Code Sample Description

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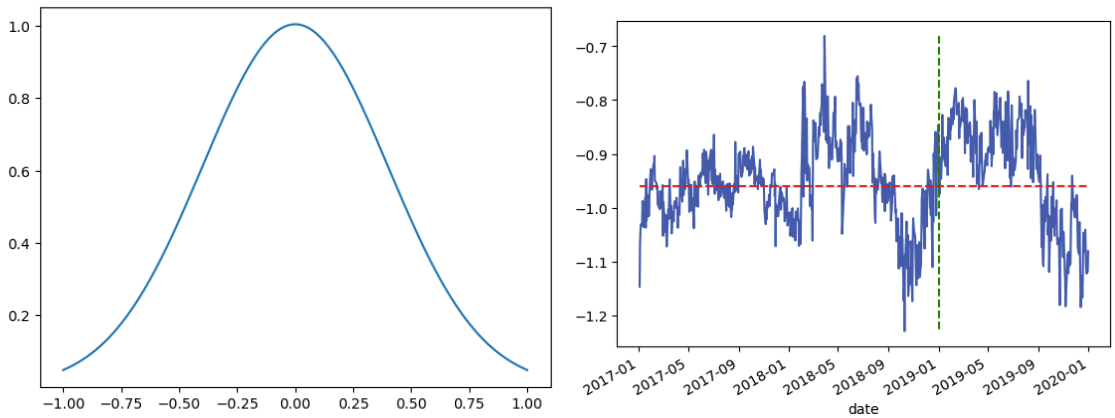
This describes a sample code from the final project at Multivariate Time Series Analysis, 2022 Spring, University of Chicago. Please refer to the code_sample.py in Code Sample. For complete codebase and writing of the project, see Non-linear-Cointegration.

First, the code prints a table of stability and cointegration tests results for the functional-coefficient cointegration model (Xiao, 2009). It analyzes non-linear cointegration between exchange-traded funds, which is the VV and SPY pair. The model requires a covariate process for kernel estimation, and the data used are daily return series of S&P500 return and differenced VIX. The length of data used for testing is between 2017-01-01 and 2018-12-31.

Covariate	Type	ADF	p-value	1%	5%	10%
VIX	Stability	1532.04	0.00	9.84	11.65	9.60
	Cointegration	-1.26	0.10	-2.33	-1.64	-1.28
S&P500	Stability	1139.64	0.00	12.40	10.48	8.50
	Cointegration	-1.10	0.13	-2.33	-1.64	-1.28

Table 1: Stability and Cointegration Tests

Second, the code generates two plots. Figure 1a is the shape of the probability density function used to estimate the functional-coefficient cointegration model. As the model requires a kernel with support over [-1, 1], the shape is truncated at -1 and 1. Next, figure 1b plots the common trend (stationary spread) of VV and SPY, which is estimated by the Vector Error Correction Model (VECM). The horizontal line is the average spread on the train period (2017 and 2018). The vertical line separates the train (2017, 2018) and test period (2019). This plot shows the non-linearity of spread in the test period while it passes the linear-cointegration test (Johansen test of VECM) in the train period.



(a) Truncated Gaussian Kernel

(b) Common Trend using VECM

- Reference: Xiao, Z. (2009). Functional-coefficient cointegration models. Journal of Econometrics, 152(2), 81-92.