

Quantile Regression in EViews

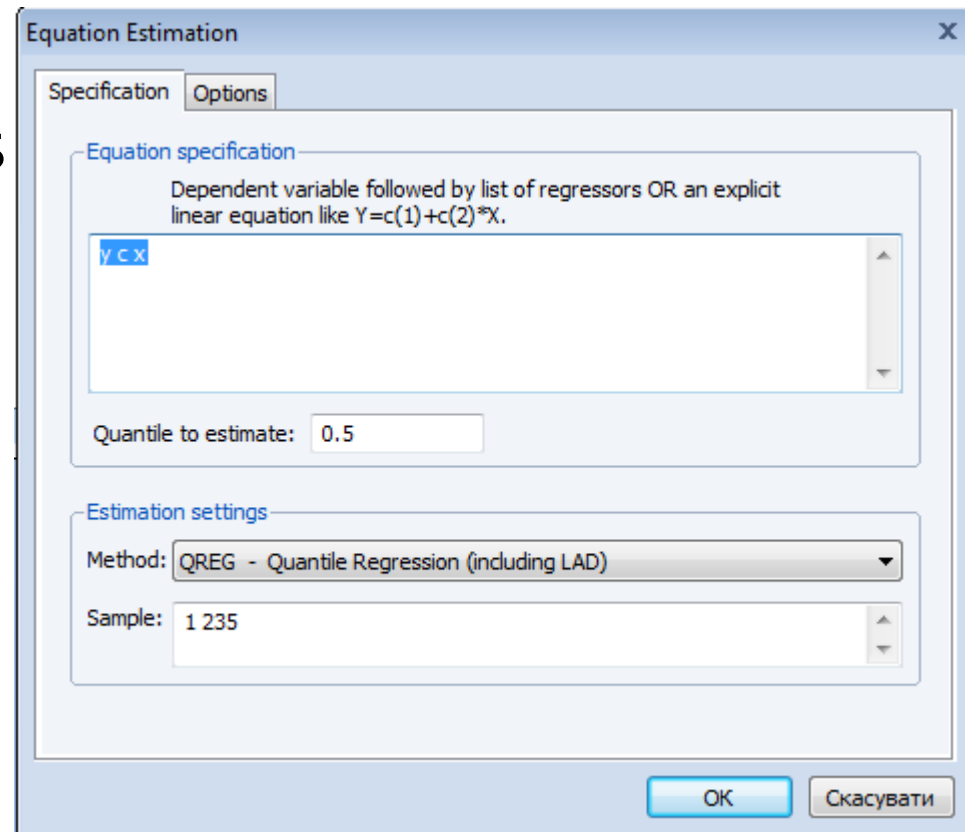
Ass.Prof. Andriy Stavytskyy

File: Engel.wf1

- ▶ Y – food expenditure
- ▶ X – household income

Estimation

- ▶ To estimate a quantile regression specification in EViews you may select **Object/New Object.../Equation** or **Quick/Estimate Equation...** from the main menu
- ▶ From the main estimation dialog you should select **QREG – Quantile Regression (including LAD)**.



Estimation Options – 1

- ▶ The options on the left-hand side of the page control the method for computing the coefficient covariances, allow you to specify a weight series for weighted estimation, and specify the method for computing scalar sparsity estimates.

The screenshot shows the 'Equation Estimation' dialog box with the 'Options' tab selected. The dialog is divided into several sections:

- Estimation options:**
 - Coefficient Covariance: Huber Sandwich (dropdown)
 - Weight: None (dropdown)
 - Weight series: (empty text box)
 - Scaling: EViews default (dropdown)
- Sparsity Estimation:**
 - Method: Kernel (residual) (dropdown)
 - Bandwidth Method: Hall-Sheather (dropdown)
 - Size Param: 0.05 (text box)
 - Quantile Method: Rankit (Cleveland) (dropdown)
 - Kernel: Epanechnikov (dropdown)
- Iteration control:**
 - Max Iterations: 500 (text box)
 - Starting values: Zero (dropdown)
 - ☐ Display settings
- Bootstrap settings:**
 - Method: XY-pair (dropdown)
 - Replications: 100 (text box)
 - No. of obs: (empty text box)
 - Output: (empty text box)
 - Random generator: Knuth (dropdown)
 - Seed: (empty text box) with a 'Clear' button

At the bottom right, there are two buttons: 'OK' and 'Скасувати' (Cancel).

Estimation Options – 2

- ▶ The iteration control section offers the standard edit field for changing the maximum number of iterations, a combo box for specifying starting values, and a check box for displaying the estimation settings in the output. Note that the default starting value for quantile regression is 0, but you may choose a fraction of the OLS estimates, or provide a set of user specified values.

The screenshot shows the 'Equation Estimation' dialog box with the 'Options' tab selected. The dialog is divided into several sections:

- Estimation options:**
 - Coefficient Covariance: Huber Sandwich
 - Weight: None
 - Weight series: (empty text field)
 - Scaling: EViews default
- Sparsity Estimation:**
 - Method: Kernel (residual)
 - Bandwidth Method: Hall-Sheather
 - Size Param: 0.05
 - Quantile Method: Rankit (Cleveland)
 - Kernel: Epanechnikov
- Iteration control:**
 - Max Iterations: 500
 - Starting values: Zero
 - ☐ Display settings
- Bootstrap settings:**
 - Method: XY-pair
 - Replications: 100
 - No. of obs: (empty text field)
 - Output: (empty text field)
 - Random generator: Knuth
 - Seed: (empty text field) Clear

At the bottom right, there are two buttons: 'OK' and 'Скасувати' (Cancel).

Estimation Options – 3

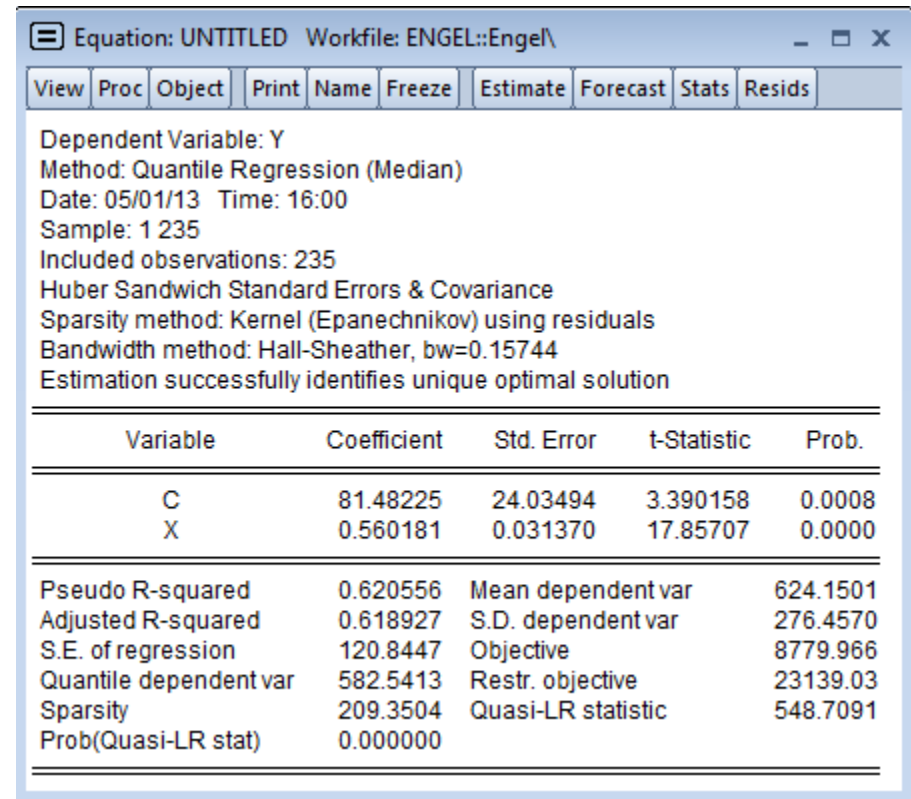
- ▶ When you select **Bootstrap** in the **Coefficient Covariance** combo, the right side of the dialog changes to offer a set of bootstrap options.

The screenshot shows the 'Equation Estimation' dialog box with the 'Options' tab selected. The 'Coefficient Covariance' is set to 'Huber Sandwich'. The 'Weight' is set to 'None'. The 'Weight series' is empty. The 'Scaling' is set to 'EViews default'. The 'Sparsity Estimation' section includes 'Method' set to 'Kernel (residual)', 'Bandwidth Method' set to 'Hall-Sheather', 'Size Param' set to '0.05', 'Quantile Method' set to 'Rankit (Cleveland)', and 'Kernel' set to 'Epanechnikov'. The 'Iteration control' section includes 'Max Iterations' set to '500', 'Starting values' set to 'Zero', and a checked 'Display settings' checkbox. The 'Bootstrap settings' section includes 'Method' set to 'XY-pair', 'Replications' set to '100', 'No. of obs' set to an empty field, 'Output' set to an empty field, 'Random generator' set to 'Knuth', and 'Seed' set to an empty field with a 'Clear' button. The 'OK' and 'Скасувати' buttons are at the bottom right.

Section	Option	Value
Coefficient Covariance	Coefficient Covariance	Huber Sandwich
	Weight	None
	Weight series	
	Scaling	EViews default
Sparsity Estimation	Method	Kernel (residual)
	Bandwidth Method	Hall-Sheather
	Size Param	0.05
	Quantile Method	Rankit (Cleveland)
	Kernel	Epanechnikov
Iteration control	Max Iterations	500
	Starting values	Zero
	Display settings	<input checked="" type="checkbox"/>
Bootstrap settings	Method	XY-pair
	Replications	100
	No. of obs	
	Output	
	Random generator	Knuth
Seed		Clear

Estimation Output – 1

- ▶ The top portion of the output displays the estimation settings. Here we see that our estimates use the Huber sandwich method for computing the covariance matrix, with individual sparsity estimates obtained using kernel methods.



The screenshot shows a software window with a menu bar (View, Proc, Object, Print, Name, Freeze, Estimate, Forecast, Stats, Resids) and a text area containing the following information:

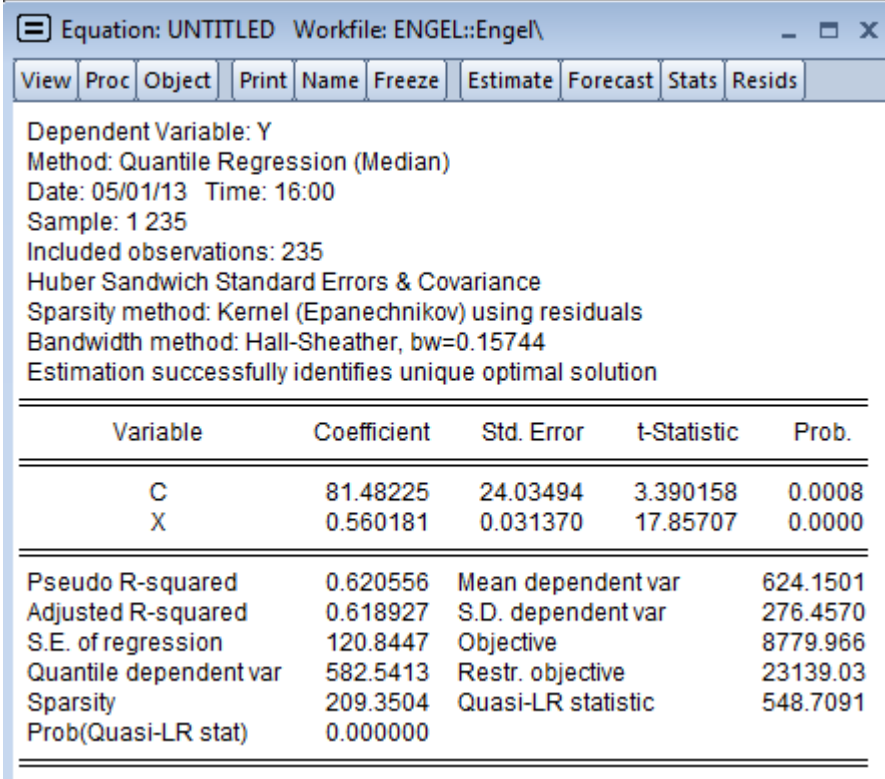
Dependent Variable: Y
Method: Quantile Regression (Median)
Date: 05/01/13 Time: 16:00
Sample: 1 235
Included observations: 235
Huber Sandwich Standard Errors & Covariance
Sparsity method: Kernel (Epanechnikov) using residuals
Bandwidth method: Hall-Sheather, bw=0.15744
Estimation successfully identifies unique optimal solution

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	81.48225	24.03494	3.390158	0.0008
X	0.560181	0.031370	17.85707	0.0000

Pseudo R-squared	0.620556	Mean dependent var	624.1501
Adjusted R-squared	0.618927	S.D. dependent var	276.4570
S.E. of regression	120.8447	Objective	8779.966
Quantile dependent var	582.5413	Restr. objective	23139.03
Sparsity	209.3504	Quasi-LR statistic	548.7091
Prob(Quasi-LR stat)	0.000000		

Estimation Output – 2

- Below the header information are the coefficients, along with standard errors, t -statistics and associated p -values. We see that both coefficients are statistically significantly different from zero and conventional levels.



Equation: UNTITLED Workfile: ENGEL::Engel\

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Dependent Variable: Y
Method: Quantile Regression (Median)
Date: 05/01/13 Time: 16:00
Sample: 1 235
Included observations: 235
Huber Sandwich Standard Errors & Covariance
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Prob(Quasi-LR stat)	0.000000		

Estimation Output – 3

- ▶ The bottom portion of the output reports the goodness-of-fit measure (pseudo R-squared), and adjusted version of the statistic, as well as the scalar estimate of the sparsity using the kernel method. Note that this scalar estimate is not used in the computation of the standard errors in this case since we are employing the Huber sandwich method.
- ▶ Also reported are the minimized value of the objective function ("Objective"), the minimized constant-only version of the objective ("Objective (const. only)"), the constant-only coefficient estimate ("Quantile dependent var"), and the corresponding form of the Quasi-LR statistic and associated probability for the difference between the two specifications.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	81.48225	24.03494	3.390158	0.0008
X	0.560181	0.031370	17.85707	0.0000

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Prob(Quasi-LR stat)	0.000000		

Different methods of estimation – 1

Equation Estimation

Specification Options

Estimation options

Coefficient Covariance: Huber Sandwich

Weight: None

Weight series:

Scaling: EViews default

Sparsity Estimation

Method: Kernel (residual)

Bandwidth Method: Hall-Sheather

Size Param: 0.05

Quantile Method: Rankit (Cleveland)

Kernel: Epanechnikov

Iteration control

Max Iterations: 500

Starting values: Zero

☐ Display settings

Bootstrap settings

Method: XY-pair

Replications: 100

No. of obs:

Output:

Random generator: Knuth

Seed: Clear

OK Скасувати

Equation Estimation

Specification Options

Estimation options

Coefficient Covariance: Bootstrap

Weight: None

Weight series:

Scaling: EViews default

Sparsity Estimation

Method: Kernel (residual)

Bandwidth Method: Hall-Sheather

Size Param: 0.05

Quantile Method: Rankit (Cleveland)

Kernel: Epanechnikov

Iteration control

Max Iterations: 500

Starting values: Zero

☐ Display settings

Bootstrap settings

Method: XY-pair

Replications: 100

No. of obs:

Output:

Random generator: Knuth

Seed: Clear

OK Скасувати

Different methods of estimation – 2

Equation: UNTITLED Workfile: ENGEL::Engel\

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Dependent Variable: Y
 Method: Quantile Regression (Median)
 Date: 05/01/13 Time: 16:00
 Sample: 1 235
 Included observations: 235
 Huber Sandwich Standard Errors & Covariance
 Sparsity method: Kernel (Epanechnikov) using residuals
 Bandwidth method: Hall-Sheather, bw=0.15744
 Estimation successfully identifies unique optimal solution

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	81.48225	24.03494	3.390158	0.0008
X	0.560181	0.031370	17.85707	0.0000

Pseudo R-squared	0.620556	Mean dependent var	624.1501
Adjusted R-squared	0.618927	S.D. dependent var	276.4570
S.E. of regression	120.8447	Objective	8779.966
Quantile dependent var	582.5413	Restr. objective	23139.03
Sparsity	209.3504	Quasi-LR statistic	548.7091
Prob(Quasi-LR stat)	0.000000		

Equation: UNTITLED Workfile: ENGEL::Engel\

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Dependent Variable: Y
 Method: Quantile Regression (Median)
 Date: 05/01/13 Time: 16:10
 Sample: 1 235
 Included observations: 235
 Bootstrap Standard Errors & Covariance
 Bootstrap method: XY-pair, reps=100, rng=kn, seed=570811158
 Sparsity method: Kernel (Epanechnikov) using residuals
 Bandwidth method: Hall-Sheather, bw=0.15744
 Estimation successfully identifies unique optimal solution

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	81.48225	27.07972	3.008977	0.0029
X	0.560181	0.034541	16.21803	0.0000

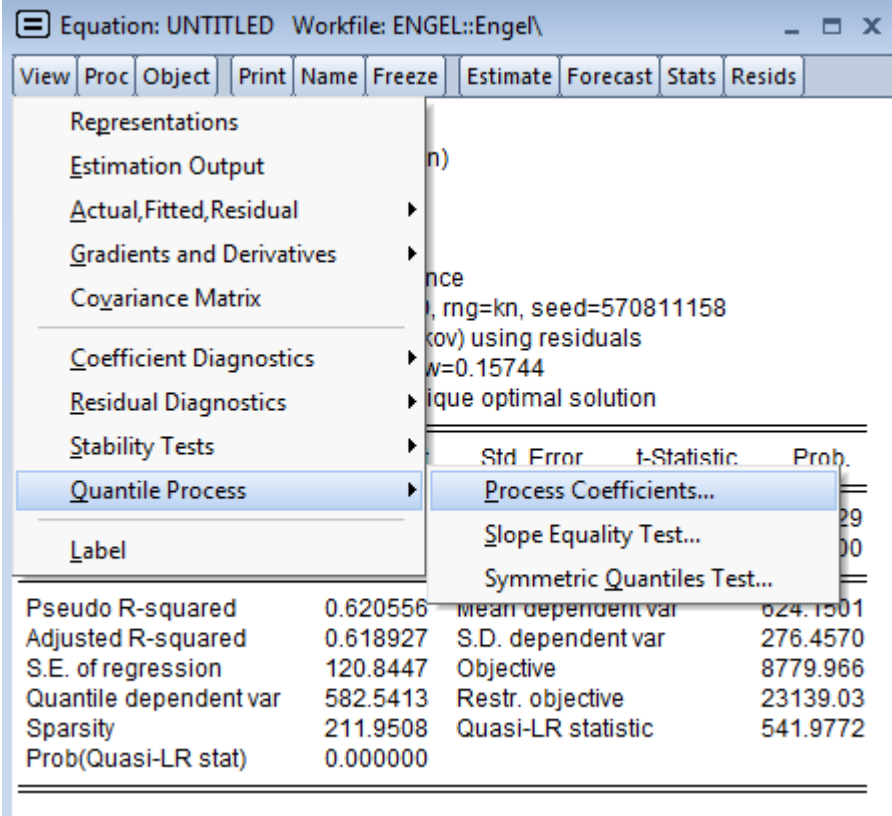
Pseudo R-squared	0.620556	Mean dependent var	624.1501
Adjusted R-squared	0.618927	S.D. dependent var	276.4570
S.E. of regression	120.8447	Objective	8779.966
Quantile dependent var	582.5413	Restr. objective	23139.03
Sparsity	211.9508	Quasi-LR statistic	541.9772
Prob(Quasi-LR stat)	0.000000		

Statistical procedures

- ▶ With the exception of **Quantile Process**, the quantile regression views and procedures should be familiar to ordinary least squares regression.

Quantile Process Views

- ▶ The Quantile Process view submenu lists three specialized views that rely on quantile process estimates.



Equation: UNTITLED Workfile: ENGEL::Engel\

View Proc Object Print Name Freeze Estimate Forecast Stats Resids

Representations
Estimation Output
Actual, Fitted, Residual
Gradients and Derivatives
Covariance Matrix
Coefficient Diagnostics
Residual Diagnostics
Stability Tests
Quantile Process
Label

Process Coefficients...
Slope Equality Test...
Symmetric Quantiles Test...

	Std. Error	t-Statistic	Prob.
Pseudo R-squared	0.620556		
Adjusted R-squared	0.618927		
S.E. of regression	120.8447		
Quantile dependent var	582.5413		
Sparsity	211.9508		
Prob(Quasi-LR stat)	0.000000		

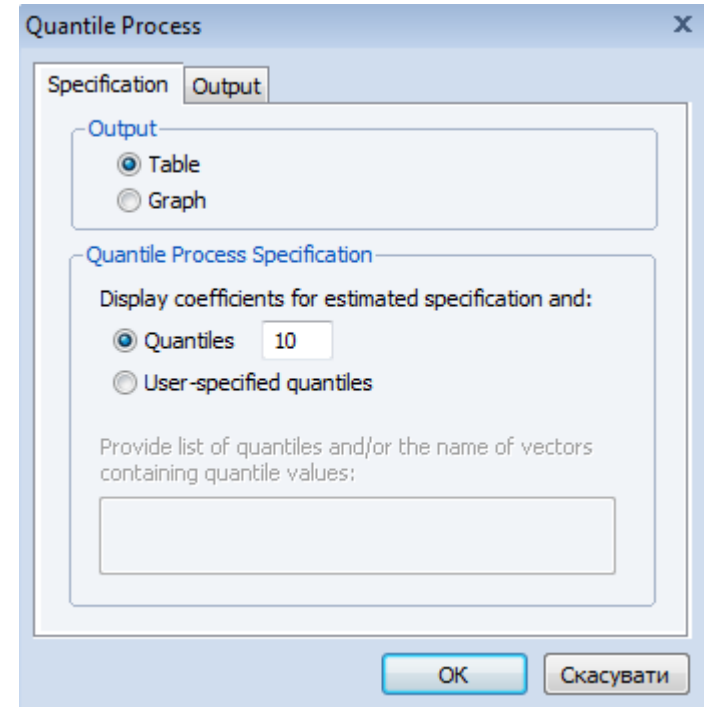
mean dependent var 624.1501
S.D. dependent var 276.4570
Objective 8779.966
Restr. objective 23139.03
Quasi-LR statistic 541.9772

Process Coefficients – 1

- ▶ You may select **View/Quantile Process/Process Coefficients** to examine the process coefficients estimated at various quantiles.

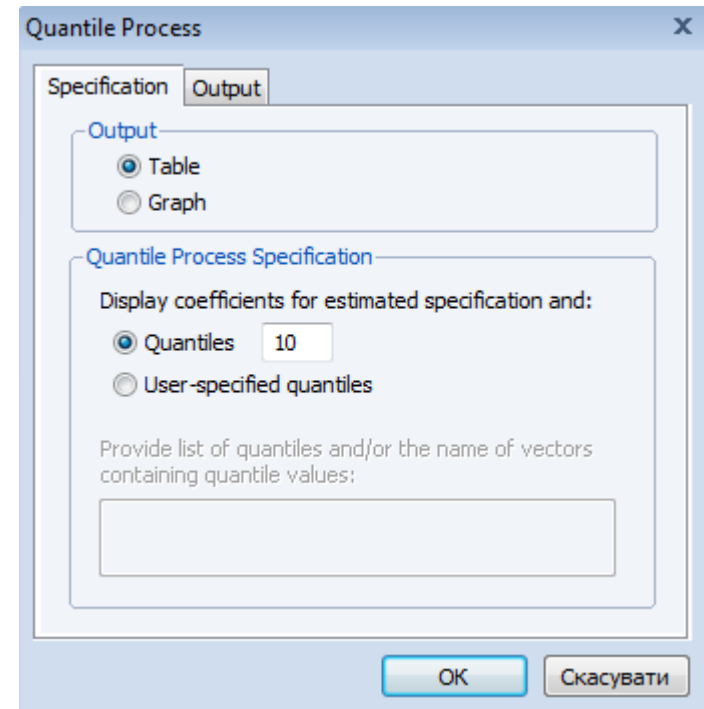
Process Coefficients – 2

- ▶ The **Output** section of the **Specification** page is used to control how the process results are displayed. By default, EViews displays the results as a table of coefficient estimates, standard errors, t -statistics, and p -values. You may instead click on the **Graph** radio button and enter the size of the confidence interval in the edit field that appears. The default is to display a 95% confidence interval.



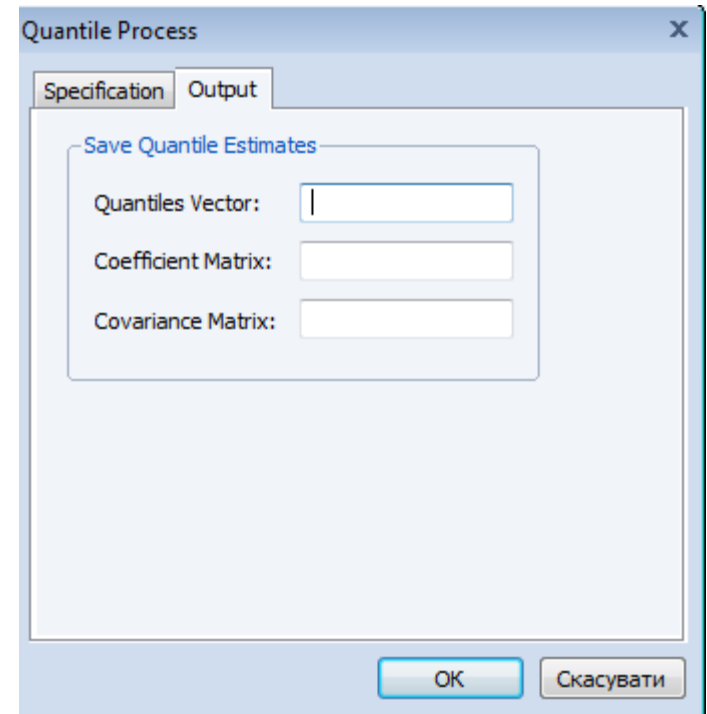
Process Coefficients – 3

- ▶ The **Quantile Process Specification** section of the page determines the quantiles at which the process will be estimated. By default, EViews will estimate models for each of the deciles (10 quantiles,). You may specify a different number of quantiles using the edit field, or you may select **User-specified quantiles** and then enter a list of quantiles or one or more vectors containing quantile values.



Process Coefficients – 4

- ▶ The **Output** page of the dialog allows you to save the results of the quantile process estimation. You may provide a name for the vector of quantiles, the matrix of process coefficients, and the covariance matrix of the coefficients. For the k sorted quantile estimates, each row of the $k \times p$ coefficient matrix contains estimates for a given quantile.



Process Coefficients – 5

Equation: UNTITLED Workfile: ENGEL::Engel\

ViewProcObjectPrintNameFreezeEstimateForecastStatsResids

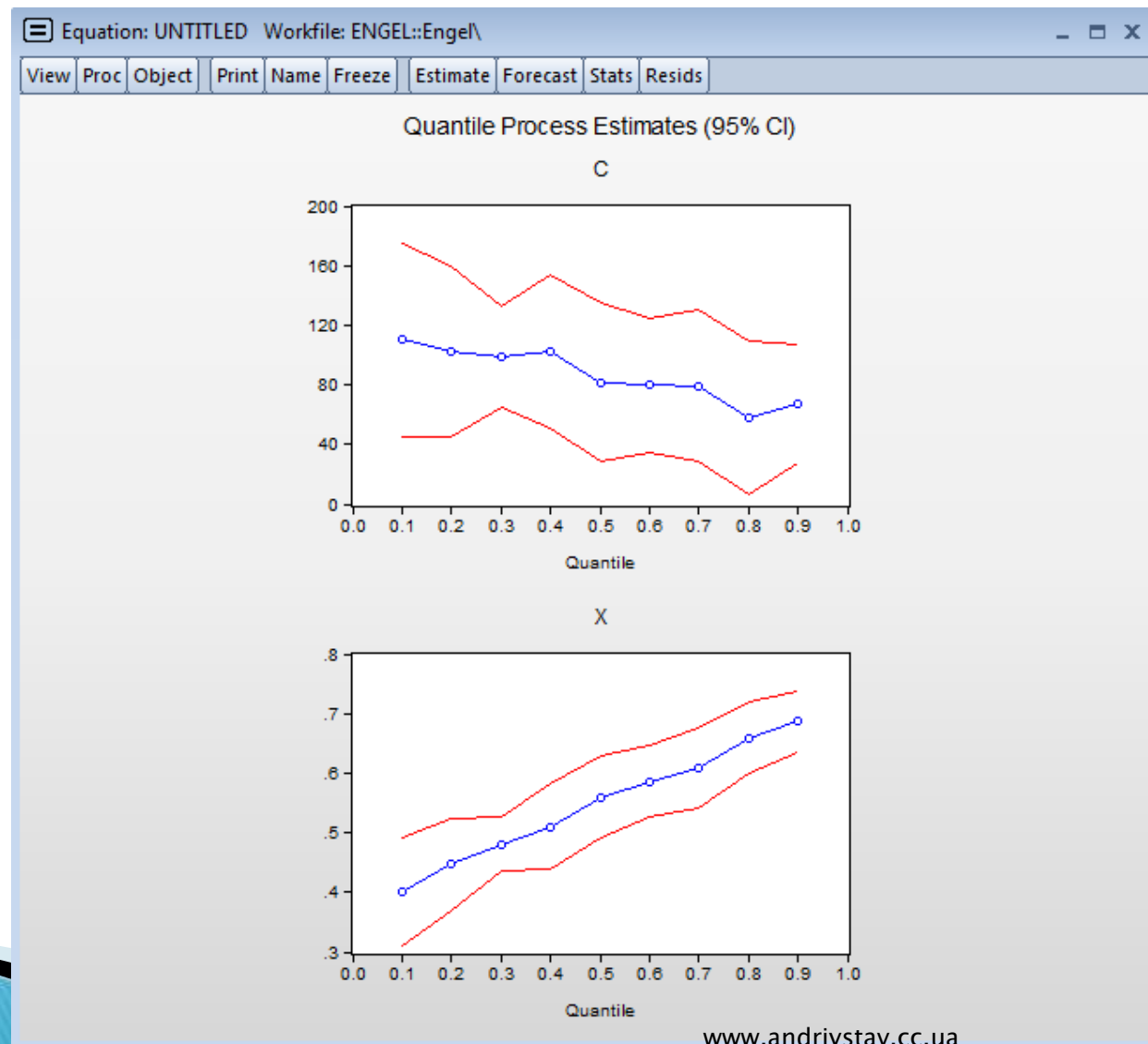
Quantile Process Estimates

Equation: UNTITLED

Specification: Y C X

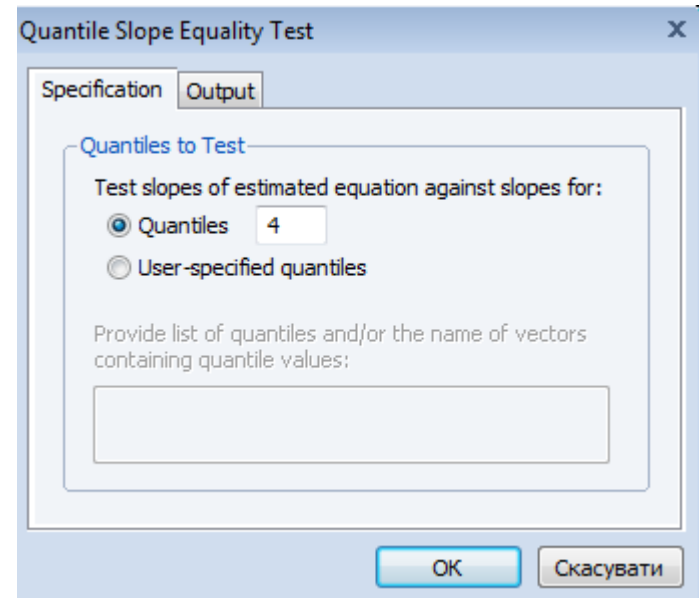
	Quantile	Coefficient	Std. Error	t-Statistic	Prob.
C	0.100	110.1416	33.03477	3.334110	0.0010
	0.200	102.3139	29.34735	3.486308	0.0006
	0.300	99.11058	17.36812	5.706467	0.0000
	0.400	101.9599	26.15952	3.897621	0.0001
	0.500	81.48225	27.21614	2.993895	0.0031
	0.600	79.70227	22.84821	3.488337	0.0006
	0.700	79.28362	25.95253	3.054947	0.0025
	0.800	58.00666	26.13330	2.219645	0.0274
	0.900	67.35087	20.37842	3.305010	0.0011
X	0.100	0.401766	0.046306	8.676274	0.0000
	0.200	0.446900	0.039406	11.34096	0.0000
	0.300	0.481240	0.022713	21.18808	0.0000
	0.400	0.509896	0.036755	13.87282	0.0000
	0.500	0.560181	0.034715	16.13674	0.0000
	0.600	0.585849	0.030706	19.07959	0.0000
	0.700	0.608851	0.034557	17.61886	0.0000
	0.800	0.659511	0.031173	21.15681	0.0000
	0.900	0.686299	0.025756	26.64616	0.0000

Process Coefficients – 6



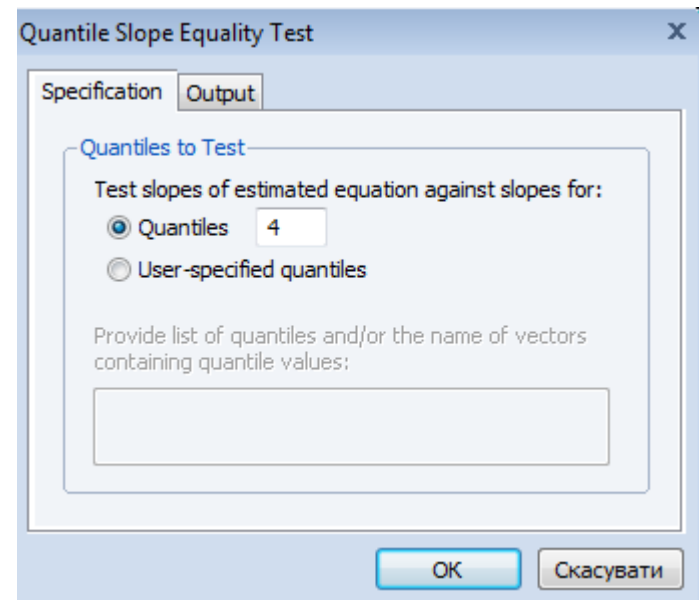
Slope Equality Test – 1

- ▶ To perform the test for the equality of the slope coefficients across quantiles, select **View/Quantile Process/Slope Equality Test...** and fill out the dialog.



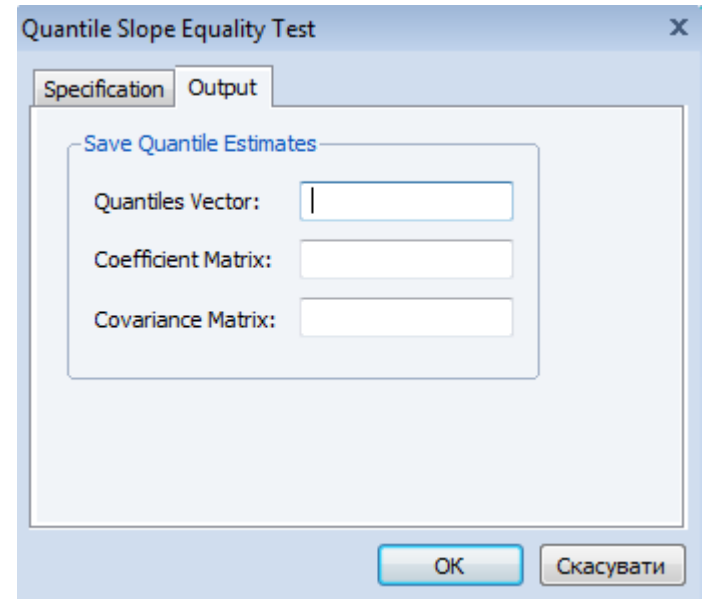
Slope Equality Test – 2

- ▶ The **Specification** page is used to determine the quantiles at which the process will be compared.
- ▶ EViews will compare with slope (non-intercept) coefficients of the estimated tau, with the taus specified in the dialog.
- ▶ By default, the comparison taus will be the three quartile limits (0.25, 0.50, 0.75), but you may select **User-specified quantiles** and provide your own values.



Slope Equality Test – 3

- ▶ The **Output** page allows you to save the results from the supplementary process estimation.
- ▶ You may provide a name for the vector of quantiles, the matrix of process coefficients, and the covariance matrix of the coefficients.



The screenshot shows a software dialog box titled "Quantile Slope Equality Test". It has two tabs: "Specification" and "Output", with "Output" currently selected. Inside the "Output" tab, there is a section titled "Save Quantile Estimates" which contains three input fields: "Quantiles Vector:", "Coefficient Matrix:", and "Covariance Matrix:". Each field has a text input area. At the bottom right of the dialog, there are two buttons: "OK" and "Скасувати" (Cancel).

Slope Equality Test – 4

- ▶ We compare the slope coefficient for the median against those estimated at the upper and lower quartile.
- ▶ The top portion of the output shows the equation specification, and the Wald test summary. Not surprisingly (given the graph of the coefficients above), we see that the χ^2 -statistic value of 21.04 is statistically significant at conventional test levels.
- ▶ We conclude that coefficients differ across quantile values and that the conditional quantiles are not identical.

Equation: UNTITLED Workfile: ENGEL::Engel\				
View	Proc	Object	Print	Name
Freeze	Estimate	Forecast	Stats	Resids
Quantile Slope Equality Test				
Equation: UNTITLED				
Specification: Y C X				
Test Summary		Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Wald Test		21.04210	2	0.0000
Restriction Detail: $b(\tau_h) - b(\tau_k) = 0$				
Quantiles	Variable	Restr. Value	Std. Error	Prob.
0.25, 0.5	X	-0.086077	0.031161	0.0057
0.5, 0.75	X	-0.083834	0.029134	0.0040

Symmetric Quantiles Test – 1

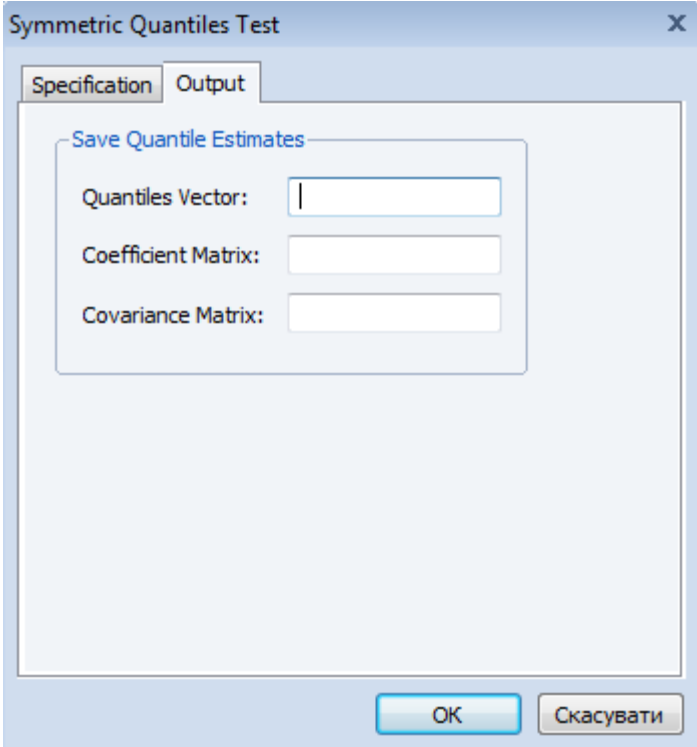
- ▶ Conditional symmetry implies that the average value of two sets of coefficients for symmetric quantiles around the median will equal the value of the coefficients at the median:

$$\frac{\beta(\tau) + \beta(1 - \tau)}{2} = \beta\left(\frac{1}{2}\right)$$

The screenshot shows a software dialog box titled "Symmetric Quantiles Test". It has two tabs: "Specification" and "Output", with "Specification" currently selected. Inside the dialog, there is a section titled "Quantiles to Test" with the instruction "Test for symmetry using coefficients of equation and:". Below this instruction are three radio button options: "Quantiles" (which is selected), "User-specified quantiles", and "Equation quantile only (0.5)". Next to the "Quantiles" option is a text input field containing the number "4". Below these options is a text area with the prompt "Provide list of quantiles and/or the name of vectors containing quantile values:". At the bottom of the dialog is another section titled "Test Specification" with two radio button options: "All coefficients" (selected) and "Intercept only". At the very bottom of the dialog are two buttons: "OK" and "Скасувати" (Cancel).

Symmetric Quantiles Test – 2

- ▶ You may use the **Output** page to save the results from the supplementary process estimation.
- ▶ You may provide a name for the vector of quantiles, the matrix of process coefficients, and the covariance matrix of the coefficients.



The screenshot shows a software dialog box titled "Symmetric Quantiles Test" with a close button (X) in the top right corner. It has two tabs: "Specification" and "Output", with "Output" currently selected. Inside the "Output" tab, there is a section titled "Save Quantile Estimates" which contains three input fields: "Quantiles Vector:", "Coefficient Matrix:", and "Covariance Matrix:". At the bottom of the dialog, there are two buttons: "OK" and "Скасувати" (Cancel).

Symmetric Quantiles Test – 3

- ▶ We see that the test compares estimates at the first and third quantile with the median specification.
- ▶ While earlier we saw strong evidence that the slope coefficients are not constant across quantiles, we now see that there is little evidence of departures from symmetry.
- ▶ The overall p -value for the test is around 0.78, and the individual coefficient restriction test values show even less evidence of asymmetry.

Equation: UNTITLED Workfile: ENGEL::Engel\				
View	Proc	Object	Print	Name
Freeze	Estimate	Forecast	Stats	Resids
Symmetric Quantiles Test				
Equation: UNTITLED				
Specification: Y C X				
Test statistic compares all coefficients				
Test Summary		Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Wald Test		0.508385	2	0.7755
Restriction Detail: $b(\text{tau}) + b(1-\text{tau}) - 2*b(.5) = 0$				
Quantiles	Variable	Restr. Value	Std. Error	Prob.
0.25, 0.75	C	-5.084370	37.86883	0.8932
	X	-0.002244	0.047568	0.9624

Questions?



Self study