HW: Exponentially Weighted Regression

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Recall that, for variables x, y, so long as we have some measure of covariance and variance, we can calculate the beta between them as

$$\hat{\beta} = \frac{\mathrm{Cov}(x, y)}{\mathrm{Var}(x)}$$

1 Obtain Daily Data

Obtain daily adjusted closing prices for SPY and 200+ other securities in the time range Jan 1 2016 to Dec 31 2020, and convert to daily returns. We will treat this as a regular time series.

2 Exponentially Weighted Regressions

Write code[1] such that, given a characteristic time $1/\lambda$ and equity at index i, you can form exponentially-weighted regression coefficients $\beta_t^{i,\lambda}$ between SPY and equity i for each day t on and after Feb 1 2016. Choose a few reasonable values of λ and compute $\beta_t^{i,\lambda}$ for all λ, i and t.

Compute boxcar windowed regression coefficients $b_{t'}^{i;w}$ between SPY and equity i with windows of length $w = 2/\lambda$ for each of your λ.

Now calculate out-of-sample regression coefficients c_s^i on 5-trading-day boxcar windows using data subsequent to all dates. Consider these the empirically "correct" regression coefficients you were targeting with your exponential and boxcar regressions above.

[1] You may use packages and libraries like *MASS* and *statsmodels*

3 Analysis

Assess the out of sample performance of exponentially weighted regression coefficients β versus window coefficients b at your various windows and characteristic times.