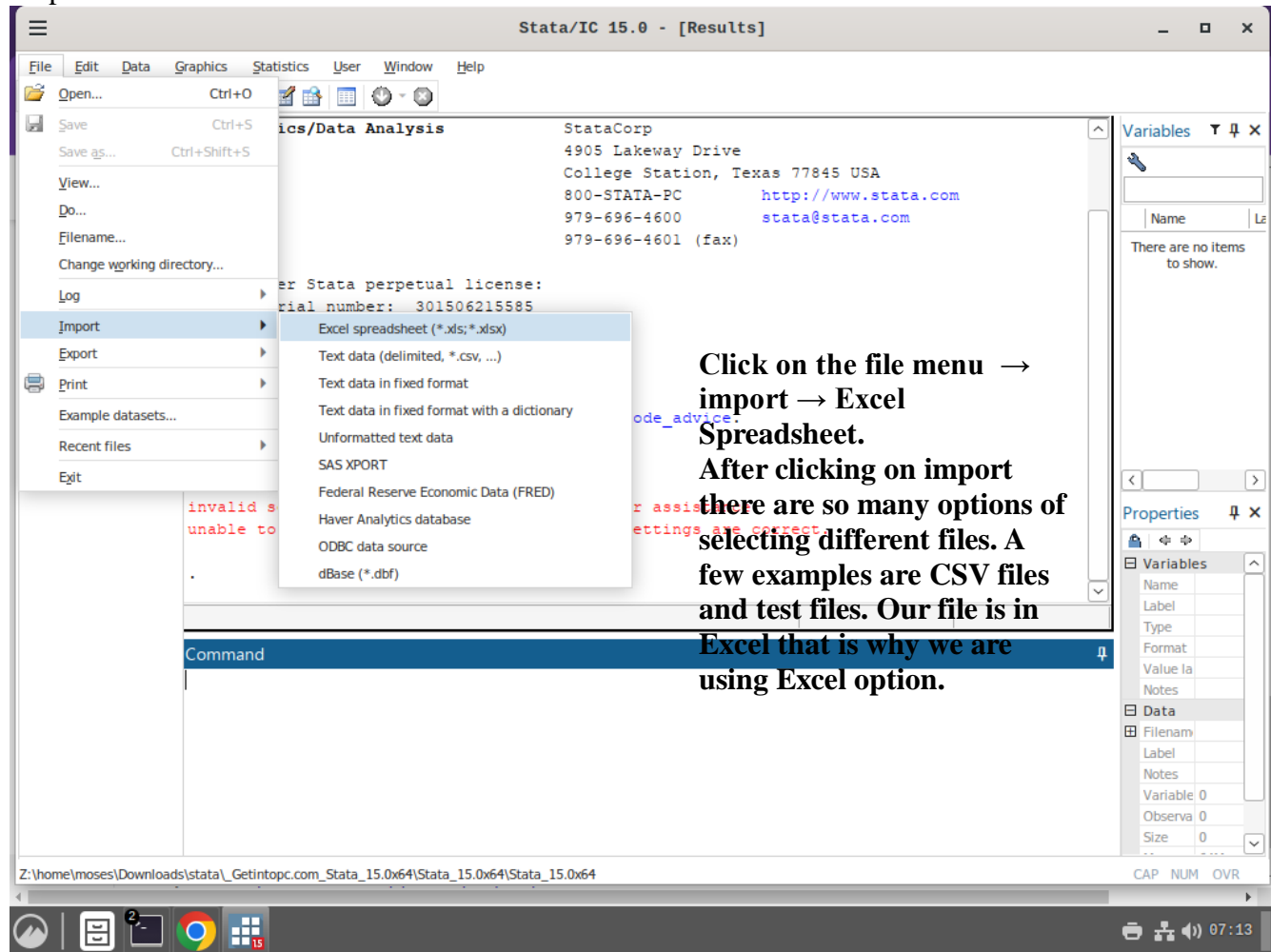
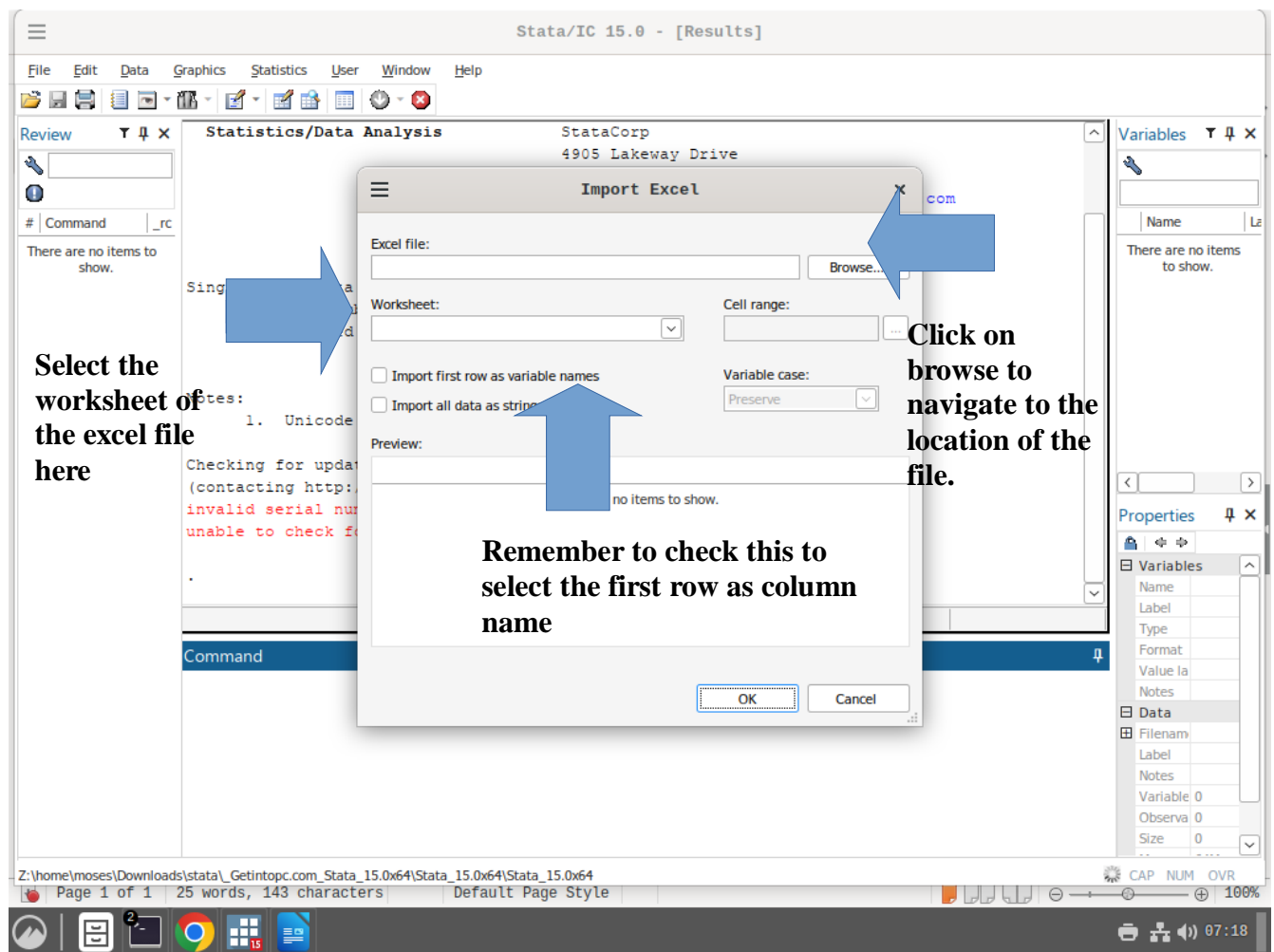


Fitting an ARIMA model in Stata Using Box-jenkins Approach

Step 1: Load the dataset into stata



After clicking the above this is what will appear.



Once you have done the above, click okay and the file will be loaded to stata. The below image shows shows the evidence of the Data set loaded into stata.

Stata/IC 15.0 - [Results]

File Edit Data Graphics Statistics User Window Help

Review

College Station, Texas 77845 USA
800-STATA-PC <http://www.stata.com>
979-696-4600 stata@stata.com
979-696-4601 (fax)

Single-user Stata perpetual license:
Serial number: 301506215585
Licensed to: www.Downloadly.ir
Iran Will Defeat US

Notes:
1. Unicode is supported; see [help unicode_advice](#).

Checking for updates...
(contacting <http://www.stata.com>)
invalid serial number; contact [service.com](http://www.service.com) for assistance
unable to check for update; verify Internet settings are correct.

. import excel "Z:\home\moses\Downloads\Data USA ARIMA.xls", sheet("FRED Graph") firstrow
.

Command

Variables

Name	Label
time	tin
cpi	cp

You will see the variable names here

Z:\home\moses\Downloads\stata_Getintopc.com_Stata_15.0x64\Stata_15.0x64\Stata_15.0x64
Page 2 of 2 55 words, 297 characters Default Page Style
CAP NUM OVR
100%
07:24

Now, its time we create a date variable because this dataset does not have a good date variable. We use the command below.

Stata/IC 15.0 - [Results]

File Edit Data Graphics Statistics User Window Help

979-696-4600 stata@stata.com
979-696-4601 (fax)

Single-user Stata perpetual license:
Serial number: 301506215585
Licensed to: www.Downloadly.ir
Iran Will Defeat US

Notes:
1. Unicode is supported; see [help unicode_advice](#).

Checking for updates...
(contacting <http://www.stata.com>)
invalid serial number; contact service.com for assistance
unable to check for update; verify Internet settings are correct.

```
. import excel "Z:\home\moses\Downloads\Data USA ARIMA.xls", sheet("FRED Graph") firstrow  
. generate months =tm(2008m1)+_n-1  
.
```

Command

Variables

Name	Label
time	tm
cpi	cp
months	

Properties

Variables

Name	Label	Type	Format	Value la	Notes
time	tm				
cpi	cp				
months					

Data

Filename	Label	Notes	Variable	3	Observa	Size
					158	2.16K

Z:\home\moses\Downloads\stata_Getintopc.com_Stata_15.0x64\Stata_15.0x64\Stata_15.0x64

Page 3 of 3 78 words, 421 characters Default Page Style

CAP NUM OVR 100%

07:27

This is the command that we are using. It creates a time variable with column name months. For this dataset, we are using monthly time series and therefore we create the same monthly dates column. Note. This should not happen if the date column is well defined in your dataset.

Lets look at the months column that we have created.

Stata/IC 15.0 - [Results]

Data Editor (Edit) - [Untitled]

time[1] 01jan2008

time cpi months

1 01jan2008 212.174 576

2 01feb2008 212.687 577

3 01mar2008 213.448 578

4 01apr2008 213.942 579

5 01may2008 215.208 580

6 01jun2008 217.463 581

7 01jul2008 219.016 582

8 01aug2008 218.69 583

9 01sep2008 218.877 584

10 01oct2008 216.995 585

11 01nov2008 213.153 586

12 01dec2008 211.398 587

13 01jan2009 211.933 588

14 01feb2009 212.705 589

15 01mar2009 212.495 590

16 01apr2009 212.709 591

17 01may2009 213.022 592

18 01jun2009 214.79 593

19 01jul2009 214.726 594

Ready Vars: 3 Order: Dataset Obs: 158 Filter: Off Mode: Edit CAP NUM

Variables

Name Label

☒ time time

☒ cpi cpi

☒ months

Variables Snapshots

Properties

Variables

Name time

Label time

Type int

Format %td

Value label

Notes

Data

Filename

Label

Notes

Variables

Name

Label

Type

Format

Value label

Notes

Data

Filename

Label

Notes

Variable 3

Observed 158

Size 2.16K

Page 4 of 4 88 words, 475 characters Default Page Style CAP NUM OVR 100%

07:32

You can see that the column has some numbers and we created it to have dates. This is a Stata way of identifying the specific months. Its like computer language.

Lets format the months column very well

Stata/IC 15.0 - [Results]

Data Editor (Edit) - [Untitled]

File Edit Data Graphics Statistics User Window

time[1] 01jan2008

time cpi months

1 01jan2008 212.174 2008m1

2 01feb2008 212.687 2008m2

3 01mar2008 213.448 2008m3

4 01apr2008 213.942 2008m4

5 01may2008 215.208 2008m5

6 01jun2008 217.463 2008m6

7 01jul2008 219.016 2008m7

8 01aug2008 218.69 2008m8

9 01sep2008 218.877 2008m9

10 01oct2008 216.995 2008m10

11 01nov2008 213.153 2008m11

12 01dec2008 211.398 2008m12

13 01jan2009 211.933 2009m1

14 01feb2009 212.705 2009m2

15 01mar2009 212.495 2009m3

16 01apr2009 212.709 2009m4

17 01may2009 213.022 2009m5

18 01jun2009 214.79 2009m6

19 01jul2009 214.726 2009m7

Variables

Variables Snapshots

Properties

Variables

Name time

Label time

Type int

Format %td

Value label

Notes

Data

Filename

Label

Notes

Ready Vars: 3 Order: Dataset Obs: 158 Filter: Off Mode: Edit CAP

Observa 158

Size 2.16K

CAP NUM OVR

Page 5 of 5 95 words, 514 characters Default Page Style 100%

07:34

Single-user Stata perpe
Serial number:
Licensed to:

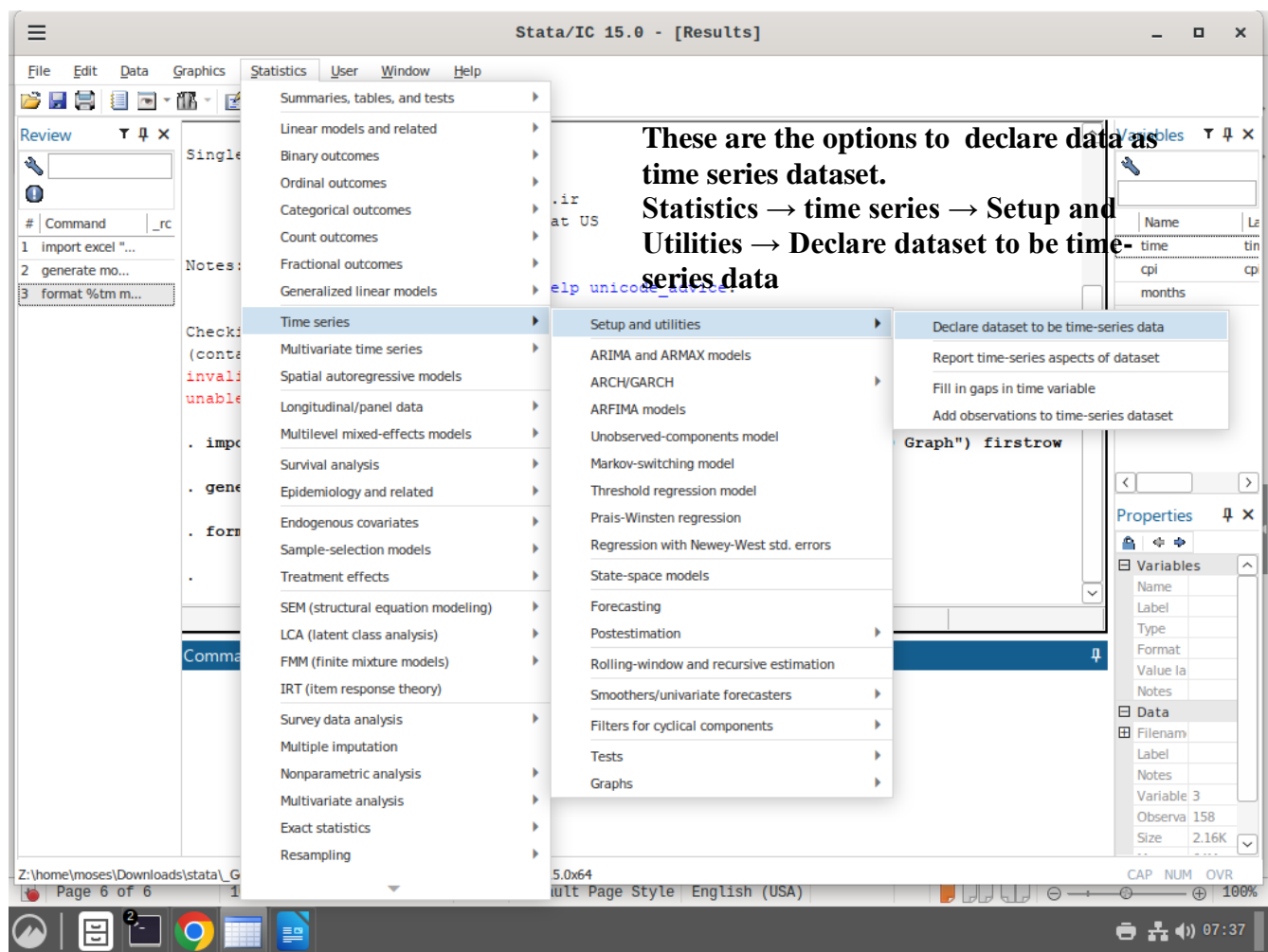
Notes:
1. Unicode is su
Checking for updates...
(contacting http://www.
invalid serial number;
unable to check for upd
. import excel "Z:\home
generate months =tm(2
format %tm months

1 import excel "...
2 generate mo...
3 format %tm m...

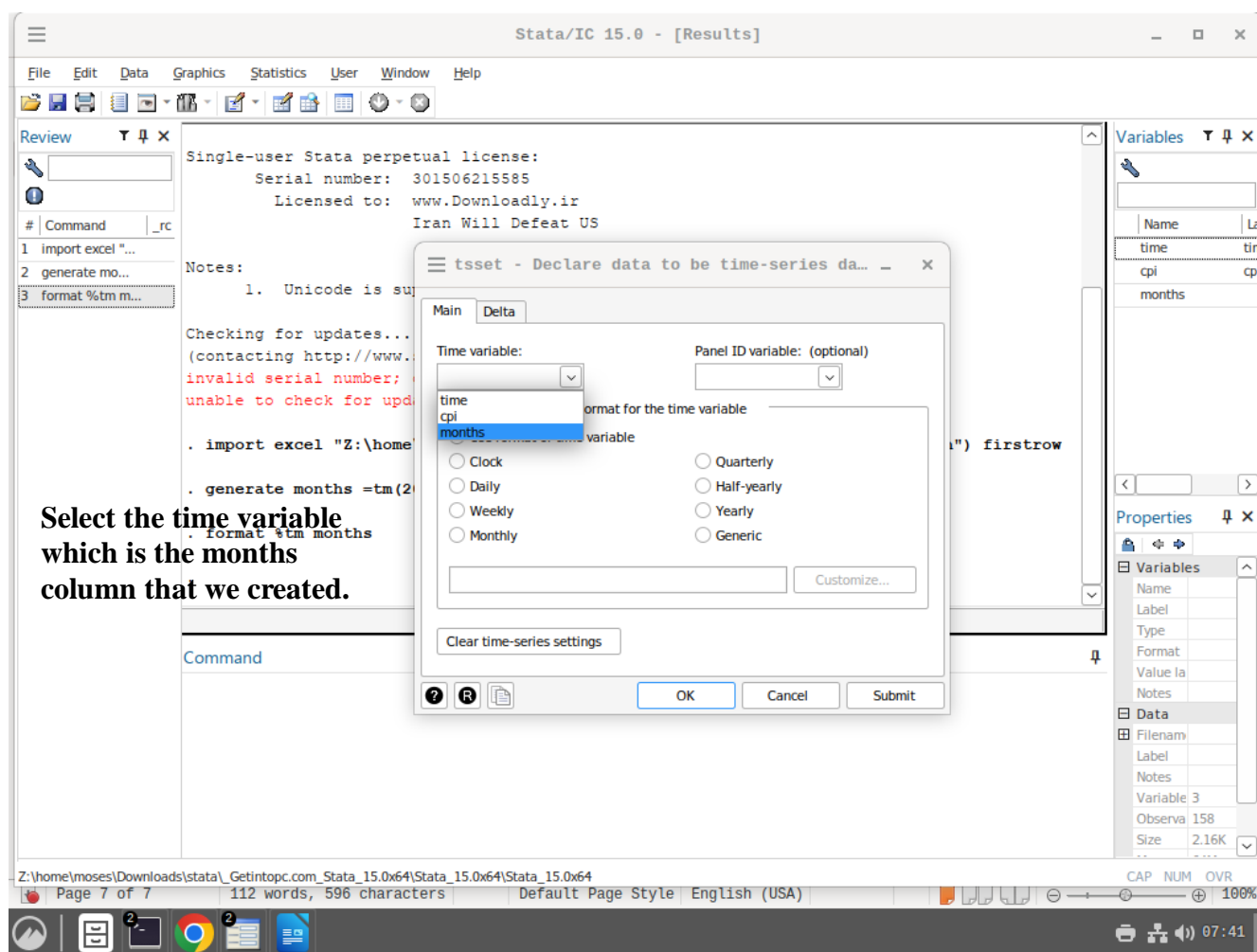
Now the months column is in a way that we can easily understand.

This is the code used to format the column in the way we can easily understand.

step 2: set the data set as time series



If you click on it, the following appears.



On the output window this is what appears.

Stata/IC 15.0 - [Results]

File Edit Data Graphics Statistics User Window Help

Review

Notes:

1. Unicode is supported; see [help unicode_advice](#).

Checking for updates...
(contacting <http://www.stata.com>)
invalid serial number; contact service.com for assistance
unable to check for update; verify Internet settings are correct.

```
. import excel "Z:\home\moses\Downloads\Data USA ARIMA.xls", sheet("FRED Graph") firstrow  
. generate months =tm(2008m1)+_n-1  
. format %tm months  
. tsset months  
    time variable:  months, 2008m1 to 2021m2  
        delta:    1 month  
. 
```

Command

Variables

Name	Label
time	tin
cpi	cp
months	

Properties

Variables

Name	Label	Type	Format	Value la	Notes
time	tin				

Data

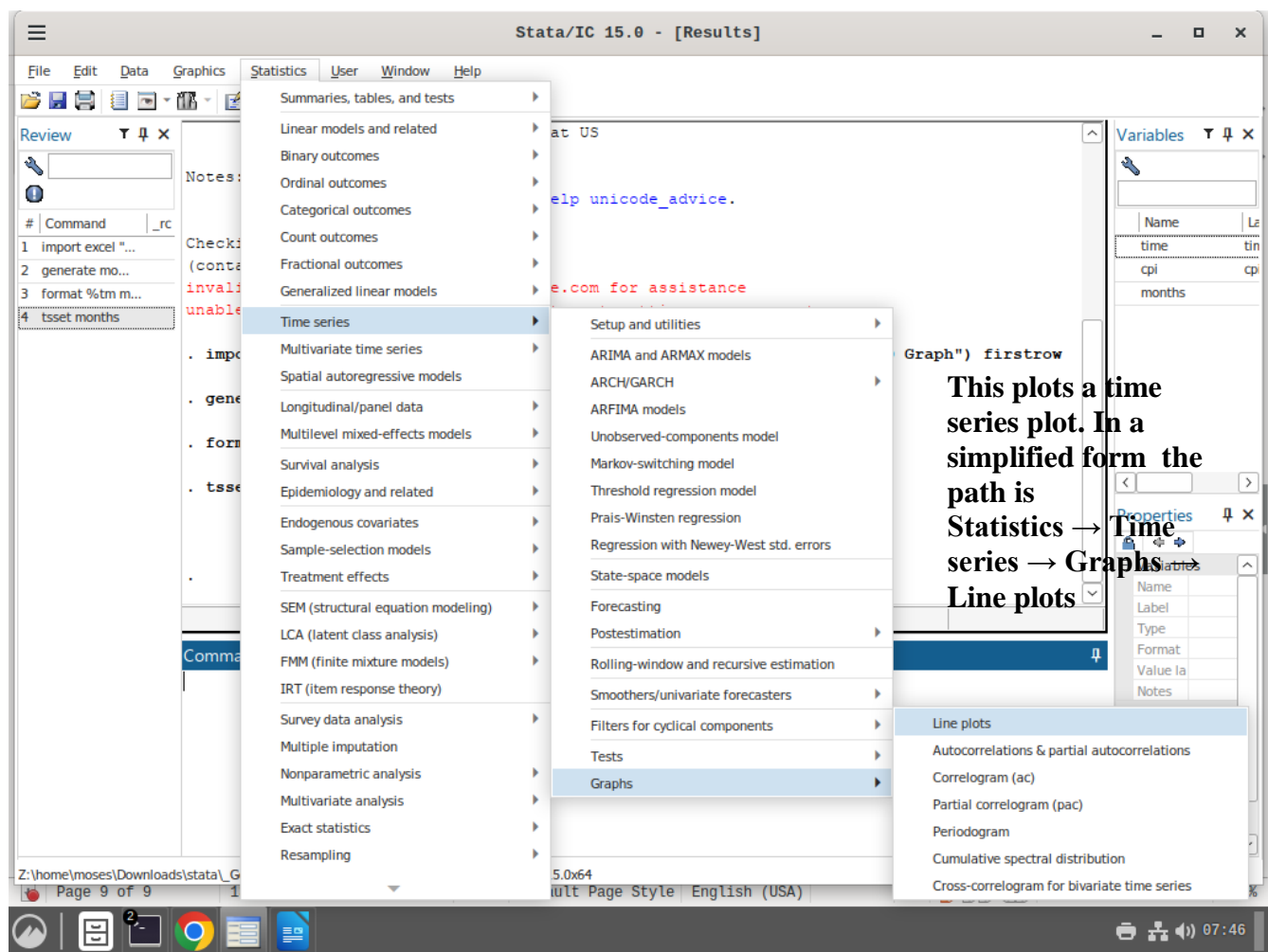
Filename	Label	Notes	Variable	Size
			3	2.16K

Page 8 of 8 120 words, 639 characters Default Page Style English (USA) 07:43

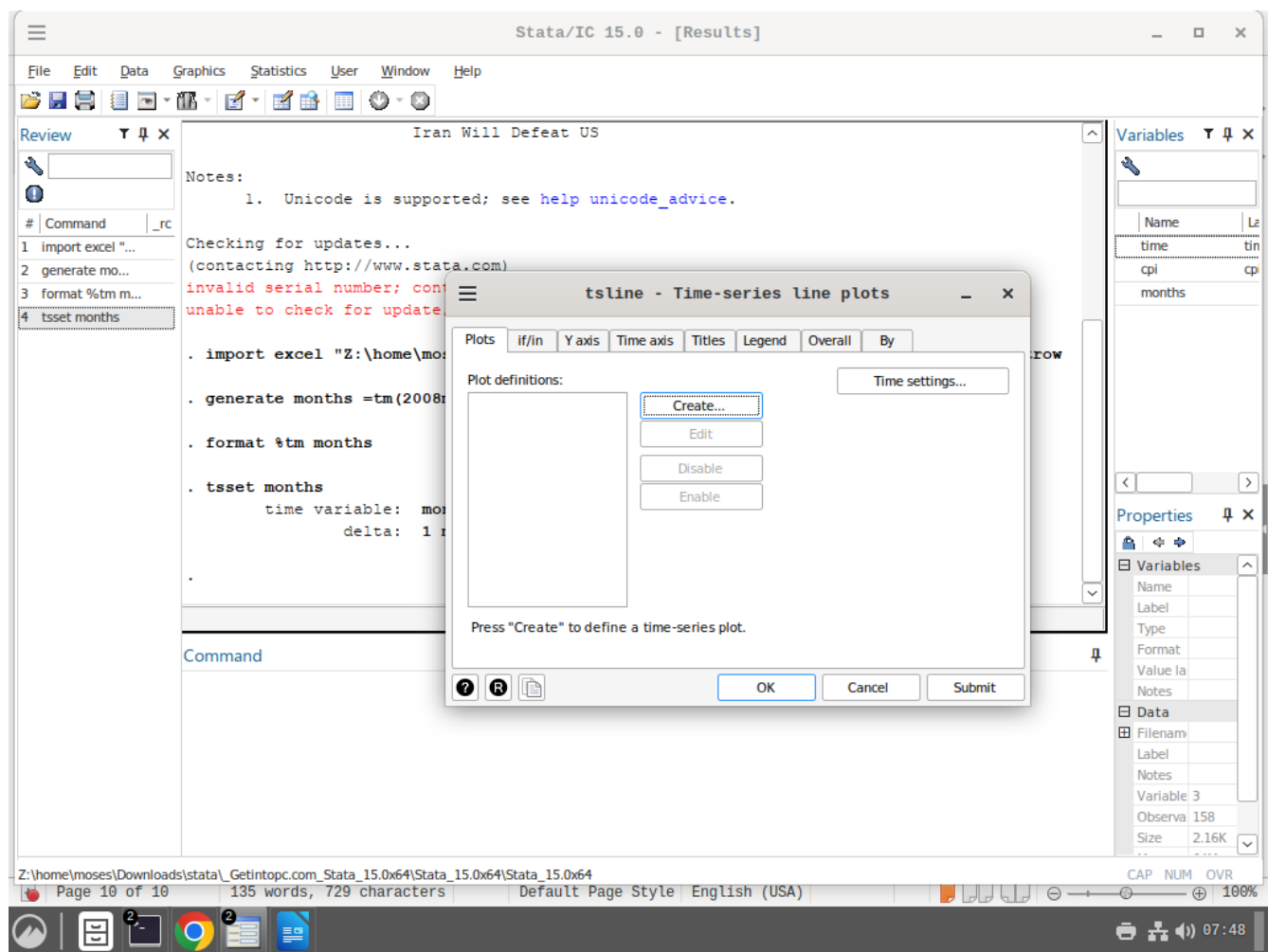
The command **tsset months** is run. Months is the column we selected. Also, the delta option shows the frequency of the data set which is monthly.

Step 3: Checking for stationary

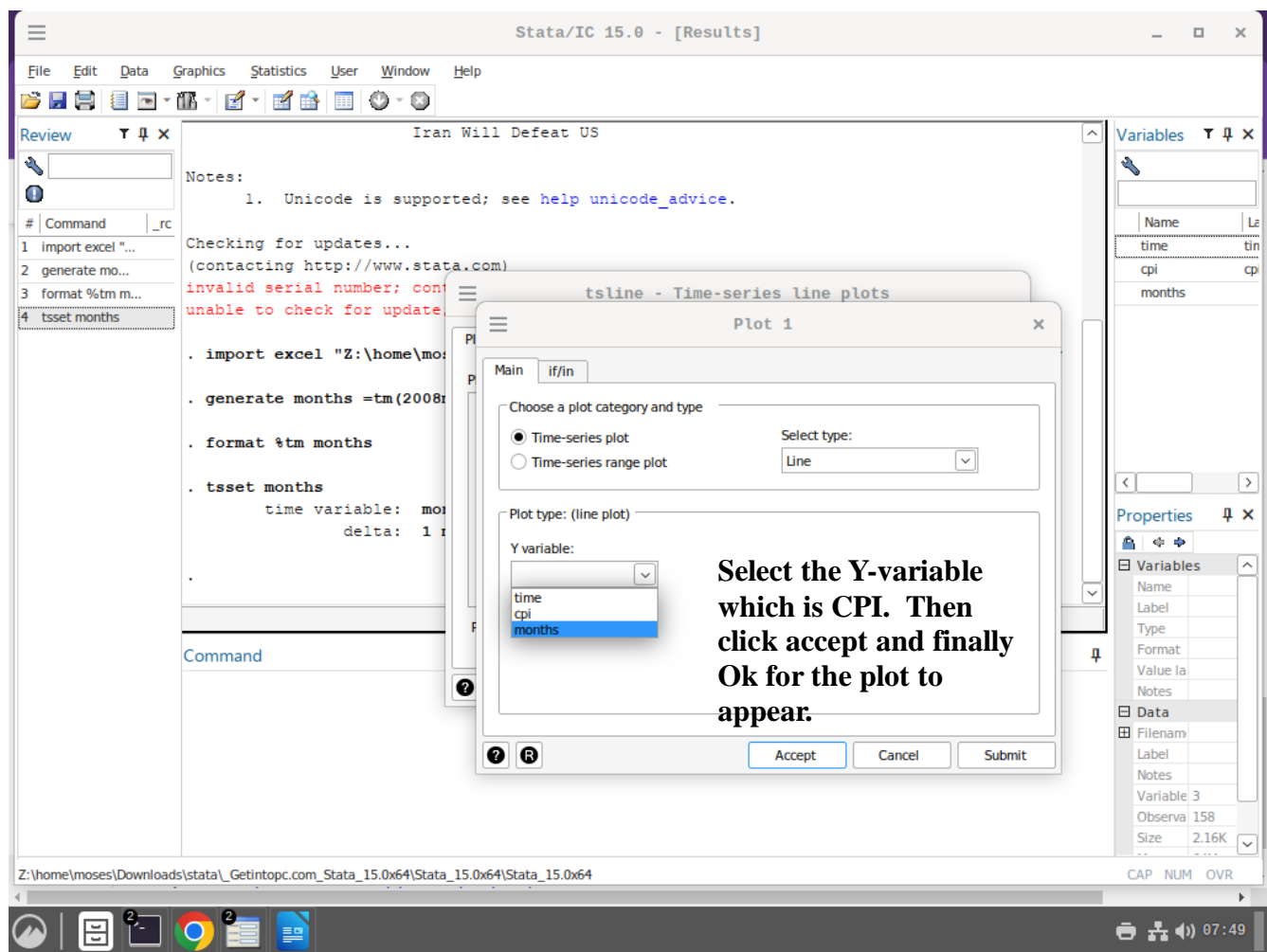
First we start with the visual inspection of the dataset.



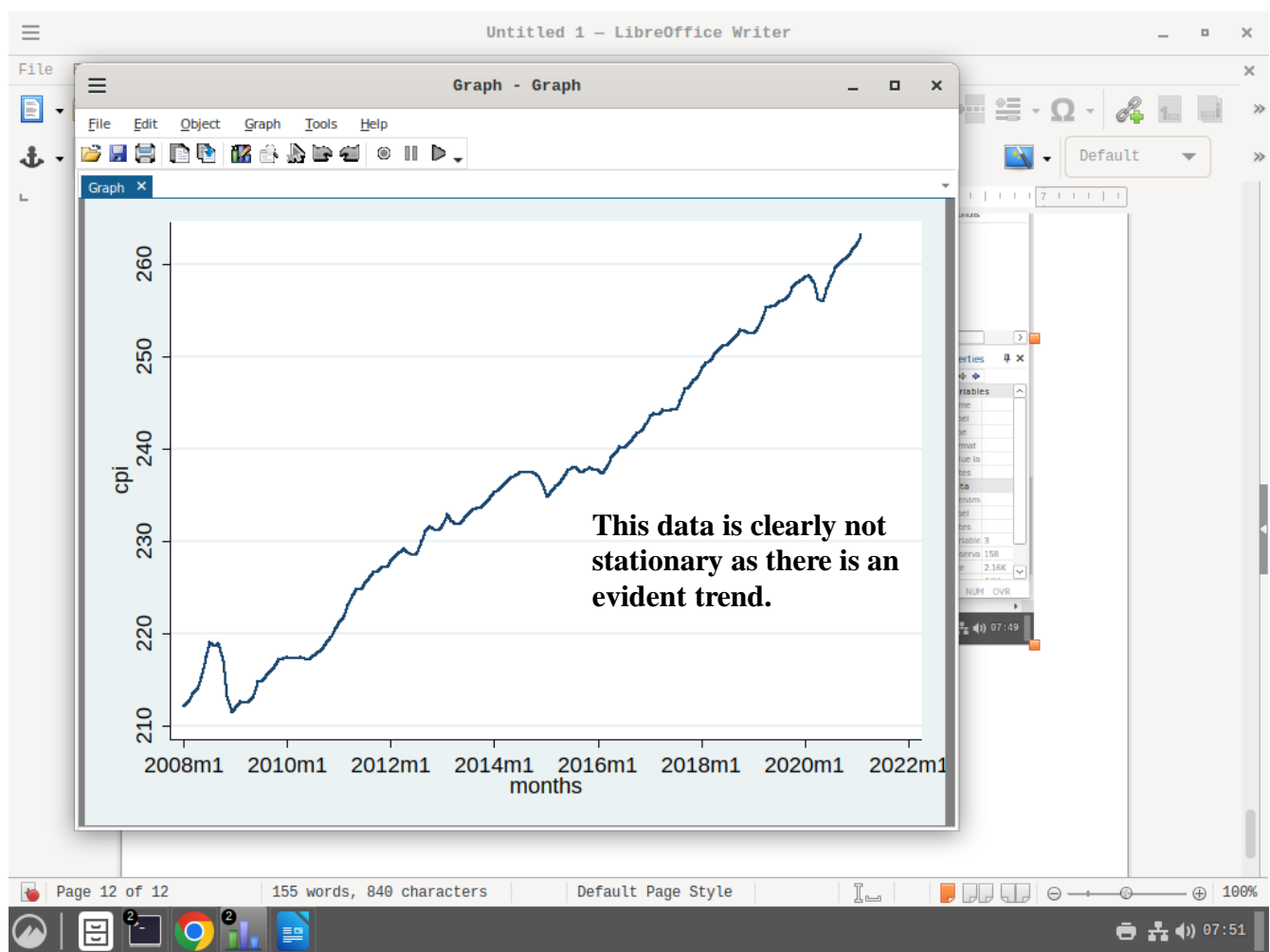
The following dialog box appears.



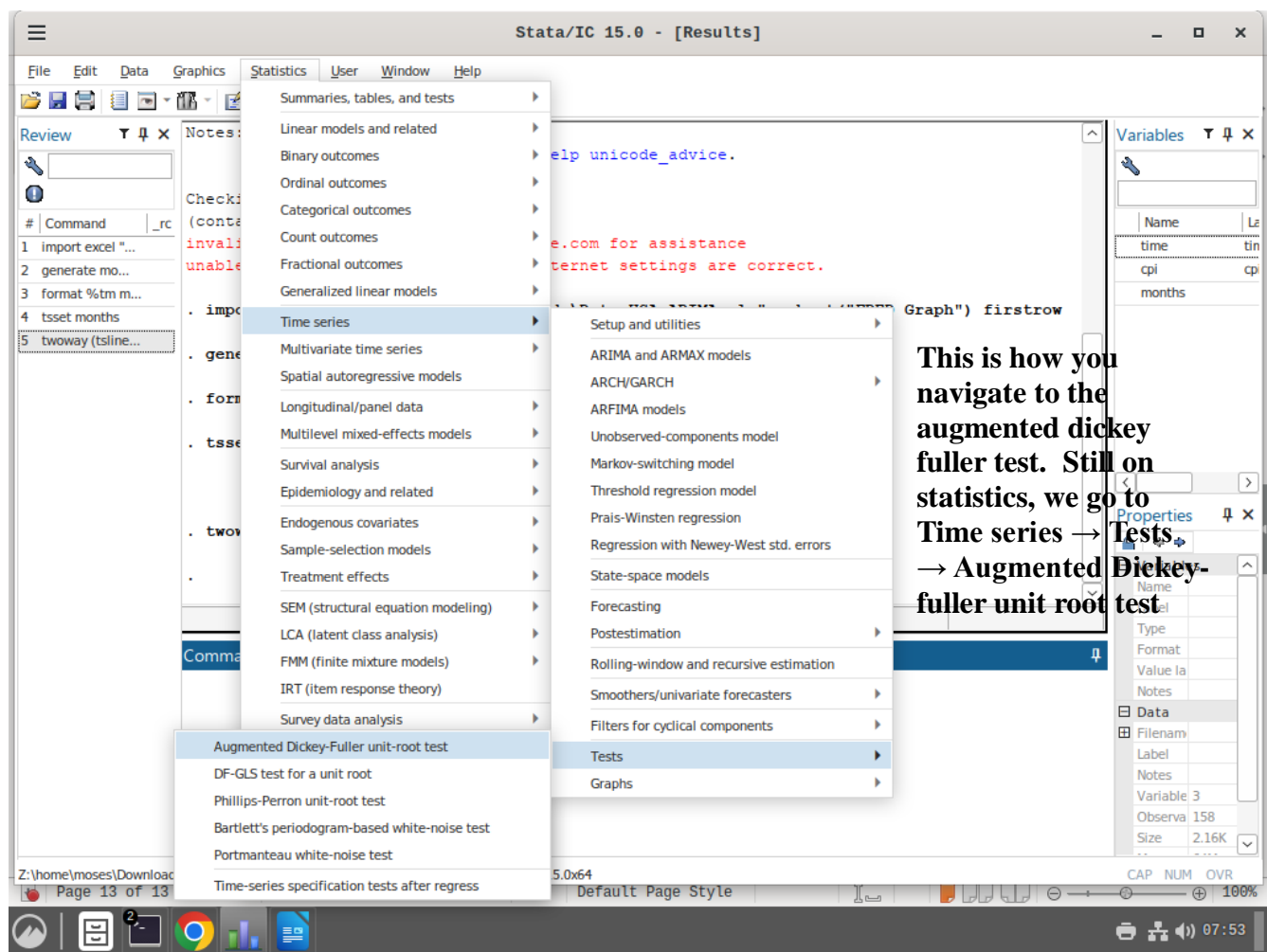
Click on create and another window appears that we will use to create a plot.



The following is a plot the opens on a new window.



Lets check for stationarity using a statistical test. Lets just use Dickey fuller test



This is what appears when you click on it.

Stata/IC 15.0 - [Results]

File Edit Data Graphics Statistics User Window Help

Review

Notes:

```
1. Unicode is supported; see help unicode\_advice.  
Checking for updates...  
(contacting http://www.stata.com)  
invalid serial number; contact service.com for assistance  
unable to check for update; verify Internet settings are correct.
```

```
. import excel "Z:\home\moses\Downloads\stata_Getintopc.com_Stata_15.0x64\Stata_15.0x64\Stata_15.0x64" --sheet "Sheet1" --firstsheet  
. generate months = tm(2008m1) --in  
. format %tm months  
. tsset months  
    time variable: months  
    delta: 1 month  
. twoway (tsline cpi)
```

Command

Variables

Name	Label
time	tm
cpi	cp
months	

Properties

Variables

Name	Label	Type	Format	Value label	Notes
time	tm	string	%tm		
cpi	cp	float	%f		
months		string	%tm		

Data

File name	Label	Notes	Variable	Size
time	tm		3	158
cpi	cp		3	2.16K
months			3	2.16K

dfuller - Augmented Dickey-Fuller unit-ro... - x

Main if/in

Variable:

cpi
time
months

☐ Include trend term in regression
☐ Include drift term in regression
☐ Display regression table

0 Lagged differences

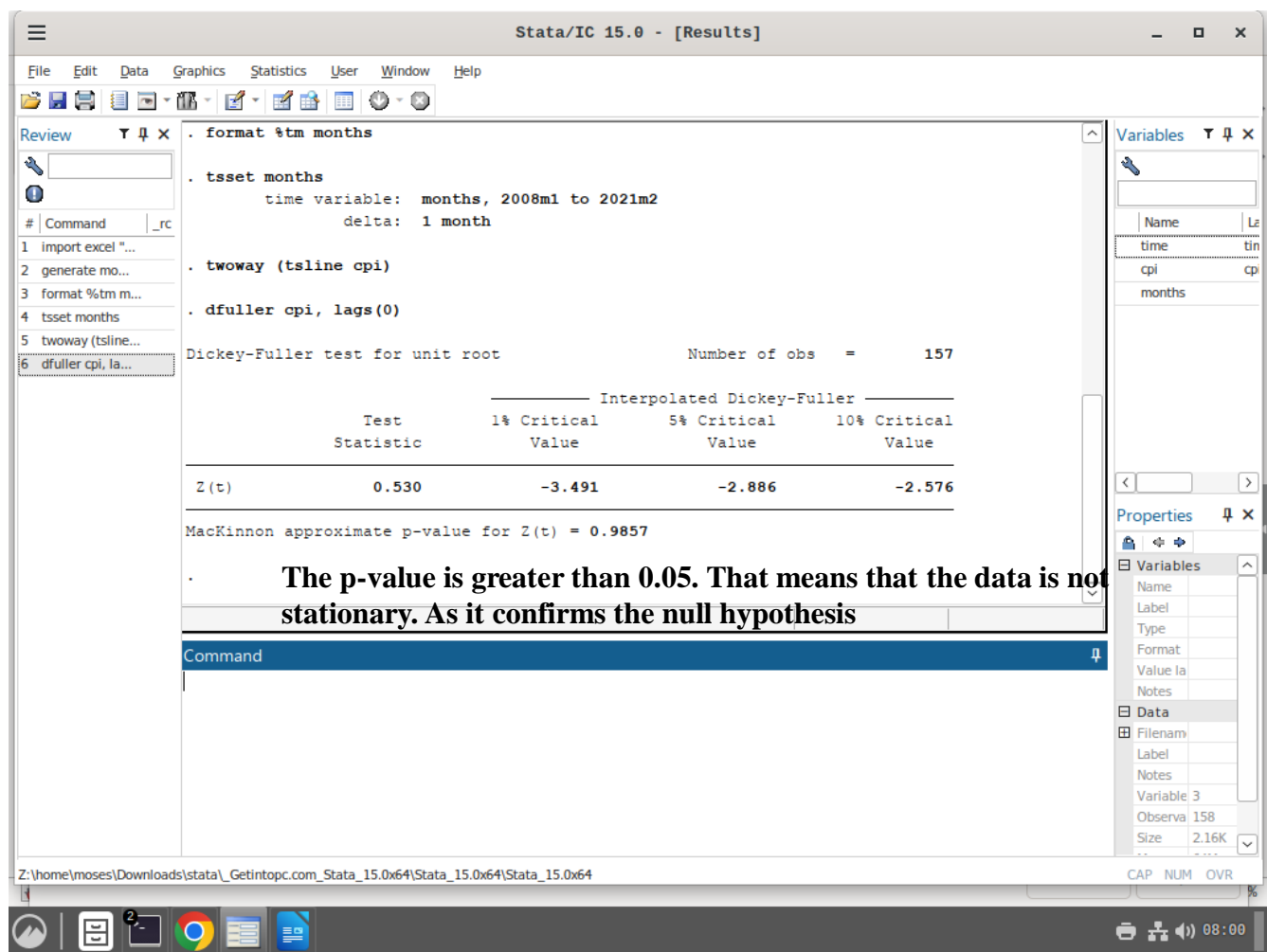
Time settings...

OK Cancel Submit

Select the variable that we are testing for unit roots.

Page 14 of 14 189 words, 1,020 characters Default Page Style CAP NUM OVR 100% 07:58

Lets see the results and interpret



Step 3: differencing if necessary

Stata/IC 15.0 - [Results]

File Edit Data Graphics Statistics User Window Help

Review

```

1 import excel "...
2 generate mo...
3 format %tm m...
4 tsset months
5 twoway (tsline...
6 dfuller cpi, la...

```

Command

```

. format %tm months
. tsset months
    time variable:  months, 2008m1 to 2021m2
                  delta:  1 month
. twoway (tsline cpi)
. dfuller cpi, lags(0)

```

Results

Dickey-Fuller test for unit root

Test	Statistic
$z(t)$	-0.530

MacKinnon approximate p-value

Command

dfuller - Augmented Dickey-Fuller unit-ro...

Main if/in

Variable: d.cpi

Options

- ☐ Suppress constant term in regression
- ☐ Include trend term in regression
- ☐ Include drift term in regression
- ☐ Display regression table
- ☐ Lagged differences

0

OK Cancel Submit

Variables

Name	Label
time	tin
cpi	cp
months	

Properties

Variables

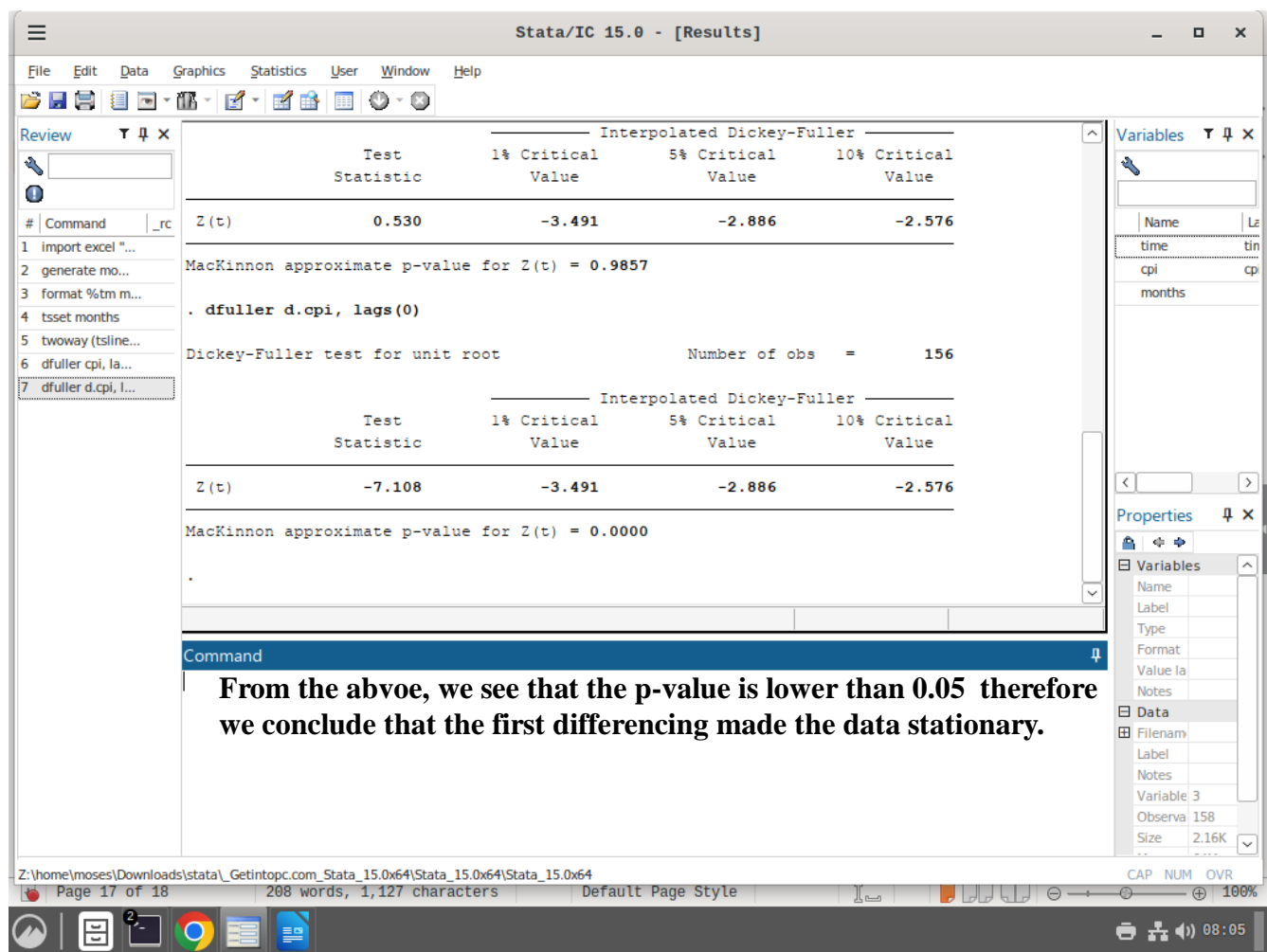
Name	Label	Type	Format	Value la	Notes
time	tin	string	%tm		
cpi	cp	float	%f		
months		string	%tm		

Data

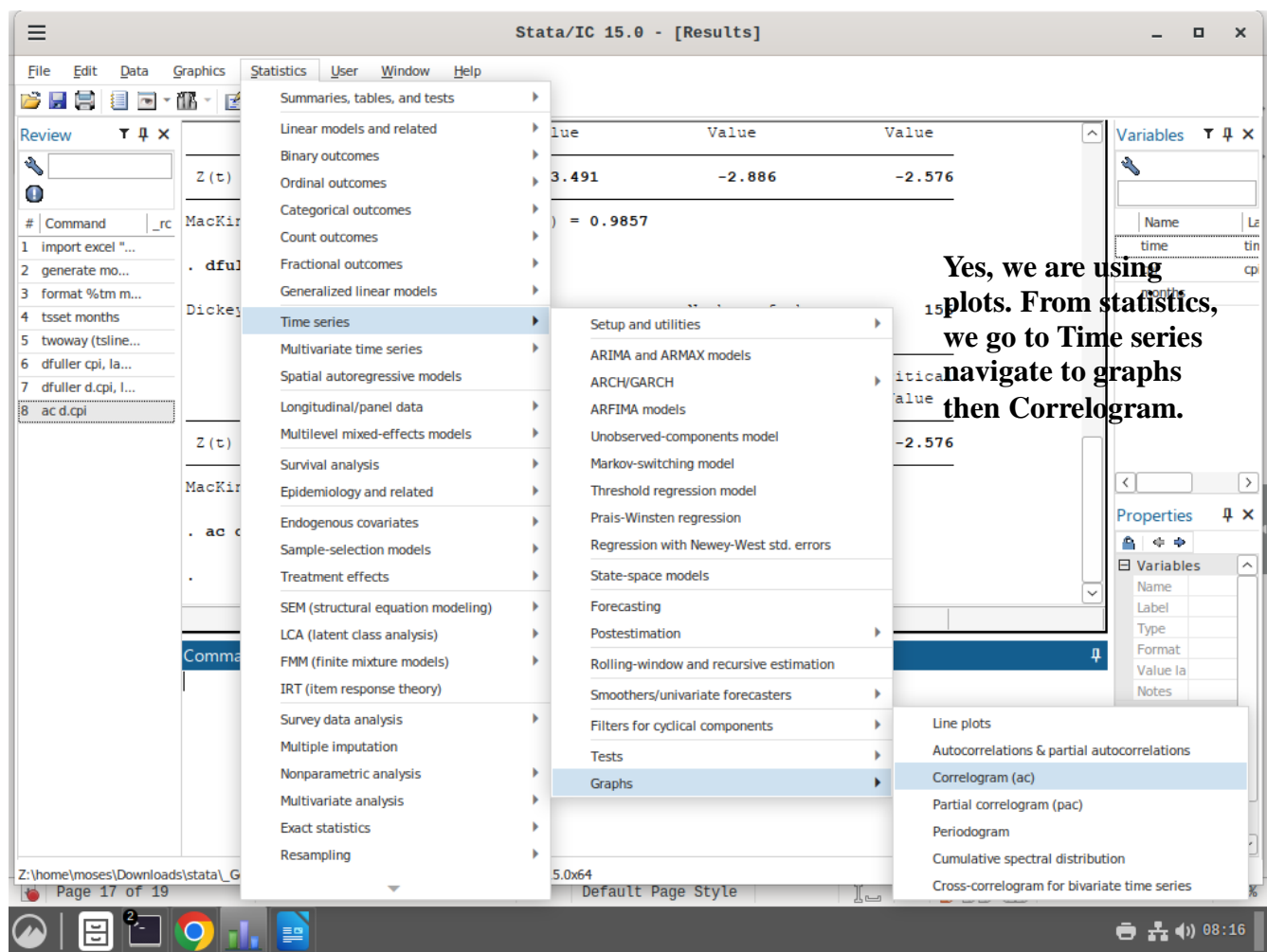
File name	Label	Notes	Variable	Observations	Size
Stata_15.0x64			3	158	2.16K

Page 16 of 17 200 words, 1,087 characters Default Page Style 100% 08:03

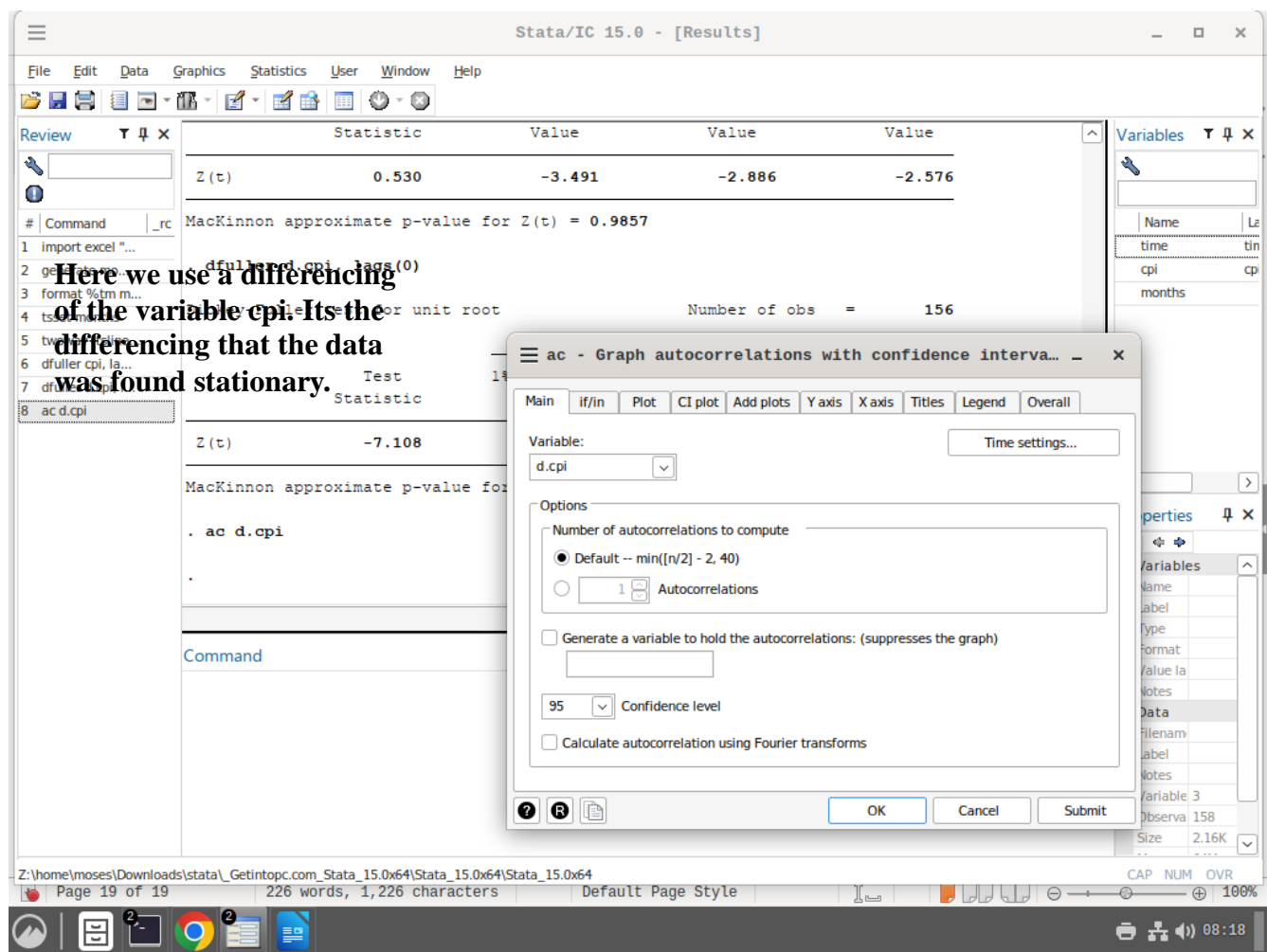
The results of the above is shown below.



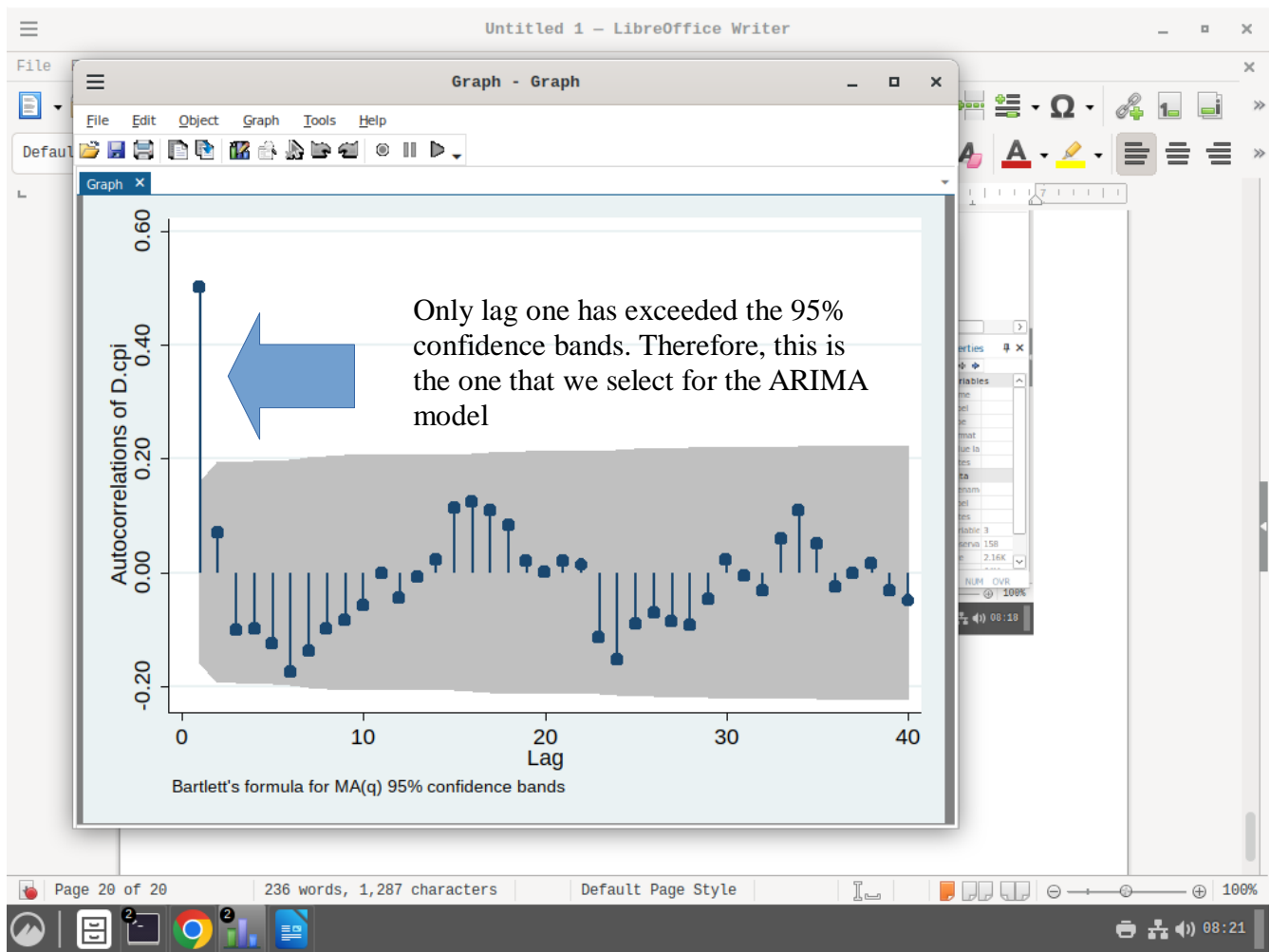
Step 5: Determine the ma values using ACF plots



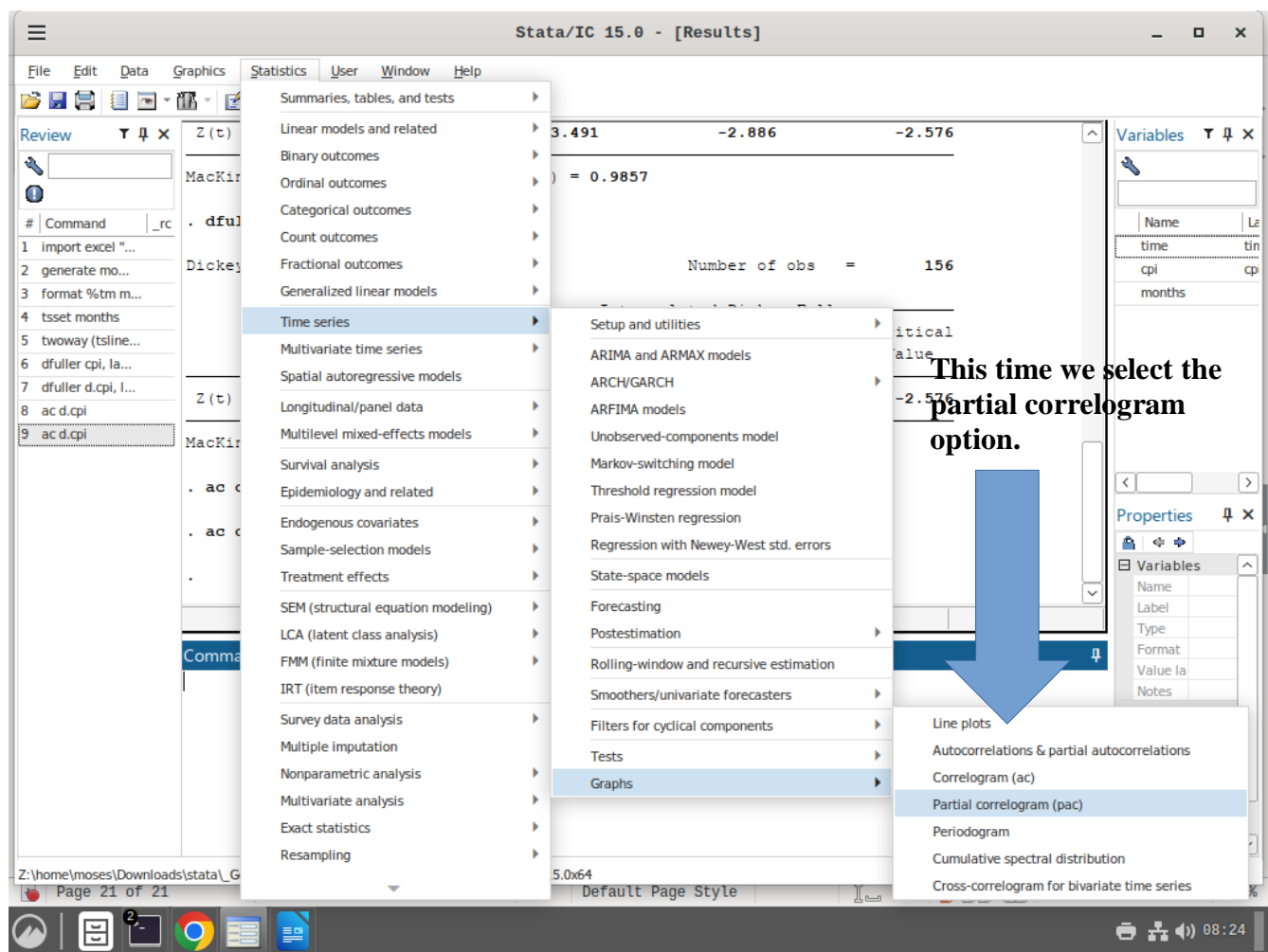
After clicking the above, we see the following window.



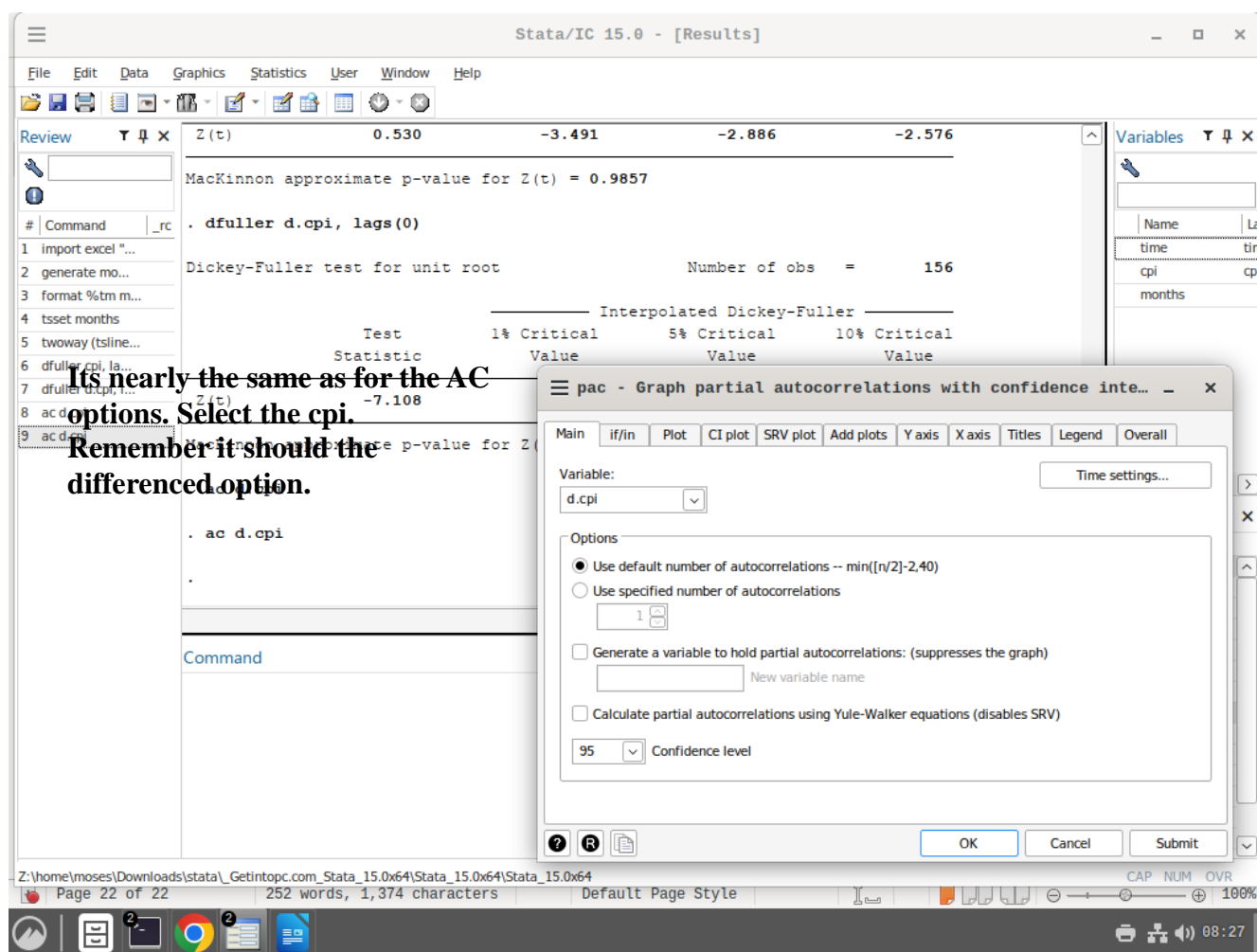
After clicking okay, this is the chart that is displayed.



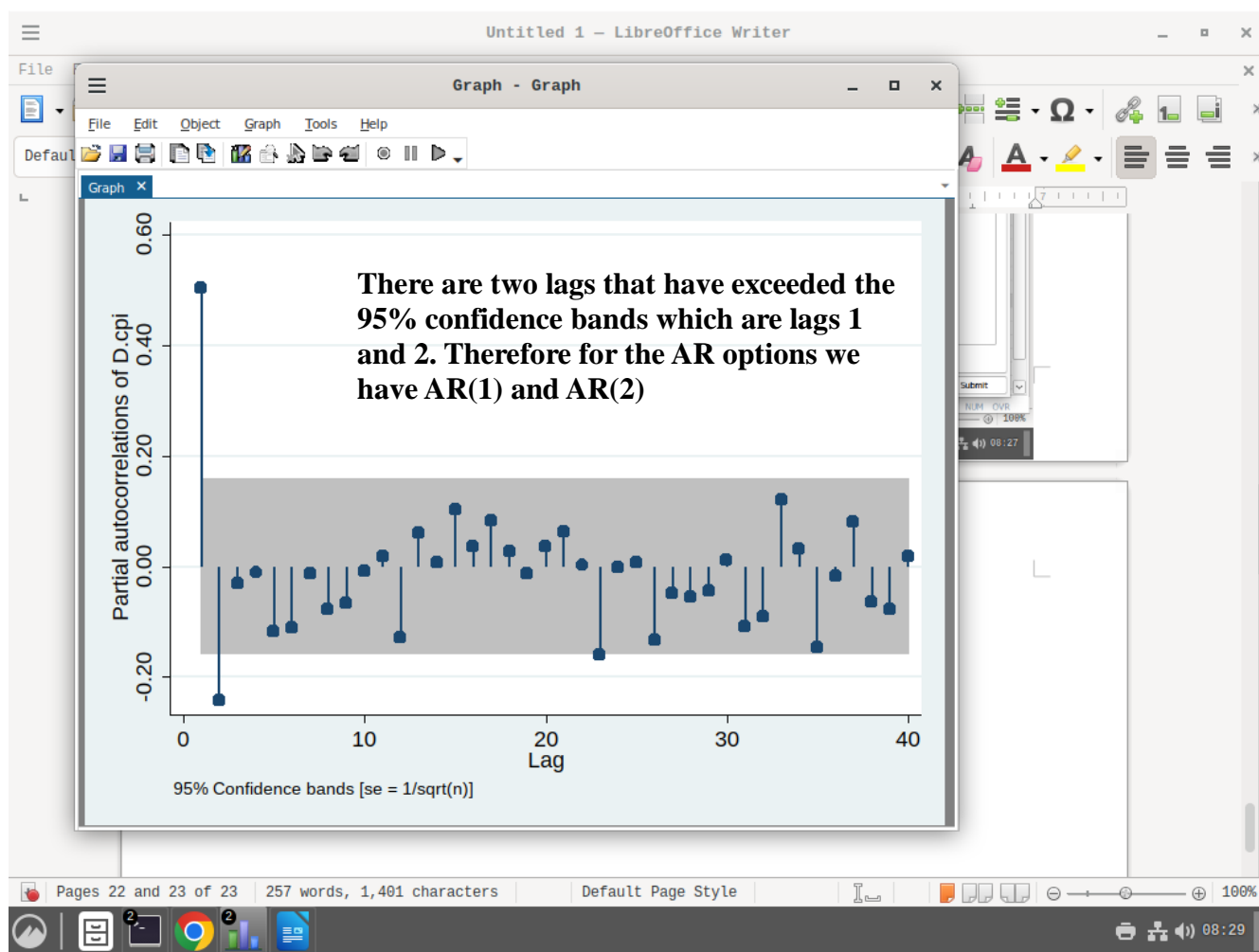
Step 6: Selecting the p values for the model.



This is the resulting window that appears



This is the resulting graph



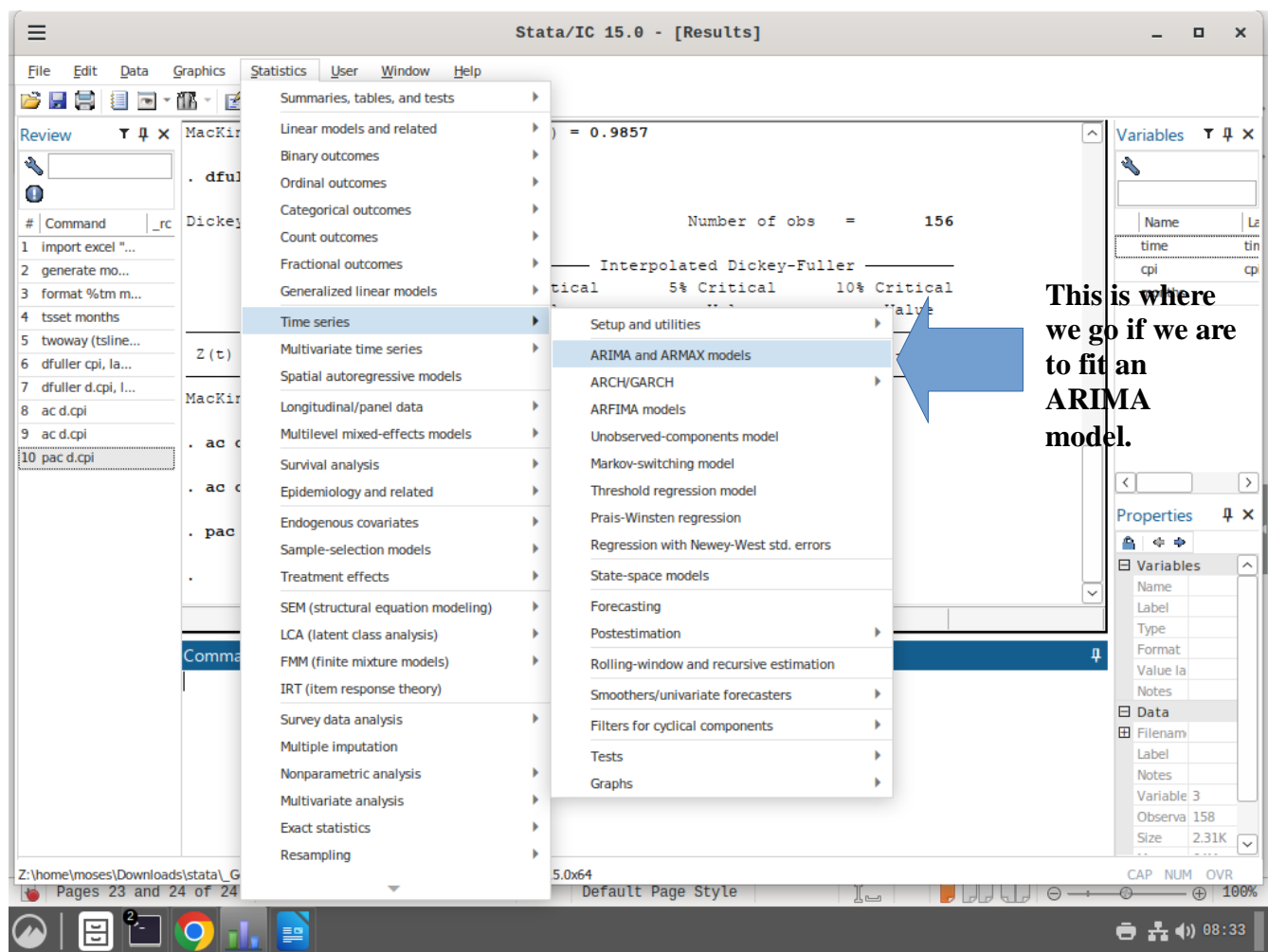
A simple summary of what we have obtained.

AR	I	ma
1	1	1
2		

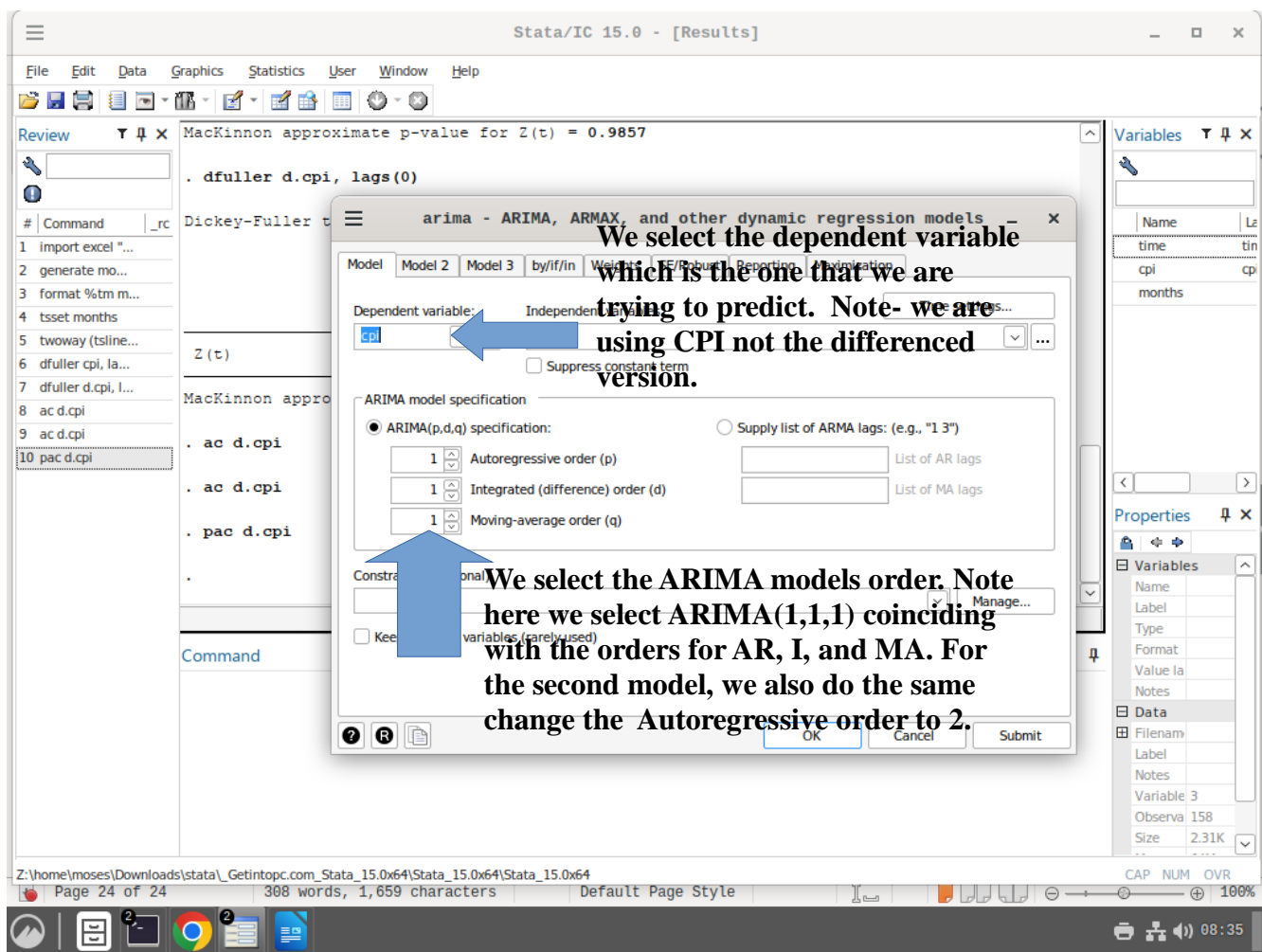
Therefore we have the options of the following ARIMA models

ARIMA(1,1,1) and ARIMA (2,1,1). These are the ones that we will fit.

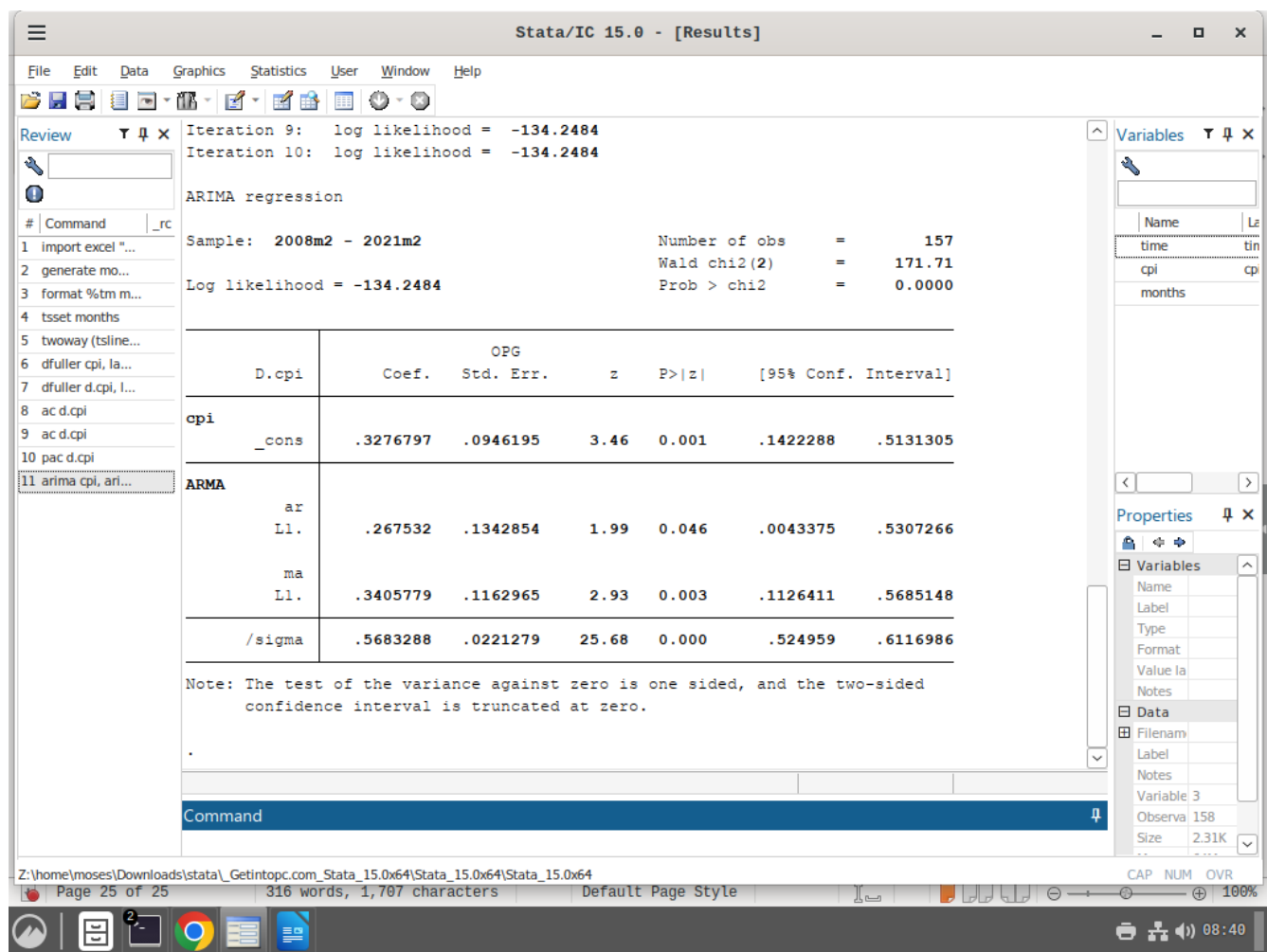
Fitting the models that we found



After clicking the above this is what appears.



The results of the ARIMA(1,1,1) is shown below.



Note that ar at lag 1, ma at lag 1 and the constant is significant and 0.05.

For the ARIMA(2,1,1) I did not provide the screenshot of fitting it as the approach is the same. However, here is the output.

Stata/IC 15.0 - [Results]

File Edit Data Graphics Statistics User Window Help

Review Y ↑ × Iteration 10: log likelihood = -132.69119

ARIMA regression

Sample: 2008m2 - 2021m2 Number of obs = 157
 Log likelihood = -132.6912 Wald chi2(3) = 276.22
 Prob > chi2 = 0.0000

	D.cpi	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
cpi						
_cons		.3174474	.0563575	5.63	0.000	.2069888 .4279059
ARMA						
ar						
L1.		1.303678	.1158491	11.25	0.000	1.076617 1.530738
L2.		-.5294072	.0536028	-9.88	0.000	-.6344668 -.4243476
ma						
L1.		-.7688469	.1386567	-5.54	0.000	-1.040609 -.4970848
/sigma		.5624717	.0260107	21.62	0.000	.5114916 .6134517

Note: The test of the variance against zero is one sided, and the two-sided confidence interval is truncated at zero.

Command

Variables Y ↑ ×

Properties Y ↑ ×

Variables

Name

Label

Type

Format

Value la

Notes

Data

Filenam

Label

Notes

Variable 3

Observa 158

Size 2.31K

Z:\home\moses\Downloads\stata_Getintopc.com_Stata_15.0x64\Stata_15.0x64\Stata_15.0x64

Page 26 of 26 356 words, 1,911 characters Default Page Style

CAP NUM OVR

100%

08:44

This one has added lag 2. now it has 4 parameters out of which all of them are statistically significant.

Comparison of the two models

Stata/IC 15.0 - [Results]

File Edit Data Graphics Statistics User Window Help

Review

Command _rc

```

1 import excel "...
2 generate mo...
3 format %tm m...
4 arima cpi, ari... 111
5 tsset cpi 451
6 tsset months
7 arima cpi, ari...
8 estat ic

```

Note: The test of the variance against zero is one-sided, and the two-sided confidence interval is truncated at zero.

. estat ic

Akaike's information criterion and Bayesian information criterion

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	157	.	-134.2484	4	276.4968	288.7218

Note: N=Obs used in calculating BIC; see [R] BIC note.

Command

These are the metrics that we need to evaluate the models. Re do this for the ARIMA(2,1,1)

Variables

Name	Label
time	tin
cpi	cp
months	

Properties

Variables

Data

Filenam

Label

Notes

Variable 3

Observa 158

Size 2.31K

Z:\home\moses\Downloads\stata_Getintopc.com_Stata_15.0x64\Stata_15.0x64\Stata_15.0x64

Page 28 of 28 361 words, 1,939 characters Default Page Style

18:43

The results of the ARIMA(2,1,1)

Stata/IC 15.0 - [Results]

File Edit Data Graphics Statistics User Window Help

Review

Command _rc

```

1 import excel "...
2 generate mo...
3 format %tm m...
4 arima cpi, ari... 111
5 tsset cpi 451
6 tsset months
7 arima cpi, ari...
8 estat ic
9 arima cpi, ari...
10 estat ic

```

	ma					
L1.	-.7688469	.1386567	-5.54	0.000	-1.040609	-.4970848
/sigma	.5624717	.0260107	21.62	0.000	.5114916	.6134517

Note: The test of the variance against zero is one sided, and the two-sided confidence interval is truncated at zero.

. estat ic

Akaike's information criterion and Bayesian information criterion

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	157	.	-132.6912	5	275.3824	290.6636

Note: N=Obs used in calculating BIC; see [R] BIC note.

Command

Copy the values for the AIC, BIC, and LL to a table and evaluate for the two variables.

Variables

Name	Label
time	tin
cpi	cp
months	

Properties

Variables

Name	Label	Type	Format	Value la	Notes
time	tin				
cpi	cp				
months					

Data

Filename	Label	Notes	Variable	Observa	Size
			3	158	2.31K

Page 29 of 29 366 words, 1,970 characters Default Page Style English (USA) 100% 18:47

We found that ARIMA(2,1,1) was stable. So we use this model and perform diagnostic analysis.

Make residual predictions

The screenshot shows the Stata/IC 15.0 - [Results] window. The 'Statistics' menu is open, and 'Postestimation' is highlighted. A blue arrow points to the 'Postestimation' option. The main window displays regression results for a model with variables 'time', 'cpi', and 'months'.

Variable	Coef.	Std. Err.	z	P > z
time	-5.54	0.000	-1.040609	.4970848
cpi	21.62	0.000	.5114916	.6134517
months				

Model fit statistics:

Statistic	Value
ll(model)	-132.6912
df	5
AIC	275.3824
BIC	290.6636

Postestimation results:

Statistic	Value
ll(model)	-132.6912
df	5
AIC	275.3824
BIC	290.6636

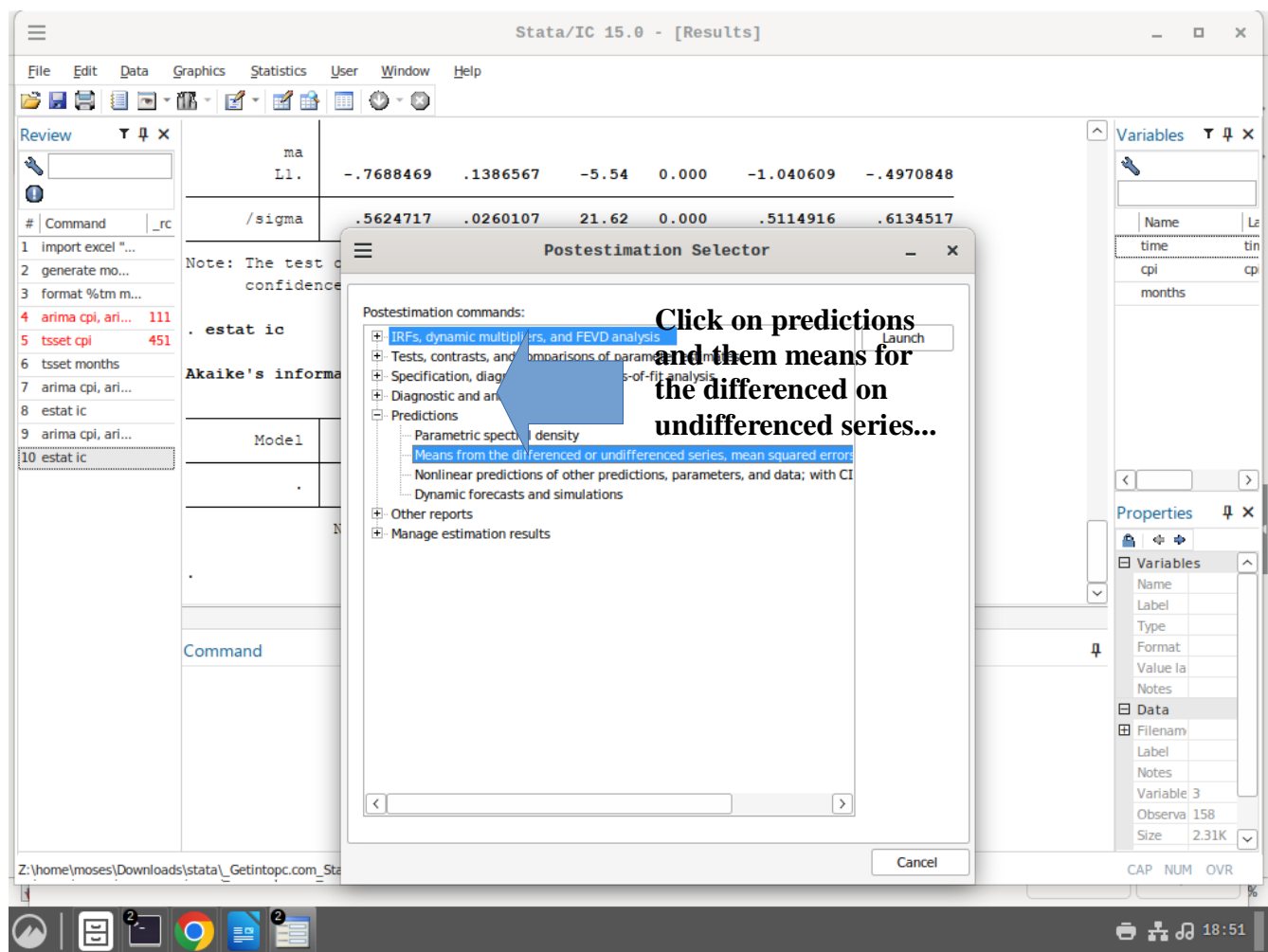
Model fit statistics:

Statistic	Value
ll(model)	-132.6912
df	5
AIC	275.3824
BIC	290.6636

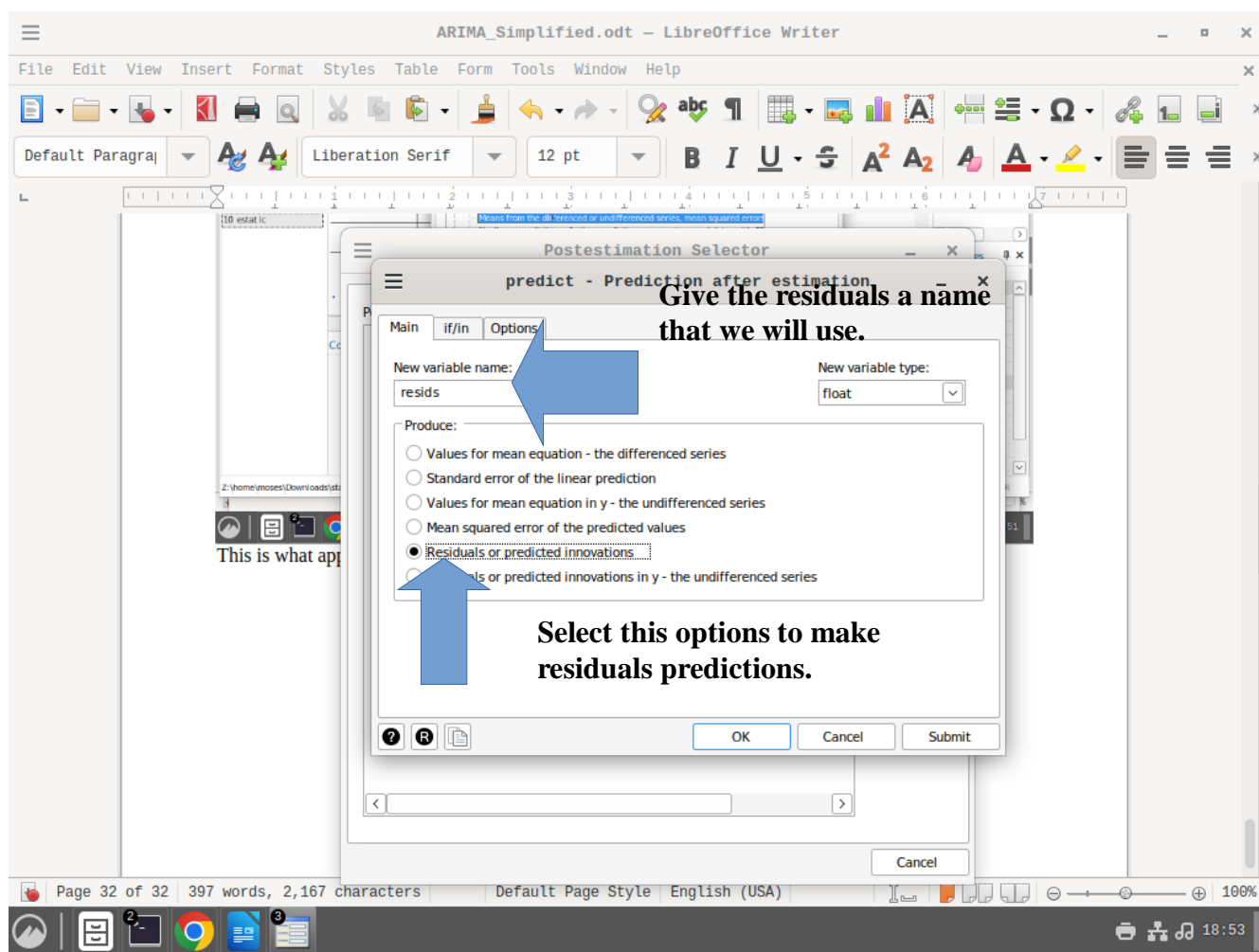
Model fit statistics:

Statistic	Value
ll(model)	-132.6912
df	5
AIC	275.3824
BIC	290.6636

after clicking post estimation, we get the following.



This is what appears next



With that lets perform the Portmanteau test.

Stata/IC 15.0 - [Results]

FileEditDataGraphicsStatisticsUserWindowHelp

Review

#Command_rc

1import excel "..."

2generate mo...

3format %tm m...

4arima cpi, ari...111

5tsset cpi451

6tsset months

7arima cpi, ari...

8estat ic

9arima cpi, ari...

10estat ic

11predict resids,...

12wntestq resids

ModelObsll(null)ll(model)dfAICBIC

157-132.69125275.3824290.6636

Note: N=Obs used in calculating BIC; see [R] BIC note.

. predict resids, residuals

(1 missing value generated)

. wntestq resids

Portmanteau test for white noise

Portmanteau (Q) statistic = 28.0021

Prob > chi2(40) = 0.9235

Command

Variables

NameLz

time

cpi

months

resids

Properties

Variables

Name

Label

Type

Format

Value la

Notes

Data

Filenam

Label

Notes

Variable 4

Observa 158

Size 2.93K

Z:\home\moses\Downloads\stata_Getintopc.com_Stata_15.0x64\Stata_15.0x64\Stata_15.0x64

Page 34 of 34415 words, 2,269 charactersDefault Page StyleCAP NUM OVR100%

18:59

This is the test with its p-value

