income (income relative to prices), average house prices (indicating household wealth), and a change in base interest rates (indicating ease of obtaining credit).

In a model in which the independent variables account for 96.6% of any variation in consumption spending as a percentage of GDP this would seem to be a significant result. So we can say that social theories of consumption, particularly Veblen's and Bourdieu's hypotheses that households can make consumption decisions based on status are firmly backed by the results of this model.

Furthermore, household final consumption expenditure, etc. (constant 2005 US$) increased from $563.919 billion in 1975 to $1,568.586 in 2007, a total increase of $1,004.667 billion (data from the World Bank). In 2005 the average $US to sterling exchange rate was 0.55000 (Antweiler, 2013).

Therefore we can say that household final consumption, etc in the UK increased by about £552.567 billion between 1975 and 2007. Using the results of our model we can therefore say that 84.5% of this, or £466.919, is predicted to be due to an increase in inequality.

Using data from the Bank for International Settlements we know that total outstanding credit to households and NPISH was £188.454 billion in 1975 and £1,289.754 billion in 2007 (BIS, 2014). This is at constant 2005 sterling prices using the UK annual average RPI (ONS, 2014). The total difference then is £1,101.299 billon. Using the results of the model, and the predicted amount of consumption due to inequality of £466.919, we could infer that about 42.4% of the total outstanding credit increase between 1975 and 2007 could be attributable to an increase in inequality. This leaves the rest of the total credit increase in this period to the other variables included in the model, as well as debts to meet the interest payments of previous debts, but perhaps most significantly an increase in mortgage debt.

But 42.2% is still a significant portion of total household debt, and in terms of the effect of household debt in potentially helping to cause the financial crisis of 2007-08, and certainly deepen the following recession, this is a stark figure for policy makers to consider as a consequence of inequality.

6. Conclusion

This project set out to answer the question: How does consumer spending relative to GDP differ with economic inequality? The answer would appear to be that consumer spending increases as a consequence of increasing inequality. This result strongly suggests that neo-classical economic consumer theories are not sufficient to accurately model consumer decision making.

But if policy makers act to stifle lending then what about the dissatisfaction caused by hampering a consumer's ability to maintain their social status? If policy makers leave lending regulations as they are, then with inequality continuing to grow (along with house prices), are we walking into another debt fuelled financial crisis? Further studies and models are required to explore this issue further.

But it should always born in mind that a single regression model is not singularly an infallible determinant of social policy. Perhaps inequality is exacerbated by increased levels of consumption by households lured by lower interest rates and easier access to credit. Could cause and effect be reversed? Does excessive consumption increase inequality? As is often the case with economic modelling, the real world is too complex to be captured by a simple regression equation. It is likely that cause and effect does run both ways, in what could be a vicious cycle of debt supported consumption helping to create inequalities, and inequalities spurring consumption supported by debt. Again, further studies are required.

To have created a more complete model and analysis other developed countries which have gone through a period of changing inequality could have been studied, and other factors such as advertising expenditure might play a role in changing consumption patterns. With more time and data a more complete picture of how inequality interacts with consumption will emerge.

However, the model's results are significant, and whatever the complexities, the findings at least lend weight to the growing body of evidence that economic inequality is a significant cause for concern, economically as well as socially, and should perhaps be at the forefront of public policy debates.

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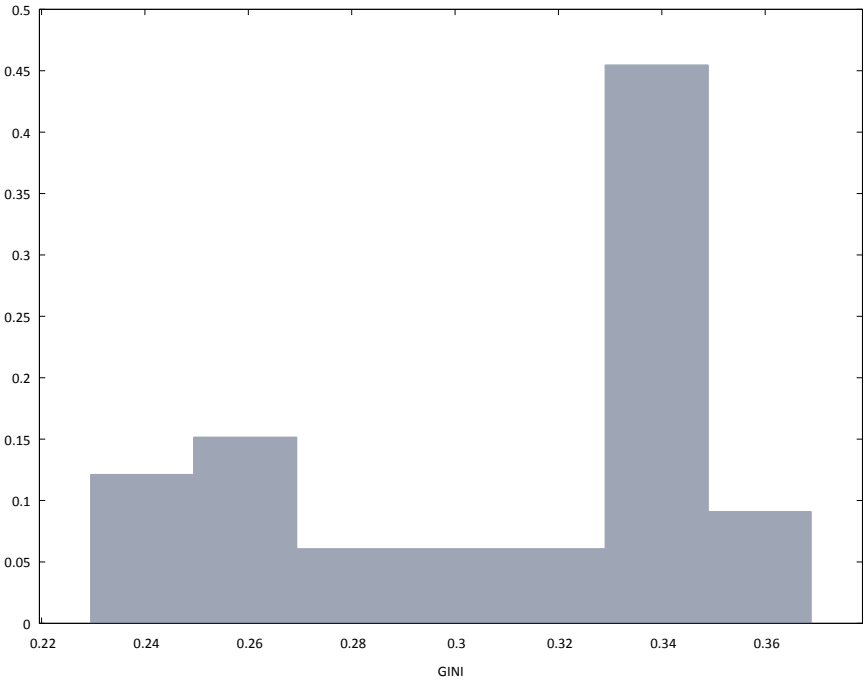
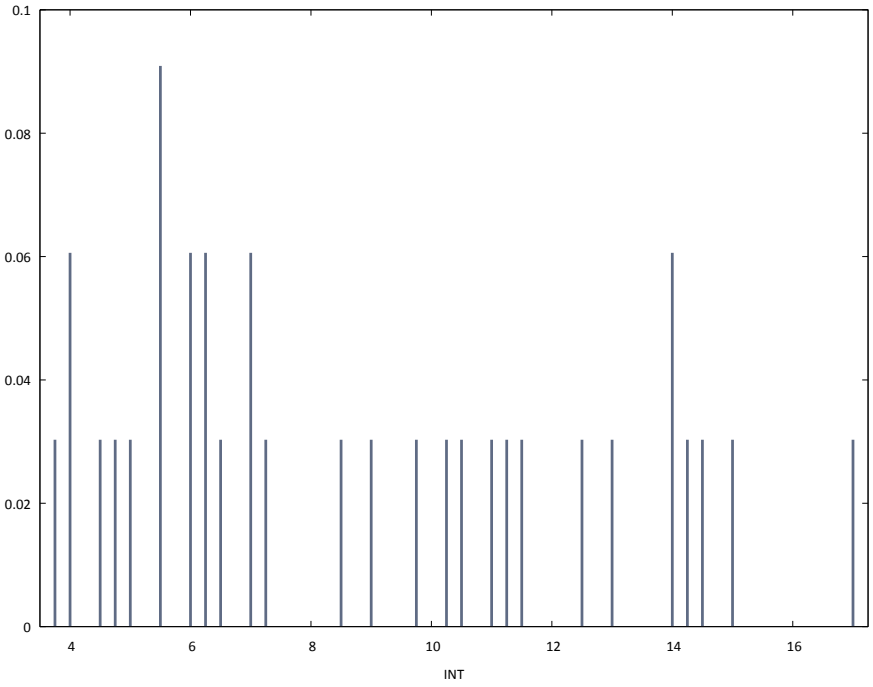
Appendices

Appendix A:

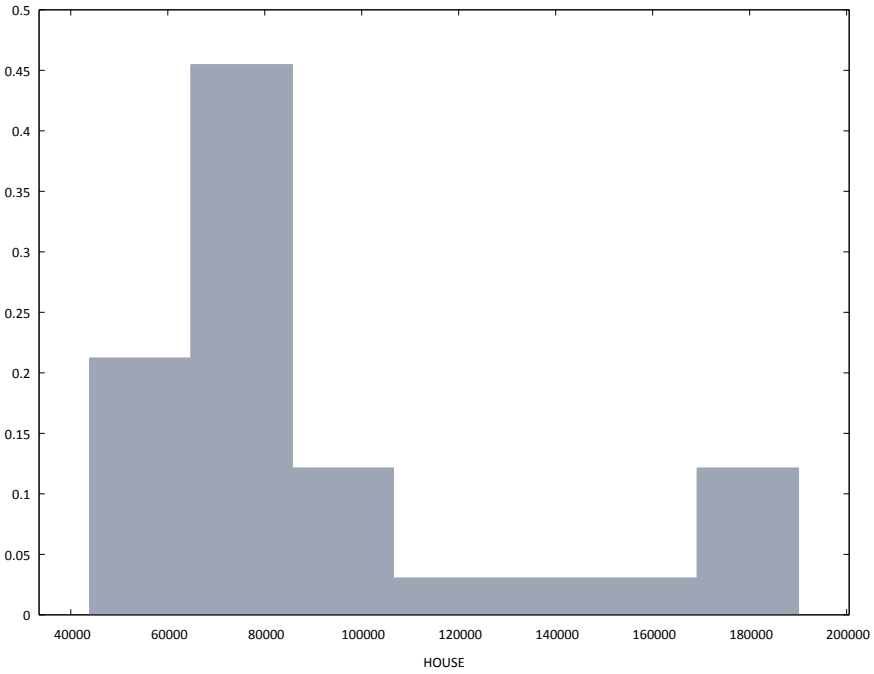
GINI frequency plot



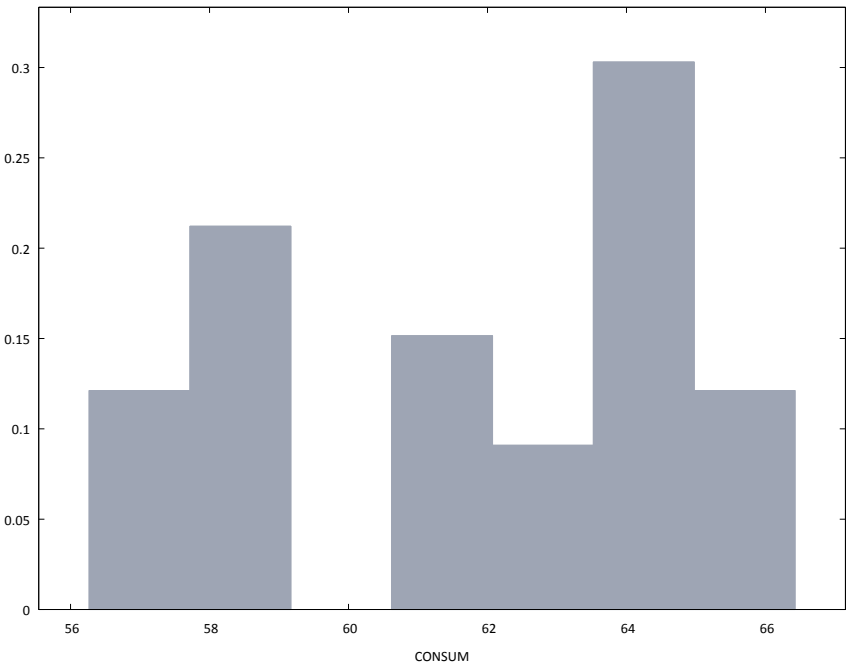
INT frequency plot



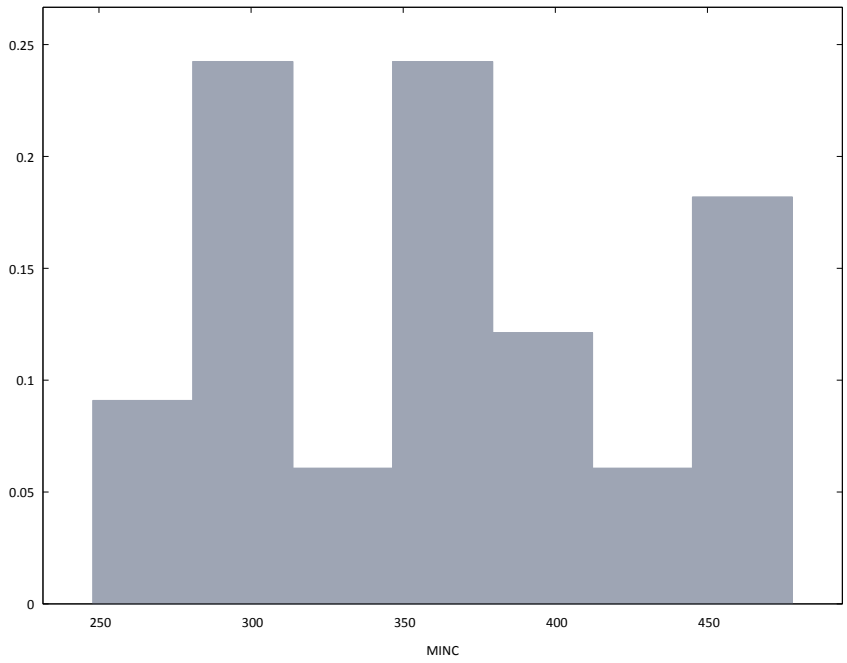
HOUSE frequency plot



CONSUM frequency plot



MINC frequency plot



Appendix B:

The OLS model results without variable transformations.

gretl: model 8

File Edit Tests Save Graphs Analysis LaTeX

```
Model 8: OLS, using observations 1975-2007 (T = 33)
Dependent variable: CONSUM

             coefficient     std. error     t-ratio     p-value
  ---------------------------------------------------------------
  const       45.2206         1.21052       37.36      1.96e-025 ***
  MINC         0.0430490      0.00956476     4.501     0.0001    ***
  GINI        16.9926         9.32511        1.822     0.0791    *
  INT         -0.138596       0.0376799     -3.678     0.0010    ***
  HOUSE       -3.29304e-05    7.83154e-06   -4.205     0.0002    ***

Mean dependent var    61.78359   S.D. dependent var    2.939977
Sum squared resid     8.563783   S.E. of regression    0.553037
R-squared             0.969038   Adjusted R-squared    0.964615
F(4, 28)              219.0842   P-value(F)            1.08e-20
Log-likelihood       -24.56704   Akaike criterion      59.13408
Schwarz criterion     66.61662   Hannan-Quinn          61.65173
rho                  -0.025296   Durbin-Watson         1.726258
```

Appendix C:

Summary statistics of the variables used for the model, with transformations.

gretl: summary statistics

	Mean	Median	Minimum	Maximum
CONSUM	61.784	62.615	56.993	65.700
MINC	361.64	365.96	264.44	461.50
l_GINI	-1.1789	-1.0991	-1.4292	-1.0247
l_INT	2.0809	1.9810	1.3218	2.8332
l_HOUSE	11.373	11.260	10.903	12.099

	Std. Dev.	C.V.	Skewness	Ex. kurtosis
CONSUM	2.9400	0.047585	-0.30948	-1.3824
MINC	64.334	0.17790	0.12397	-1.2598
l_GINI	0.14100	0.11961	-0.65785	-1.2198
l_INT	0.44751	0.21506	-0.0058491	-1.2604
l_HOUSE	0.35091	0.030854	1.0291	-0.079800

	5% perc.	95% perc.	IQ range	Missing obs.
CONSUM	57.020	65.652	5.4833	0
MINC	268.27	461.35	120.62	0
l_GINI	-1.4292	-1.0365	0.25796	0
l_INT	1.3669	2.7456	0.77929	0
l_HOUSE	10.957	12.093	0.34279	0

Appendix D:

The original model including all variables.

gretl: model 1

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Model 1: OLS, using observations 1975-2007 (T = 33)
Dependent variable: CONSUM

	coefficient	std. error	t-ratio	p-value	
const	158.095	46.1580	3.425	0.0023	***
l_GINI	10.5718	6.00051	1.762	0.0914	*
l_INT	-1.55014	0.622992	-2.488	0.0205	**
l_HOUSE	-5.46193	1.94191	-2.813	0.0099	***
POP	-8.33641e-07	5.57990e-07	-1.494	0.1488	
SAVING	-0.00409423	0.0634483	-0.06453	0.9491	
HOURS	0.259465	0.563014	0.4609	0.6492	
UNEM	0.264646	0.224264	1.180	0.2500	
MINC	0.0465395	0.0242273	1.921	0.0672	*
CREDIT	0.000317323	0.000200084	1.586	0.1264	

Mean dependent var	61.78359	S.D. dependent var	2.939977
Sum squared resid	7.582061	S.E. of regression	0.574156
R-squared	0.972587	Adjusted R-squared	0.961861
F(9, 23)	90.67019	P-value(F)	8.17e-16
Log-likelihood	-22.55805	Akaike criterion	65.11610
Schwarz criterion	80.08118	Hannan-Quinn	70.15139
rho	-0.117123	Durbin-Watson	2.002464

Excluding the constant, p-value was highest for variable 4 (SAVING)

Appendix E:

The model including the variable CREDIT, representing total outstanding credit to households and non-profit institutions serving households.

gretl: model 2

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```
Model 2: OLS, using observations 1975-2007 (T = 33)
Dependent variable: CONSUM

              coefficient     std. error     t-ratio     p-value
  ---------------------------------------------------------------
  const       106.749         11.0994          9.618    3.26e-010 ***
  l_GINI       11.5044         5.46507         2.105     0.0447    **
  l_INT        -1.43459        0.422799       -3.393     0.0021    ***
  l_HOUSE      -3.31324        1.09758        -3.019     0.0055    ***
  MINC          0.0241253      0.0197848       1.219     0.2332
  CREDIT        6.85903e-05    9.12828e-05     0.7514    0.4589

Mean dependent var    61.78359   S.D. dependent var    2.939977
Sum squared resid     9.216790   S.E. of regression    0.584262
R-squared             0.966677   Adjusted R-squared    0.960506
F(5, 27)              156.6511   P-value(F)            4.63e-19
Log-likelihood       -25.77954   Akaike criterion      63.55908
Schwarz criterion     72.53812   Hannan-Quinn          66.58025
rho                   0.036046   Durbin-Watson         1.603860

Excluding the constant, p-value was highest for variable 9 (CREDIT)
```

Appendix F:

A correlation matrix of variables including CREDIT.

gretl: correlation matrix

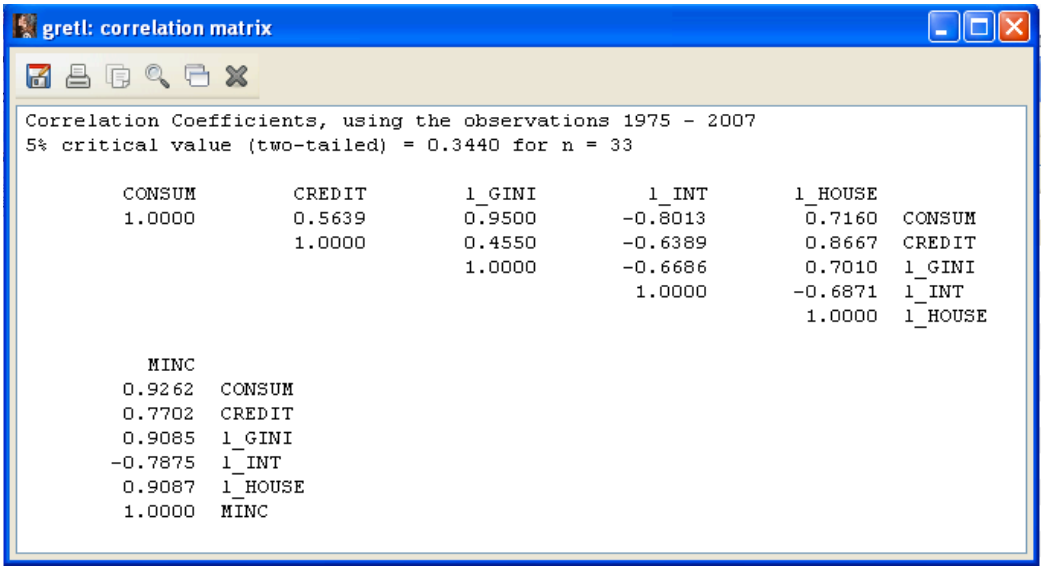
```
Correlation Coefficients, using the observations 1975 - 2007
5% critical value (two-tailed) = 0.3440 for n = 33

        CONSUM          MINC        CREDIT        l_GINI         l_INT
        1.0000        0.9262        0.5639        0.9500       -0.8013  CONSUM
                      1.0000        0.7702        0.9085       -0.7875  MINC
                                    1.0000        0.4550       -0.6389  CREDIT
                                                  1.0000       -0.6686  l_GINI
                                                                1.0000  l_INT

       l_HOUSE
        0.7160  CONSUM
        0.9087  MINC
        0.8667  CREDIT
        0.7010  l_GINI
       -0.6871  l_INT
        1.0000  l_HOUSE
```

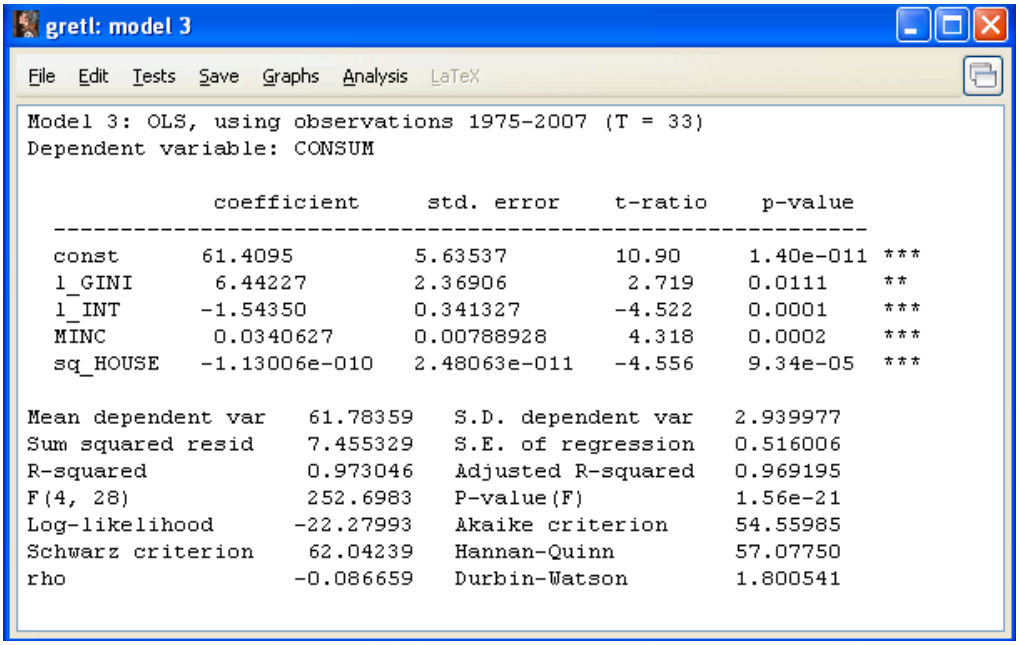
Appendix G:

A correlation matrix of the variables used in the final model.



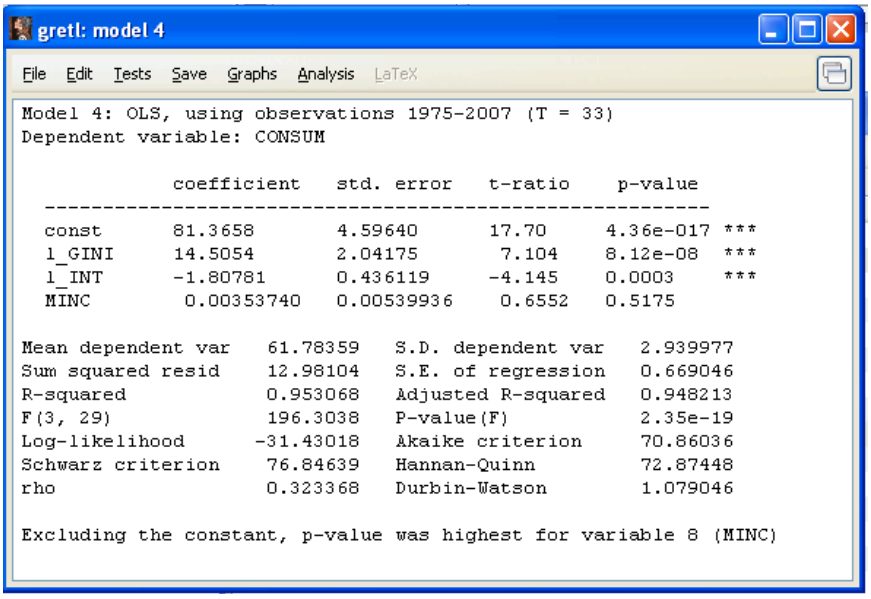
Appendix H:

OLS model results including sq_HOUSE, showing l_GINI with a reduce p-value.



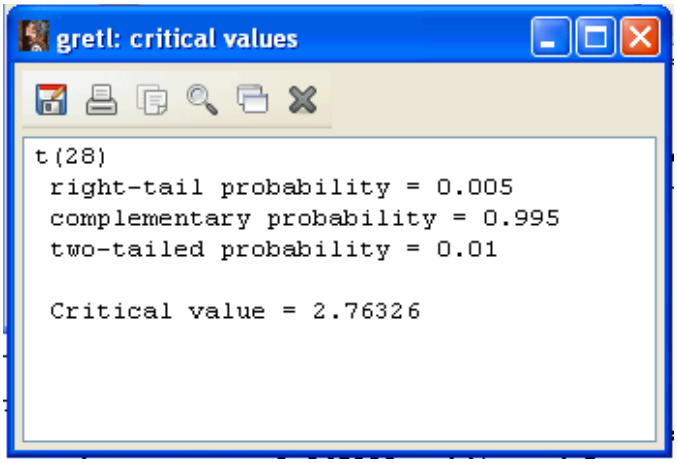
Appendix I:

OLS model results without l_HOUSE showing MINC having no statistical significance.



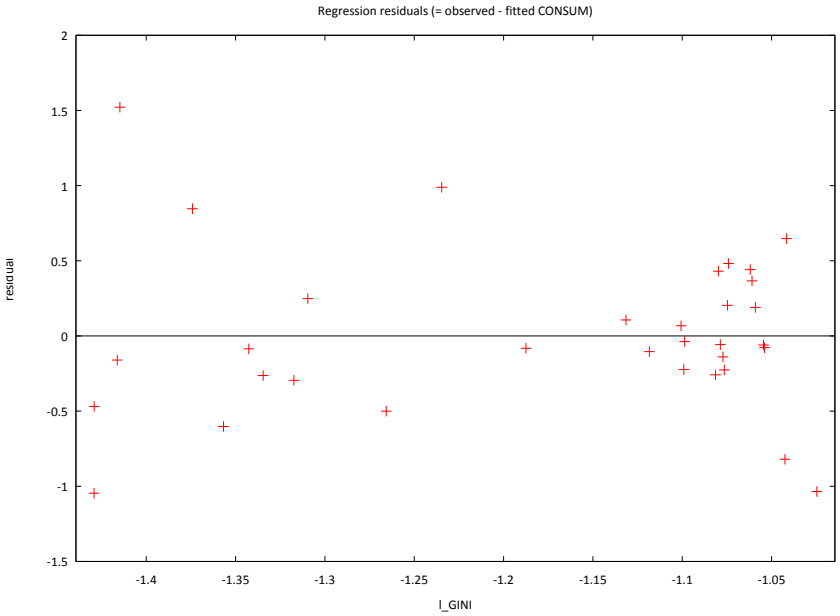
Appendix J:

Using a t-distribution, Gretl produces a critical value of 2.76326 at the 1% significance level.

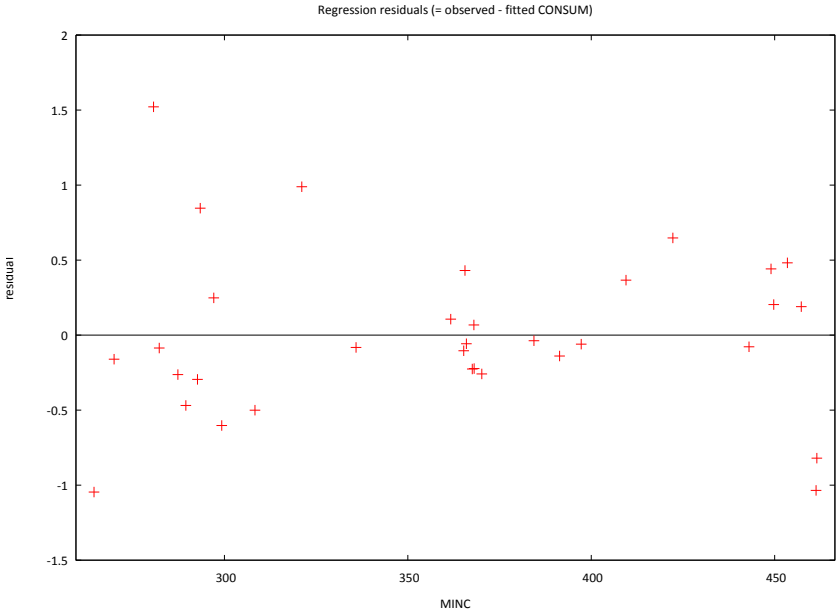


Appendix K:

Risidual plot of l_GINI showing a random pattern with no line of best fit:



Risidual plot of MINC showing a random pattern with no line of best fit:



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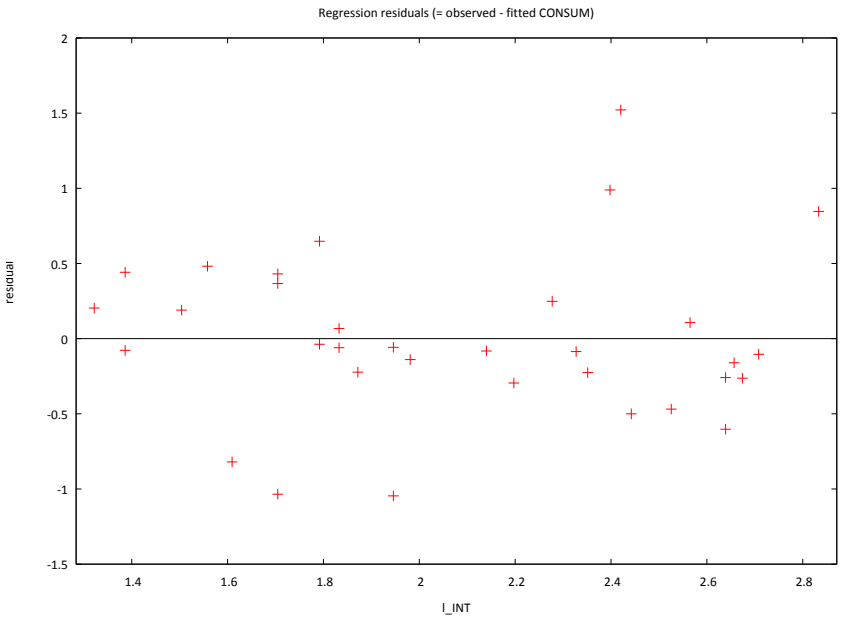
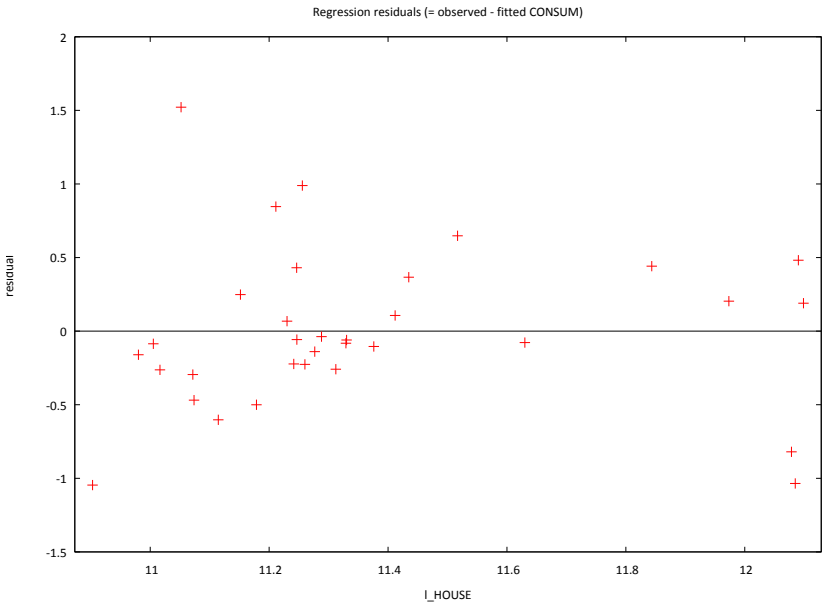
Risidual plot of l_INT showing a random pattern with no line of best fit:



Risidual plot of l_HOUSE showing a random pattern with no line of best fit:



Appendix L:

White's test for heteroskedasticity: