

In [58]:

```
import numpy as np
import pandas as pd
import matplotlib as mp
import statsmodels.api as sm

from statsmodels.sandbox.regression.gmm import IV2SLS
# There is a package named IV2SLS in Python. Do not use this package! The exo
# be entered as instruments. So it gives wrong answers
from statsmodels.sandbox.regression.gmm import GMM
```

In [59]:

```
input_table = pd.read_csv('small_retailers_stock_performance.csv')
input_table.head()
```

Out[59]:

	Constant	Stock Change	Inventory Turnover	Operating Profit	Interaction Effect	Current Ratio	Quick Ratio	Debt Asset Ratio
0	1	0.870332	1.795946	0.115846	0.208053	1.672527	0.255171	0.473317
1	1	-0.047347	1.395501	0.436967	0.609788	1.637261	0.221763	0.489967
2	1	0.001176	1.664563	0.541016	0.900555	1.640619	0.189141	0.374269
3	1	-0.901200	1.605738	0.539399	0.866133	1.436221	0.131944	0.224399
4	1	-0.176353	1.591451	0.539938	0.859285	1.433140	0.183095	0.213446

In [60]:

```
model_iv = sm.OLS(input_table["Inventory Turnover"], input_table[["Constant", "Debt Asset Ratio"]])
endog_predict = model_iv.predict(input_table[["Constant", "Current Ratio", "Quick Ratio"]])
input_table["Endogenous Param"] = endog_predict
```

In [61]:

```
model_2sls = sm.OLS(input_table["Stock Change"], input_table[["Constant", "Endogenous Param"]]).fit()
model_2sls.summary()
```

Out[61]:

```

OLS Regression Results

Dep. Variable:   Stock Change      R-squared:    0.015
Model:            OLS      Adj. R-squared:    0.013
Method:         Least Squares      F-statistic:    8.530
Date:    Sun, 16 Oct 2022      Prob (F-statistic): 1.27e-05
Time:            00:51:06      Log-Likelihood: -1186.5
No. Observations: 1696          AIC:           2381.
Df Residuals:    1692          BIC:           2403.
Df Model:         3
Covariance Type: nonrobust
```

	coef	std err	t	P> t	[0.025	0.975]
<b>Constant</b>	-0.0176	0.020	-0.896	0.370	-0.056	0.021
<b>Endogenous Param</b>	0.0011	0.001	1.827	0.068	-7.76e-05	0.002
<b>Operating Profit</b>	-0.1201	0.028	-4.319	0.000	-0.175	-0.066
<b>Interaction Effect</b>	0.0014	0.000	3.621	0.000	0.001	0.002
<b>Omnibus:</b>	368.832	<b>Durbin-Watson:</b>	2.243			
<b>Prob(Omnibus):</b>	0.000	<b>Jarque-Bera (JB):</b>	3433.920			
<b>Skew:</b>	0.742	<b>Prob(JB):</b>	0.00			
<b>Kurtosis:</b>	9.811	<b>Cond. No.</b>	109.			

Notes:

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

In [62]:

```

y_vals = np.array(input_table["Stock Change"])
x_vals = np.array(input_table[["Inventory Turnover","Operating Profit","Inte
iv_vals = np.array(input_table[["Current Ratio","Quick Ratio","Debt Asset Rat

class gmm(GMM):
    def momcond(self, params):
        p0, p1, p2, p3 = params
        endog = self.endog
        exog = self.exog
        inst = self.instrument

        error0 = endog - p0 - p1 * exog[:,0] - p2 * exog[:,1] - p3 * exog[:,2]
        error1 = (endog - p0 - p1 * exog[:,0] - p2 * exog[:,1] - p3 * exog[:,
        error2 = (endog - p0 - p1 * exog[:,0] - p2 * exog[:,1] - p3 * exog[:,
        error3 = (endog - p0 - p1 * exog[:,0] - p2 * exog[:,1] - p3 * exog[:,
        error4 = (endog - p0 - p1 * exog[:,0] - p2 * exog[:,1] - p3 * exog[:,
        error5 = (endog - p0 - p1 * exog[:,0] - p2 * exog[:,1] - p3 * exog[:,

        g = np.column_stack((error0, error1, error2, error3, error4, error5))
        return g

beta0 = np.array([0.1, 0.1, 0.1, 0.1])
res = gmm(endog = y_vals, exog = x_vals, instrument = iv_vals, k_moms=6, k_pa

res.summary()
```

Optimization terminated successfully.

Current function value: 0.000046

Iterations: 8

Function evaluations: 12

Gradient evaluations: 12

Optimization terminated successfully.

Current function value: 0.000373

Iterations: 7

```

      Function evaluations: 13
      Gradient evaluations: 13
Optimization terminated successfully.
      Current function value: 0.000372
      Iterations: 5
      Function evaluations: 9
      Gradient evaluations: 9
Optimization terminated successfully.
      Current function value: 0.000372
      Iterations: 5
      Function evaluations: 11
      Gradient evaluations: 11
Optimization terminated successfully.
      Current function value: 0.000372
      Iterations: 0
      Function evaluations: 1
      Gradient evaluations: 1

```

Out[62]:

gmm Results

```

Dep. Variable:          y      Hansen J:  0.6317
Model:             gmm  Prob (Hansen J):  0.729
Method:             GMM
Date:   Sun, 16 Oct 2022
Time:   00:51:06
No. Observations:    1696

```

	coef	std err	z	P> z	[0.025	0.975]
<b>p 0</b>	-0.0200	0.021	-0.964	0.335	-0.061	0.021
<b>p 1</b>	0.0011	0.001	1.843	0.065	-6.89e-05	0.002
<b>p 2</b>	-0.1071	0.032	-3.370	0.001	-0.169	-0.045
<b>p 3</b>	0.0011	0.000	2.760	0.006	0.000	0.002