

```
In [1]: import pandas as pd
import statsmodels.api as sm
from helper import ordinary_least_squares_regression

%matplotlib inline

#HSBC and ETF data was from Nasdaq and all other columns were from Ken French https://mba.tuck.dartmouth.edu
df = pd.read_excel("HSBC.ods", engine="odf")
```

```
In [2]: # cleaning data, data from French is already expressed in percent
for column in ["XLF-rf", "IXG-rf", "HSBC-rf", "HSBC with dividends-rf", "HSBC- developed rf", "HSBC with dividend yield-rf"]
    df[column] = pd.to_numeric(df[column], errors='coerce')*100
df_cleaned = df.dropna()
print(df_cleaned.info())
df_cleaned
```

```
<class 'pandas.core.frame.DataFrame'>
```

```
Index: 1202 entries, 53 to 1254
```

```
Data columns (total 39 columns):
```

#	Column	Non-Null Count	Dtype
0	Date	1202 non-null	object
1	HSBC Close/Last	1202 non-null	object
2	Volume	1202 non-null	int64
3	Open	1202 non-null	object
4	High	1202 non-null	object
5	Low	1202 non-null	object
6	HSBC Dividends	1202 non-null	object
7	HSBC return	1202 non-null	object
8	HSBC price return	1202 non-null	object
9	XLF Close/Last	1202 non-null	float64
10	XLF return	1202 non-null	object
11	IXG Close/Last	1202 non-null	float64
12	IXG return	1202 non-null	object
13	Mkt-RF	1202 non-null	float64
14	SMB	1202 non-null	float64
15	HML	1202 non-null	float64
16	RMW	1202 non-null	float64
17	CMA	1202 non-null	float64
18	RF	1202 non-null	float64
19	XLF-rf	1202 non-null	float64
20	IXG-rf	1202 non-null	float64
21	Banks-rf	1202 non-null	float64
22	Insur-rf	1202 non-null	float64
23	RlEst-rf	1202 non-null	float64
24	Fin -rf	1202 non-null	float64
25	Banks	1202 non-null	float64
26	Insur	1202 non-null	float64
27	RlEst	1202 non-null	float64
28	Fin	1202 non-null	float64
29	HSBC with dividends-rf	1202 non-null	float64
30	HSBC-rf	1202 non-null	float64
31	Developed Mkt-RF	1202 non-null	float64
32	Developed SMB	1202 non-null	float64
33	Developed HML	1202 non-null	float64
34	Developed RMW	1202 non-null	float64
35	Developed CMA	1202 non-null	float64
36	Developed RF	1202 non-null	float64

```

37 HSBC with dividends - developed rf 1202 non-null float64
38 HSBC- developed rf 1202 non-null float64
dtypes: float64(28), int64(1), object(10)
memory usage: 375.6+ KB
None

```

Out[2]:

	Date	HSBC Close/ Last	Volume	Open	High	Low	HSBC Dividends	HSBC return	HSBC price return	XLF Close/ Last	...	HSBC with dividends- rf	HSBC-r
53	12/31/2024	\$49.46	768225	\$49.78	\$49.86	\$49.40	0	-0.00101	-0.00101	48.33	...	-1.800990	-1.80099
54	12/30/2024	\$49.51	1344573	\$49.22	\$49.66	\$49.11	0	0.004463	0.004463	48.28	...	-1.253662	-1.25366
55	12/27/2024	\$49.29	1088110	\$49.03	\$49.32	\$49.01	0	0.000609	0.000609	48.75	...	-1.639099	-1.63909
56	12/26/2024	\$49.26	516346	\$49.30	\$49.455	\$49.195	0	0.000203	0.000203	49.11	...	-1.679695	-1.67969
57	12/24/2024	\$49.25	308990	\$48.74	\$49.30	\$48.71	0	0.011501	0.011501	48.99	...	-0.549867	-0.54986
...
1250	03/30/2020	\$28.86	4859009	\$28.42	\$28.91	\$28.27	0	-0.000346	-0.000346	21.41	...	-0.634638	-0.63463
1251	03/27/2020	\$28.87	6997786	\$28.82	\$29.50	\$28.56	0	-0.041819	-0.041819	21.01	...	-4.781879	-4.78187
1252	03/26/2020	\$30.13	7979577	\$29.30	\$30.21	\$29.22	0	0.014478	0.014478	21.67	...	0.847811	0.84781
1253	03/25/2020	\$29.70	7512773	\$29.47	\$30.42	\$29.08	0	0.003717	0.003717	20.39	...	-0.228253	-0.22825
1254	03/24/2020	\$29.59	7844320	\$29.32	\$30.08	\$28.837	0	0.051902	0.051902	19.85	...	4.590188	4.59018

1202 rows × 39 columns

correlation table

```

In [3]: df_cleaned[['Mkt-RF', 'SMB', 'HML', 'RMW', 'CMA', 'XLF-rf', 'IXG-rf', 'Banks-rf', 'Insur-rf', 'RlEst-rf', 'Fin
           'HSBC with dividends-rf', 'HSBC-rf']].corr()

```

Out[3]:

	Mkt-RF	SMB	HML	RMW	CMA	XLF-rf	IXG-rf	Banks-rf	Insur-rf	REst-rf	Fin -
Mkt-RF	1.000000	0.241713	-0.149459	-0.231911	-0.334568	0.667645	0.665665	0.772806	0.701076	0.787788	0.872955
SMB	0.241713	1.000000	0.341334	-0.300474	0.056323	0.336009	0.320983	0.445459	0.210226	0.518404	0.367765
HML	-0.149459	0.341334	1.000000	0.402650	0.602861	0.335870	0.288290	0.398252	0.247018	0.124394	0.148594
RMW	-0.231911	-0.300474	0.402650	1.000000	0.332726	-0.025180	-0.041786	-0.058386	0.041845	-0.203812	-0.188287
CMA	-0.334568	0.056323	0.602861	0.332726	1.000000	-0.016949	-0.020420	-0.070568	0.003107	-0.182833	-0.204975
XLF-rf	0.667645	0.336009	0.335870	-0.025180	-0.016949	1.000000	0.967325	0.814004	0.680716	0.653767	0.770289
IXG-rf	0.665665	0.320983	0.288290	-0.041786	-0.020420	0.967325	1.000000	0.766868	0.642052	0.646327	0.738759
Banks-rf	0.772806	0.445459	0.398252	-0.058386	-0.070568	0.814004	0.766868	1.000000	0.737845	0.774963	0.886440
Insur-rf	0.701076	0.210226	0.247018	0.041845	0.003107	0.680716	0.642052	0.737845	1.000000	0.613500	0.730809
REst-rf	0.787788	0.518404	0.124394	-0.203812	-0.182833	0.653767	0.646327	0.774963	0.613500	1.000000	0.800856
Fin -rf	0.872955	0.367765	0.148594	-0.188287	-0.204975	0.770289	0.738759	0.886440	0.730809	0.800856	1.000000
HSBC with dividends-rf	0.407005	0.237129	0.311943	0.045277	0.094175	0.700079	0.761041	0.544512	0.412411	0.431036	0.489855
HSBC-rf	0.402379	0.234949	0.310128	0.045605	0.094390	0.695969	0.756837	0.541191	0.407572	0.426230	0.485555

```
In [4]: df_cleaned[['Developed Mkt-RF','Developed SMB','Developed HML','Developed RMW','Developed CMA',  
                  'HSBC with dividends-rf','HSBC-rf']].corr()
```

Out[4]:

	Developed Mkt-RF	Developed SMB	Developed HML	Developed RMW	Developed CMA	HSBC with dividends-rf	HSBC-rf
Developed Mkt-RF	1.000000	-0.360447	-0.064421	-0.147379	-0.303869	-0.019487	-0.021782
Developed SMB	-0.360447	1.000000	0.202590	-0.230002	0.142094	0.031566	0.028542
Developed HML	-0.064421	0.202590	1.000000	-0.349174	0.774313	0.003974	0.006831
Developed RMW	-0.147379	-0.230002	-0.349174	1.000000	-0.075813	0.001535	0.004569
Developed CMA	-0.303869	0.142094	0.774313	-0.075813	1.000000	0.017086	0.021718
HSBC with dividends-rf	-0.019487	0.031566	0.003974	0.001535	0.017086	1.000000	0.996183
HSBC-rf	-0.021782	0.028542	0.006831	0.004569	0.021718	0.996183	1.000000

Both XLF and IXG with Fama-French American factors

```

In [5]: X_columns = ['Mkt-RF', 'SMB', 'HML', 'RMW', 'CMA', 'XLF-rf', 'IXG-rf', 'Banks-rf', 'Insur-rf', 'REst-rf', 'Fir

y_to_try = ["HSBC-rf", 'HSBC with dividends-rf']
X = sm.add_constant(df_cleaned[X_columns])

for y_tried in y_to_try:
    print(y_tried)
    y = df_cleaned[y_tried]
    results, df_residual = ordinary_least_squares_regression(y=y, X=X)

```

HSBC-rf

OLS Regression Results

```

=====
Dep. Variable:          HSBC-rf      R-squared:                0.620
Model:                  OLS          Adj. R-squared:           0.617
Method:                 Least Squares F-statistic:              176.8
Date:                  Sun, 30 Mar 2025 Prob (F-statistic):       3.25e-241
Time:                  18:53:34      Log-Likelihood:           -1985.9
No. Observations:      1202         AIC:                      3996.
Df Residuals:          1190         BIC:                      4057.
Df Model:              11
Covariance Type:       nonrobust
=====

```

```

=====
              coef      std err          t      P>|t|      [0.025      0.975]
-----
const          0.0007      0.052       0.013      0.990      -0.101      0.102
Mkt-RF        -0.2500      0.104      -2.413      0.016      -0.453     -0.047
SMB           -0.0320      0.064      -0.497      0.619      -0.158      0.094
HML           0.0029      0.081       0.036      0.971      -0.156      0.162
RMW           0.1345      0.073       1.851      0.064      -0.008      0.277
CMA           0.2209      0.091       2.430      0.015       0.043      0.399
XLF-rf        -0.7657      0.097      -7.882      0.000      -0.956     -0.575
IXG-rf         1.7667      0.094     18.876      0.000       1.583      1.950
Banks-rf       0.2032      0.074       2.756      0.006       0.059      0.348
Insur-rf      -0.1333      0.049      -2.714      0.007      -0.230     -0.037
RLEst-rf      -0.0133      0.037      -0.362      0.717      -0.086      0.059
Fin -rf       0.0319      0.072       0.441      0.659      -0.110      0.174
=====

```

```

=====
Omnibus:          174.984   Durbin-Watson:           2.150
Prob(Omnibus):    0.000   Jarque-Bera (JB):       2342.546
Skew:             -0.007   Prob(JB):               0.00
Kurtosis:         9.839   Cond. No.               15.2
=====

```

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

HSBC with dividends-rf

OLS Regression Results

```

=====
Dep. Variable:      HSBC with dividends-rf      R-squared:                0.626
Model:              OLS          Adj. R-squared:           0.622
Method:             Least Squares F-statistic:              181.0

```

```

Date:                Sun, 30 Mar 2025    Prob (F-statistic):    6.10e-245
Time:                18:53:34           Log-Likelihood:        -1966.7
No. Observations:    1202              AIC:                  3957.
Df Residuals:        1190              BIC:                  4018.
Df Model:            11
Covariance Type:     nonrobust

```

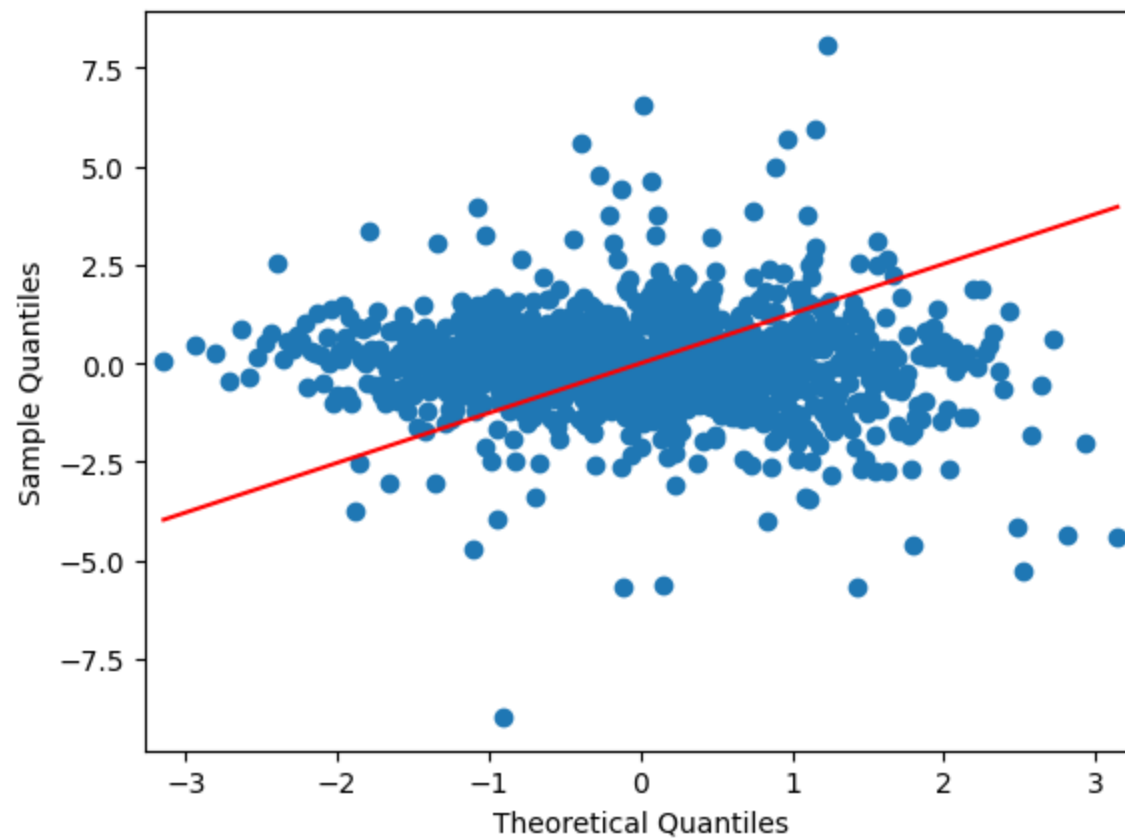
	coef	std err	t	P> t	[0.025	0.975]
-----	-----	-----	-----	-----	-----	-----
const	0.0101	0.051	0.198	0.843	-0.090	0.110
Mkt-RF	-0.2266	0.102	-2.223	0.026	-0.427	-0.027
SMB	-0.0320	0.063	-0.505	0.613	-0.156	0.092
HML	0.0225	0.080	0.283	0.777	-0.134	0.179
RMW	0.1290	0.072	1.803	0.072	-0.011	0.269
CMA	0.2091	0.089	2.337	0.020	0.034	0.385
XLF-rf	-0.7568	0.096	-7.916	0.000	-0.944	-0.569
IXG-rf	1.7514	0.092	19.014	0.000	1.571	1.932
Banks-rf	0.1813	0.073	2.499	0.013	0.039	0.324
Insur-rf	-0.1277	0.048	-2.642	0.008	-0.223	-0.033
REst-rf	-0.0103	0.036	-0.283	0.777	-0.081	0.061
Fin -rf	0.0313	0.071	0.440	0.660	-0.108	0.171
=====	=====	=====	=====	=====	=====	=====
Omnibus:	181.172		Durbin-Watson:		2.159	
Prob(Omnibus):	0.000		Jarque-Bera (JB):		2574.319	
Skew:	0.056		Prob(JB):		0.00	
Kurtosis:	10.169		Cond. No.		15.2	
=====	=====	=====	=====	=====	=====	=====

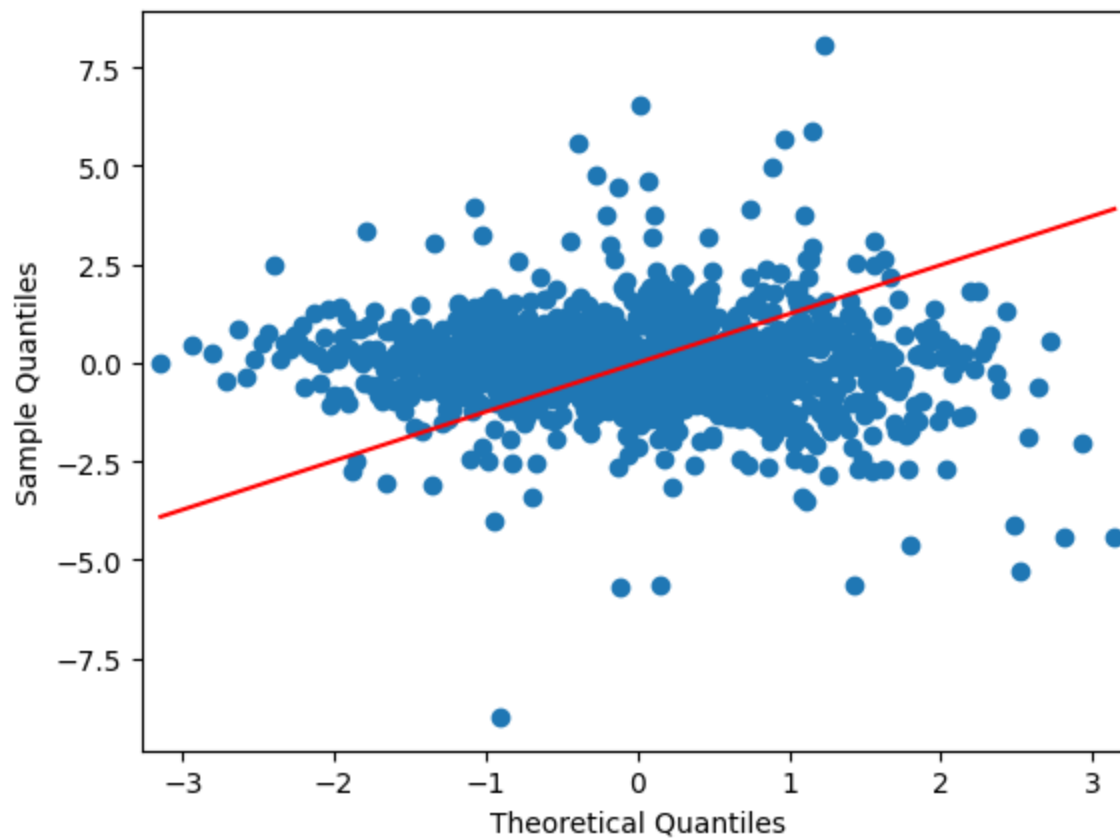
Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

/home/george/HSBC/helper.py:12: UserWarning: FigureCanvasAgg is non-interactive, and thus cannot be shown
plot.show()

/home/george/HSBC/helper.py:12: UserWarning: FigureCanvasAgg is non-interactive, and thus cannot be shown
plot.show()





```
In [6]: X_columns = ['Mkt-RF', 'SMB', 'HML', 'RMW', 'CMA', "IXG-rf", 'Banks-rf', 'Insur-rf', 'REst-rf', 'Fin -rf']

y_to_try = ["HSBC-rf", 'HSBC with dividends-rf']
X = sm.add_constant(df_cleaned[X_columns])

for y_tried in y_to_try:
    print(y_tried)
    y = df_cleaned[y_tried]
    results, df_residual = ordinary_least_squares_regression(y=y, X=X)
```

HSBC-rf

OLS Regression Results

```

=====
Dep. Variable:          HSBC-rf      R-squared:          0.601
Model:                  OLS          Adj. R-squared:      0.597
Method:                 Least Squares  F-statistic:         179.1
Date:                   Sun, 30 Mar 2025  Prob (F-statistic):    2.89e-229
Time:                   18:53:34      Log-Likelihood:       -2016.5
No. Observations:       1202          AIC:                  4055.
Df Residuals:           1191          BIC:                  4111.
Df Model:                10
Covariance Type:        nonrobust
=====

```

```

=====
              coef      std err          t      P>|t|      [0.025      0.975]
-----
const          0.0789      0.052        1.513      0.131      -0.023      0.181
Mkt-RF         -0.1276      0.105       -1.215      0.225      -0.334      0.078
SMB            -0.0268      0.066       -0.406      0.684      -0.156      0.103
HML             0.0126      0.083        0.152      0.879      -0.150      0.175
RMW             0.1211      0.074        1.626      0.104      -0.025      0.267
CMA             0.2466      0.093        2.647      0.008       0.064      0.429
IXG-rf          1.0881      0.038       28.910      0.000       1.014      1.162
Banks-rf        0.0663      0.073        0.902      0.367      -0.078      0.210
Insur-rf       -0.1919      0.050       -3.854      0.000      -0.290     -0.094
RLEst-rf        0.0066      0.038        0.176      0.861      -0.067      0.081
Fin -rf        -0.0394      0.074       -0.535      0.593      -0.184      0.105
=====

```

```

=====
Omnibus:          165.851   Durbin-Watson:          2.116
Prob(Omnibus):    0.000   Jarque-Bera (JB):       1994.070
Skew:             -0.037   Prob(JB):                0.00
Kurtosis:         9.309   Cond. No.                13.1
=====

```

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

HSBC with dividends-rf

OLS Regression Results

```

=====
Dep. Variable:      HSBC with dividends-rf  R-squared:          0.606
Model:              OLS                    Adj. R-squared:      0.603
Method:             Least Squares          F-statistic:         183.3
Date:               Sun, 30 Mar 2025        Prob (F-statistic):    6.95e-233

```

```

Time:                18:53:34    Log-Likelihood:        -1997.5
No. Observations:    1202        AIC:                4017.
Df Residuals:        1191        BIC:                4073.
Df Model:             10
Covariance Type:     nonrobust

```

```

=====
              coef      std err          t      P>|t|      [0.025      0.975]
-----
const          0.0874        0.051        1.703      0.089      -0.013      0.188
Mkt-RF         -0.1056        0.103       -1.022      0.307      -0.308      0.097
SMB            -0.0269        0.065       -0.414      0.679      -0.154      0.101
HML            0.0321        0.082        0.393      0.694      -0.128      0.192
RMW            0.1157        0.073        1.578      0.115      -0.028      0.260
CMA            0.2345        0.092        2.558      0.011        0.055      0.414
IXG-rf         1.0806        0.037       29.170      0.000        1.008      1.153
Banks-rf        0.0460        0.072        0.636      0.525      -0.096      0.188
Insur-rf       -0.1856        0.049       -3.787      0.000      -0.282     -0.089
RLEst-rf        0.0095        0.037        0.255      0.799      -0.063      0.082
Fin -rf        -0.0391        0.072       -0.540      0.589      -0.181      0.103
=====
Omnibus:                170.917    Durbin-Watson:                2.122
Prob(Omnibus):           0.000    Jarque-Bera (JB):            2180.660
Skew:                    0.027    Prob(JB):                     0.00
Kurtosis:                9.598    Cond. No.                     13.1
=====

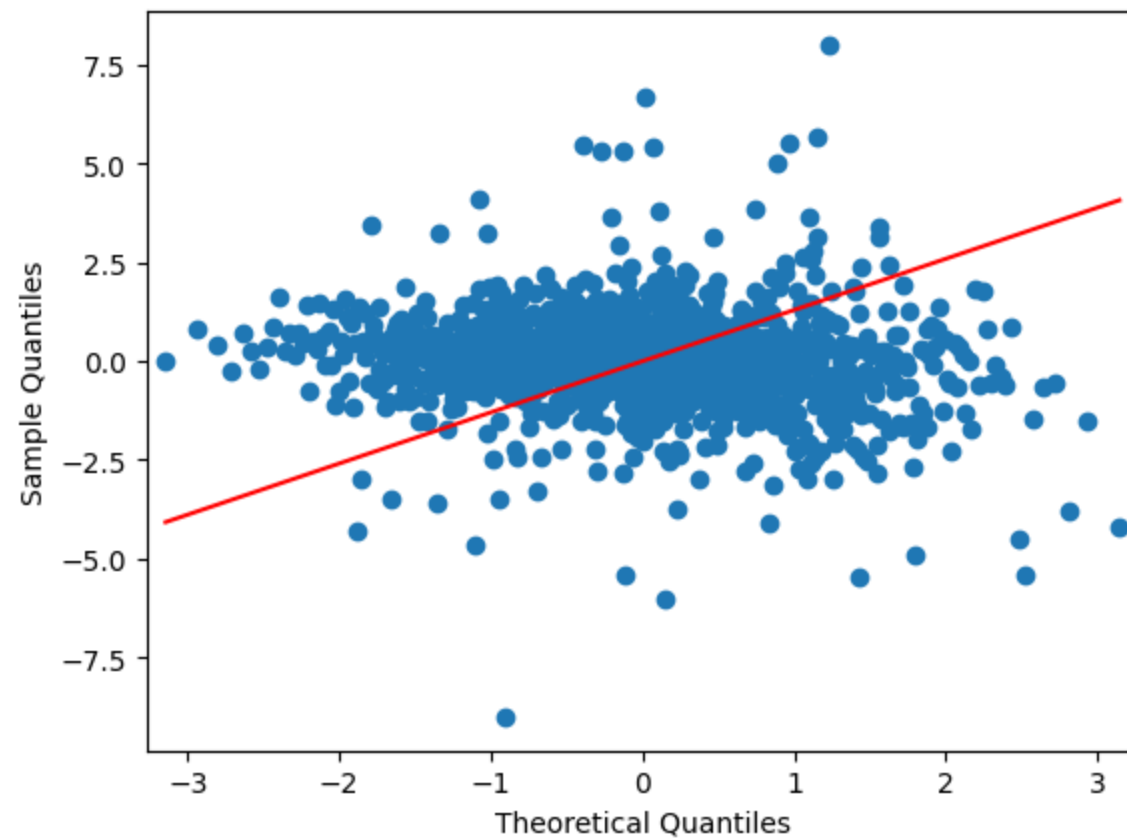
```

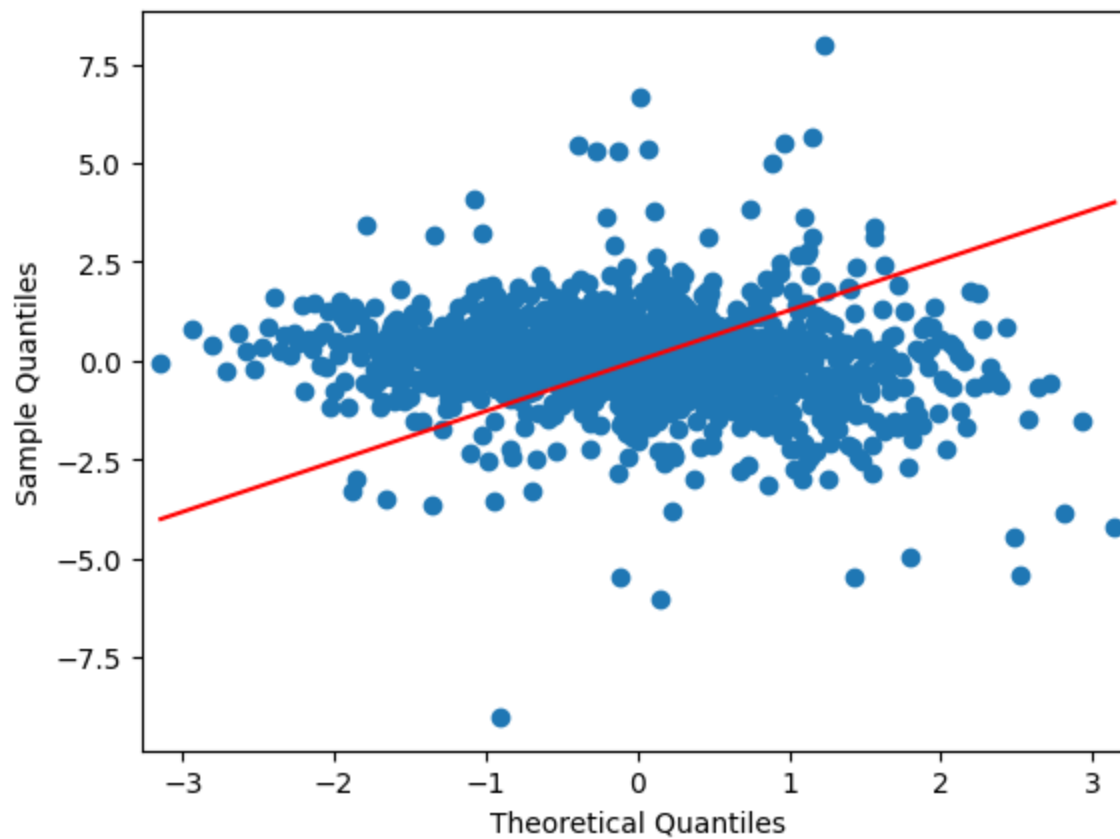
Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

/home/george/HSBC/helper.py:12: UserWarning: FigureCanvasAgg is non-interactive, and thus cannot be shown
plot.show()

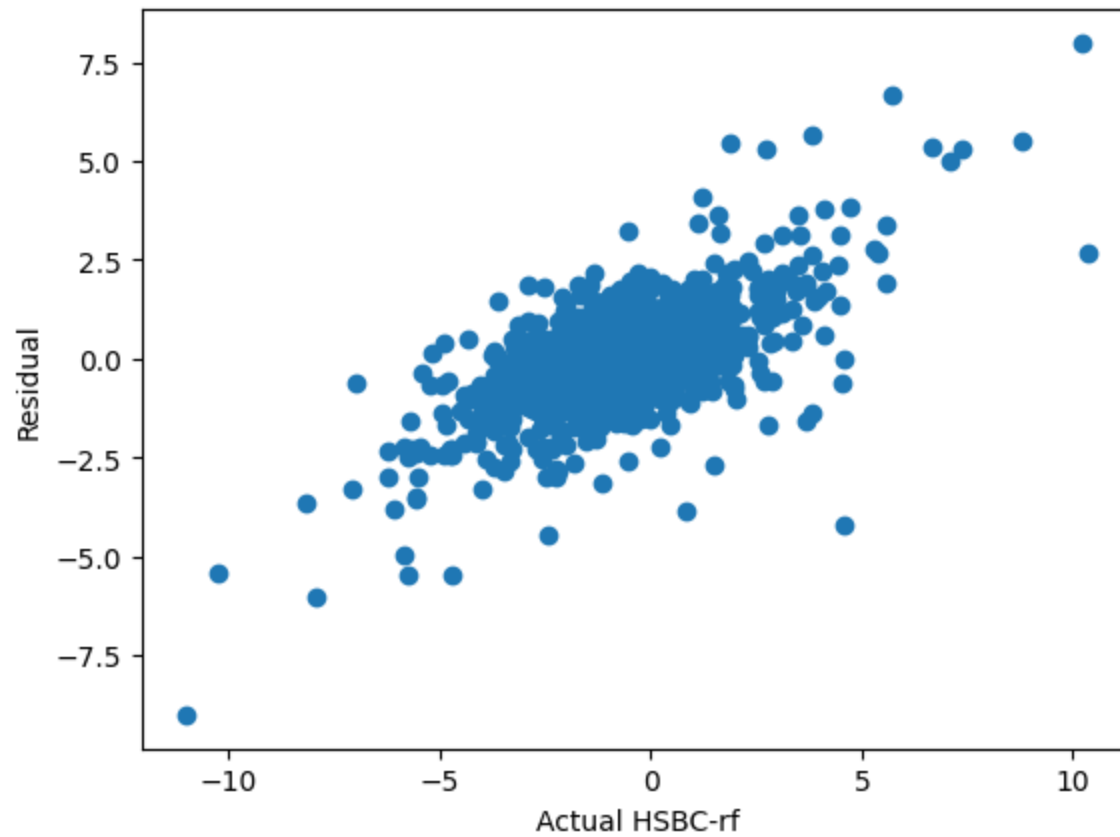
/home/george/HSBC/helper.py:12: UserWarning: FigureCanvasAgg is non-interactive, and thus cannot be shown
plot.show()





```
In [7]: from matplotlib import pyplot as plt

fig = plt.figure()
ax = fig.add_subplot()
ax.set_xlabel("Actual HSBC-rf")
ax.set_ylabel("Residual")
ax.plot(df_cleaned["HSBC-rf"], df_residual["error"], 'o')
plt.show()
```



Both XLF and IXG with Fama-French Developed factors

```
In [8]: X_columns = ['Developed Mkt-RF', 'Developed SMB', 'Developed HML', 'Developed RMW',  
                    'Developed CMA', 'XLF-rf', 'IXG-rf', 'Banks-rf', 'Insur-rf', 'REst-rf', 'Fin -rf']  
  
X = sm.add_constant(df_cleaned[X_columns])  
  
y_to_try = ['HSBC- developed rf', 'HSBC with dividends - developed rf']  
  
for y_tried in y_to_try:  
    print(y_tried)  
    y = df_cleaned[y_tried]  
    results, df_residual = ordinary_least_squares_regression(y=y, X=X)
```

HSBC- developed rf

OLS Regression Results

Dep. Variable:	HSBC- developed rf	R-squared:	0.445			
Model:	OLS	Adj. R-squared:	0.440			
Method:	Least Squares	F-statistic:	86.64			
Date:	Sun, 30 Mar 2025	Prob (F-statistic):	1.52e-143			
Time:	18:53:34	Log-Likelihood:	-2179.6			
No. Observations:	1202	AIC:	4383.			
Df Residuals:	1190	BIC:	4444.			
Df Model:	11					
Covariance Type:	nonrobust					
=====						
	coef	std err	t	P> t	[0.025	0.975]

const	-0.2725	0.060	-4.512	0.000	-0.391	-0.154
Developed Mkt-RF	-0.0140	0.053	-0.266	0.790	-0.118	0.089
Developed SMB	-0.0030	0.117	-0.026	0.980	-0.232	0.226
Developed HML	-0.0640	0.135	-0.474	0.635	-0.329	0.201
Developed RMW	-0.2720	0.175	-1.557	0.120	-0.615	0.071
Developed CMA	0.2119	0.207	1.022	0.307	-0.195	0.619
XLF-rf	-1.2169	0.112	-10.860	0.000	-1.437	-0.997
IXG-rf	1.6199	0.108	15.035	0.000	1.408	1.831
Banks-rf	0.6077	0.065	9.362	0.000	0.480	0.735
Insur-rf	-0.0180	0.053	-0.339	0.735	-0.122	0.086
REst-rf	-0.0788	0.037	-2.122	0.034	-0.152	-0.006
Fin -rf	-0.0672	0.070	-0.956	0.339	-0.205	0.071
=====						
Omnibus:	124.260	Durbin-Watson:	1.714			
Prob(Omnibus):	0.000	Jarque-Bera (JB):	899.171			
Skew:	0.103	Prob(JB):	5.59e-196			
Kurtosis:	7.232	Cond. No.	21.2			
=====						

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

HSBC with dividends - developed rf

OLS Regression Results

=====			
Dep. Variable:	HSBC with dividends - developed rf	R-squared:	0.448
Model:	OLS	Adj. R-squared:	0.443
Method:	Least Squares	F-statistic:	87.97

```

Date:                Sun, 30 Mar 2025    Prob (F-statistic):    2.78e-145
Time:                18:53:34           Log-Likelihood:       -2165.0
No. Observations:    1202              AIC:                 4354.
Df Residuals:        1190              BIC:                 4415.
Df Model:            11
Covariance Type:     nonrobust

```

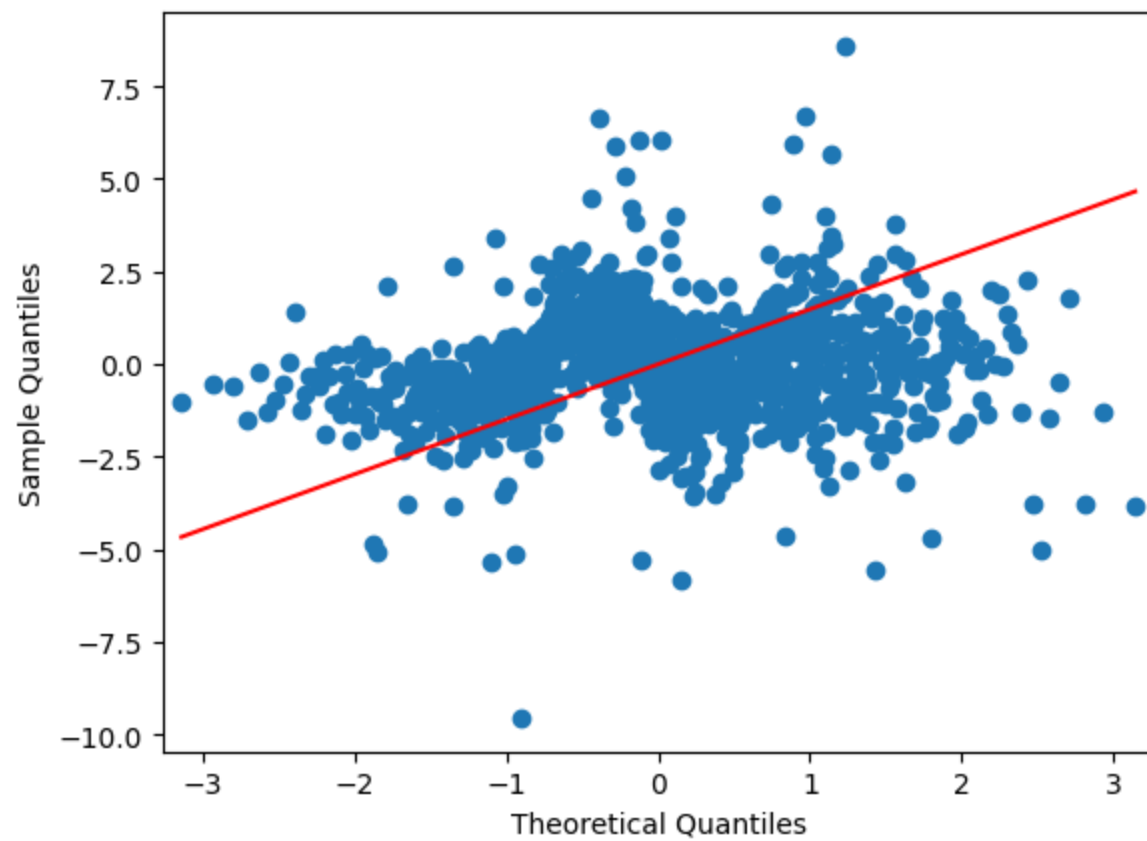
	coef	std err	t	P> t	[0.025	0.975]
-----	-----	-----	-----	-----	-----	-----
const	-0.2620	0.060	-4.391	0.000	-0.379	-0.145
Developed Mkt-RF	-0.0088	0.052	-0.169	0.866	-0.111	0.093
Developed SMB	0.0162	0.115	0.140	0.888	-0.210	0.242
Developed HML	-0.0719	0.133	-0.539	0.590	-0.333	0.190
Developed RMW	-0.2905	0.173	-1.683	0.093	-0.629	0.048
Developed CMA	0.1950	0.205	0.952	0.341	-0.207	0.597
XLF-rf	-1.2098	0.111	-10.929	0.000	-1.427	-0.993
IXG-rf	1.6069	0.106	15.097	0.000	1.398	1.816
Banks-rf	0.5973	0.064	9.313	0.000	0.471	0.723
Insur-rf	-0.0104	0.052	-0.199	0.843	-0.113	0.092
REst-rf	-0.0736	0.037	-2.007	0.045	-0.146	-0.002
Fin -rf	-0.0627	0.069	-0.903	0.367	-0.199	0.073
=====	=====	=====	=====	=====	=====	=====
Omnibus:	128.915		Durbin-Watson:		1.708	
Prob(Omnibus):	0.000		Jarque-Bera (JB):		929.661	
Skew:	0.162		Prob(JB):		1.34e-202	
Kurtosis:	7.296		Cond. No.		21.2	
=====	=====	=====	=====	=====	=====	=====

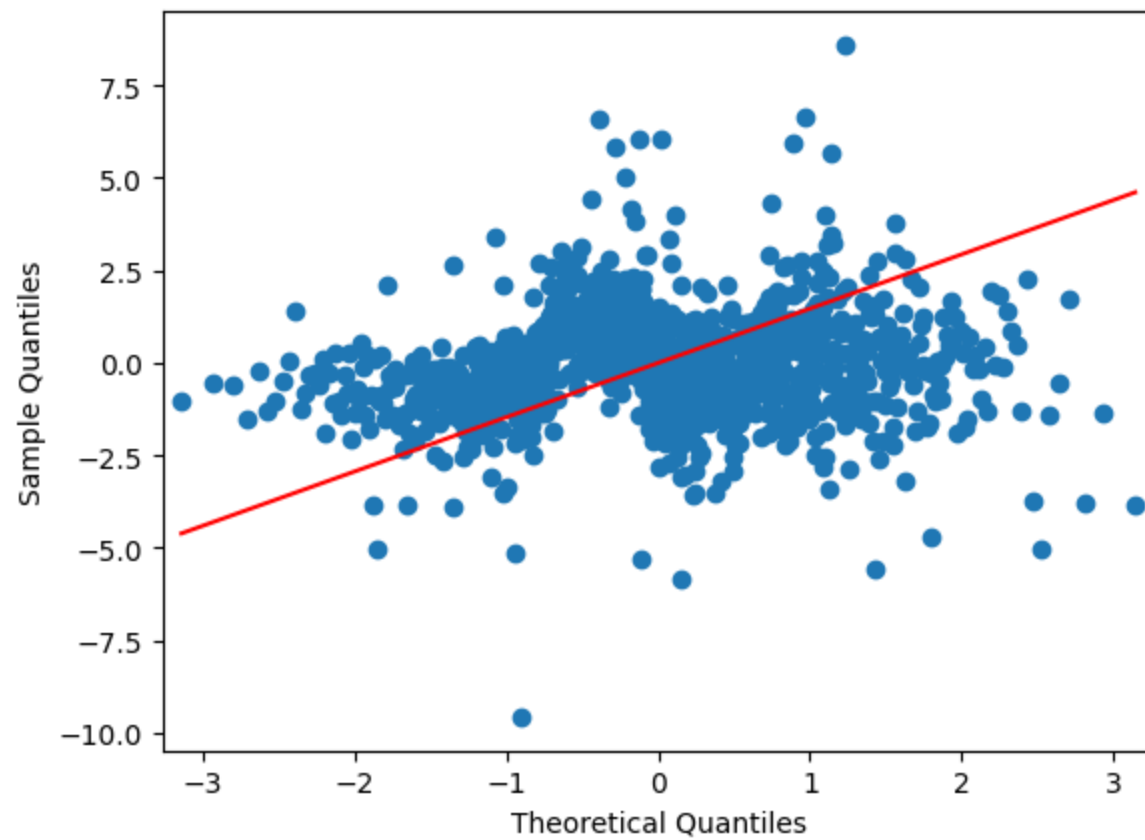
Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

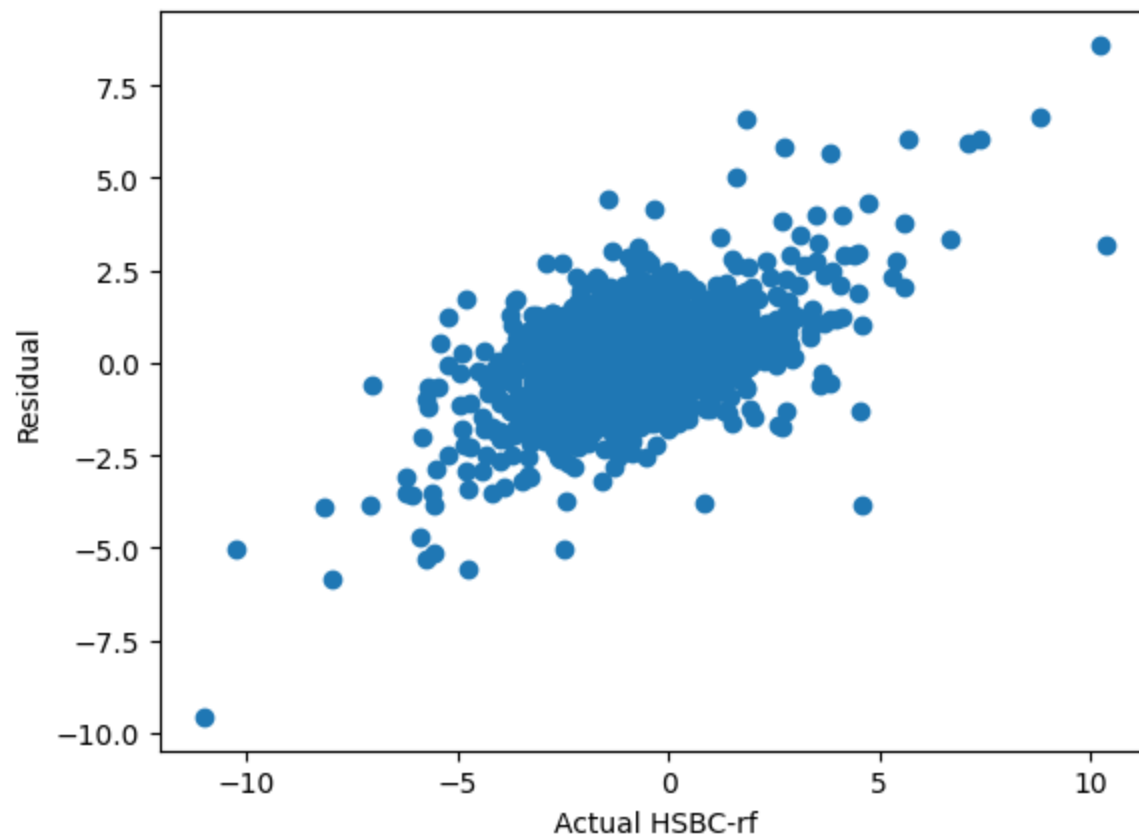
/home/george/HSBC/helper.py:12: UserWarning: FigureCanvasAgg is non-interactive, and thus cannot be shown
plot.show()

/home/george/HSBC/helper.py:12: UserWarning: FigureCanvasAgg is non-interactive, and thus cannot be shown
plot.show()





```
In [9]: fig = plt.figure()
ax = fig.add_subplot()
ax.set_xlabel("Actual HSBC-rf")
ax.set_ylabel("Residual")
ax.plot(df_cleaned["HSBC-rf"], df_residual["error"], 'o')
plt.show()
```



```
In [10]: import warnings

cumulative_returns = ["HSBC return", 'HSBC price return', 'IXG return', 'XLF return', 'Mkt-RF', 'Developed Mkt-

with warnings.catch_warnings():
    warnings.simplefilter("ignore")
    df_reversed = df_cleaned.iloc[::-1]
    for column in cumulative_returns:
        if column=="Mkt-RF":
            df_reversed[f"cumulative {column}"]=((df_reversed[column]+df_reversed["RF"])/100+1).cumprod()
        elif column=="Developed Mkt-RF":
            df_reversed[f"cumulative {column}"]=((df_reversed[column]+df_reversed["Developed RF"])/100+1).c
        else:
            df_reversed[f"cumulative {column}"]=(df_reversed[column]+1).cumprod()
```

```
columns_to_plot = [f"cumulative {column}" for column in cumulative_returns]
df_reversed["Date"] = pd.to_datetime(df_reversed["Date"])

def clean_label(some_str):
    if "-RF" in some_str:
        some_str = some_str[:-3]

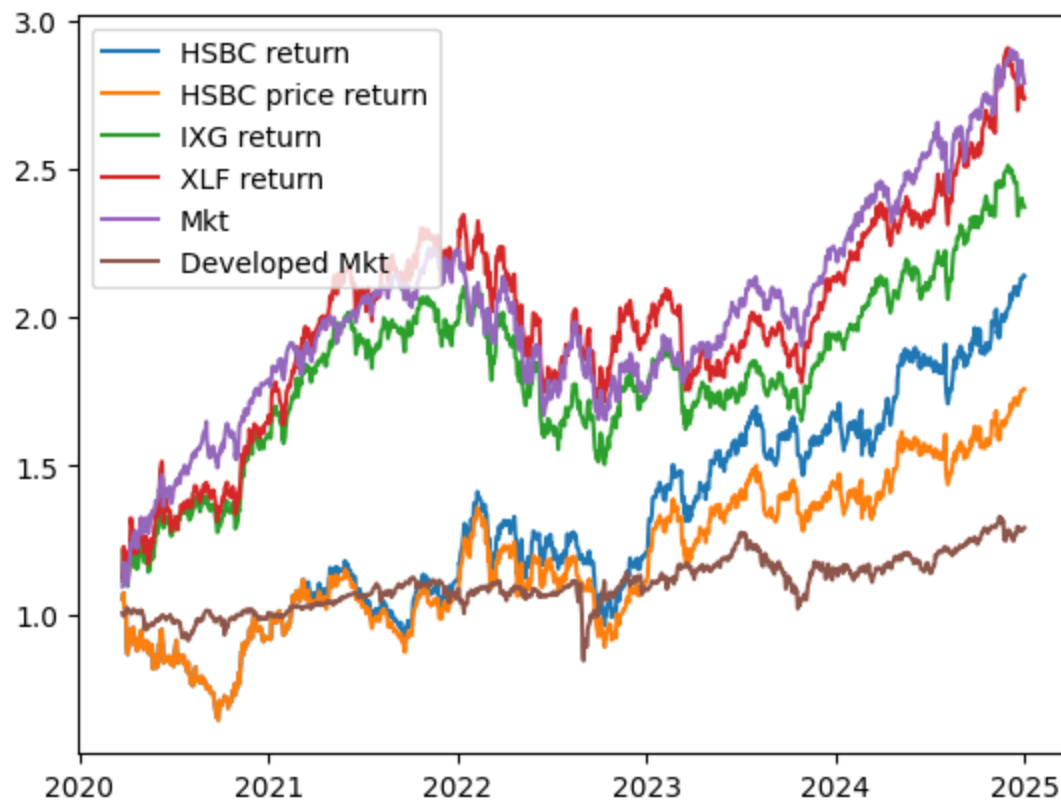
    return some_str[len("cumulative "):]

for column in columns_to_plot:
    plt.plot(df_reversed["Date"], df_reversed[column], label = clean_label(column))
plt.legend()
```

/tmp/ipykernel_202542/934776928.py:18: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
df_reversed["Date"] = pd.to_datetime(df_reversed["Date"])

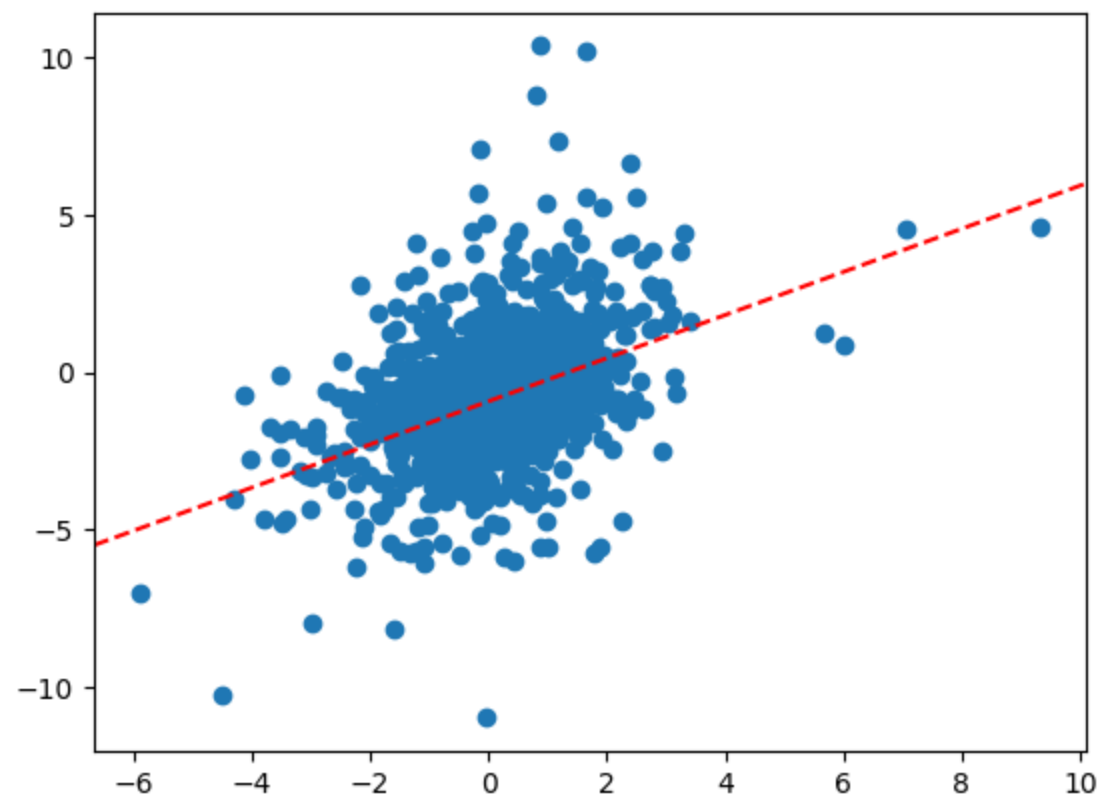
Out[10]: <matplotlib.legend.Legend at 0x79e44eb7ad80>



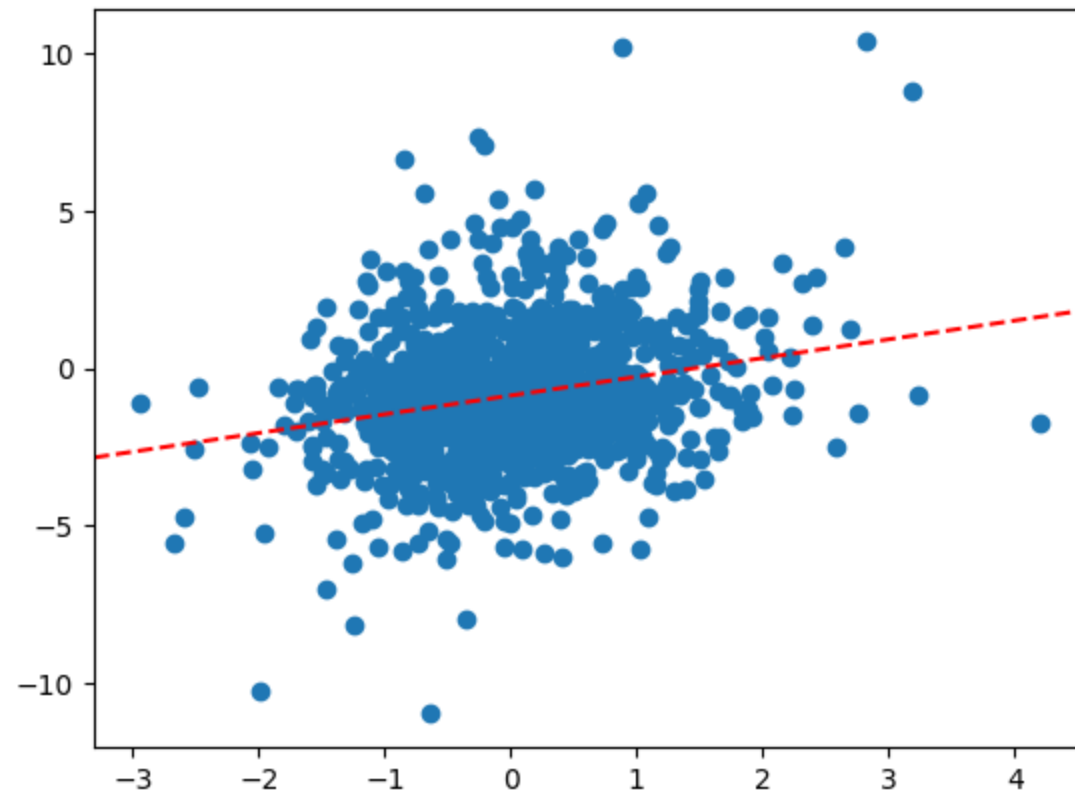
Plots of HSBC on the Y and selected factors

```
In [11]: for column in ['Mkt-RF', 'SMB', 'HML', 'RMW', 'CMA', 'XLF-rf', 'IXG-rf', 'Banks-rf', 'Insur-rf', 'REst-rf', 'I
          print(column)
          b, m = sm.OLS(df_cleaned['HSBC with dividends-rf'], sm.add_constant(df_cleaned[column])).fit().params
          plt.plot(df_cleaned[column], df_cleaned['HSBC with dividends-rf'], 'o')
          plt.axline(xyl=(0, b), slope=m, label=f'$y = {m:.1f}x {b:+.1f}$', linestyle="--", color='red')
          plt.show()
```

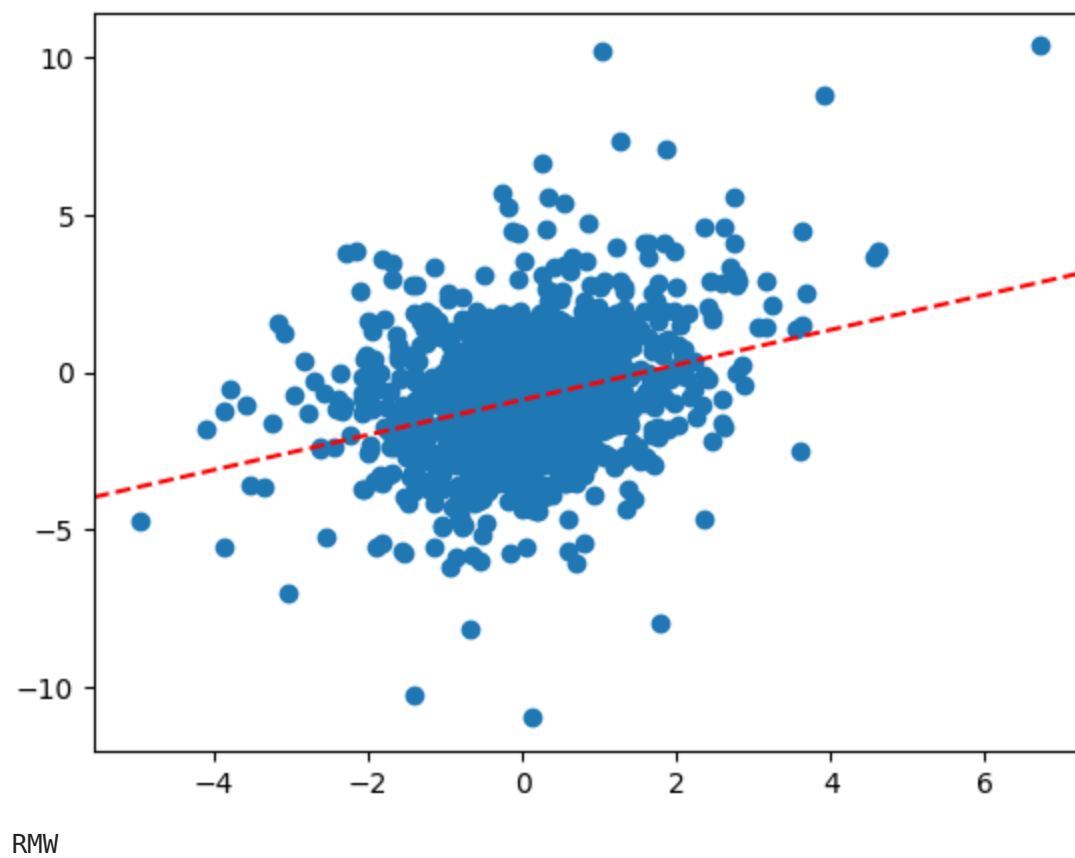
Mkt-RF

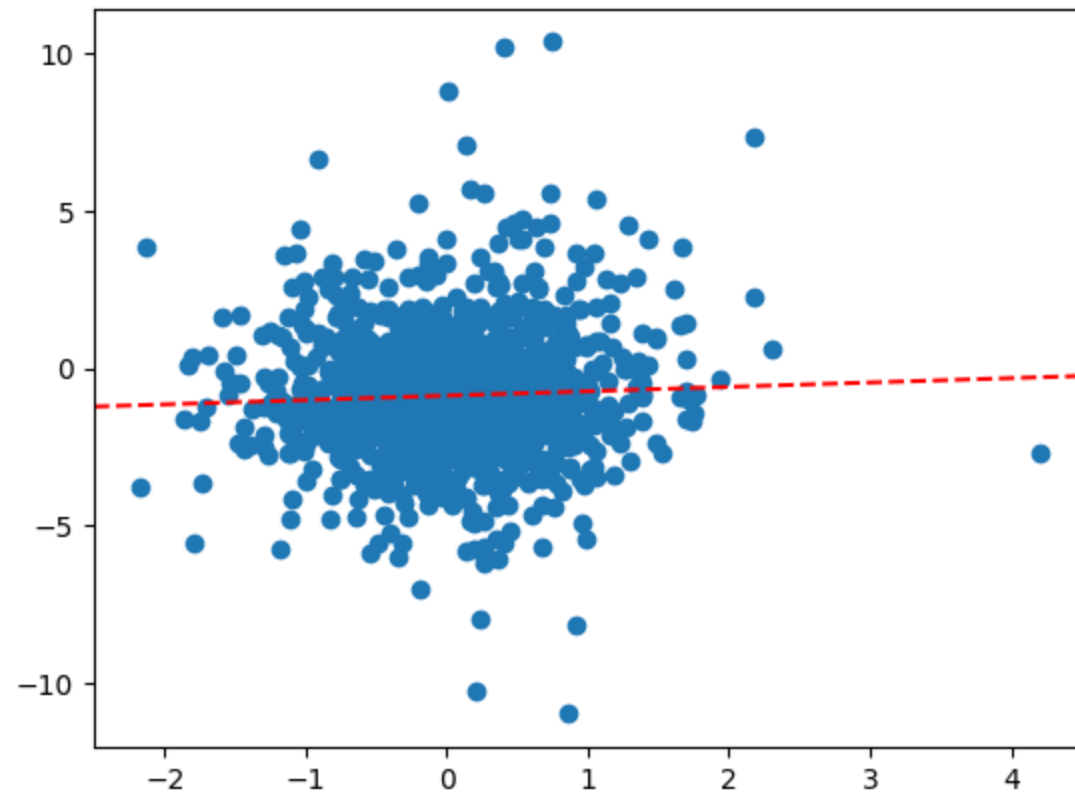


SMB

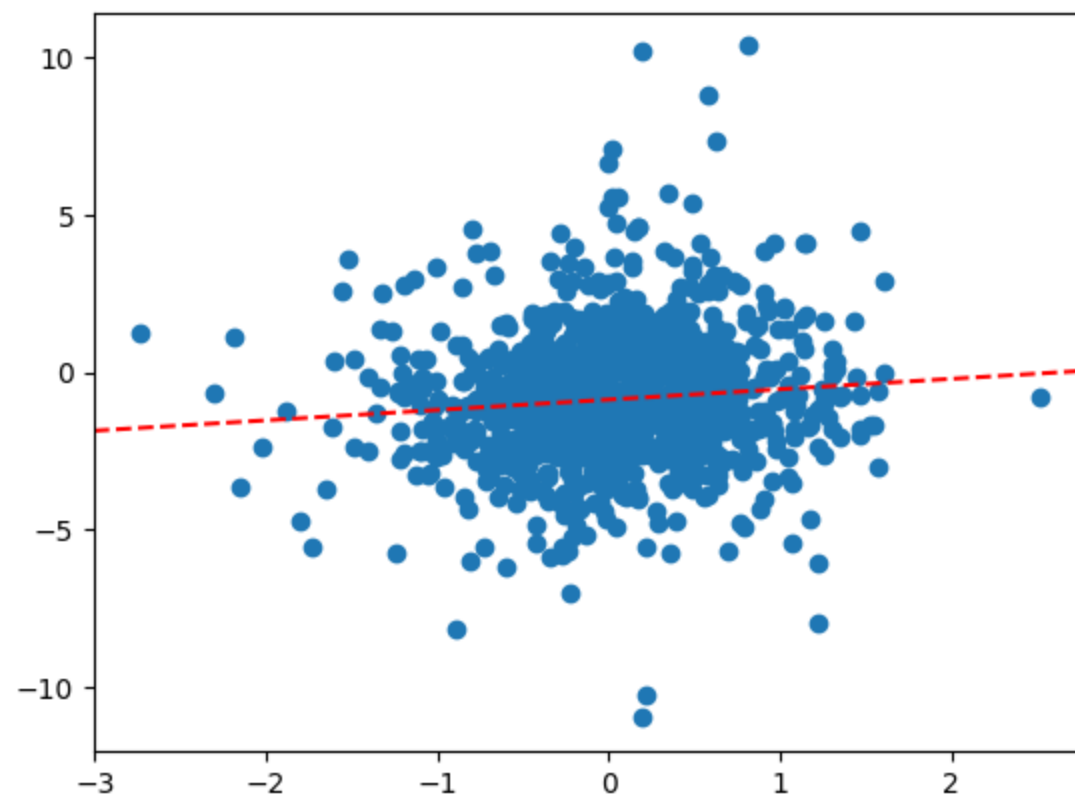


HML

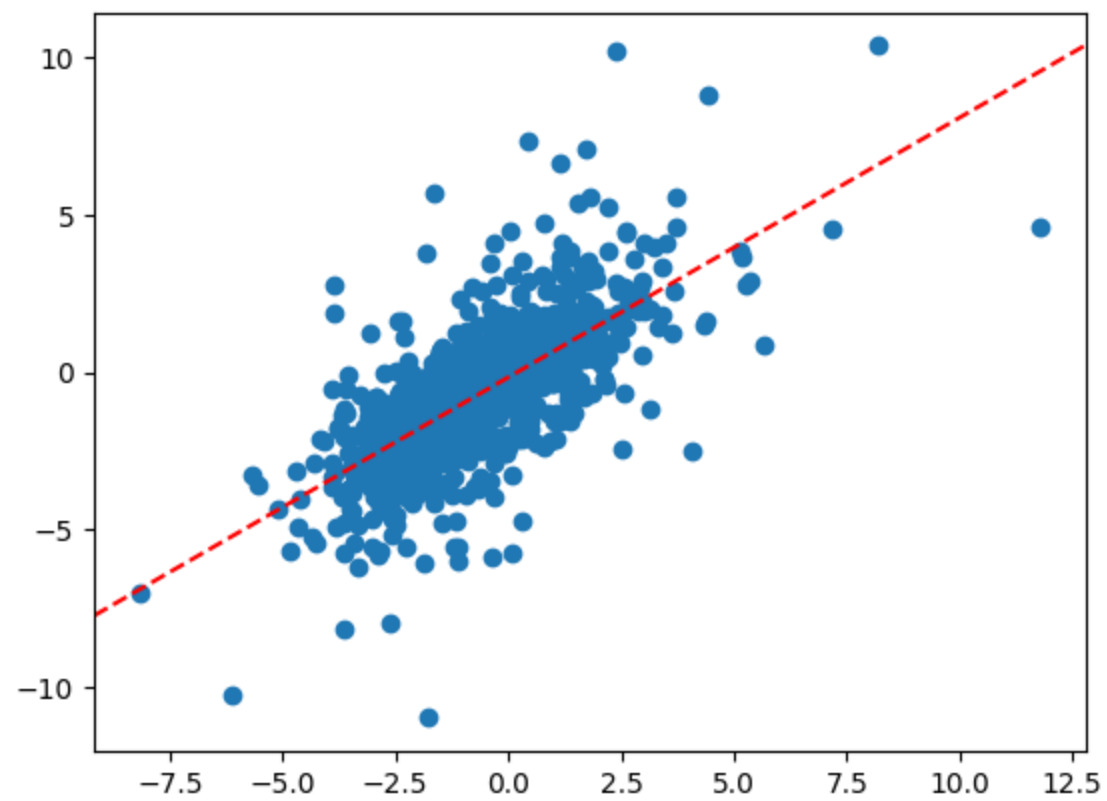




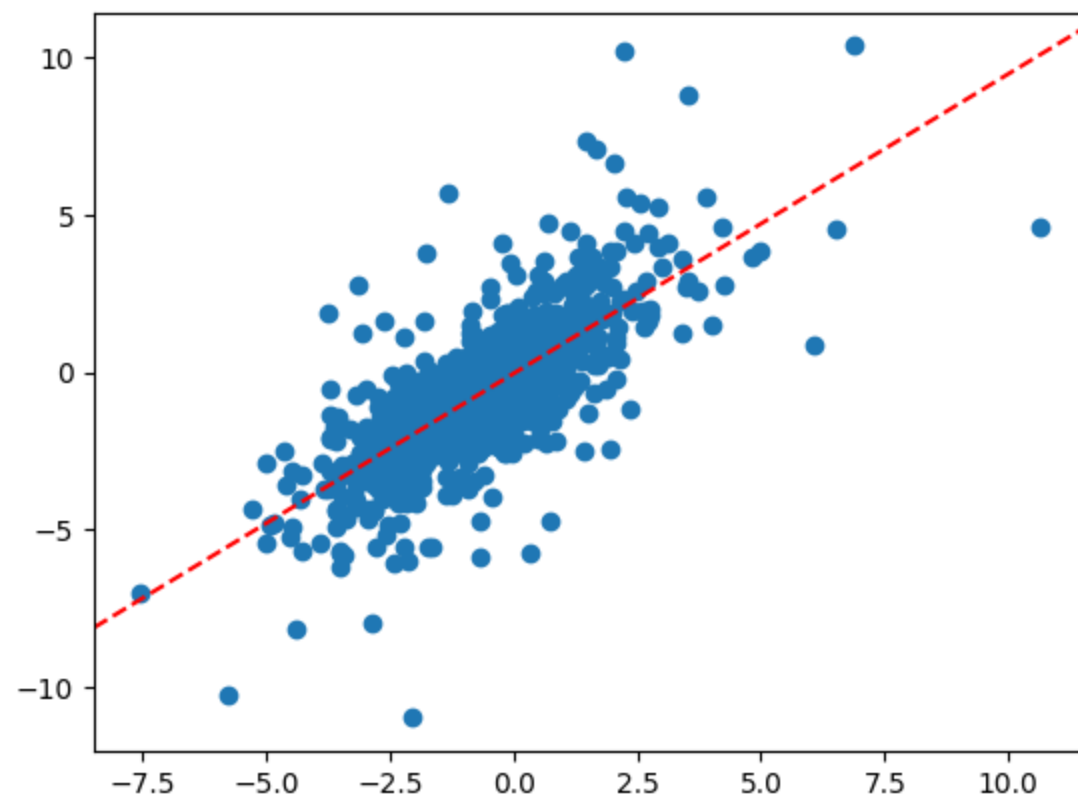
CMA



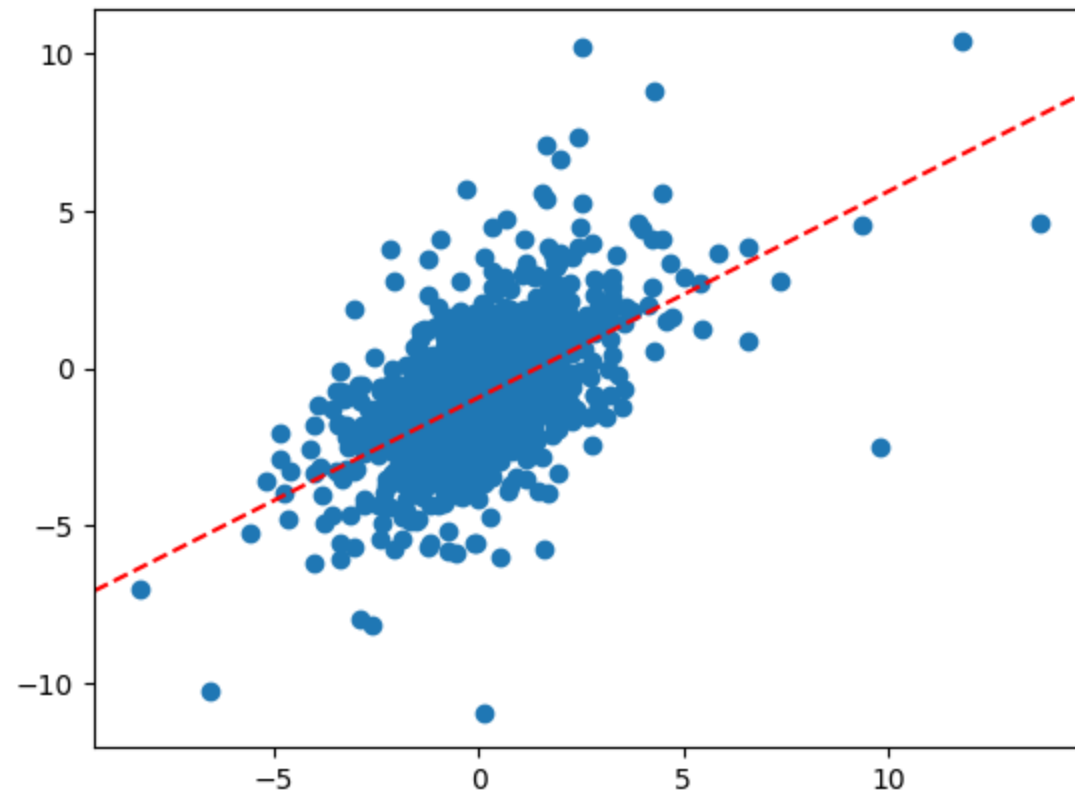
XLF-rf



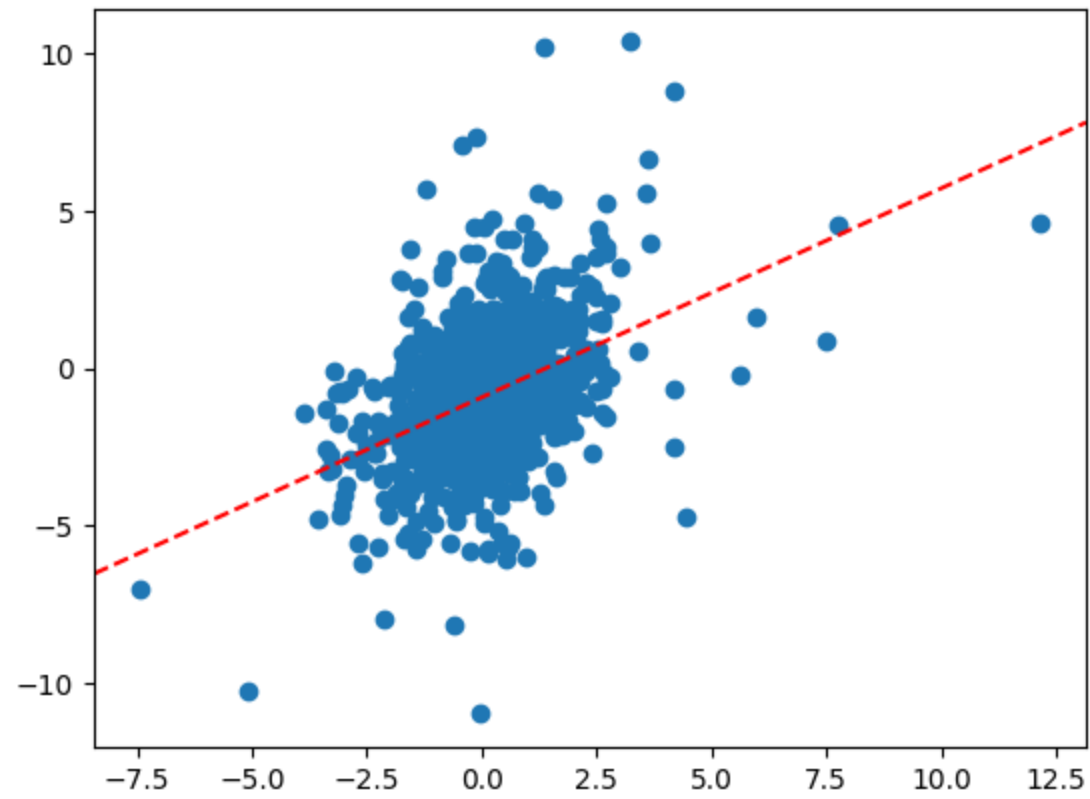
IXG-rf



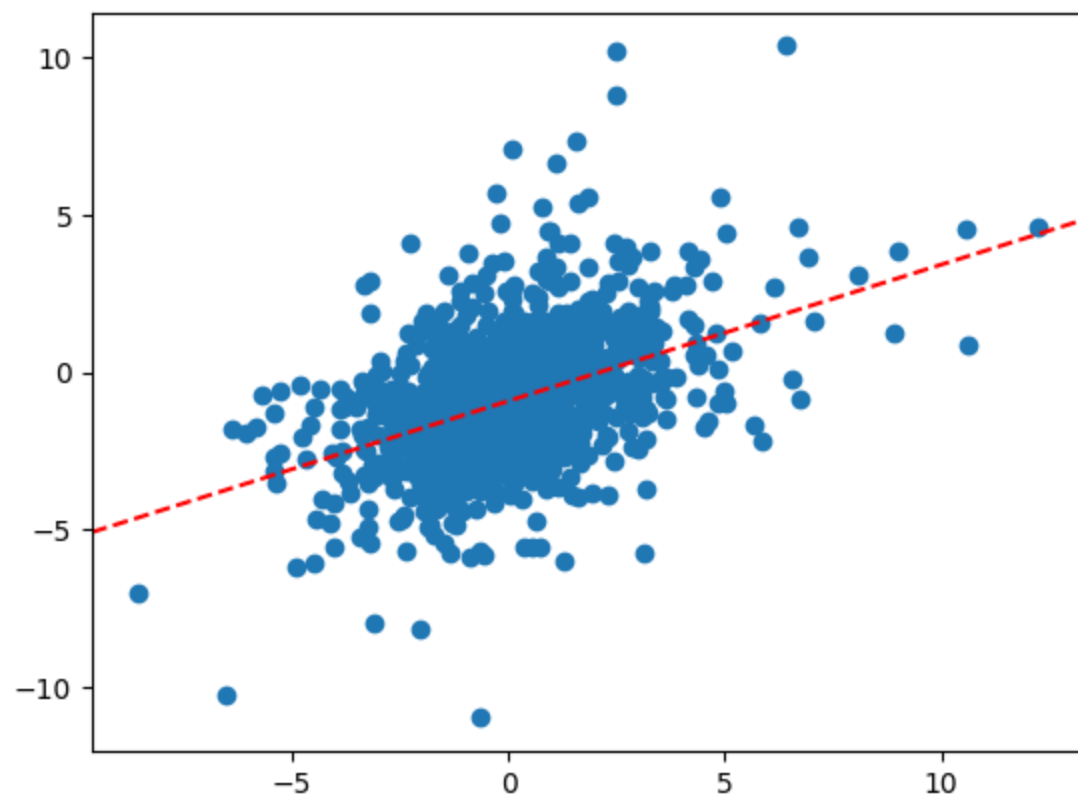
Banks - rf



Insur-rf



RLEst-rf



Fin -rf

