Monthly Presentation of Drawdown project

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Overview

Asset Description

US Equity

- AGG: iShares Core US Aggregate Bond
- HYG: iShares iBoxx $ High Yield Corporate Bd
- TIP: iShares TIPS Bond

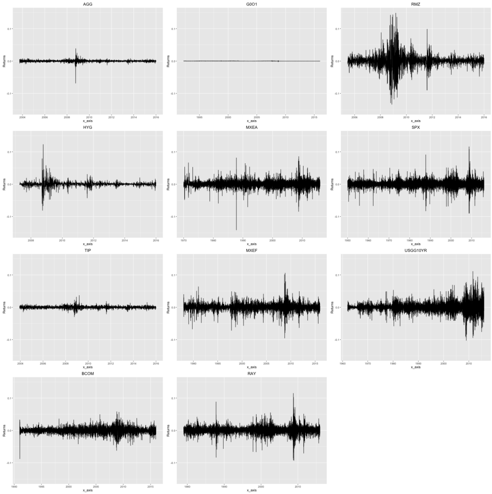
Index

- BCOM: Bloomberg Commodity Index
- G0O1: 3-Month U.S. Treasury Bill Index
- MXEA: MSCI EAFE Index
- MXEF: MSCI Emerging Markets Index
- RAY: Russell 3000 Index
- RMZ: MSCI US REIT Index
- SPX: S&P 500 Index
- USGG10YR: US Generic Govt 10 Year

Returns

Heading

1. Statement
2. Explanation
3. Example



Return Distribution

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1. Statement
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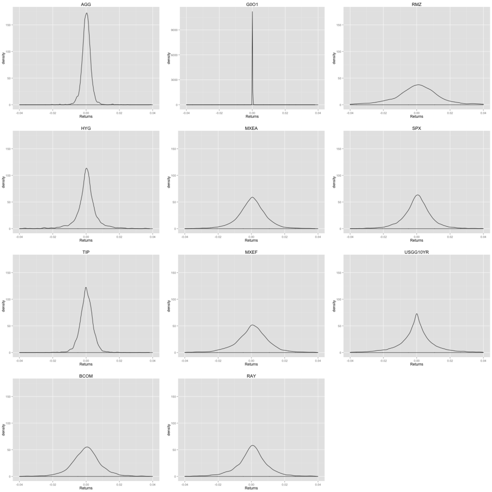


Sharpe Ratio, Standard deviation, Skewnes and Kurtosis

- Sharpe Ratio

$$sharpe\_ratio = \frac{\bar{r}_i - Rf}{\sigma_i} \tag{1}$$

Here we let $Rf = 0$

- Standard deviation

$$standard\_deviation_i = \sqrt{\frac{1}{n-1}\sum_{t=1}^{n}(r_i^t - \bar{r}_i)^2} \tag{2}$$

- Skewness

$$skewness_i = E_t\left[\left(\frac{r_i^t - \bar{r}_i}{\sigma_i}\right)^3\right] \tag{3}$$

- Kurtosis

$$kurtosis_i = \frac{E_t\left[\left(r_i^t - \bar{r}_i\right)^4\right]}{\left(E_t\left[\left(r_i^t - \bar{r}_i\right)^2\right]\right)^2} \tag{4}$$

i: represents different index.
t: time period.

Sharpe Ratio, Standard deviation, Skewnes and Kurtosis

Table: Statistical Summary of Assets

Asset	Sharpe	Sd.	Skewness	Kurtosis
AGG	0.052	0.003	-2.51	81.36
HYG	0.025	0.008	0.87	36.74
TIP	0.040	0.004	0.10	6.49
BCOM	0.001	0.009	-0.27	4.34
G0O1	0.717	0.000	0.69	26.77
MXEA	0.030	0.010	-0.32	10.75
MXEF	0.031	0.011	-0.39	7.71
RAY	0.036	0.011	-0.66	17.22
RMZ	0.016	0.023	0.36	13.69
SPX	0.035	0.010	-0.65	21.12
USGG10YR	0.003	0.013	0.12	8.81

VaR & ES

- *Value at Risk (VaR)*

$$VaR_\alpha(L) = inf\{l \in \mathbb{R} : P(L > l) \leq 1 - \alpha\} = inf\{l \in \mathbb{R} : F_L(l) \geq \alpha\} \tag{5}$$

- *Expected shortfall (ES)*

$$ES_\alpha(L) = E\left[L | L < VaR_\alpha(L)\right] \tag{6}$$

VaR & ES

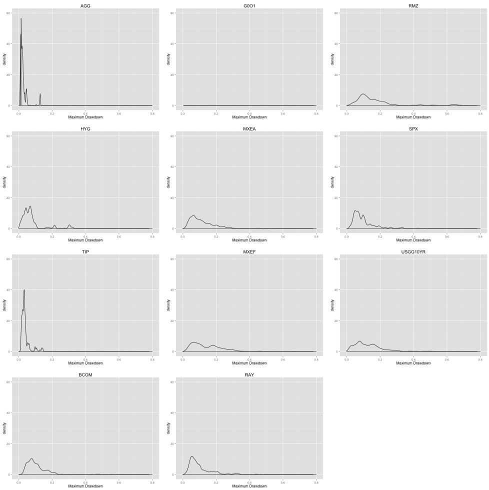
Table: VaR and ES under various probabilities

	VaR(%)			ES(%)		
Asset	0.90	0.95	0.99	0.90	0.95	0.99
AGG	-0.29	-0.40	-0.69	-0.50	-0.66	-1.23
HYG	-0.62	-1.03	-2.50	-1.41	-2.03	-4.01
TIP	-0.44	-0.62	-1.01	-0.72	-0.91	-1.47
BCOM	-1.04	-1.47	-2.62	-1.71	-2.20	-3.55
G0O1	0.00	0.00	-0.01	-0.01	-0.01	-0.03
MXEA	-1.02	-1.46	-2.59	-1.74	-2.26	-3.76
MXEF	-1.21	-1.76	-3.32	-2.11	-2.75	-4.67
RAY	-1.11	-1.62	-2.97	-1.95	-2.56	-4.42
RMZ	-1.91	-3.00	-7.56	-3.99	-5.62	-9.99
SPX	-0.99	-1.43	-2.58	-1.71	-2.23	-3.80
USGG10YR	-1.26	-1.95	-3.59	-2.28	-2.99	-4.89

Maximum Drawdown Distribution

Heading

1. Statement
2. Empirical distribution of maximum drawdown under 6 month rolling window
3. Example



Tail Mean of Maximum Drawown Distribution

Table: tail mean of maximum drawdown distribution under 3-month and 6-month rolling window

	3 month			6 month		
Asset	0.9	0.95	0.99	0.9	0.95	0.99
AGG	5.60	7.72	12.84	8.12	11.45	12.84
HYG	18.41	24.07	29.67	26.43	30.77	32.26
TIP	7.48	9.90	13.10	11.14	12.91	14.39
BCOM	18.14	22.54	38.03	26.61	33.66	51.74
G0O1	0.10	0.145	0.26	0.14	0.23	0.26
MXEA	20.39	23.73	33.32	27.21	31.79	47.11
MXEF	26.21	30.80	48.03	36.35	43.30	59.63
RAY	20.65	25.64	35.95	27.81	34.08	45.08
RMZ	37.30	48.41	63.45	52.04	62.41	67.61
SPX	18.35	22.67	32.46	25.18	30.65	40.69
USGG10YR	23.28	28.11	41.83	32.78	39.00	49.28

Conditional Expected Drawdown

The conditional expected drawdown is defined as:

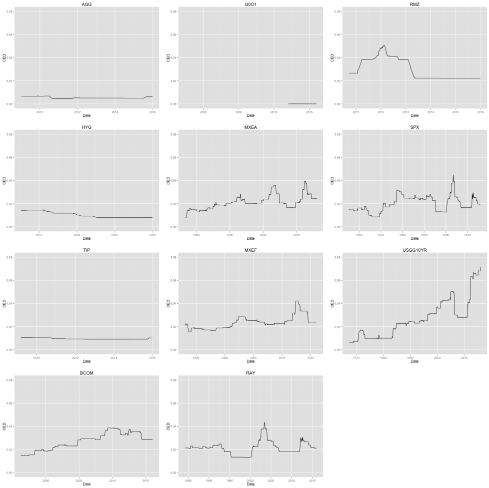
$$CED_{\alpha}(X_{T_n}) = \mathbf{E}(\mu(X_{T_n})|\mu(X_{T_n}) > DT_{\alpha}) \tag{7}$$

where $\mu(X_{T_n})$ is the maximum drawdown distribution over a finite path. We calculate the CED of various assets under 0.9, 0.95, 0.99 confidence level for different path length (3 months, 6 months, 1 year, 2 years, 5 years) separately.

Conditional Expected Drawdown

Heading

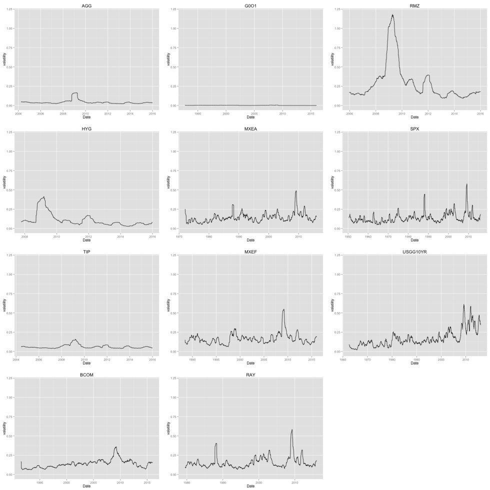
1. Statement CED under 3month5year Rolling Window (confidence level = 0.95)
2. Example



Time Varying Volatility

Heading

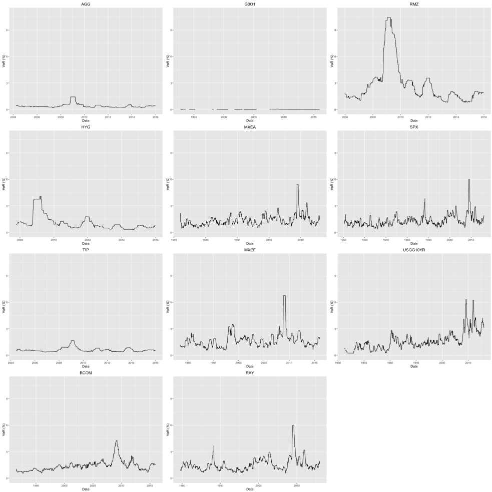
1. Volatility under 6month rolling window
2. Example



Time Varying VaR

Heading

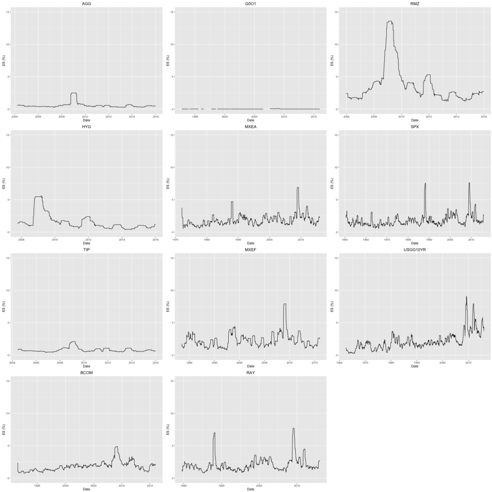
1. VaR(%) under 6month rolling window
2. Example



Time varying ES

Heading

1. ES(%) under 6month rolling window
2. Example



Questions

The End