Financial Econometrics Tutorial - Marinus_Tutorial

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Abstract

The following tutorial makes use of financial data from the JSE to build individual GARCH models from which volatility forecasts can be made. The tutorial also aims to improve the ABSA GARCH model's forecast accuracy by specifying the conditional volatility of Sanlam as an external regressor in the variance model. The 3 found that ABSA's GARCH model's predictive power is improved by including Sanlam as an external regressor.

Keywords: GARCH

JEL classification

1. Introduction

The objective of this tutorial is to accumulate experience in working with Texevier and RMarkdown. The tutorial is outlined in the accompanying README with the bulk of the code written in functions within R Scripts in order to neaten the write-up process. The tutorial answers the questions as outlined in the README document.

2. Data

After loading our findata we inspect the 1st and 2nd moments. From table 2.1 and table 2.2 it is evident that our sample period from 2006-2008 differs greatly from 2010-2013. Upon closer inspection we can see that both the mean and median for the 2nd moment of 2006-2008 is more than twice that of 2010-2013. This paired with the maximum 2nd moment value indicate towards considerably more volatility during the Global Financial Crisis (GFC) period.

Structurally we can gather from the skewness and kurtosis values of the returns that our period from 2006-2008 have wide and fat tails of volatility, compared to 2010-2013. Negative skewness for the period 2010-2013, indicate relatively more positive returns than the period 2006-2008.

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	vars	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
Return	1	4585.00	-0.01	2.11	0.00	-0.02	1.44	-12.58	12.64	25.22	0.05	3.31	0.03
Return_Sqd	2	4585.00	4.47	10.30	0.94	2.18	1.38	0.00	159.77	159.77	6.18	58.96	0.15

Table 2.1: 1st and 2nd Moments (2006-2008)

	vars	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
Return	1	7000.00	0.04	1.43	0.00	0.06	1.03	-36.42	6.87	43.29	-2.46	61.35	0.02
Return_Sqd	2	7000.00	2.06	16.33	0.48	1.00	0.70	0.00	1326.58	1326.58	76.38	6184.91	0.20

Table 2.2: 1st and 2nd Moments (2010-2013)

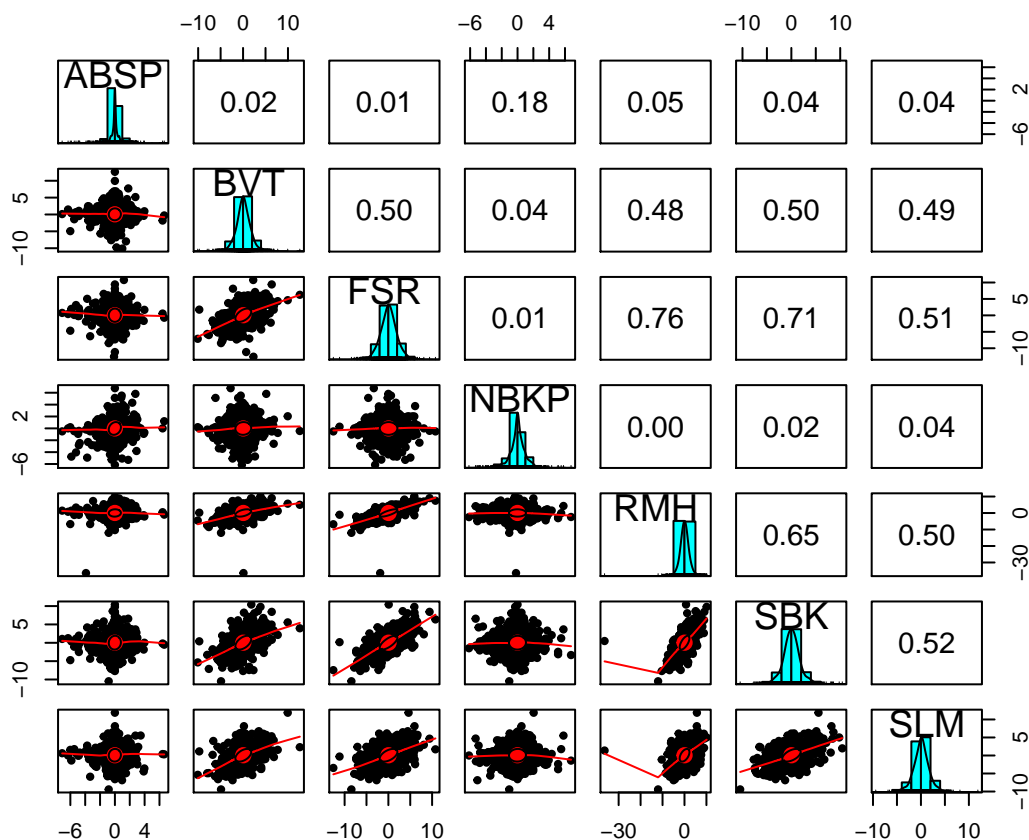|	ABSP	BVT	FSR	NBKP	RMH	SBK	SLM
ABSP	1.00	0.02	0.01	0.18	0.05	0.04	0.04
BVT	0.02	1.00	0.50	0.04	0.48	0.50	0.49
FSR	0.01	0.50	1.00	0.01	0.76	0.71	0.51
NBKP	0.18	0.04	0.01	1.00	-0.00	0.02	0.04
RMH	0.05	0.48	0.76	-0.00	1.00	0.65	0.50
SBK	0.04	0.50	0.71	0.02	0.65	1.00	0.52
SLM	0.04	0.49	0.51	0.04	0.50	0.52	1.00

Table 2.3: Unconditional Correlations

Figure 2.1: Pairs Panel

Table 2.3 and Figure 2.1 above convey the unconditional correlations between the stocks as a table and a pairs panel.

3. Results

The following section illustrate the GARCH ht processes of our ABSA GARCH11 model along with the ABSA GARCH11 model when an external regressor, SLM's conditional volatility, is included.

The model coefficients in table 3.1 and table 3.2 highlight the significance of the p-values. Table 3.2 indicate that the external regressor, SLM's conditional volatility, is significant. Table 3.3 and Table 3.4 exhibit the information criteria between the two models. The results indicate that including Sanlam's conditional volatility possibly improves the model's fit to the underlying data (Tsay 1989).

	Estimate	Std. Error	t value	Pr(>|t|)
mu	0.01	0.01	0.84	0.40
ar1	-0.08	0.03	-2.88	0.00
omega	0.06	0.01	5.36	0.00
alpha1	0.19	0.03	6.22	0.00
beta1	0.78	0.03	24.58	0.00
gamma1	-0.14	0.03	-4.79	0.00

Table 3.1: Coefficients: ABSA GARCH11

	Estimate	Std. Error	t value	Pr(>|t|)
mu	0.01	0.01	0.85	0.39
ar1	-0.08	0.03	-2.91	0.00
omega	0.05	0.01	5.12	0.00
alpha1	0.20	0.03	6.53	0.00
beta1	0.76	0.03	24.98	0.00
gamma1	-0.15	0.03	-4.96	0.00
vxreg1	0.01	0.00	2.91	0.00

Table 3.2: Coefficients: ABSA GARCH11 with Sanlam external regressor

	V1
Akaike	2.14
Bayes	2.15
Shibata	2.14
Hannan-Quinn	2.14

Table 3.3: Infocriteria: ABSA GARCH11

	V1
Akaike	2.13
Bayes	2.15
Shibata	2.13
Hannan-Quinn	2.14

Table 3.4: Infocriteria: GARCH11 with Sanlam external regressor

References

Tsay, Ruey S. 1989. "Testing and Modeling Threshold Autoregressive Processes." *Journal of the American Statistical Association* 84 (405). Taylor & Francis Group: 231–40.