IENAC22 / Econometrics 1 / Applied Problem Set 1

Topic: Introduction to Multivariate Regression

- This class is an introduction to the **menu-driven features** of EViews 6. The data is available on the website as cigarette.txt.
- The problem set covers (i) file import and workfile save, (ii) statistical analysis, (iii) creation of groups, (iv) ordinary least squares, (v) (robust) inference, and (vi) diagnostic testing.
- We use data on (i) the log of cigarette consumption (in packs) per person of smoking age (> 16 years) for 46 U.S. states in 1992: LNC (ln(C)), (ii) the log real price of cigarettes in each state, normalized at 1983\$ per pack: LNP (ln(P)), and (iii) the log of real disposable income per capita in each state, in 1983\$1000: LNY (ln(Y)).
- Perform all of the steps described in Figures 1–85 (answering any corresponding questions, and carefully considering the methods and output, noting any new or confusing tools), and end by responding in full to the following questions:
 - 1. Regress log consumption on log prices (eq01):



What is the estimated price elasticity of consumption? Answer:



and so a [___] increase/decrease in price results in a [___] increase/decrease in consumption.

2. Regress log consumption on log prices and log income (eq02):

$$\widehat{\ln(C_i)} \approx \boxed{[]} + \boxed{[]} \ln(P_i) + \boxed{[]} \ln(Y_i).$$

3. Regress log income on log prices (eq03):





5. Regress
$$\widehat{u}_i^{(1)}$$
 on $\widehat{u}_i^{(3)}$ (eq05):



 Regress log consumption on log income, log income squared, and log prices (eq06):



crease/decrease in consumption. The income elasticity of consumption is now:



which is greater than (equal to) less than 1 as $\ln(Y_i)$ is less than (equal to) greater than $\boxed{[]}$ (as Y_i is less than (equal to) greater than []): use the full available accuracy on the estimated coefficients when performing this computation. Interpret your findings carefully.

- 7. Compare equations eq02, eq04 and eq05. In eq02, [] quantifies the impact of log income on log consumption. In eq04, û_i⁽³⁾ is the part of log income not explained by log price, and so [] quantifies the impact on log consumption of that part of log income not explained by log price. In eq05, û_i⁽¹⁾ is the part of log consumption not explained by log price, and so [] quantifies the impact on that part of log consumption not explained by log price, and so explained by log price. Carefully explain the intuition behind these results.
- Special attention should be paid to observations 3 (Arkansas), 15 (Kentucky) and 40 (Utah): Arkansas and Kentucky have particularly high sales, Kentucky is a producer with rather low prices, and Utah has especially low sales because of its high Mormon population (which bans smoking). It is important to build a deep understanding of the structure and peculiarities of your data before you start modelling.

Importing Data into a Workfile

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3	5.107	09	0.2	3406	4.59	9435				
4	4.504	49	0.3	86399	4.88	3147				
5	4.669	983	0.3	32149	5.09	9472				
6	5.047	05	0.2	21929	4.8	7087				
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9	4.979	974	0.1	.0735 L2826	4.73	3299				
10	4.749	02	0.1	17541	4.64	1307				
11	4.814	45	0.2	24806	4.90	0387				
12	5.111	.29	0.0	08992	4.72	2916				
13	4.808	357	0.2	24081	4.74	1211				
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18	4.777	'51	0.1	L2575	4.94	1692				
19	4.738	77	0.2	2613	4.99	9998				
20	4.947	44	0.2	23067	4.80	1620				
22	4.939	909	0.3	13638	4.52	2938				
23	5.064	30	0.0	08731	4.78	3189				
24	4.733	13	0.1	15303	4.70	0417				
25	4.775	58	0.1	18907	4.79	9671				
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Figure 1: Check that the dataset cigarette.txt can be opened by double-clicking on the website link (various data formats can be used, including .txt and .xls). Open a new workfile in EViews 6: it is possible to work on multiple workfiles simultaneously.

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Workfile Create Workfile structure type Unstructured / Undated V Irregular Dated and Panel workfiles may be made from Unstructured workfiles by later specifying date and/or other identifier series.	Data range Observations: 46 Names (optional) WF: Page:

Figure 2: Choose the workfile structure: unstructured/undated (this can often be convenient even for time-series). Choose the number of observations: using this method, it is necessary to know the sample size before importing the data. Alternatively, data can be imported by File - Open - Foreign Data as Workfile ..., and navigating to the datafile.

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Figure 3: An unnamed workfile is opened, indicating the sample size, and EViews 'objects' that will later contain estimated parameter values (c) and estimated residuals (resid). Import the data into EViews, choosing the appropriate format.

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Figure 4: Navigate to the datafile, and open. EViews will preview the datafile, and enables various choices to be made concerning the import, including delimiter type, header, etc.

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Figure 5: Choose names for the series (stored in columns), and select 'Treat multiple delimiters as one' and both 'Tab' and 'Space'. Verify the other settings. EViews will import the data, creating objects for each of the variables (lnc, lnp, lny, obs).



Figure 6: Click on lnc, to view the data on log consumption. Click on resid, to view the estimated residuals \hat{u} : these have not yet been defined, since no model has been estimated.



Figure 7: Select the estimated coefficient object c, which has not yet been defined since the model, and $\hat{\beta}$, have not been estimated. Choose the 'Histogram and Stats' option from the Quick - Series Statistics menu.

Univariate Descriptive Statistics



Figure 8: Enter the series name: lnc. The histogram of the data also gives some basic descriptive statistics, up to the standardized fourth central moment (kurtosis), and the Jarque-Bera test for normality of the data: this performs the joint test that the skewness = 0 and the kurtosis = 3.



Figure 9: Choose 'Stats Table', and view the same descriptive statistics in spreadsheet format, with the addition of the sum $\sum_i \ln c_i$ and the sum of squared deviations $\sum_i (\ln c_i - (n^{-1} \sum_i \ln c_i))^2$, where n is the sample size.

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Figure 10: Choose 'Stats by Classification', which enables choice of descriptive statistics, binning of data, and other output options.

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Figure 11: Select the mean, standard deviation, skewness, kurtosis, and the number of observations, choose the series lnc, and set the maximum number of bins to 4. The data is grouped (binned) if (a) lnc has more than 100 distinct values (not relevant here, since n = 46), or (b) if each distinct value of lnc occurs less than twice. The maximum number of bins only provides approximate control over the actual number that will be selected by EViews. The displayed output results. Why are some statistics not computed (NA) for the first bin?

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Figure 12: Select Quick - Graph. Choose the series lnc, and then select Categorical graph - Boxplot with lnc for 'Within graph'. Before plotting the graph, choose 'Factor and Graph Layout Options'.

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Figure 13: Select 4 quantile bins, and check the 'Include category totals' box. Plot the boxplots for each of the four quartiles of lnc, and for the full sample. Can you identify the mean, median, first quartile Q1, third quartile Q3, staples (the last datapoints that do not fall below Q1-1.5IQR, or exceed Q3+1.5IQR, where IQR is the interquartile range Q3-Q1) and far outliers (observations which fall below Q1-3IQR, or exceed Q3+3IQR)? The shaded areas correspond to median±1.57IQR/ \sqrt{n} , and give an approximate confidence interval for equality of median across bins (if the shaded areas do not overlap, then the medians are (roughly) not equal).

A Hypothesis Test on a Variable Mean



Figure 14: Select 'Simple Hypothesis Tests' and choose $\bar{x}_0 = 4.8$, to test $H_0: \bar{x} = \bar{x}_0 = 4.8$ using a t statistic $t = \sqrt{n}(\bar{x} - \bar{x}_0)/\hat{\sigma} \sim t(n-1)$ under the null hypothesis, if x (lnc) is normally distributed.

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<u>Method</u> t-statistic		<u>Value</u> 1.694845	Probability 0.0970
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View Proc Obje Hypothesis Te Date: 04/06/09 Sample: 1 46 Included obse Test of Hypoth	Workfile: UNTITLED::U Series Distribution Tests Test value Mean: 6 Variance:	Mean test as Mean test wil known standa deviation if su	sumption use a ard upplied.
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Figure 15: Result of hypothesis test $H_0: \bar{x} = \bar{x}_0 = 4.8$ against the two-sided alternative. Use statistical tables to perform this test manually at the 95% level of significance: what is the decision rule and what is the outcome of the test? Note that the null is rejected at the 90% level of significance (this can be seen easily, since the 'Probability' is less than 0.10). Now set $\bar{x}_0 = 6$, to test $H_0: \bar{x} = \bar{x}_0 = 6$.

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Figure 16: Result of hypothesis test $H_0: \bar{x} = \bar{x}_0 = 6$ against the two-sided alternative. **Perform this test manually at the 95% level, using statistical tables.** Note that the null is rejected at the 99% level of significance (since the 'Probability' is less than 0.01). For lnc, select a Basic graph - Line & Symbol.

Plot Formatting



Figure 17: Plot of lnc against observation number (data not ordered). Select the graph (right click), and choose 'Options'.

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Figure 18: From the option screen, choose line width, and set to 2.0pt.



Figure 19: From the option screen, change the line colour. Display the final plot.



Figure 20: Select the graph, and choose 'Save graph to disk'. Choose a path and filename, and set the filetype to .emf. Save the graph.



Figure 21: Find the graph file and double-click on it. The graph can also be copied and pasted in the usual way: copy it into a Word document, or similar.

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Type Frame Axis/Scale Legend Line/S Characteristics Image: Characteristics	Symbol Fill Area BoxPlot Object Template Edit legend entries Natural logarithm of cigarette consumption Select entry to edit: 1 1 Natural logarithm of cigarette consumption Select entry to edit: 1

Figure 22: Select Options and Legend. Check 'Display legend' and change the legend to 'Natural logarithm of cigarette consumption'.



Figure 23: Remove the frame around the graph. Display the plot.

Univariate Descriptive Statistics (Continued)

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Added Elements Empirical CDF Add Remove	Options Quantile Method: Rankit (Cleveland) V Display confidence interval: Legend labels: Default V
	ЭК Cancel

Figure 24: Select an Empirical CDF distribution plot, and uncheck the 'Display confidence interval' box.



Figure 25: Display the plot. The empirical cumulative distribution plot displays a datacalculated $\operatorname{Prob}(X \leq x)$ for all x. Select a Quantile - Quantile plot.



Figure 26: Select 'Normal' distribution and 'Display fit line', to give the quantile-quantile plot of the data against the normal distribution: this plots each quantile of the observed data q_{α} against the corresponding quantile from the normal distribution (standardized to have the same mean and variance as the observed data).

Graph Options	
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Graph Options Type Erame Axis/Scale Legend Li Distribution Plot Customize Added Elements Kernel Density Add Remove OK	Specification Kernel: Epanechnikov Bandwidth: Uniform Triangular Biweight Triweight Normel Options Vumber of grid points: 100 Evaluation method: Olinear Binning Cancel Cancel

Figure 27: Choose a 'Kernel Density' distribution plot, with 'Normal' kernel.



Figure 28: Select 'Exact' instead of 'Linear Binning', to give the Gaussian kernel density plot of the data: $\hat{f}(x) = (nh)^{-1} \sum_{i} K((x - X_i)h^{-1})$, where *n* is the sample size, *h* is the kernel bandwidth (chosen automatically by EViews), and K() is the kernel (here, the N(0,1) pdf). Compare this to the histogram of the data that was plotted earlier.


Figure 29: Select 'Correlogram' and 'Level', with 20 lags.



Figure 30: Autocorrelation function (ACF) and partial autocorrelation function (PACF) of lnc, for the first 20 lags (s), with associated Ljung-Box Q statistic, and probability that the autocorrelations up to and including lag s are jointly equal to zero: this suggests that the series is approximately white noise (note that this test is not really useful, for the cross-sectional data that we are considering here; we will return to this when working with time series data). Select a Quick - Graph.

Multivariate Descriptive Statistics and Groups



Figure 31: Plot both lnc and lny against the observation number. Select a 'Scatter' graph.



Figure 32: Choose series lnc and lny, to give a scatter plot of log income against log consumption (note how the order of series selection corresponds to the axes). Using 'Options', change the symbol plot type.

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Figure 33: In the workfile, select the series lnc and lny.



Figure 34: Select 'Open as Group' to create a group containing series lnc and lny.



Figure 35: Name this group 'group01', and check that this appears in the workfile.

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Figure 36: Select 'Common sample' group descriptive statistics and choose group01.

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Maximum	5.379060	5.102680		
Minimum Std. Dov	4.408590	4.529380		
Skewness	0.191458	0.142201		
Kurtosis	3.005111	2,739343		
Jarque-Bera	0.282950	1.970944		
Probability	0.868077	0.373263		
Sum	223.0008	219.6709		
Sum Sq. Dev.	1.649529	0.910721		
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Figure 38: Plot of group01 series against observation. Select a 'Mixed with Lines' graph.



Figure 39: Mixed bar/line plot of lny and lnc. Select 'Scatter with Regression Line'.



Figure 40: Scatter plot of lny against lnc, with ordinary least squares (OLS) fit from a regression of lny on a constant and lnc. Plot the same figure with boxplots of lny and lnc on the axes!

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Figure 41: Select 'Scatter with Kernel Fit'.



Figure 42: Choose 'Nadaraya-Watson' regression, with 'Epanechnikov' kernel, 'Exact' rather than 'Linear Binning', and bandwidth chosen by 'Eviews', to give the Nadaraya-Watson kernel regression fit, superimposed on the scatter plot of lny against lnc. The Nadaraya-Watson kernel estimator of Y_i on X_i is given by $\widehat{R}(x) = \arg\min_{\psi} \sum_i (Y_i - \psi)^2 K((x - X_i)/h)$, where ψ is a locally fit constant, and $K(u) = (3/4)(1 - u^2)$ on [-1, 1] is the Epanechnikov kernel.



Figure 43: Choose 'Line & Symbol' and 'Multiple graphs' to give separate plots of lnc and lny against observation number.

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Covaria	ince Analysis		4.870870				
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Cross C	orrelation (2	.)	4.729160				
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Grange	r Causality	•	4.649370				
Label			4.614610				
			4.755010				
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Figure 44: Choose 'Tests of Equality' on group01, and 'Mean', to test $H_0: \bar{x}_{\text{lnc}} = \bar{x}_{\text{lny}}$.

Group: GROUP01 Wo	orkfile: UNTITL	.ED::Untitled	۱	×
View Proc Object Print Nam	e Freeze) Sample	Sheet Stats	Spec	
Test for Equality of Means E Date: 04/06/09 Time: 17:5 Sample: 1 46 Included observations: 46	9etween Series 8			
Method	df	Value	Probability	
t-test Satterthwaite-Welch t-test* Anova F-test Welch F-test*	90 83.08162 (1, 90) (1, 83.0816)	2.058329 2.058329 4.236718 4.236718	0.0424 0.0427 0.0424 0.0427	
*Test allows for unequal ce	II variances			~
Group: GROUP01 Wo	orkfile: UNTITL	ED::Untitled		×
Group: GROUP01 Wo View Proc Object Print Name Group Members Spreadsheet Dated Data Table Graph	e <mark>(Freeze) (Sample</mark> etween Series	ED::Untitled	jpec)	
Group: GROUP01 Wo View Proc Object Print Name Group Members Spreadsheet Dated Data Table Graph Descriptive Stats	orkfile: UNTITL) Freeze) Sample etween Series	ED::Untitled	ipec Probability	
Group: GROUP01 Wo Group Members Spreadsheet Dated Data Table Graph Descriptive Stats N-Way Tabulation Tests of Equality Principal Components Correlogram (1) Cross Correlation (2) Unit Root Test Granger Causality	rkfile: UNTITL a Freeze) Sample etween Series df 90 83.08162 (1, 90) (1, 83.0816) I variances	ED::Untitled Sheet Stats (Value 2.058329 2.058329 4.236718 4.236718	pec Probability 0.0424 0.0427 0.0424 0.0427	

Figure 45: Results of the test $H_0: \bar{x}_{\text{lnc}} = \bar{x}_{\text{lny}}$: without entering into the details of the tests, note that we reject the null at the 95% level of significance, against the two-sided alternative, using the *t* test, since 'Probability' is below 0.05. Select 'Covariance Analysis'.

Covariance Ana	lveie			
Statistics Method: Or Covariance Correlation SSCP t-statistic Probability Layout: Sp Sample 1 46 Balanced sa	dinary dinary Number of Number of Sum of we t = 0 readsheet mple (listwise deletio	Cases ights Optic Weig Weig Weig Image: Save N K Cathering	al analysis s or groups for conditions hting: None ht series:	oning: (optional)
Group: GR	COUPO1 Worl	kfile: UNTITL	ED::Untitled	
		Correlation		
	LNC	LNY		
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LNY	-0.168673	1.000000		
				=
				~
	/			N

Figure 46: Select 'Correlation' and 'Spreadsheet', to give the sample correlation matrix.

Covariance Analysis				X
Statistics Method: Ordinary Covariance M Correlation M SSCP S t-statistic Probability t = 0 Layout: Spreadsheet Sample List Spreadsheet Spreadsheet 1 46 Ø Balanced sample (listwi	Jumber of cases Jumber of obs. Soum of weights	Partial analysis Series or groups Options Weighting: Weight series: d.f. correct Multiple compari adjustments: Saved results basename:	None	ng: (optional)
	ОК	Cancel		
Covariance Analysis: Date: 04/06/09 Time: Sample: 1 46 Included observations	ок Workfile: UN Name Freeze S Ordinary 18:00	Cancel	t <mark>itle d\</mark> Stats (Spec)	



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obs	LNC	LNP	LNY		
1	4.962130	0.204870	4.640390		~
2	4.663120	0.166400	4.683890		
3	5.107090	0.234060	4.594350		
4	4.504490	0.363990	4.881470		
5	4.669830	0.321490	5.094720		
6	5.047050	0.219290	4.870870		
7	4.656370	0.289460	5.059600		
8	4.800810	0.287330	4.811550		
9	4.979740	0.128260	4.732990		
10	4.749020	0.175410	4.643070		
11	4.814450	0.248060	4.903870		
12	5.111290	0.089920	4.729160		
13	4.808570	0.240810	4.742110		
14	4.792630	0.216420	4.796130		
15	5.379060	-0.032600	4.649370		_
16	4.986020	0.238560	4.614610		
17	4.987220	0.291060	4.755010		_
18	4.777510	0.125750	4.946920		
19	4.738770	0.226130	4.999980		<u>×</u>
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View Proc obs 1 2 3 4 5 6	p: UNTITLED Object Print M 4.962130 4.663120 5.107090 4.504490 4.669830 5.047050	Workfile: UNT lame Freeze Del LNP 0.204870 0.166400 0.234060 0.363990 0.321490 0.219290	ITL ED::Untitl ault So 4.640390 4.683890 4.594350 4.881470 5.094720 4.870870	e d\ rt) (Transpose)	Edit+/- Smpl+/- Titl
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Figure 48: Open lnc, lnp and lny as 'group02'.



Figure 49: Plot a matrix scatterplot of lnc, lnp and lny, and name the graph graph01.



Figure 50: Check that graph01 appears in the workfile. Click the AddText button.



Figure 51: Label the graph as shown, with text font size 20.

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G group01	Open	1
	Сору	
Miny Nako	Paste Paste Special	
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	Store to DB Object conv	
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	Delete	
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A First Regression

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Figure 54: (eq01) Enter 'lnc c lnp' for a regression of log consumption on a constant and log price. Observe that the regression output gives estimated coefficients (by ordinary least squares), standard errors, probabilities for individual tests of significance, and various statistics, including coefficients of determination, the sum of squared residuals, the Durbin-Watson statistic for autocorrelation, the Akaike and Schwarz Information Criteria, and the F statistic for significance of the entire regression (we will return to these statistics later in the course).

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Figure 56: Check that the estimated residuals have been recorded in the workfile object resid: note that the estimated residuals are overwritten each time that a new regression is performed. Name the equation 'eq01'.

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Figure 57: Select 'eq01' and 'Representations'.



Figure 58: Alternative representations of estimated equation eq01. Select 'Actual, Fitted, Residual Graph', and 'Residual Graph', and check the output.



Figure 59: Several representations of the fitted residuals \hat{u} .



Figure 60: Select 'Covariance Matrix' and check the output. This gives $\hat{\sigma}^2(X'X)^{-1}$.



Figure 61: Select 'Confidence Ellipse...', and check the output (this will be discussed in class when we cover joint hypothesis tests).

A Hypothesis Test on the Estimated Coefficients


Figure 62: Select 'Wald - Coefficient Restrictions'.

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Figure 63: Enter 'c(2)=-1' to perform a Wald test of $H_0: \beta_1 = -1$. Observe that both exact (F) and asymptotic (χ^2) statistics are reported: the result of the test is that we do not reject the null at the 90% level (say). Why is an F test reported, not a t test?

Asking for Help!

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Figure 64: Select 'Help'.



Figure 65: Choose help on 'Wald test (Coefficient Restrictions)'. (Read it later!)

Diagnostic Tests on the Residuals



Figure 66: Descriptive statistics, and Jarque-Bera test on estimated residuals from eq01, suggesting that the null of normality of residuals cannot be rejected at usual levels of significance. Select 'Heteroskedasticity Tests'.

Equation: E001	Workfile: UN	ITITLED::Untit	le d\		×
View Heteroskedasti	city Tests				
Specification Test type Breusch-Pag Harvey Glejser ARCH White Custom Test	an-Godfrey Wizard	Dependent varial The White Test rr residuals on the t the original regre Include White	ole: RESID^2 agresses the s he cross prod ssors and a co a cross terms	quared uct of instant.	
	ОК	Cancel)		
					-
Equation: EQ01 View Proc Object Print	Workfile: UN Name Freeze	TITLED::Untit [Estimate][Foreca	le d \ ist][Stats][Res	ids)	
Equation: EQ01 View Proc Object Print Heteroskedasticity Te	Workfile: UN Name Freeze st: White	TITLED::Untit [Estimate][Foreca	le d\ ist Stats Res	ids)	
Equation: EQ01 View Proc Object Print Heteroskedasticity Ter F-statistic Obs*R-squared Scaled explained SS	Workfile: UN Name Freeze st: White 0.411710 0.864317 0.855790	TITLED::Untit Estimate) Foreca Prob. F(2,43) Prob. Chi-Squ Prob. Chi-Squ	le d\ st]Stats]Res are(2) are(2)	0.6651 0.6491 0.6519	
Equation: EQ01 View Proc Object Print Heteroskedasticity Te F-statistic Obs*R-squared Scaled explained SS Test Equation: Dependent Variable: F Method: Least Square Date: 04/06/09 Time: Sample: 1 46 Included observations	Workfile: UN Name Freeze st: White 0.411710 0.864317 0.855790 RESID^2 s 19:08 : 46	TITLED::Untit Estimate Foreca Prob. F(2,43) Prob. Chi-Squ Prob. Chi-Squ	led\ ist_Stats_Res are(2) are(2)	0.6651 0.6491 0.6519	
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Equation: EQ01 View Proc Object Print Heteroskedasticity Te F-statistic Obs*R-squared Scaled explained SS Test Equation: Dependent Variable: F Method: Least Square Date: 04/06/09 Time: Sample: 1 46 Included observations C LNP LNP ²	Workfile: UN Name Freeze st: White 0.411710 0.864317 0.855790 RESID^2 s 19:08 : 46 Coefficient 0.023937 0.088082 -0.335795	TITLED::Untit Estimate Foreca Prob. F(2,43) Prob. Chi-Squ Prob. Chi-Squ Std. Error 0.023957 0.240537 0.578343	led\ st_Stats_Res are(2) are(2) t-Statistic 0.999169 0.366190 -0.580615	0.6651 0.6491 0.6519 0.6519 Prob. 0.3233 0.7160 0.5645	

Figure 67: Choose White's nR^2 test for heteroscedasticity, including cross product terms. (This checks one of the classical assumptions: $Var(u) = \sigma^2 I_n$). The results suggest that the null of homoscedasticity should not be rejected at usual levels of significance.

Equation: EQ01	Workfile: UN	TITLED::Untitled\	
View Proc Object Print	Name Freeze	Estimate Forecast Stats Res	ids
Representations	e		
Estimation Output	. –		
Actual,Fitted,Residual	• 11710	Prob. F(2,43)	0.6651
ARMA Structure	64317	Prob. Chi-Square(2) Prob. Chi-Square(2)	0.6491
Gradients and Derivativ	les • 53730	FIOD: CIII-Square(2)	0.0319
Coefficient Tests			
Residual Tests	▶ F	Prophosipt Test	-
Stability rests	Quan	dt-Andrews Breakpoint Test	
Label	Chow	/ Forecast Test	
Included observations:	46 Rams	ey RESET Test	
	Cot Recu	rsive Estimates (OLS only)	Prob.
	0.023937	0.023957 0.999169	0.3233
LNP^2	-0.335795	0.578343 -0.580615	0.5645
R-squared	0.018789	Mean dependent var	0.025414
S E of regression	-0.026848	S.D. dependent var Akaike info criterion	0.037802
Sum squared resid	0.063096	Schwarz criterion	-3.504164
Log likelihood	86.33873	Hannan-Quinn criter.	-3.578748
F-statistic	0.411710	Durbin-Watson stat	1.902611
Prob(F-statistic)	0.665100		
1			
Equation: E001	Workfile: UN	TITLED:://ntitled\	
Equation: EQ01	Workfile: UN	TITLED::Untitled\	
Equation: EQ01	Workfile: UN Name Freeze	TITLED::Untitled\ [Estimate]Forecast]Stats]Res	ids
Equation: EQ01 View Proc Object Print Ramsey RESET Test:	Workfile: UN Name Freeze	TITLED::Untitled\ [Estimate][Forecast][Stats][Res	ids
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Equation: EQ01 View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio	Workfile: UN Name Freeze 2.363848 2.461708	TTTLED::Untitled\ Estimate Forecast Stats Res Prob. F(1,43) Prob. Chi-Square(1)	0.1315 0.1167
Equation: EQ01 View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio	Workfile: UN Name Freeze 2.363848 2.461708	TTTLED::Untitled\ Estimate Forecast Stats Res Prob. F(1,43) Prob. Chi-Square(1)	0.1315 0.1167
Equation: EQ01 View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio Test Equation:	Workfile: UN Name Freeze 2.363848 2.461708	TITLED::Untitled\ Estimate Forecast Stats Res Prob. F(1,43) Prob. Chi-Square(1)	0.1315 0.1167
Equation: EQ01 View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio Test Equation: Dependent Variable: LI	Workfile: UN Name Freeze 2.363848 2.461708	TTTLED::Untitled\ Estimate Forecast Stats Res Prob. F(1,43) Prob. Chi-Square(1)	0.1315 0.1167
Equation: EQ01 View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio Test Equation: Dependent Variable: LI Method: Least Squares	Workfile: UN Name Freeze 2.363848 2.461708	TTTLED::Untitled\ Estimate Forecast Stats Res Prob. F(1,43) Prob. Chi-Square(1)	0.1315 0.1167
Equation: EQ01 V View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio Test Equation: Dependent Variable: LI Method: Least Squares Date: 04/06/09 Time: Parameter 4/06	Workfile: UN Name Freeze 2.363848 2.461708 NC 3 19:09	TTTLED::Untitled\ Estimate Forecast Stats Res Prob. F(1,43) Prob. Chi-Square(1)	0.1315 0.1167
Equation: EQ01 V View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio Test Equation: Dependent Variable: L1 Method: Least Squares Date: 04/06/09 Time: Sample: 1 46 Included observations:	Workfile: UN Name Freeze 2.363848 2.461708 NC 3 19:09 46	TTTLED::Untitled\ Estimate Forecast Stats Res Prob. F(1,43) Prob. Chi-Square(1)	0.1315 0.1167
Equation: EQ01 View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio Test Equation: Dependent Variable: LI Method: Least Squares Date: 04/06/09 Time: Sample: 1 46 Included observations:	Workfile: UN Name Freeze 2.363848 2.461708 NC 3 19:09 46	TTTLED::Untitled\ Estimate Forecast Stats Res Prob. F(1,43) Prob. Chi-Square(1)	0.1315 0.1167
Equation: EQ01 View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio Test Equation: Dependent Variable: L1 Method: Least Squares Date: 04/06/09 Time: Sample: 1 46 Included observations:	Workfile: UN Name Freeze 2.363848 2.461708 NC 3 19:09 46 Coefficient	TTTLED::Untitled\ Estimate Forecast Stats Res Prob. F(1,43) Prob. Chi-Square(1) Std. Error t-Statistic	0.1315 0.1167 Prob.
Equation: EQ01 View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio Test Equation: Dependent Variable: L1 Method: Least Squares Date: 04/06/09 Time: Sample: 1 46 Included observations: C	Workfile: UN Name Freeze 2.363848 2.461708 NC 19:09 46 Coefficient -6212665	TTTLED::Untitled\ Estimate Forecast Stats Res Prob. F(1,43) Prob. Chi-Square(1) Std. Error t-Statistic 43.72075 -14.20985	0.1315 0.1167 Prob.
Equation: EQ01 View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio Test Equation: Dependent Variable: L1 Method: Least Squares Date: 04/06/09 Time: Sample: 1 46 Included observations: C LNP	Workfile: UN Name Freeze 2.363848 2.461708 NC 5 19:09 46 Coefficient -62.12565 28.99398	TITLED::Untitled\ Estimate Forecast Stats Res Prob. F(1,43) Prob. Chi-Square(1) Std. Error t-Statistic 43.72075 -1.420965 19.63947 1.476312	0.1315 0.1167 0.1167 Prob. 0.1625 0.1471
Equation: EQ01 View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio Test Equation: Dependent Variable: LI Method: Least Squares Date: 04/06/09 Time: Sample: 1 46 Included observations: C LNP FITTED^2	Workfile: UN Name Freeze 2.363848 2.461708 NC 3 19:09 46 Coefficient -62.12565 28.99398 2.595053	Std. Error t-Statistic 43.72075 -1.420965 19.63947 1.476312	0.1315 0.1167 Prob. 0.1625 0.1471 0.1315
Equation: EQ01 View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio Test Equation: Dependent Variable: LI Method: Least Squares Date: 04/06/09 Time: Sample: 1 46 Included observations: C LNP FITTED^2 R-squared	Workfile: UN Name Freeze 2.363848 2.461708 NC 319:09 46 Coefficient -62.12565 28.99398 2.595053	TITLED::Untitled\ Estimate Forecast Stats Res Prob. F(1,43) Prob. Chi-Square(1) Std. Error t-Statistic 43.72075 -1.420965 19.63947 1.476312 1.637860 1.537481	Ids 0.1315 0.1167 Prob. 0.1625 0.1471 0.1315
Equation: EQ01 View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio Test Equation: Dependent Variable: LI Method: Least Squares Date: 04/06/09 Time: Sample: 1 46 Included observations: C LNP FITTED^2 R-squared Adjusted R-squared	Workfile: UN Name Freeze 2.363848 2.461708 NC 5 19:09 46 Coefficient -62.12665 28.99398 2.595053 0.328214 0.296968	TTTLED::Untitled\ Estimate Forecast Stats Res Prob. F(1,43) Prob. Chi-Square(1) Std. Error t-Statistic 43.72075 -1.420965 19.63947 1.476312 1.687860 1.537481 Mean dependent var S.D. dependent var	0.1315 0.1167 0.1167 Prob. 0.1625 0.1471 0.1315 4.847844 0.191458
Equation: EQ01 View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio Test Equation: Dependent Variable: LI Method: Least Squares Date: 04/06/09 Time: Sample: 1 46 Included observations: C LNP FITTED^2 R-squared Adjusted R-squared S.E. of regression	Workfile: UN Name Freeze 2.363848 2.461708 NC 5 19:09 46 Coefficient -62.12565 28.99398 2.595053 0.328214 0.328214 0.328214 0.328214	TTTLED::Untitled\ Estimate Forecast Stats Res Prob. F(1,43) Prob. Chi-Square(1) Std. Error t-Statistic 43.72075 -1.420965 19.63947 1.476312 1.687860 1.537481 Mean dependent var S.D. dependent var Akaike info criterion	C.1315 0.1315 0.1167 Prob. 0.1625 0.1471 0.1315 4.847844 0.191458 -0.757655
Equation: EQ01 View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio Test Equation: Dependent Variable: LI Method: Least Squares Date: 04/06/09 Time: Sample: 1 46 Included observations: C LNP FITTED^2 R-squared Adjusted R-squared S.E. of regression Sum squared resid	Workfile: UN Name Freeze 2.363848 2.461708 NC 19:09 46 Coefficient -62.12665 28.99398 2.595053 0.328214 0.296968 0.166532 1.108131	TTTLED::Untitled\ Estimate Forecast Stats Res Prob. F(1,43) Prob. Chi-Square(1) Std. Error t-Statistic 43.72075 -1.420965 19.63947 1.476312 1.687860 1.537481 Mean dependent var S.D. dependent var S.D. dependent var Akaike info criterion Schwarz criterion	C.1315 0.1315 0.1167 Prob. 0.1625 0.1471 0.1315 4.847844 0.191458 -0.757655 -0.6383960
Equation: EQ01 View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio Test Equation: Dependent Variable: L1 Method: Least Squares Date: 04/06/09 Time: Sample: 1 46 Included observations: C LNP FITTED^2 R-squared Adjusted R-squared S.E. of regression Sum squared resid Log likelihood E-statistic	Workfile: UN Name Freeze 2.363848 2.461708 NC 3 19:09 46 Coefficient -62.12565 28.99398 2.595053 0.328214 0.296968 0.160532 1.108131 20.42606 10.61423	TITLED::Untitled\ Estimate Forecast Std. Error t-Statistic 43.72075 -1.420965 19.63947 1.476312 1.687860 1.537481 Mean dependent var S.D. dependent var Mean atter of terion Schwarz criterion Hannan-Quinn criter. Durbine/Wate on stat	C.1315 0.1315 0.1167 0.1167 Prob. 0.1625 0.1471 0.1315 4.847844 0.191458 -0.757655 -0.638396 -0.712980 2.358091
Equation: EQ01 View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio Test Equation: Dependent Variable: L1 Method: Least Squares Date: 04/06/09 Time: Sample: 1 46 Included observations: C LNP FITTED^2 R-squared Adjusted R-squared S.L. of regression Sum squared resid Log likelihood F-statistic Prob(F-statistic)	Workfile: UN Name Freeze 2.363848 2.461708 2.461708 NC 3 19:09 46 Coefficient -62.12565 28.99398 2.595053 0.328214 0.296968 0.160532 1.108131 20.42606 10.50423 0.00193	TITLED::Untitled\ Estimate Forecast Std. Error t-Statistic 43.72075 -1.420965 19.63947 1.476312 1.687860 1.537481 Mean dependent var S.D. dependent var Schwarz criterion Hannan-Quinn criter. Durbin-Watson stat	0.1315 0.1167 0.1167 Prob. 0.1625 0.1471 0.1315 4.847844 0.191458 -0.757655 -0.638396 -0.712980 2.358091
Equation: EQ01 View Proc Object Print Ramsey RESET Test: F-statistic Log likelihood ratio Test Equation: Dependent Variable: LI Method: Least Squares Date: 04/06/09 Time: Sample: 1 46 Included observations: C LNP FITTED^2 R-squared Adjusted R-squared S.E. of regression Sum squared resid Log likelihood F-statistic Prob(F-statistic)	Workfile: UN Name Freeze 2.363848 2.461708 2.363848 2.461708 NC 3 19:09 46 Coefficient -62.12565 28.99398 2.595053 0.328214 0.296968 0.160532 1.108131 20.42606 10.50423 0.000193 0.000193	TITLED::Untitled\ Estimate Forecast Stats Res Prob. F(1,43) Prob. Chi-Square(1) Prob. Chi-Square(1) - - - Std. Error t-Statistic 43.72075 -1.420965 1.9.63947 1.476312 1.687860 1.537481 Mean dependent var S.D. dependent var Schwarz criterion Hannan-Quinn criter. Durbin-Watson stat -	Image: Constraint of the second state of the second sta

Figure 68: Select the 'Ramsey RESET Test' with one fitted term, to include the squared fitted dependent variable in the RESET test, and observe that the RESET test does not reject the null of no omitted nonlinearity/correct functional form, at usual levels of significance. (This provides some support for the classical assumption $y = X\beta + u$).



Figure 69: Choose 'Recursive Estimates (OLS only)...', select 'Recursive Coefficients', and set coefficient display list to 'c(1) c(2)'.



Figure 70: Recursive ordinary least squares estimates for eq01, including an additional datapoint at each step. Select scatter plot of lnp and resid from eq01.



Figure 71: Scatterplot of residuals from eq01 against lnp. Estimate a new equation.

Further Regressions

Equation Es	timation					×
Specification	Options					
Equation	specification Dependent v	ariable followed	by list of regress	ors including Al	RMA	
	and PDL term	ns, OR an explici	t equation like Y=	=c(1)+c(2)*X.		
Inc c Inp) Iny				<u>^</u>	
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Estimatio	on settings -					
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Equation View Proc O Dependent Method: Lea Date: 04/06 Sample: 1 4 Included ob I I R-squared Adjusted R- S.E. of regre Sum square Log likeliho F-statistic Prob(F-stati	n: UNTITL bject Print Variable: LI ast Squares 109 Time: : 16 servations: C NP NY squared ession ed resid od stic)	ED Workfile Name Freeze NC 3 19:43 46 Coefficient 4.299662 -1.338335 0.172386 0.303714 0.271328 0.163433 1.148545 19.60218 9.378101 0.000417	: UNTITLED:: Estimate Forec Std. Error 0.908926 0.324601 0.196754 Mean depend S.D. depende Akaike info S.D. depende Akaike info S.C. warz crite Hannan-Quin Durbin-Watsc	Untitled\ ast Stats Res t-Statistic 4.730488 -4.123009 0.876148 lent var iterion rion n criter. on stat	Prob. 0.0000 0.0002 0.3858 4.847844 0.191458 -0.721834 -0.602575 -0.677159 2.315716	

Figure 72: (eq02) Run the regression of log consumption on a constant, log price, and log income, using ordinary least squares, and consider the regression output.

Equation: UNTITLE View Proc Object Print (f Dependent Variable: LN Method: Least Squares Date: 04/06/09 Time: 1 Sample: 1 46 Included observations: 4	D Workfile: Jame Freeze E C 9:43 46	UNTITLED::Ur stimate Forecast	ntitled\ Stats Resids		
C	Coefficient	Std. Error 0.908926	t-Statistic 4.730488	Prob.	
LNP LNY	-1.338335	0.324601 -	4.123009	0.0002	
R-squared Adjusted R-squared S.E. of regression Sum squared resid Log likelihood F-statistic Prob(F-statistic)	0. 0. 1. 1. 9. 0. Display	name for labeling	24 chara or fewe tables and grap	acters maximum r recommended ohs (optional) –	, 16
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Equation: EQ02	Workfile: UN Name Freeze)	TITLED::Unti Estimate Fored	tled\ :ast]Stats]Res	sids)	
Equation: EQ02 View Proc Object Print Dependent Variable: L Method: Least Square Date: 04/06/09 Time: Sample: 1 46 Included observations	Workfile: UN Name Freeze NC s 19:43 : 46	TITLED::Unti (Estimate)(Forec	tled\ :ast]Stats]Res	sids	
Equation: EQ02 View Proc Object Print Dependent Variable: L Method: Least Square Date: 04/06/09 Time: Sample: 1 46 Included observations	Workfile: UN Name Freeze NC s 19:43 : 46 Coefficient	TTTLED::Unti Estimate Forect	tled\ :ast)Stats)Res t-Statistic	sids Prob.	
Equation: EQ02 View Proc Object Print Dependent Variable: L Method: Least Square Date: 04/06/09 Time: Sample: 1 46 Included observations C LNP LNY	Workfile: UN Name Freeze NC s 19:43 : 46 Coefficient 4.299662 -1.338335 0.172386	Std. Error 0.908926 0.324601 0.196754	tled\ ast Stats Res t-Statistic 4.730488 -4.123009 0.876148	Prob. 0.0000 0.0002 0.3858	

Figure 73: Name the equation 'eq02'.

Equation Estimat	ion				
Specification Optic	ons				
- Equation specifi Depend and PD	cation dent variable fo L terms, OR an	llowed by list c explicit equati	of regressors i on like Y=c(1)	ncluding ARMA I+c(2)*X.	
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Method: LS - L	.east Squares (I	NLS and ARMA	,)		~
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Equation: UNTIT	ED Workfile	: UNTITLED:: Estimate Foreca	Untitled\ ast Stats Resid		3
Equation: UNTIT View Proc Object Print Dependent Variable: I Method: Least Square Date: 04/06/09 Time Sample: 1 46 Included observations	LED Workfile Name Freeze NY 19 19:44 19:44	: UNTITLED:::	Untitled\ ast Stats Resid		3
Equation: UNTIT View Proc Object Print Dependent Variable: I Method: Least Square Date: 04/06/09 Time Sample: 1 46 Included observations	LED Workfile Name Freeze NY 19 19:19:44 19:44 19:44 Coefficient	: UNTITLED::: Estimate Forect	Untitled\ ast_Stats_Resid t-Statistic	Prob.	
Equation: UNTIT View Proc Object Print Dependent Variable: I Method: Least Square Date: 04/06/09 Time Sample: 1 46 Included observations C LNP	ED Workfile Name Freeze NY 55 : 19:44	UNTITLED:: Estimate Forect Std. Error 0.048168 0.216482	Untitled\ ast Stats Resident E-Statistic 95.67605 3.751988	Prob. 0.0000 0.0005	
Equation: UNTIT View Proc Object Print Dependent Variable: 1 Method: Least Square Sample: 1 46 Included observations C LNP R-squared Adjusted R-squared S.E. of regression Sum squared resid Log likelihood F-statistic Prob(F-statistic)	ED Workfile Name Freeze NY 19:44 2: 19:44 2: 46 Coefficient 4:608533 0.812239 0.242391 0.225172 0.125224 0.689971 31.32303 14.07742 0.000510	Std. Error 0.048168 0.216482 0bject Nam Name to ide 2003 Display nam	LINTITLE d\ ast Stats Resident t-Statistic 95.67605 3.751988 e ntify object e for labeling ta	Prob. 0.0000 0.0005 24 characte or fewer rec	rs maximum, 16 commended

Figure 74: (eq03) Regress log income on a constant and log price, using ordinary least squares, and consider the regression output. Name this equation 'eq03'.

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Figure 75: Select 'Generate Series' and enter 'resid_eq03=resid', to store the residuals from eq03, and to prevent them from being overwritten by a new regression.

Workfile: UNTITLED
View Proc Object Print Save Details+/- Show Fetch Store Delete Genr Sample
Range: 1.46 46 obs Display Filter: * Sample: 1.46 46 obs
<pre> c eq01 eq02 eq03 fnc Inp fny resid resid_eq03 </pre>
Equation Estimation
Specification Options
Cauation specification
Dependent variable followed by list of regressors including ARMA and PDL terms, OR an explicit equation like $Y=c(1)+c(2)*X$.
Incic resid_eq03
- Estimation settings
Method: LS - Least Squares (NLS and ARMA)
Sampley 146
Janpie, 1 To

Figure 76: (eq04) Check that resid_eq03 appears in the workfile, and run the regression of log consumption on a constant and resid_eq03.



Figure 77: Name this equation 'eq04', and then select the eq01 object.

(
Workfile: UNTITLE	ED			J		
View Proc Object Print	Save Details+/- Show	etch Store Del	lete Genr Sample			
Range: 1 46 46 ob Sample: 1 46 46 ob)S)S		Display Filter: *			
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Inp	View Proc Object Print	Name Freeze	Estimate Foreca	st Stats Resi	ds	
V obs V resid V resid_eq03	Dependent Variable: L Method: Least Square Date: 04/06/09 Time: Sample: 1 46 Included observations	NC s 18:34 : 46				
		Coefficient	Std. Error	t-Statistic	Prob.	
< >∖ Untitled <u>New F</u>	C LNP	5.094108 -1.198316	0.062699 0.281789	81.24707 -4.252537	0.0000 0.0001	
	R-squared Adjusted R-squared S.E. of regression Sum squared resid Log likelihood F-statistic Prob(F-statistic)	0.291284 0.275176 0.163001 1.169048 19.19521 18.08407 0.000108	Mean dependi S.D. depender Akaike info crit Schwarz criter Hannan-Quinr Durbin-Watso	ent var nt var terion ion n criter. n stat	4.847844 0.191458 -0.747618 -0.668112 -0.717834 2.307050	
Workfile: UNTITLE	D			1		
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resid		_				
M resia_equ3	Dependent	' /ariable followed	by list of regress	ors including Al	RMA	
	and PDL terr	ns, OR an explici	t equation like Y=	c(1)+c(2)*X.		
	Inc c Inp				~	
() United of (Name)						
K P Condied <u>A New F</u>					~	
	Methody US	Severes /MLC				
	Methou: L5 - Least	oquares (NLS an	iu arima)		~	
	Sample: 1 46					
	Sample: 1 46					

Figure 78: Perform the eq01 regression once again.

Workfile: UNTITLED		Equati	on: EQ01	Workfile: UN	TITLED::Untit	iled\	
(vew)[Proc/Object] (Princ [save] Decais+) Range: 146	<u>) prow (reconj xore jueero juero j juero juero juer</u>	Depender Method: L Date: 04/0 Sample: 1 Included (object j Printj east Square: 06/09 Time: 146 observations:	<u>(vame) Freeze</u> NC 3 19:46 46	Listimate Poreca	<u>ast jotats jike</u>	305
■ eq04	Constato Socias by Equation		1	Coefficient	Std. Error	t-Statistic	Prob.
∑ inp ∑ iny ∑ obs	Enter equation	<u> </u>	C NP	5.094108 -1.198316	0.062699 0.281789	81.24707 -4.252537	0.0000 0.0001
⊠resid ⊠resid_eq03	resid_eq01=resid		squared ession ed resid od stic)	0.291284 0.275176 0.163001 1.169048 19.19521 18.08407 0.000108	Mean depend S.D. depende Akaike info cri Schwarz criter Hannan-Quin Durbin-Watso	ent var nt var terion rion n criter. n stat	4.847844 0.191458 -0.747618 -0.668112 -0.717834 2.307050
₹ \ Untitled / New Page /	146						
l	OK						
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View Proc Object	Print Save Details+	'-) (Sha	w Fet	ch Stor	e Delet	e Gen	r Sample
Sample: 1 46	46 obs					ispiay	r Filler. "
B c ■ eq01 ■ eq02 ■ eq04 M Inc M Inp M Iny M obs resid_eq01 M resid_eq03							
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Figure 79: Store the regression residuals in the object 'resid_eq01', and check that they appear in the workfile.

Equation Estimation	'n				
Specification Option	าร				
Equation specific Depende and PDL resid_eq01 c res	ation ent variable folk terms, OR an e sid_eq03	owed by list ol explicit equation	[:] regressors in In like Y=c(1)+	cluding ARMA ⊦c(2)*X.	
- Estimation setting	16				>
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Sample: 1 46					
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Equation: UNTITL View Proc Object Print Dependent Variable: R Method: Least Square: Date: 04/06/09 Time: Sample: 1 46	ED Workfile: Name Freeze (ESID_EQ01 3 19:47	UNTITLED::I	Untitled\ ast)Stats)Resid	5	<
Included observations	46				
C RESID_EQ03	Coefficient 1.12E-15 0.172386	Std. Error 0.023821 0.194506	4.69E-14 0.886277	Prob. 1.0000 0.3803	
R-squared Adjusted R-squared S.E. of regression Sum squared resid Log likelihood F-statistic Prob(F-statistic)	0.017539 -0.004790 0.161565 1.148545 19.60218 0.785487 0.380287	Dbject Name Name to iden 2005 Display name	tify object for labeling tabl	24 characte or fewer rev les and graphs	ers maximum, 16 commended
		(ОК	Cancel	

Figure 80: (eq05) Run the regression of resid_eq01 on a constant and resid_eq03, and name this equation 'eq05'.

View Proc Object Print Dependent Variable: L	Workfile: UNTITL Name Freeze Estim	ED : : Untitle d\ hate Forecast Sta	Ls Resids		
Method: Least Squares Date: 04/06/09 Time: Sample: 1 46 Included observations:	; 19:43 46			_	
	Equation Estima	tion			
C LNP LNY R-squared Adjusted R-squared S.E. of regression Sum squared resid Log likelihood F-statistic Prob(F-statistic)	Specification Opt Equation speci Deper and P Inc c Inp Iny	ions fication dent variable follo DL terms, OR an e:	wed by list of regr cplicit equation like	essors including ARI Y=c(1)+c(2)*X.	MA
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View Proc Object Pr	workfile: UN	Estimate Forec	ast Stats Resid		
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Method: Least Squa Date: 04/06/09 Tim Sample: 1 46 Included observatio	res res ns: 19:49 Coefficient	Std. Error	t-Statistic	Prob.	-
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Ceperiodii (variable Method: Least Squa Date: 04/06/09 Tim Sample: 1 46 Included observatio C LNP LNY R-squared Adjusted R-squared S.E. of regression Sum squared resid Log likelihood F-statistic Prob(F-statistic)	. LINC res le: 19:49 hs: 46 <u>Coefficient</u> 4.299662 -1.338335 0.172386 0.303714 0.271328 0.163433 1.148545 19.60218 9.378101 0.000417	Std. Error 0.908926 0.324601 0.196754 Generate Se Enter equal resid_eq02 Sample	t-Statistic 4.730488 -4.123009 0.876148 eries by Equa ion erresid	Prob. 0.0000 0.0002 0.3858	

Figure 81: Select the eq02 object, and re-run the regression once again. Store the residuals as 'resid_eq02'.

```
Equation: EQ02 Workfile: UNTITLED::Untitled\
                                                                       View Proc Object Print Name Freeze Estimate Forecast Stats Resids
 Dependent Variable: LNC
 Method: Least Squares
Date: 04/06/09 Time: 19:49
 Sample: 1 46
 Included observations: 46
                         Coefficient
                                         Std. Error
                                                       t-Statistic
                                                                      Prob.
                         Heteroskedasticity Tests
                                                                                            X
          LŇP
          LNY
                            Specification
                             Test type
 R-squared
                                                         Dependent variable: RESID^2
 Adjusted R-squared
                               Breusch-Pagan-Godfrey
 S.E. of regression
                              Harvey
Glejser
ARCH
White
                                                         The White Test regresses the squared 
residuals on the the cross product of 
the original regressors and a constant.
 Sum squared resid
 Log likelihood
 F-statistic
                               Custom Test Wizard...
 Prob(F-statistic)
                                                         Include White cross terms
                                                  ОК
                                                              Cancel
                                                                                  Equation: EQ02 Workfile: UNTITLED::Untitled
View Proc Object Print Name Freeze Estimate Forecast Stats Resids
 Heteroskedasticity Test: White
                               4.127779
15.65644
                                                                                0.0041
 F-statistic
                                             Prob. F(5,40)
 Obs*R-squared
                                             Prob. Chi-Square(5)
 Scaled explained SS
                               12.82597
                                             Prob. Chi-Square(5)
                                                                                 0.0251
 Test Equation:
 Dependent Variable: RESID^2
 Method: Least Squares
Date: 04/06/09 Time: 19:50
 Sample: 1 46
Included observations: 46
                              Coefficient
                                                Std. Error
                                                                t-Statistic
                                                                                 Prob.
              С
                               18.22199
                                                5.374060
                                                                3.390730
                                                                                0.0016
           LNP
LNP^2
                               9.506059
                                                3.302570
                                                                2.878382
                                                                                 0.0064
                               1.281141
                                                0.656208
                                                                1.952340
                                                                                0.0579
                              -2.078635
                                                0.727523 2.329386
                                                               -2.857139
                                                                                0.0068
         LNP*LNY
           LNY
LNY<sup>A</sup>2
                               0.855726
                                                0.253048
                                                                3.381670
                                                                                0.0016
                                                                             0.024968
                               0.340357
 R-squared
                                             Mean dependent var
 Adjusted R-squared
S.E. of regression
                               0.257902 0.029778
                                             S.D. dependent var
Akaike info criterion
                                                                             0.034567
                                                                             4.068982
 Sum squared resid
                               0.035469
                                             Schwarz criterion
                                                                             -3.830464
                               99.58660
4.127779
                                             Hannan-Quinn criter.
Durbin-Watson stat
 Log likelihood
                                                                             3.979632
 F-statistic
                                                                             1.853360
 Prob(F-statistic)
                               0.004073
```

Figure 82: For eq02, perform White's nR^2 test (with cross terms) for heteroscedasticity: homoscedasticity is rejected at all usual levels of significance. (This provides some evidence against the classical assumption $Var(u) = \sigma^2 I_n$).



Figure 83: Plot a scatter of resid_eq02 against lny, and note that the variation appears to decrease with lny.

Equation: UNTITL	ED Workfile:	UNTITLED	:Untitled\		X	
View [Proc] Object] [Print] Dependent Variable: LI Method: Least Squares Date: 04/06/09 Time: Sample: 1 46 Included observations:	NC S 19:51 46	Estimate Fore	cast Stats Re	esids		
	Coefficient	Std. Error	t-Statisti	c Prob.		
C LNY LNY ^A 2 LNP	-34.77352 16.43209 -1.689935 -1.347610	22.48072 9.349677 0.971544 0.317261	-1.546815 1.757503 -1.739434 -4.247644	5 0.1294 3 0.0861 4 0.0893 4 0.0001		
R-squared Adjusted R-squared S.E. of regression Sum squared resid Log likelihood F-statistic Prob(F-statistic)	0.350503 0.304110 0.159714 1.071365 21.20211 7.555130 0.000376	Object Nan Name to id eq06 Display nar	1e entify object — me for labeling	24 cha or few tables and gra	racters m er recomn phs (opt	aximum, 16 nended
			ОК	Ca	ncel	
Equation: EQ00	6 Workfile	: UNTITLE	D::Untitle	d۱		
View Proc Object Pr	6 Workfile rint (Name) Fre	: UNTITLE eze) (Estima	D::Untitle ite (Forecast	d \]Stats]Resi	lds)	
Equation: EQ0 View Proc Object Pr Heteroskedasticity F-statistic Obs*R-squared Scaled explained S	5 Workfile rint Name Fre Test: White 4.677 21.29 8 15.54	EUNTITLE EEZE ESTIMA 827 Prob 147 Prob 862 Prob	D::Untitle Ite Forecast . F(7,38) . Chi-Squar . Chi-Squar	d\ <u>Stats</u> Resi (7) e(7)	0.00 0.01	007 034 296
Equation: EQ0 View Proc Object Pr Heteroskedasticity F-statistic Obs*R-squared Scaled explained S Test Equation: Dependent Variable Method: Least Squa Date: 04/06/09 Tin Sample: 1 46 Included observatio Collinear test regre	5 Workfile rint Name) Fre 4.6771 21.29 8 15.541 e: RESID^2 ares ne: 19:52 ms: 46 ssors droppe	EUNTITLE Estima 827 Prob 827 Prob 862 Prob	D::Untitle te (Forecast F(7,38) Chi-Squar Chi-Squar	d\ Stats Resi e(7) e(7)	ds 0.00 0.00	007 034 296
Equation: EQ0 View Proc Object Pr Heteroskedasticity F-statistic Obs*R-squared Scaled explained S Test Equation: Dependent Variable Method: Least Squ Date: 04/06/09 Tin Sample: 1 46 Included observatio Collinear test regre	5 Workfile rint Name) Fre 4.6771 21.29 S 15.541 S: RESID^2 artes ne: 19:52 ons: 46 ssors droppe Coeffici	EUNTITLE ESE EStima 827 Prob 862 Prob 862 Prob	D::Untitle Forecast F(7,38) Chi-Squar Chi-Squar chi-Squar ecification	d\ <u>]Stats]Res</u> e(7) e(7) t-Statistic	0.00 0.00 0.00	007 034 296
Equation: EQ0 View Proc Object Pr Heteroskedasticity F-statistic Obs*R-squared Scaled explained S Test Equation: Dependent Variable Method: Least Squa Date: 04/06/09 Tin Sample: 1 46 Included observatio Collinear test regre C LNY LNY LNY LNY LNY LNY LNY LNY	5 Workfile rint Name) Fre 1.6771 21.29 8 15.541 8: RESID^2 ares e: RESID^2 ares 0.5541 0.554 0.5657 0.5654 0.5657	ed from spe ient Sta 068 17 257 11 268 17 257 11 384 24 306 1.7 384 24 306 1.7 383 36 840 38 379 88 379 88	D::Untitle F(7,38) . Chi-Squar . Chi-Squa	d\ (Stats) Resi e(7) e(7) t-Statistic 0.819736 0.821280 0.819189 0.813352 0.8193352 1.536869 1.471292 1.536859 1.471292 1.53761	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.41 0.44 0.41 0.41	007 0034 2296 ab. 175 166 178 211 178 211 178 221 494 190 035

Figure 84: (eq06) Perform the regression of log consumption on a constant, log income, log income squared, and log price, and name the equation 'eq06'. Perform White's nR^2 test for heteroscedasticity: note that homoscedasticity is rejected at all usual levels of significance. (This is evidence against the classical assumption $Var(u) = \sigma^2 I_n$).

Saving the Workfile



Figure 85: Select 'Save As'. Name the workfile 'applied problem set 1', and select type '.wf1' (Eviews workfile). Store with 'Double precision'. You have saved your work!