

SSRMC Time Series Analysis

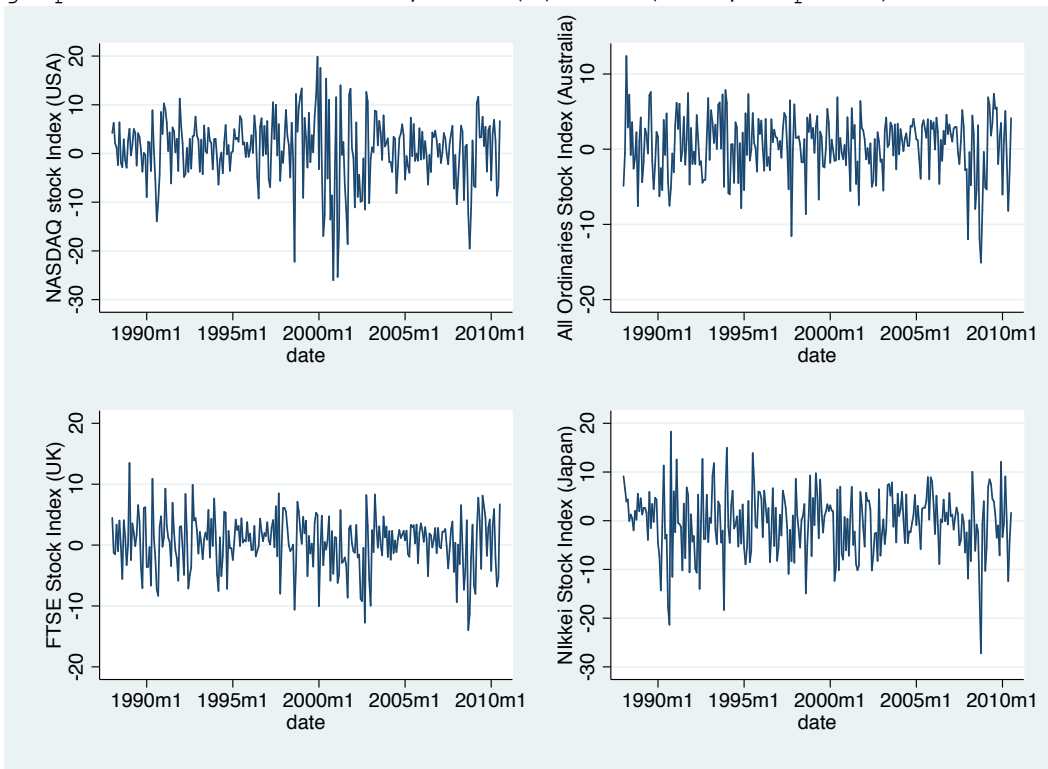
Topic Four: Time-Varying Volatility and ARCH Models

STATA Codes and Outputs

1. Plot time series (Slides 3 & 4)

```
use returns, clear
gen date = m(1988m1) + _n - 1
format date %tm
tsset date
```

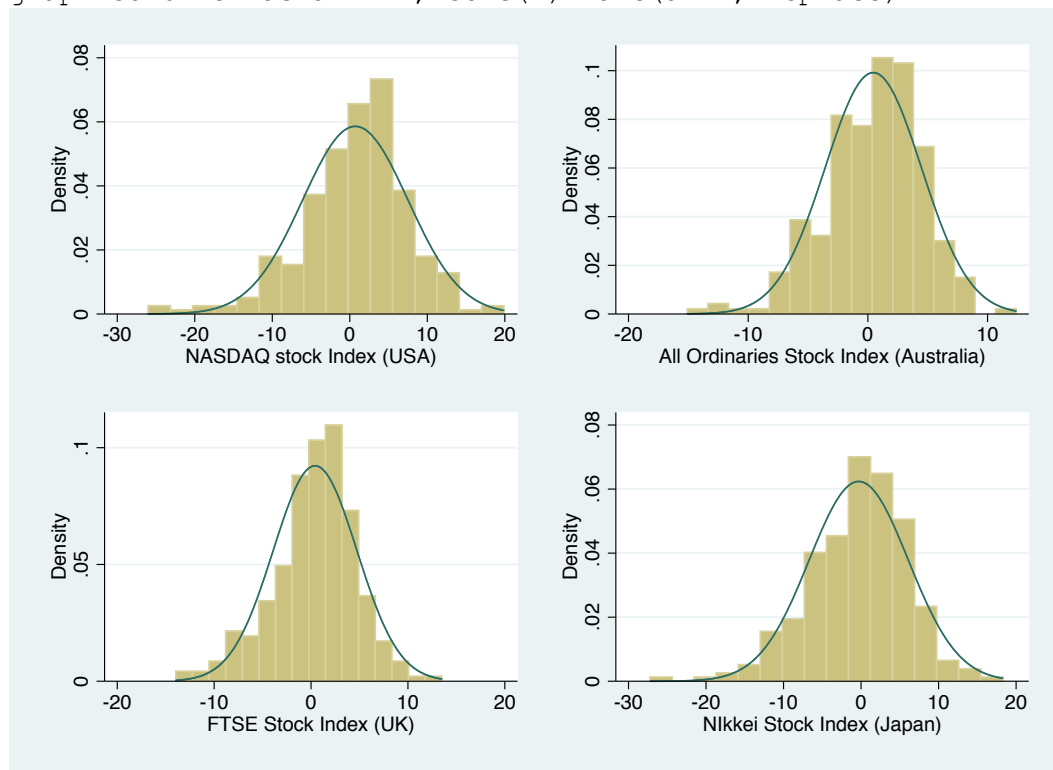
```
qui tsline nasdaq, name(nas, replace)
qui tsline allords, name(a, replace)
qui tsline ftse, name(f, replace)
qui tsline nikkei, name(nk, replace)
graph combine nas a f nk, cols(2) name(all1, replace)
```



```

qui histogram nasdaq, normal name(nas, replace)
qui histogram allords, normal name(a, replace)
qui histogram ftse, normal name(f, replace)
qui histogram nikkei, normal name(nk, replace)
graph combine nas a f nk, cols(2) name(all2, replace)

```



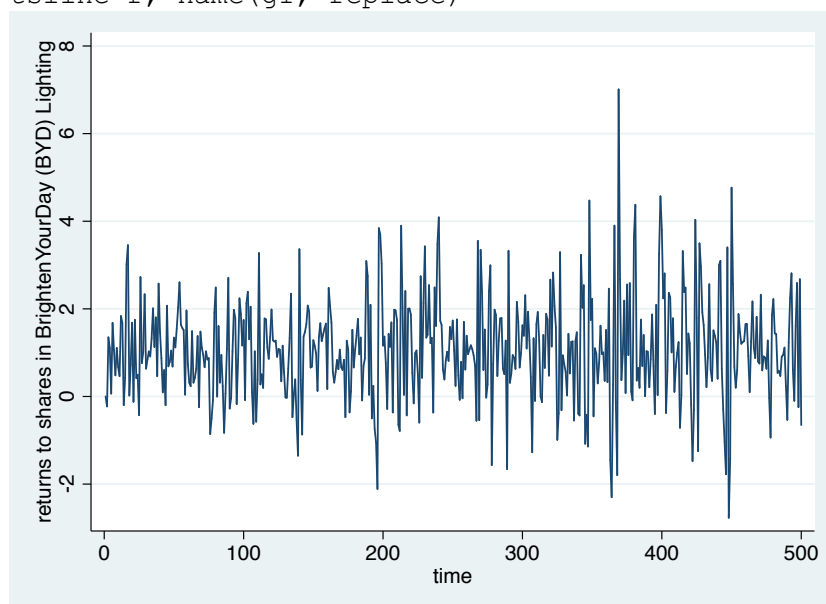
2. Testing for ARCH (Slides 12 & 13)

```

use byd, clear
gen time = _n
tsset time

tsline r, name(g1, replace)

```



```
regress r
```

Source	SS	df	MS	Number of obs	=	500
Model	0	0	.	F(0, 499)	=	0.00
Residual	700.737278	499	1.40428312	Prob > F	=	.
				R-squared	=	0.0000
Total	700.737278	499	1.40428312	Adj R-squared	=	0.0000
				Root MSE	=	1.185

r	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
_cons	1.078294	.0529959	20.35	0.000	.9741716 1.182417

```
predict ehat, residual
```

```
gen ehat2 = ehat * ehat
```

```
reg ehat2 L.ehat2
```

Source	SS	df	MS	Number of obs	=	499
Model	424.501834	1	424.501834	F(1, 497)	=	70.72
Residual	2983.28622	497	6.00258797	Prob > F	=	0.0000
				R-squared	=	0.1246
Total	3407.78805	498	6.8429479	Adj R-squared	=	0.1228
				Root MSE	=	2.45

ehat2	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
ehat2 L1.	.3530715	.0419848	8.41	0.000	.2705819 .435561
_cons	.9082618	.1244012	7.30	0.000	.6638447 1.152679

```
scalar TR2 = e(N)*e(r2)
```

```
scalar pvalue = chi2tail(1,TR2)
```

```
scalar crit = invchi2tail(1,.05)
```

```
scalar list TR2 pvalue crit
```

```
TR2 = 62.159504
```

```
pvalue = 3.167e-15
```

```
crit = 3.8414588
```

```
regress r
```

```
estat archlm, lags(1)
```

```
LM test for autoregressive conditional heteroskedasticity (ARCH)
```

lags(p)	chi2	df	Prob > chi2
1	62.160	1	0.0000

```
H0: no ARCH effects vs. H1: ARCH(p) disturbance
```

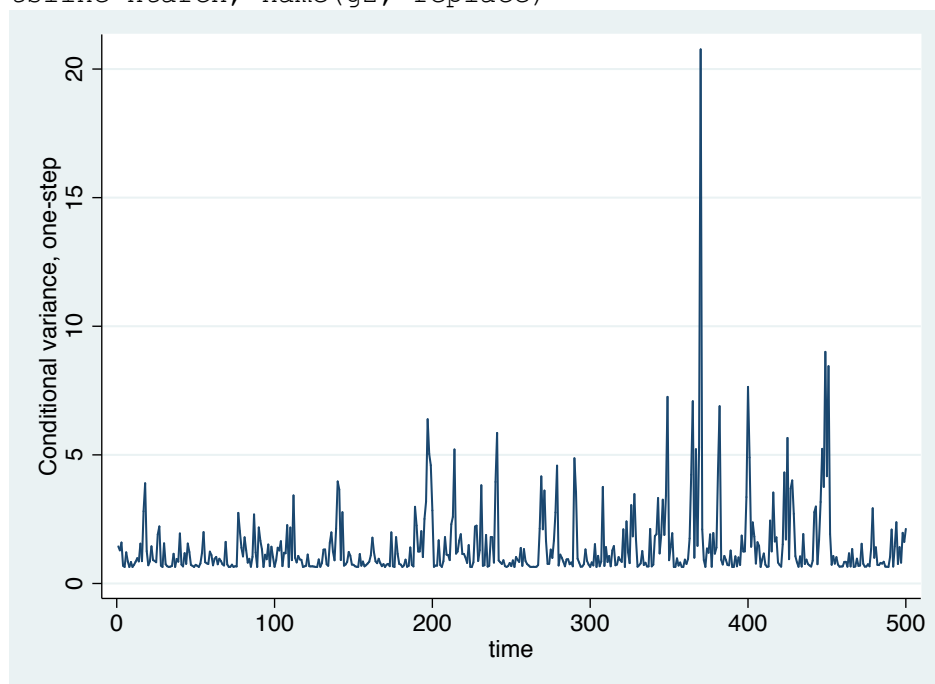
3. Estimating ARCH(1) Models (Slides 14 & 15)

```
arch r, arch(1)
ARCH family regression
```

```
Sample: 1 - 500           Number of obs =      500
Distribution: Gaussian    Wald chi2(.) =      .
Log likelihood = -740.7932 Prob > chi2 =      .
```

		OPG				[95% Conf. Interval]	
r		Coef.	Std. Err.	z	P> z		
r							
	_cons	1.063941	.0394424	26.97	0.000	.9866353	1.141247
ARCH							
	arch						
	L1.	.569351	.1028432	5.54	0.000	.3677821	.77092
	_cons	.6421377	.0632134	10.16	0.000	.5182418	.7660337

```
predict htarch1, variance
tsline htarch, name(g2, replace)
```



```
gen ht_1 = _b[ARCH:_cons]+_b[ARCH:L1.arch]*(L.r-_b[r:_cons])^2
list htarch ht_1 in 496/500
```

	htarch1	ht_1
496.	1.412281	1.412281
497.	.8093833	.8093833
498.	1.968768	1.968768
499.	1.614941	1.614941
500.	2.122526	2.122526

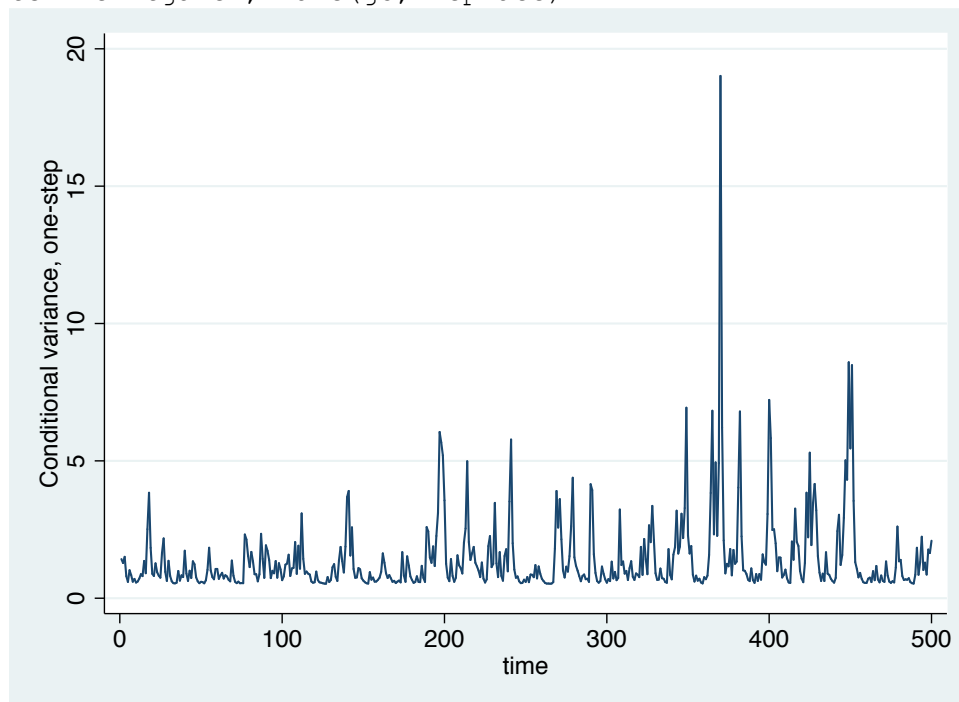
4. Estimating GARCH(1,1) Models (Slide 20)

```
arch r, arch(1) garch(1)
ARCH family regression
```

```
Sample: 1 - 500                Number of obs   =      500
Distribution: Gaussian          Wald chi2(.)    =      .
Log likelihood = -736.0281     Prob > chi2    =      .
```

		OPG		z	P> z	[95% Conf. Interval]	
r		Coef.	Std. Err.				
r							
	_cons	1.049856	.0404623	25.95	0.000	.9705517	1.129161
ARCH							
	arch						
	L1.	.4911796	.1015995	4.83	0.000	.2920482	.6903109
	garch						
	L1.	.2379837	.1114836	2.13	0.033	.0194799	.4564875
	_cons	.4009868	.0899182	4.46	0.000	.2247505	.5772232

```
predict htgarch, variance
tsline htgarch, name(g3, replace)
```

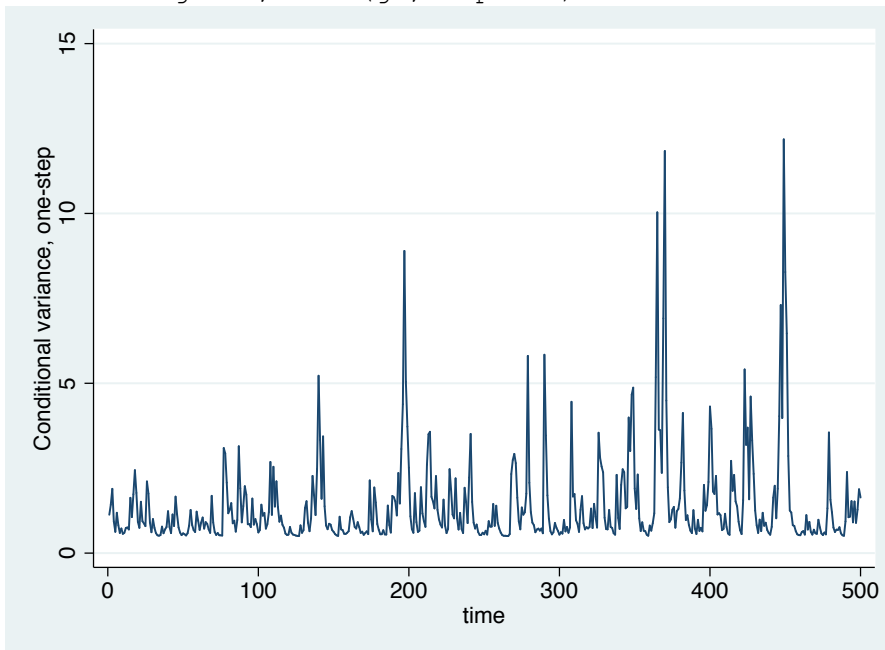


5. Estimating T-GARCH Models (Slide 22)

```
arch r, arch(1) garch(1) tarch(1)
```

		OPG		z	P> z	[95% Conf. Interval]	
r		Coef.	Std. Err.				
r							
	_cons	.9948399	.0429174	23.18	0.000	.9107234	1.078956
ARCH							
	arch						
	L1.	.754298	.2003852	3.76	0.000	.3615501	1.147046
	tarch						
	L1.	-.4917071	.2045045	-2.40	0.016	-.8925285	-.0908856
	garch						
	L1.	.2873	.1154888	2.49	0.013	.0609462	.5136538
	_cons	.3557296	.0900538	3.95	0.000	.1792274	.5322318

```
predict httgarch, variance
tsline httgarch, name(g4, replace)
```



6. Estimating GARCH-In-Mean Models (Slide 24)

arch r, archm arch(1) garch(1) tarch(1)

		OPG				
r		Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
r						
	_cons	.8181453	.0711579	11.50	0.000	.6786783 .9576122
ARCHM						
	sigma2	.1958843	.067164	2.92	0.004	.0642453 .3275233
ARCH						
	arch					
	L1.	.6160302	.1634603	3.77	0.000	.2956538 .9364066
	tarch					
	L1.	-.321069	.1621927	-1.98	0.048	-.6389608 -.0031772
	garch					
	L1.	.2783425	.1039073	2.68	0.007	.074688 .481997
	_cons	.3705214	.0818646	4.53	0.000	.2100698 .5309731

```

predict m_mgarch, xb
predict htmgarch, variance
qui tsline m_mgarch, name(g5, replace)
qui tsline htmgarch, name(g6, replace)
graph combine g5 g6, cols(1)

```

