$$r = r_f + \beta_1(r_m - r_f) + \beta_2(SMB) + \beta_3(HML) + \varepsilon$$

In [1]:

```
import pandas_datareader.data as reader
import pandas as pd
import datetime as dt
import statsmodels.api as sm
```

In [6]:

```
end = dt.datetime.now()
start = dt.date(end.year - 5, end.month, end.day)
funds = ['FDGRX'] #fidelity
```

In [7]:

```
reader.get_data_yahoo(funds,start,end)['Adj Close']
```

Out[7]:

Symbols	FDGRX
Date	
2016-12-19	10.932183
2016-12-20	11.014380
2016-12-21	10.988975
2016-12-22	10.917238
2016-12-23	10.994952
...	...
2021-12-09	41.020000
2021-12-10	41.009998
2021-12-13	40.279999
2021-12-14	39.669998
2021-12-15	40.529999

1257 rows × 1 columns

In [9]:

```
returns = reader.get_data_yahoo(funds,start,end)['Adj Close'].pct_change()
```

In [10]:

```
returns_month = returns.resample('M').agg(lambda x: (x+1).prod() -1)
```

In [26]:

```
returns_month = returns_month[:-2]
#must be equal to the factors check the 10th cell
```

In [27]:

```
returns_month
```

2017-03-31	0.020223
2017-04-30	0.022739
2017-05-31	0.046671
2017-06-30	0.007494
2017-07-31	0.040509
2017-08-31	0.019141
2017-09-30	0.014434
2017-10-31	0.041314
2017-11-30	0.016627
2017-12-31	0.009721
2018-01-31	0.100196
2018-02-28	-0.018926
2018-03-31	-0.025100

In [18]:

```
factors = reader.DataReader('F-F_Research_Data_Factors',
                            'famafrench',start,end)[0]
```

In [19]:

```
factors
```

Out[19]:

Date	Mkt-RF	SMB	HML	RF
2016-12	1.82	0.09	3.60	0.03
2017-01	1.94	-1.13	-2.74	0.04
2017-02	3.57	-2.04	-1.67	0.04
2017-03	0.17	1.13	-3.33	0.03
2017-04	1.09	0.72	-2.13	0.05
2017-05	1.06	-2.52	-3.75	0.06
2017-06	0.78	2.23	1.49	0.06
2017-07	1.87	-1.46	-0.22	0.07
2017-08	0.16	-1.65	-2.07	0.09

In [30]:

```
returns_month.shape ,factors.shape
```

Out[30]:

```
((59, 1), (59, 4))
```

In [31]:

```
returns_month.index = factors.index
```

In [33]:

```
merg = pd.merge(returns_month,factors,on='Date')
```

In [34]:

```
merg
```

Out[34]:

Date	FDGRX	Mkt-RF	SMB	HML	RF
2016-12	-0.010165	1.82	0.09	3.60	0.03
2017-01	0.042989	1.94	-1.13	-2.74	0.04
2017-02	0.036380	3.57	-2.04	-1.67	0.04
2017-03	0.020223	0.17	1.13	-3.33	0.03
2017-04	0.022739	1.09	0.72	-2.13	0.05
2017-05	0.046671	1.06	-2.52	-3.75	0.06
2017-06	0.007494	0.78	2.23	1.49	0.06
2017-07	0.040509	1.87	-1.46	-0.22	0.07
2017-08	0.019141	0.16	-1.65	-2.07	0.09

In [38]:

```
merg[['Mkt-RF','SMB','HML','RF']] = merg[['Mkt-RF','SMB','HML','RF']]/100
```

In [39]:

```
merg
```

Out[39]:

Date	FDGRX	Mkt-RF	SMB	HML	RF
2016-12	-0.010165	0.0182	0.0009	0.0360	0.0003
2017-01	0.042989	0.0194	-0.0113	-0.0274	0.0004
2017-02	0.036380	0.0357	-0.0204	-0.0167	0.0004
2017-03	0.020223	0.0017	0.0113	-0.0333	0.0003
2017-04	0.022739	0.0109	0.0072	-0.0213	0.0005
2017-05	0.046671	0.0106	-0.0252	-0.0375	0.0006
2017-06	0.007494	0.0078	0.0223	0.0149	0.0006
2017-07	0.040509	0.0187	-0.0146	-0.0022	0.0007
2017-08	0.019141	0.0016	-0.0165	-0.0207	0.0009

In [41]:

```
merg['FDGRX-RF'] = merg.FDGRX - merg.RF #dependent vrbl
```

In [43]:

```
y = merg['FDGRX-RF']
X = merg[['Mkt-RF','SMB','HML']]

Xsm = sm.add_constant(X)
```

In [46]:

```
mdl = sm.OLS(y,Xsm)
fit = mdl.fit()
fit.summary()
```

Out[46]:

OLS Regression Results

Dep. Variable:	FDGRX-RF	**R-squared:**	0.936
Model:	OLS	**Adj. R-squared:**	0.932
Method:	Least Squares	**F-statistic:**	266.6
Date:	Fri, 17 Dec 2021	**Prob (F-statistic):**	9.90e-33
Time:	02:50:30	**Log-Likelihood:**	167.25
No. Observations:	59	**AIC:**	-326.5
Df Residuals:	55	**BIC:**	-318.2
Df Model:	3		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	0.0030	0.002	1.446	0.154	-0.001	0.007
Mkt-RF	1.1567	0.044	26.408	0.000	1.069	1.245
SMB	0.1794	0.077	2.340	0.023	0.026	0.333
HML	-0.4706	0.054	-8.661	0.000	-0.579	-0.362

Omnibus:	0.024	**Durbin-Watson:**	1.914
Prob(Omnibus):	0.988	**Jarque-Bera (JB):**	0.183
Skew:	0.021	**Prob(JB):**	0.912
Kurtosis:	2.730	**Cond. No.**	41.0

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

```
Alpha > 0 positive performance %3 per month ???
Fidelity has a tendency to invest in small stocks (see SMB positive)
Fidelity has more market risk than the index (see Mkt-RF)
Fidelity likes growth stocks more than the market (see HML)
```