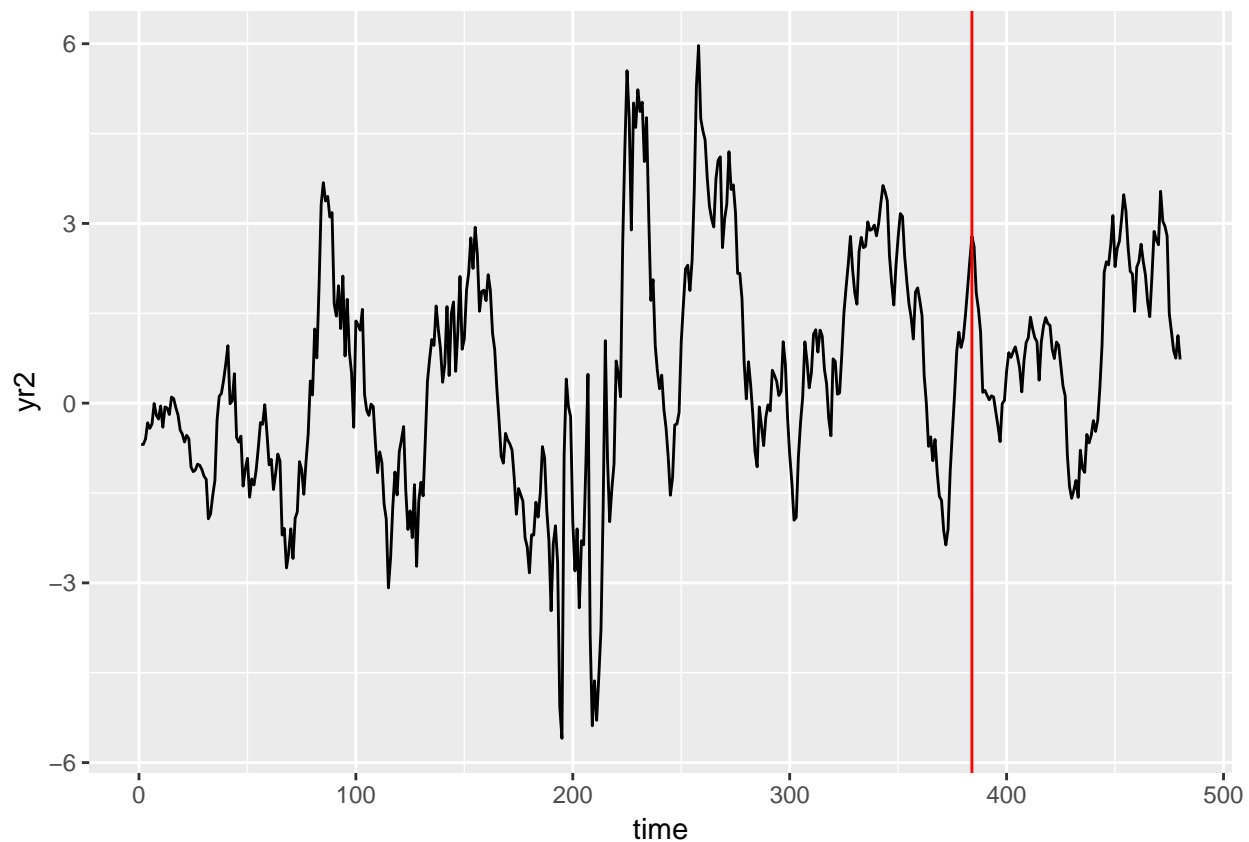


NG and ADF test (excess return)

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Data

Data: 131-8=123 series in total, 480 observations.

The “spread” series (difference between two I(1) series) are removed.

log() is done.

ADF test suggest I(0) for all four bond returns, whether use “trend” or “drift” specification.

Lasso 1

I(2) is first differenced, others are original.

$$\begin{aligned} y_t = & I(0)_{t-1} + I(0)_{t-2} + I(0)_{t-3} + I(0)_{t-4} \\ & + I(1)_{t-1} + I(1)_{t-2} + I(1)_{t-3} + I(1)_{t-4} \\ & + \Delta I(2)_{t-1} + \Delta I(2)_{t-2} + \Delta I(2)_{t-3} + \Delta I(2)_{t-4} \end{aligned}$$

Lasso 2

All stationary.

$$\begin{aligned}y_t = & I(0)_{t-1} + I(0)_{t-2} + I(0)_{t-3} + I(0)_{t-4} \\ & + \Delta I(1)_{t-1} + \Delta I(1)_{t-2} + \Delta I(1)_{t-3} + \Delta I(1)_{t-4} \\ & + \Delta^2 I(2)_{t-1} + \Delta^2 I(2)_{t-2} + \Delta^2 I(2)_{t-3} + \Delta^2 I(2)_{t-4}\end{aligned}$$

Lasso 3

Combination of Lasso 1 and 2.

$$\begin{aligned}y_t = & I(0)_{t-1} + I(0)_{t-2} + I(0)_{t-3} + I(0)_{t-4} \\ & + \Delta I(1)_{t-1} + \Delta I(1)_{t-2} + \Delta I(1)_{t-3} + \Delta I(1)_{t-4} \\ & + \Delta^2 I(2)_{t-1} + \Delta^2 I(2)_{t-2} + \Delta^2 I(2)_{t-3} + \Delta^2 I(2)_{t-4} \\ & + I(1)_{t-1} + \Delta I(2)_{t-1}\end{aligned}$$

yr2 as the dependent variable

- AIC chooses 13 lags for yr2.
- The out-of-sample MSE of AR(13) is 0.091.
- The estimated AR(1) coefficient is 0.9308.

Table 1: out-of-sample MSE of LASSO, when the dependent variable is YR2

	NG	AIC	BIC
LASSO 1	0.4879	0.4879	0.4879
LASSO 2	0.4512	0.3884	0.4523
LASSO 3	0.4725	0.4725	0.4725

yr3 as the dependent variable

- AIC chooses 25 lags for yr3.
- The out-of-sample MSE of AR(25) is 0.077.
- The estimated AR(1) coefficient is 0.934.

Table 2: out-of-sample MSE of LASSO, when the dependent variable is yr3

	NG	AIC	BIC
LASSO 1	0.521	0.5146	0.5141
LASSO 2	0.5726	0.492	0.5599

	NG	AIC	BIC
LASSO 3	0.5068	0.509	0.5109

yr4 as the dependent variable

- AIC chooses 25 lags for yr4.
- The out-of-sample MSE of AR(25) is 0.0735.
- The estimated AR(1) coefficient is 0.9342.

Table 3: out-of-sample MSE of LASSO, when the dependent variable is yr4

	NG	AIC	BIC
LASSO 1	0.5356	0.5266	0.5226
LASSO 2	0.5811	0.4749	0.5708
LASSO 3	0.5179	0.5223	0.5251

yr5 as the dependent variable

- AIC chooses 25 lags for yr5.
- The out-of-sample MSE of AR(25) is 0.066.
- The estimated AR(1) coefficient is 0.9251.

Table 4: out-of-sample MSE of LASSO, when the dependent variable is yr5

	NG	AIC	BIC
LASSO 1	0.5724	0.5609	0.5548
LASSO 2	0.6202	0.5122	0.6116
LASSO 3	0.5526	0.5634	0.5663