Teaching Financial Econometrics in Stata

Carlos Alberto Dorantes, Tec de Monterrey

EUSMEX 2018
Outline

The getsymbols command

The mvport ssc package

Teaching Financial Econometrics with Stata

- Descriptive statistics
- Histograms
- Linear relationships
- Market Regression model
- Writing a command for CAPM model
- Moving CAPM betas
- Illustrating diversification using portfolios
- Portfolio optimization
- Portfolio strategy based on CAPM
- Forecasting with ARIMA/SARIMA
- Volatility models
getsymbols downloads data from Quandl, Yahoo Finance, and Alpha Vantage. Here an example:

```
. capture getsymbols BTC-USD, fy(2017) yahoo clear
. tsline close_BTC_USD
```

Figure 1: Bitcoin USD prices
... getsymbols command

Getting data from several assets from Yahoo:

```
capture getsymbols ^MXX AMXL.MX ALFAA.MX ALSEA.MX, fy(2014) ///
> freq(m) yahoo clear price(adjclose)
*With the price option, returns are calculated
qui gen year=yofd(dofm(period))
.graph box R_*, by(year, rows(1))
```

Figure 2: Box plot of monthly returns by year
The mvport package

The mvport package has 11 commands:

- meanrets and varrets for estimation of expected mean returns and variance-covariance matrix
- mvport, gmvport, ovport for portfolio optimization
- efrontier identifies the efficient frontier based on a set of assets
- cmvline calculates both the efficient frontier and the Capital Market Line
- backtest and cbacktest for portfolio backtesting
- holdingrets calculates holding period returns of assets
- simvport simulates portfolios with random weights and estimates expected risk and return
Teaching Financial Econometrics/Programming

- Descriptive statistics
- Histograms
- Plotting linear relationships
- Market Regression model
- Writing a command for CAPM model
- Moving CAPM betas
- Illustrating diversification
- Portfolio optimization
- Portfolio backtesting
- Portfolio strategy based on CAPM
- Forecasting with ARIMA/SARIMA
- Volatility models
- VAR models
Descriptive statistics

Descriptive statistics of returns

```
capture getsymbols `MXX AMXL.MX, fy(2014) ///
> freq(m) yahoo clear price(adjclose)

. su R_AMXL R__MXX

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>R_AMXL_MX</td>
<td>55</td>
<td>0.0058009</td>
<td>0.0587706</td>
<td>-0.1045638</td>
<td>0.1591078</td>
</tr>
<tr>
<td>R__MXX</td>
<td>55</td>
<td>0.0039337</td>
<td>0.0324539</td>
<td>-0.0764216</td>
<td>0.0791098</td>
</tr>
</tbody>
</table>
```

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Histograms

. capture getsymbols ~MXX AMXL.MX, fy(2010) ///
> freq(m) yahoo clear price(adjclose)
. twoway (hist R_AMXL, width(0.04) freq color(green) ) ///
> (hist R__MXX, width(0.04) freq fcolor(none) lcolor(black)), ///
> legend(order(1 "America Móvil return" 2 "IPyC return" ))

Figure 3: Histogram of AMXL and Market returns from 2010 to 2018
Plotting linear relationships

How ALFA returns are related to the market returns:

```stata
. capture getsymbols ~MXX ALFA.A.MX, fy(2008) ///
  > freq(m) yahoo clear price(adjclose)
. twoway (scatter r_ALFAA_MX r__MXX) ///
  > (lfit r_ALFAA_MX r__MXX), xlabel(-0.60(0.10) 0.40)
```

Figure 4: Alfa monthly returns vs Market returns from 2008 to 2018
I run a regression model to evaluate the relationship between market returns and Alfa returns:

```
capture getsymbols ^MXX ALFAA.MX, fy(2008) ///
> freq(m) yahoo clear price(adjclose)
qui reg r_ALFAA_MX r__MXX
._coef_table
```

| r_ALFAA_MX | Coef.   | Std. Err. | t     | P>|t|  | [95% Conf. Interval] |
|------------|---------|-----------|-------|------|---------------------|
| r__MXX     | 1.767932| 0.1395922 | 12.66 | 0.000| 1.491662 2.044203   |
| _cons      | 0.0034723| 0.006395 | 0.54  | 0.588| -.0091841 .0161288  |

The market beta of Alfa is 1.77

The alpha coefficient of Alfa is 0.003472
Writing a command for CAPM model

```
capture program drop capm
program define capm, rclass
  syntax varlist(min=3 numeric) [if]
  local stockret: word 1 of `varlist'
  local mktret: word 2 of `varlist'
  local rfrate: word 3 of `varlist'
  capture drop prem`stock'
  quietly gen prem`stock'=`stockret'-'rfrate'
  capture drop mktpremium
  quietly gen mktpremium=`mktret'-'rfrate'
  quietly reg prem`stock' mktpremium `if'
  matrix res= r(table)
  local b1=res[1,1]
  local b0=res[1,2]
  local SEb1=res[2,1]
  local SEb0=res[2,2]
  local N=e(N)
  di "Market beta is " %3.2f `b1'
  di " std error of beta is " %8.6f `SEb1'
  di "Alfa coeff. is " %8.6f `b0'
  di " its std error is " %8.6f `SEb0'
  return scalar b1=`b1'
  return scalar b0=`b0'
  return scalar SEb1=`SEb1'
  return scalar SEb0=`SEb0'
  return scalar N=`N'
end
```
Once I define the capm command I get data to run it:

The parameters of my capm command are:

1 - stock return 2 - market return 3 - risk-free return

*I have to get data for risk-free rate from the FED:
i qui freduse INTGSTMXM193N, clear
* This monthly series has annual rates in %, so I create a monthly rate:
qui gen m_R_cetes = (INTGSTMXM193N/100)/12
* I calculate the continuously compounded return from the simple returns:
qui gen m_r_cetes = ln(1 + m_R_cetes)
** I create the monthly variable:
qui gen period =mofd(daten)
format period %tm
* Now I indicate Stata that the time variable is period:
qui tsset period
* I save the CETES dataset as cetes:
qui save rfrate, replace
Writing a command for CAPM

. * I get the stock data from Yahoo Finance:
. capture getsymbols ^MXX ALFAA.MX, fy(2008) ///
> freq(m) yahoo clear price(adjclose)

. * I merge it with the risk-free dataset:
. qui merge 1:1 period using rfrate, keepusing(m_r_cetes)
. qui drop if _merge!=3
. qui drop _merge
. qui save mydata1,replace

Now I can use my capm command:

. capm r_ALFAA_MX r__MXX m_r_cetes
Market beta is 1.77; std error of beta is 0.141680
Alfa coeff. is 0.006548, its std error is 0.006508
. return list
scalars:
   r(N) =   124
   r(SEb0) =   .006508329271266
   r(SEb1) =   .141680230176724
   r(b0) =   .0065479530113093
   r(b1) =   1.765364922187618
I can examine how market beta of a stock changes over time

I run my capm command using 24-month rolling windows:

```
. rolling b1=r(b1) seb1=r(SEb1), window(24) saving(capmbetas,replace): ///
>     capm r_ALFAA_MX r__MXX m_r_cetes
(running capm on estimation sample)
Rolling replications (102)
.............................. 50
.............................. 100
.                          
file capmbetas.dta saved
```
... moving betas

. qui use capmbetas,clear
. label var b1 "beta"
. label var seb1 "StdErr Beta"
. label var end "Month"
. qui tsset end
. tsline b1

Figure 5: Market beta over time for Alfa using 24-month windows
Illustrating diversification with portfolio weights

```
capture getsymbols ALFAA.MX BIMBOA.MX, fy(2009) ///
>       freq(m) yahoo clear price(adjclose)
qui meanrets r_ *
qui varrets r_ *
qui egen double wa=fill(0(0.1)1)
qui set obs 11
qui format wa %tg
qui gen wb=1-wa
qui format wb %tg
* Now I computed both expected return and variance of the 11 portfolios
qui gen ERP = wa*MEANRETS[1,1] + wb*MEANRETS[2,1]
qui gen varP= wa^2*COV[1,1] + wb^2*COV[2,2] + 2*wa*wb*COV[2,1]
* Now I compute the risk (standard dev) of the portfolios:
qui gen sdP=sqrt(varP)
```
Illustrating diversification with portfolio weights

. twoway (scatter ERP sdP, msize(medlarge) mlabel(wa) mlabcolor(edkblue)), ///
> ytitle(Retorno) ylabel(#5) xtitle(Riesgo) ///
> title(Frontier using 2 stocks: Alfa and Bimbo) note(Alfa weights are doed fo ///
> r each portfolio)

Figure 6: Diversification using 2 stocks and changing weights
Illustrating diversification with correlation

. local paramgraficas ""
. * I define a macro with the parameters for the twoway command
. local i=0
. * I loop over different values of correlation:
. forvalues rho1=-1(0.5)1 {
2.   local i=`i´ + 1
3.   * I generate the expected return of the 11 portfolios
.     qui gen ERP`i´ = wa*MEANRETS[1,1] + wb*MEANRETS[2,1]
4.   * I assign a label for this new variable ERP`i´.
.     label variable ERP`i´ "rho = `rho1´"
5.   * I create the variance of the 11 portfolios
.     qui gen varP`i´ = wa^2*COV[1,1] + wb^2*COV[2,2] + 2*wa*wb*`rho1´*sqrt(COV[ > 1,1])*sqrt(COV[2,2])
6.   * Now I generate the corresponding risk variable
.     qui gen sdP`i´ = sqrt(varP`i´)
7.   * Now I construct the parameters for the graph
.     local paramgraficas "`paramgraficas´(connected ERP`i´ sdP`i´, mlabel(wa)) > "
8. }

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Illustrating diversification with correlation

* Now I can graph all the frontiers generated according to different hypothetical values of correlations:
  . twoway `paramgraficas´, note(Alpha weights are shown in each point) ///
  > title(Frontiers with different correlations) ///
  > ytitle(Expected Return) xtitle(Expected Risk)

Figure 7: Diversification using 2 stocks and changing correlation
Portfolio optimization - efficient frontier

. capture getsymbols ALFAA.MX BIMBOA.MX ALSEA.MX AMXL.MX, ///
   >   fy(2014) freq(m) yahoo clear price(adjclose)
. qui efrontier r_*

Figure 8: Efficient Frontier with 4 assets
Portfolio optimization - Capital Market Line

```
capture getsymbols ALFAA.MX BIMBOA.MX ALSEA.MX AMXL.MX, ///
fy(2014) freq(m) yahoo clear price(adjclose)
qui cmline r_*, noshort
```

Figure 9: Capital Market Line with 4 assets
Finding the GMV Portfolio:

```
capture getsymbols ALFAA.MX BIMBOA.MX ALSEA.MX AMXL.MX ARA.MX OMAB.MX, ///
  fy(2014) freq(m) yahoo clear price(adjclose)
* Finding the GMV Portfolio without short sales:
gmvport r_*, noshort
Number of observations used to calculate expected returns and var-cov matrix:
> 56
The weight vector of the Global Minimum Variance Portfolio (NOT Allow Short Sal
> es) is:

   Weights
  r_ALFAA_MX   .01162011
  r_BIMBOA_MX  .34878676
  r_ALSEA_MX   .14596726
  r_AMXL_MX    .2554765
  r_ARA_MX     .1966382
  r_OMAB_MX    .04151117
The return of the Global Minimum Variance Portfolio is: .00532839
The standard deviation (risk) of the Global Minimum Variance Portfolio is: .033
> 36875
```
Finding the GMV Portfolio with restrictions:

```
capture getsymbols ALFAA.MX BIMBOA.MX ALSEA.MX AMXL.MX ARA.MX OMAB.MX, ///
   fy(2014) freq(m) yahoo clear price(adjclose)
* Finding the GMV Portfolio with weights>5%:
gmvport r_*, minw(0.05)
```

Number of observations used to calculate expected returns and var-cov matrix:
> 56

The weight vector of the Global Minimum Variance Portfolio (NOT Allow Short Sal
> es) is:

```
   Weights
    r_ALFAA_MX   .05
    r_BIMBOA_MX  .33371175
    r_ALSEA_MX   .1418426
    r_AMXL_MX    .23301119
    r_ARA_MX     .19143446
    r_OMAB_MX    .05
```

The return of the Global Minimum Variance Portfolio is: .00504362
The standard deviation (risk) of the Global Minimum Variance Portfolio is: .033
> 48313
Finding the GMV Portfolio with restrictions:

```stata
capture getsymbols ALFAA.MX BIMBOA.MX ALSEA.MX AMXL.MX ARA.MX OMAB.MX, ///
> fy(2014) freq(m) yahoo clear price(adjclose)
* Finding the GMV Portfolio without short sales, and weights<25%:
. gmvport r_*, maxw(0.25)
Number of observations used to calculate expected returns and var-cov matrix: 
> 56
The weight vector of the Global Minimum Variance Portfolio (Allowing Short Sale 
> s) is:
   Weights
  r_ALFAA_MX  .03060067
  r_BIMBOA_MX  .25
  r_ALSEA_MX  .18964697
  r_AMXL_MX  .25
  r_ARA_MX  .21525427
  r_OMAB_MX  .06449809
The return of the Global Minimum Variance Portfolio is: .00600812
The standard deviation (risk) of the Global Minimum Variance Portfolio is: .033
> 70405
```

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Using EWMA to assign more weight to recent months:

- *Calculates expected returns using the EWMA method with lambda=0.94:
  - qui meanrets r_* , lew(0.94)
  - matrix mrets=r(meanrets)
- *Calculates the covariance matrix of returns using the EWMA method:
  - qui varrets r_* , lew(0.94)
  - matrix cov=r(cov)
- *Calculates the GMV portfolio using the calculated mean rets and COV:
  - gmvport r_* , covm(cov) mrets(mrets)

Number of observations used to calculate expected returns and var-cov matrix: > 56

The weight vector of the Global Minimum Variance Portfolio (Allowing Short Sale s) is:

<table>
<thead>
<tr>
<th>Weights</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>r_ALFAA_MX</td>
<td>0.01512741</td>
</tr>
<tr>
<td>r_BIMBOA_MX</td>
<td>0.23834664</td>
</tr>
<tr>
<td>r_ALSEA_MX</td>
<td>0.21974859</td>
</tr>
<tr>
<td>r_AMXL_MX</td>
<td>0.24542343</td>
</tr>
<tr>
<td>r_ARA_MX</td>
<td>0.26241682</td>
</tr>
<tr>
<td>r_OMAB_MX</td>
<td>0.01893709</td>
</tr>
</tbody>
</table>

The return of the Global Minimum Variance Portfolio is: 0.00264197

The standard deviation (risk) of the Global Minimum Variance Portfolio is: 0.036 > 46787
Portfolio optimization - Optimal Portfolio

```
capture getsymbols ALFAA.MX BIMBOA.MX ALSEA.MX AMXL.MX ARA.MX OMAB.MX, /// >    fy(2014) freq(m) yahoo clear price(adjclose)
.* Finding the GMV Portfolio:
     qui ovport r_*
.  di "The weights of the optimal portfolio are:"
The weights of the optimal portfolio are:
.  matlist r(weights)

<table>
<thead>
<tr>
<th>Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>r_ALFAA_MX</td>
</tr>
<tr>
<td>r_BIMBOA_MX</td>
</tr>
<tr>
<td>r_ALSEA_MX</td>
</tr>
<tr>
<td>r_AMXL_MX</td>
</tr>
<tr>
<td>r_ARA_MX</td>
</tr>
<tr>
<td>r_OMAB_MX</td>
</tr>
</tbody>
</table>

.  di "The expected return of the optimal portfolio is " r(rop)
The expected return of the optimal portfolio is .04467859
.  di "The expected risk of the optimal portfolio is " r(sdop)
The expected risk of the optimal portfolio is .09662549
```
... Portfolio optimization - Optimal Portfolio

. capture getsymbols ALFAA.MX BIMBOA.MX ALSEA.MX AMXL.MX ARA.MX OMAB.MX, ///
  > fy(2014) freq(m) yahoo clear price(adjclose)
. * Finding the GMV Portfolio without short sales:
.  ovport r_*, noshort
Number of observations used to calculate expected returns and var-cov matrix : > 56
The weight vector of the Tangent Portfolio with a risk-free rate of 0 (NOT Allo
> w Short Sales) is:

Weights
  r_ALFAA_MX 0
  r_BIMBOA_MX 0
  r_ALSEA_MX .13677267
  r_AMXL_MX .1392179
  r_ARA_MX 0
  r_OMAB_MX .72400943
The return of the Tangent Portfolio is: .01979399
The standard deviation (risk) of the Tangent Portfolio is: .05393653

The marginal contributions to risk in the Tangent Portfolio are:

<table>
<thead>
<tr>
<th>Margina_k</th>
</tr>
</thead>
<tbody>
<tr>
<td>r_ALFAA_MX</td>
</tr>
<tr>
<td>r_BIMBOA_MX</td>
</tr>
<tr>
<td>r_ALSEA_MX</td>
</tr>
<tr>
<td>r_AMXL_MX</td>
</tr>
<tr>
<td>r_ARA_MX</td>
</tr>
<tr>
<td>r_OMAB_MX</td>
</tr>
</tbody>
</table>

The weights of the optimal portfolio are:

. matlist r(weights),border

Weights
  r_ALFAA_MX 0
  r_BIMBOA_MX 0
  r_ALSEA_MX .1367727
  r_AMXL_MX .1392179
  r_ARA_MX 0
  r_OMAB_MX .7240094

. di "The expected return of the optimal portfolio is " r(rop)
. di "The expected risk of the optimal portfolio is " r(sdop)
Portfolio optimization - Minimum Variance Portfolio

. capture getsymbols ALFAA.MX BIMBOA.MX ALSEA.MX AMXL.MX ARA.MX OMAB.MX, //>
   fy(2014) freq(m) yahoo clear price(adjclose)

. * Finding the MV Portfolio given a specific required return:
  . mvport r_*, ret(0.02)

Portfolio weights of the portfolio:

<table>
<thead>
<tr>
<th></th>
<th>Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>r_ALFAA_MX</td>
<td>-0.2985335</td>
</tr>
<tr>
<td>r_BIMBOA_MX</td>
<td>0.0666618</td>
</tr>
<tr>
<td>r_ALSEA_MX</td>
<td>0.2777326</td>
</tr>
<tr>
<td>r_AMXL_MX</td>
<td>0.3547938</td>
</tr>
<tr>
<td>r_ARA_MX</td>
<td>0.0754154</td>
</tr>
<tr>
<td>r_OMAB_MX</td>
<td>0.5239299</td>
</tr>
</tbody>
</table>

Number of observations used to calculate expected returns and var-covariance matrix: 56

Required return of the Portfolio: 0.02
Minimum standard deviation of the portfolio (Allowing for short sales): 0.047503

> 64
. capture getsymbols ALFAA.MX BIMBOA.MX ALSEA.MX AMXL.MX ARA.MX OMAB.MX, fy(2014) freq(m) yahoo clear price(adjclose)

.* Finding the MV Portfolio without short sales:
.  mvport r_*, ret(0.02) noshort

<table>
<thead>
<tr>
<th>Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>r_ALFAA_MX</td>
</tr>
<tr>
<td>r_BIMBOA_MX</td>
</tr>
<tr>
<td>r_ALSEA_MX</td>
</tr>
<tr>
<td>r_AMXL_MX</td>
</tr>
<tr>
<td>r_ARA_MX</td>
</tr>
<tr>
<td>r_OMAB_MX</td>
</tr>
</tbody>
</table>

Number of observations used to calculate expected returns and var-covariance ma > trix : 56

Required return of the Portfolio: .02
Minimum standard deviation of the portfolio (DO NOT Allow Short Sales): .054502 > 24
. * Backtesting using optimal no-short portfolio:
.   qui ovport r_* if period<tm(2017m1), noshort
.   matrix W=r(weights)
.   qui cbacktest p_* if period>=tm(2017m1), weights(W) gen(holing_return) timev
> ar(period)

Figure 10: Holding return of optimal portfolio
Portfolio strategy based on CAPM

- Get stock data from 500 stocks (S&P500) using getsymbols in a loop
- Calculate CAPM of the 500 stocks using the capm command
- Selecting those stocks with alpha > 0 and p-value < 0.05
- Optimize the portfolio without the recent 12 months
- Backtest the portfolio in the recent 12 months
Forecasting with ARIMA/SARIMA

* Getting data of monthly sales of different manufacturing firms:
  use http://www.apradie.com/ec2004/salesfabs.dta, clear
  qui tsset month
* Generating the natural log of volume sales:
  qui gen lnqfab1=ln(qfab1)
  qui label var qfab1 "Sales Fab1"
. ac s12.lnqfab1

Figure 11: Autocorrelations of annual % sales growth
Forecasting with ARIMA/SARIMA

. pac s12.lnqfab1

Figure 12: Partial Autocorrelations of annual % sales growth
* Autocorrelation plots suggest the following model:
.arima s12.lnqfab1, ar(1) mma(1,12) nolog

ARIMA regression
Sample: 2011m1 - 2015m10  Number of obs = 58
Wald chi2(2) = 23.05
Log likelihood = 66.13805  Prob > chi2 = 0.0000

|              | Coef.  | Std. Err. | z     | P>|z|   | [95% Conf. Interval] |
|--------------|--------|-----------|-------|-------|----------------------|
| S12.lnqfab1  |        |           |       |       |                      |
| lnqfab1      | 0.1014176 | 0.0110564 | 9.17  | 0.000 | 0.0797475  0.1230877 |
| _cons        |        |           |       |       |                      |
| ARMA         |        |           |       |       |                      |
| ar L1.       | 0.4211392 | 0.1073157 | 3.92  | 0.000 | 0.2108043  0.6314742 |
| ARMA12       |        |           |       |       |                      |
| ma L1.       | -0.4961238 | 0.1464453 | -3.39 | 0.001 | -0.7831514 -0.2090962 |
| /sigma       | 0.0750096 | 0.00783   | 9.58  | 0.000 | 0.0596631  0.0903562 |

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

. qui tsappend, add(12)
. qui predict lnqfab1_hat, y dynamic(tm(2015m11))
. qui gen Sales_Forecast=exp(lnqfab1_hat)
. local lastmonth=tm(2015m10)
. tsline qfab1 Sales_Forecast, tline(`lastmonth')

Figure 13: Forecast of Sales Fab 1

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Volatility Models

Modelling the Mexican Market volatility

```
. capture getsymbols ^MXX, fm(1) fd(1) fy(2014) freq(d) ///
> price(adjclose) clear yahoo
. tsline R__MXX
```

Figure 14: Mexican Market Index - Volatility
Running a GARCH(1,1) model

```
. arch r__MXX, arch(1) garch(1) nolog
ARCH family regression
Sample: 1 - 1152   Number of obs =  1,152
Distribution: Gaussian   Wald chi2(.) =   .
Log likelihood = 3980.72  Prob > chi2 =   .

                  OPG
r__MXX     Coef.  Std. Err.      z    P>|z|     [95% Conf. Interval]

r__MXX
    _cons   .0002149   .0002148    1.00   0.317    -.0002061    .0006358

ARCH

arch
    L1.    .085835   .0130238    6.59   0.000     .0603089    .1113611

    garch
    L1.    .8649778   .024098    35.89   0.000     .8177466    .9122089
    _cons    3.14e-06   9.52e-07     3.30   0.001     1.28e-06     5.01e-06
```

We find evidence of volatility clustering (garch coef = 0.865)
... Volatility Models

Understanding volatility of the Market index

. qui getsymbols ^MXX, fm(1) fd(1) fy(2008) lm(12) ///
  > ld(31) ly(2008) frequency(d) price(adjclose) yahoo clear
Symbol ^MXX was downloaded
. qui drop if volume==.
. qui gen t=_n
. qui tsset t
. ** I calculate moving volatility and moving average using a rolling window
  > of 20 business days:
  > rolling mean=r(mean) volatility=r(sd), saving(rollingmxx, replace) window(2
  > 0): su r__MXX
> (running summarize on estimation sample)
Rolling replications (233)
|   | 1 | 2 | 3 | 4 | 5 |
----------------------------------
................................. 50
................................. 100
................................. 150
................................. 200
file rollingmxx.dta saved
. qui save datamxx, replace
Understanding volatility of the Market index

. qui use rollingmxx, clear
. * I rename the time variable
. ren start t
. qui tsset t
. label var volatility "volatility"
. label var mean "mean returns"
. * I merge the rolling dataset with the original
. qui merge 1:1 t using datamxx, keepusing(period)
. qui drop _merge
. qui tsset period
. \texttt{tsline mean volatility}

Figure 15: Market Volatility vs Return using 24-month rolling windows
Conclusion

- Unlike other leading econometrics software (e.g. R), Stata has a simple script language (do and ado files) that students can easily learn to better understand Econometrics.
- New user-commands are being developed for Finance students (e.g. Dr. Dicle commands, see this ssrn paper).
- The disadvantage of Stata vs other software like R or Python is that there are much more commands/packages for finance analysis in R and Python compared with Stata.
- Programming in Stata is much easier for non-programmers compared with R.
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