Problem Set 6

Xinxin

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Economic Questions
I want to test Fama-Frech three-factor model, which describes the relationship between three risk factors (market excess return, small minus big and high minus low) and expected return for stock.

Data description
I download daily stock price for Google from Yahoo Finance from January 1st, 2017 to July, 1st, 2019 and Fama-French three risk factors on daily basis during the same period. I combine these two databases based on date. The daily stock return is

$$R_t = (P_t/P_{t-1} - 1) * 100 \tag{1}$$

where R_t are daily stock return for day t, P_t is stock price for day t and P_{t-1} is stock price for day t-1.
The Fama-Frech three-factor model is

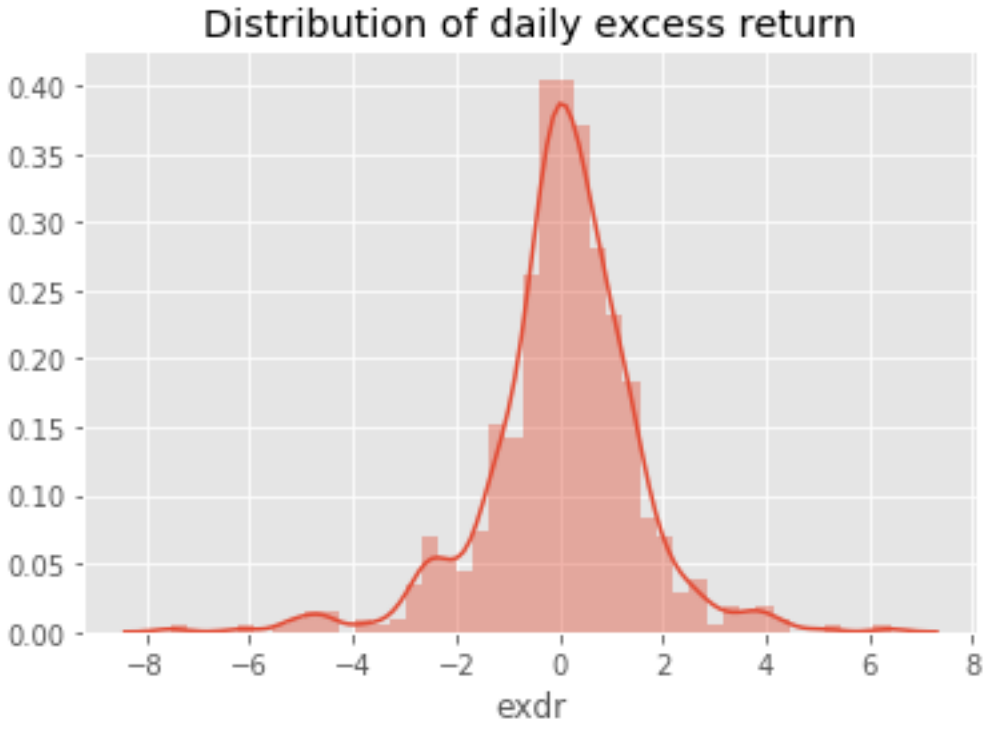
$$R_t - RF_t = \alpha + \beta_1 * MKT - RF_t + \beta_2 * SMB_t + \beta_3 * HML_t + \sigma \tag{2}$$

where R_t are daily stock return for day t, RF is risk-free return, MKT-RF is market excess return, SMB is small minus big and HML is high minus low for the same day t.
α is the excess return of stock, $\beta_1/\beta_2/\beta_3$ is the reaction of stock return to MKT-RF /SMB/HML.

Firstly, I draw the distribution of daily stock excess return for Google, shown in figure 1. The distribution of daily stock excess return for Google s like a normal distribution.

Then, I did an OLS regression without fixed effect on time-series data. The regression model is equation(2). The results is shown in figure 2. α is -0.042 but not significant. Google stock does not have excess return. β_1 is 1.1796. If market excess return increases by 1%, Google stock return increases by 1.1796%. β_2 is -0.283.If SMB increases by 1%, Google stock return decreases by 0.283% β_3 is -0.7472.If HML increases by 1%, Google stock return decreases by 0.7472%.

Figure 1: Distribution of excess return



return.png

Figure 2: OLS

OLS Regression Results

Dep. Variable:	exdr	R-squared:	0.621
Model:	OLS	Adj. R-squared:	0.619
Method:	Least Squares	F-statistic:	339.5
Date:	Tue, 05 Nov 2019	Prob (F-statistic):	1.64e-130
Time:	22:48:50	Log-Likelihood:	-821.67
No. Observations:	626	AIC:	1651.
Df Residuals:	622	BIC:	1669.
Df Model:	3		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	-0.0452	0.036	-1.247	0.213	-0.116	0.026
mkt	1.1976	0.045	26.670	0.000	1.109	1.286
SMB	-0.2823	0.074	-3.829	0.000	-0.427	-0.138
HML	-0.7472	0.069	-10.829	0.000	-0.883	-0.612

Omnibus:	170.982	Durbin-Watson:	1.899
Prob(Omnibus):	0.000	Jarque-Bera (JB):	2134.010
Skew:	-0.834	Prob(JB):	0.00
Kurtosis:	11.890	Cond. No.	2.09