SSRMC Time Series Analysis

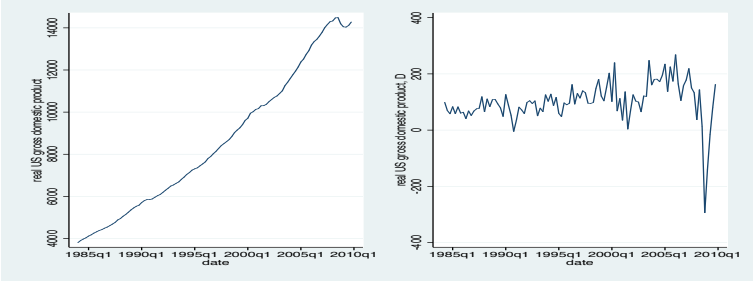
Topic Two: Regression with Time Series Data (Non-stationary Variables)

STATA Codes and Outputs

1. Graphing time series data (Slides 4 & 5)

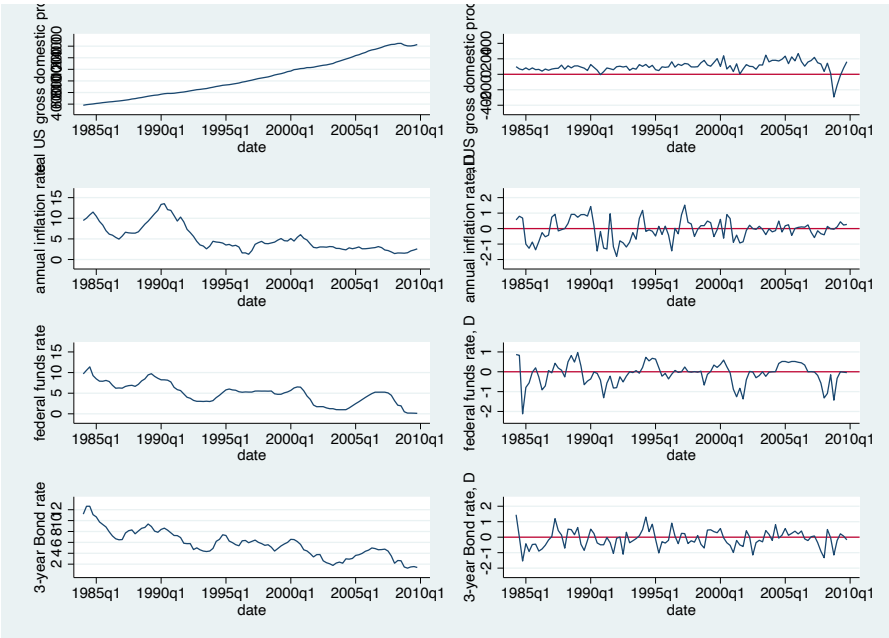
```
use usa, clear
generate date = q(1984q1) + _n-1
format date %tq
tsset date

qui tsline gdp, name(gdp, replace)
qui tsline D.gdp, name(dgdp, replace)
graph combine gdp dgdp
```




```
qui tsline inf, name(inf, replace)
qui tsline D.inf, name(dinf, replace) yline(0)
qui tsline f, name(f, replace)
qui tsline D.f, name(df, replace) yline(0)
qui tsline b, name(b, replace)
qui tsline D.b, name(db, replace) yline(0)

graph combine gdp dgdp inf dinf f df b db, cols(2)
```



2. Summary statistics (Slide 6)

```
summarize gdp inf b f D.gdp D.inf D.b D.f if tin(1984q2,1996q4)
```

Variable	Obs	Mean	Std. Dev.	Min	Max
gdp	51	5813.02	1204.604	3906.3	8023
inf	51	6.903725	3.337811	1.28	13.55
b	51	7.343137	1.939775	4.32	12.64
f	51	6.417255	2.130539	2.99	11.39
gdp D1.	51	82.65882	29.33348	-4.6	161.8
inf D1.	51	-.1605882	.8320058	-1.8	1.43
b D1.	51	-.1029412	.6312822	-1.54	1.45
f D1.	51	-.0864706	.5860711	-2.12	.97

```
summarize gdp inf b f D.gdp D.inf D.b D.f if tin(1997q1,)
```

Variable	Obs	Mean	Std. Dev.	Min	Max
gdp	52	11458.19	2052.135	8137	14484.9
inf	52	3.219423	1.116619	1.45	6.04
b	52	3.977115	1.564322	1.27	6.56
f	52	3.4875	2.025269	.12	6.52
gdp D1.	52	120.275	92.91987	-293.7	267.9
inf D1.	52	.0251923	.4617422	-.93	1.52
b D1.	52	-.0875	.4788502	-1.33	.81
f D1.	52	-.0992308	.5142893	-1.43	.59

```
summarize
```

Variable	Obs	Mean	Std. Dev.	Min	Max
gdp	104	8616.318	3313.988	3807.4	14484.9
inf	104	5.08625	3.099548	1.28	13.55
f	104	4.983846	2.568505	.12	11.39
b	104	5.697115	2.483198	1.27	12.64
date	104	147.5	30.16621	96	199
newdate	104	13468.2	2754.538	8766	18171
y	104	1996.5	7.53632	1984	2009
q	104	2.5	1.123448	1	4

3. Spurious Regression (Slides 11 & 12)

```
use spurious, clear
gen time = _n
tsset time
```

```
regress rw1 rw2
```

Source	SS	df	MS	Number of obs	=	700
				F(1, 698)	=	1667.65
Model	122116.557	1	122116.557	Prob > F	=	0.0000
Residual	51112.3314	698	73.2268359	R-squared	=	0.7049
				Adj R-squared	=	0.7045
Total	173228.888	699	247.823874	Root MSE	=	8.5573

rw1	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
rw2	.8420412	.0206196	40.84	0.000	.8015572	.8825251
_cons	17.81804	.6204776	28.72	0.000	16.59981	19.03627

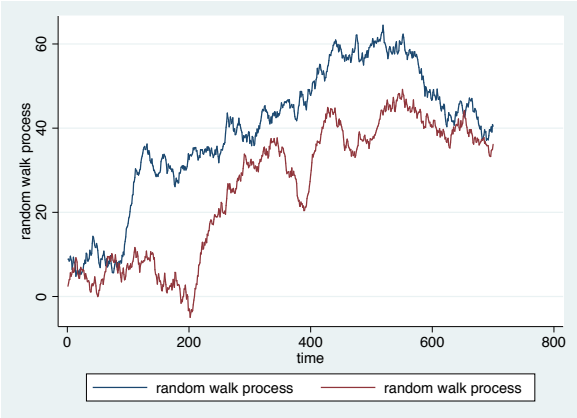
```
predict ehat, res
estat bgodfrey, lags(1 2 3 4 5)
```

Breusch-Godfrey LM test for autocorrelation

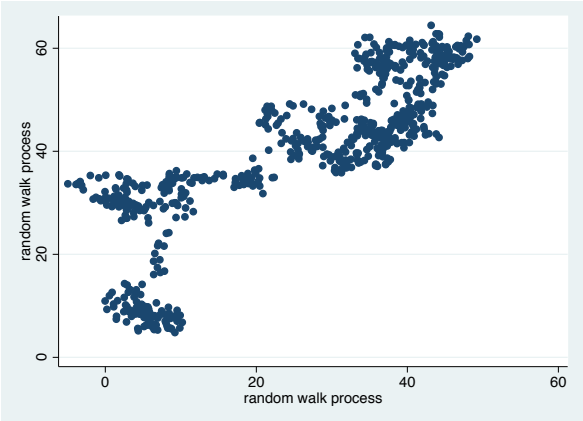
lags(*p*)	chi2	df	Prob > chi2
1	682.958	1	0.0000
2	682.971	2	0.0000
3	682.974	3	0.0000
4	682.982	4	0.0000
5	683.002	5	0.0000

H0: no serial correlation

```
tsline rw1 rw2
```




```
scatter rw1 rw2
```



4. Unit root tests for stationarity (Slides 17 & 18)

```
use usa, clear
gen date = q(1984q1) + _n - 1
format %tq date
tsset date

dfuller f, regress lags(1)
```

```
Augmented Dickey-Fuller test for unit root         Number of obs   =       102

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)           -2.505            -3.509            -2.890           -2.580
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.1143
```

D.f	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
f						
L1.	-.0446213	.0178142	-2.50	0.014	-.0799685	-.0092741
LD.	.5610582	.0809827	6.93	0.000	.4003708	.7217455
_cons	.1725221	.1002333	1.72	0.088	-.0263625	.3714067

```
dfuller b, lags(1)
```

```
Augmented Dickey-Fuller test for unit root         Number of obs   =       102

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)           -2.703            -3.509            -2.890           -2.580
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0735
```

```
dfuller D.f, noconstant lags(0)
```

```
Dickey-Fuller test for unit root                   Number of obs   =       102

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)           -5.487            -2.600            -1.950           -1.610
------------------------------------------------------------------------------
```

```
dfuller D.b, noconstant lags(0)
```

```
Dickey-Fuller test for unit root                   Number of obs   =       102

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)           -7.662            -2.600            -1.950           -1.610
------------------------------------------------------------------------------
```

5. Cointegrations test (Slides 21 – 24)

```
regress b f
predict ehat, residual

dfuller ehat, noconstant lags(1)
```

Augmented Dickey-Fuller test for unit root — Number of obs = 102

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-4.196	-2.600	-1.950	-1.610

```
* Error Correction Model

gen Db=D.b. // cannot use time series operators for the dependent variable in
the next command line

nl (Db = -{alpha}*(L.b-{beta1}-{beta2}*L.f)+{delta0}*D.f+{delta1}*D.L.f),
variables(L.b L.f D.L.f)
```

Source	SS	df	MS		
Model	15.034591	4	3.75864763	Number of obs	102
Residual	14.1807	97	.146192788	R-squared	0.5146
				Adj R-squared	0.4946
Total	29.215291	101	.289260307	Root MSE	.3823517
				Res. dev.	88.20819

Db	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
/alpha	.1418774	.0496561	2.86	0.005	.0433237	.240431
/beta1	1.429188	.6246253	2.29	0.024	.18948	2.668897
/beta2	.7765569	.1224753	6.34	0.000	.5334773	1.019637
/delta0	.8424631	.0897482	9.39	0.000	.6643378	1.020588
/delta1	-.3268445	.0847928	-3.85	0.000	-.4951347	-.1585544

```
scalar theta1 = 1-_b[alpha:_cons]
scalar list theta1
```

```
  theta1 =  .85812265
```

```
drop ehat
gen ehat = b - _b[beta1:_cons]-_b[beta2:_cons]*f
dfuller ehat, lags(1) noconstant
```

Augmented Dickey-Fuller test for unit root — Number of obs = 101

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.911	-2.600	-1.950	-1.610