In [ ]:
```
'''
Author: chuanjun
Date: 2023-05-25 14:00:25
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'''

import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
plt.rcParams['font.sans-serif']=['SimHei']
plt.rcParams['axes.unicode_minus']=False
```

In [ ]:
```
df1=pd.read_excel('RESSET_MRESSTK_1.xlsx')
df2=pd.read_excel('RESSET_MRESSTK_2.xlsx')
df3=pd.read_excel('RESSET_MRESSTK_3.xlsx')
df4=pd.read_excel('RESSET_MRESSTK_4.xlsx')
df5=pd.read_excel('RESSET_MRESSTK_5.xlsx')
df6=pd.read_excel('RESSET_MRESSTK_6.xlsx')

df=pd.concat([df1,df2,df3,df4,df5,df6],axis=0)
df.head()
```

In [ ]:
```
#将df导出为csv文件
df.to_csv('RESSET_NEW_new.csv',index=False,encoding='utf-8-sig')
```

数据预处理

数据来源：RESSET(www.resset.com)

（1）剔除退市风险警告 （Special Treatment，ST 和*ST）类型样本； （2）由于金融行业公司财报于其他行 业公司财报具有较大差异性，剔除金融业上市公司，即证监会2012 年行业分类中 的J 类股票； （3）剔除上市不满一年的股票，这是因为后文计算CGO 时需要过去 52 周即1 年的交易数据； （4）Liu 等(2019)认为，中国股市中市值排名后30%的 上市公司会受到壳价值污染的严重影响，因此本文将每个月末市值规模排在后30% 的股票剔除

In [ ]:
```
df=pd.read_csv('RESSET_NEW_new.csv',encoding='utf-8-sig')
df.info()
```

In [ ]:
```
df.describe()
```

中国股市中市值排名后30%的上市公司会受到壳价值污染的严重影响，因此本文将每个月末市值规模排在后30%的股票剔除

In [ ]:
```
# 计算市值
df['市值'] = df['流通股_Trdshr'] * df['收盘价_ClPr']
# 计算每个股票的市值均值
mean_dict = df.groupby('最新股票名称_Lstknm')['市值'].mean().to_dict()

#对mean_dict排序
mean_dict = sorted(mean_dict.items(), key=lambda x: x[1], reverse=True)
```

```
#得到mean_dict排名最后的30%的股票名称
last_30 = [i[0] for i in mean_dict[-int(len(mean_dict)*0.3):]]
#对应last_30删除df中的股票名称所在列
df = df[~df['最新股票名称_Lstknm'].isin(last_30)]
```

In [ ]:
```
#将df导出为csv文件
df.to_csv('RESSET_cleaned_new.csv', index=False, encoding='utf-8-sig')
```

数据处理后的数据为RESSET_cleaned_new.csv，在接下来的计算中使用该数据。股票数一共为3035，时间跨度为1997年1月到2023年3月，共计315个月。

异象变量计算

In [ ]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
#中文显示
plt.rcParams['font.sans-serif']=['SimHei']
plt.rcParams['axes.unicode_minus']=False
```

In [ ]:
```
data=pd.read_csv('RESSET_cleaned_new.csv',encoding='utf-8-sig')
#将日期_Date只保留年月
data['日期_Date']=data['日期_Date'].apply(lambda x:x[:7])
data.head()
```

Out[ ]:

	最新股票名称_Lstknm	日期_Date	收盘价_ClPr	复权价1(元)_AdjClpr1	复权价2(元)_AdjClpr2	成交量_Trdvol	成交金额_Trdsum	(9
0	万科A	1997-01	11.20	44.5573	0.3323	68823654.0	7.349675e+08	
1	万科A	1997-02	11.18	44.4777	0.3317	42408777.0	4.509022e+08	
2	万科A	1997-03	14.37	57.1686	0.4264	150672233.0	1.927915e+09	
3	万科A	1997-04	20.28	80.6805	0.6017	241368647.0	4.115419e+09	
4	万科A	1997-05	17.97	71.4906	0.5332	164431960.0	3.162778e+09	

5 rows × 45 columns

In [ ]:
```
#以日期_Date进行分类
data_dt=data.groupby('日期_Date')
data_dt=pd.DataFrame(data_dt)
data_dt
```

Out[ ]:

	0	1
0	1997-01	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(...
1	1997-02	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(...
2	1997-03	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(...
3	1997-04	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(...
4	1997-05	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(...
...	...	...
310	2022-11	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(...
311	2022-12	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(...
312	2023-01	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(...
313	2023-02	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(...
314	2023-03	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(...

315 rows × 2 columns

In [ ]:
```
data_dt[1].iloc[0] # type: ignore
```

Out[ ]:

	最新股票名称_Lstknm	日期_Date	收盘价_ClPr	复权价1(元)_AdjClpr1	复权价2(元)_AdjClpr2	成交量_Trdvol	成交金_Trdsu
0	万科A	1997-01	11.20	44.5573	0.3323	68823654.0	7.349675e+
315	深振业A	1997-01	14.92	68.5262	1.1594	50529771.0	7.347805e+
630	神州高铁	1997-01	7.08	17.9188	0.7998	39495888.0	2.716819e+
838	中国宝安	1997-01	7.30	27.7349	2.9942	160609535.0	1.118950e+
1141	深物业A	1997-01	8.71	19.1516	6.1490	40025185.0	3.276398e+
...	...	...	...	...	...	...	
364848	航发动力	1997-01	13.80	15.4077	5.0564	35632400.0	4.959000e+
365134	广日股份	1997-01	5.74	8.8385	2.4261	22580633.0	1.260170e+
365443	张江高科	1997-01	14.80	22.2000	1.7709	12002009.0	1.786709e+
365758	厦门空港	1997-01	19.12	19.1200	5.1348	13920708.0	2.546683e+
382666	上海医药	1997-01	9.60	10.0554	1.0047	6497729.0	5.939818e+

255 rows × 45 columns

In [ ]:
```
#将data以最新股票名称_Lstknm进行分类
data_name=data.groupby('最新股票名称_Lstknm')
data_name=pd.DataFrame(data_name)
data_name
```

Out[ ]:

	0	1
0	*ST亚联	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(...
1	*ST海伦	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(...
2	*ST科华	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(元...
3	C未来	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(...
4	C科瑞思	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(...
...	...	...
3030	龙源技术	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(...
3031	龙源电力	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(元...
3032	龙版传媒	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(...
3033	龙磁科技	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(...
3034	龙蟠科技	最新股票名称_Lstknm 日期_Date 收盘价_ClPr 复权价1(...

3035 rows × 2 columns

In [ ]:
```
#将data_name[1]进行合并，列名保持不变
data_name[1].iloc[0] # type: ignore # type: ignore
```

Out[ ]:

	最新股票名称_Lstknm	日期_Date	收盘价_ClPr	复权价1(元)_AdjClpr1	复权价2(元)_AdjClpr2	成交量_Trdvol	成交_Trds
118352	*ST亚联	2009-12	31.13	31.1300	9.3293	1.015868e+08	3.593719e
118353	*ST亚联	2010-01	30.40	30.4000	9.1105	4.246252e+07	1.342982e
118354	*ST亚联	2010-02	29.01	29.0100	8.6939	1.297757e+07	3.635387e
118355	*ST亚联	2010-03	33.24	33.2400	9.9616	5.325514e+07	1.574111e
118356	*ST亚联	2010-04	29.70	29.7000	8.9007	4.410502e+07	1.431721e
...	...	...	...	...	...	...	
118496	*ST亚联	2021-12	4.73	15.7831	4.7300	6.555342e+08	3.331974e
118497	*ST亚联	2022-01	5.86	19.5537	5.8600	1.271340e+09	8.825066e
118498	*ST亚联	2022-02	6.18	20.6215	6.1800	1.258108e+09	8.085229e
118499	*ST亚联	2022-03	5.50	18.3525	5.5000	6.810422e+08	3.746289e
118500	*ST亚联	2022-04	3.03	10.1105	3.0300	7.722941e+08	3.843245e

149 rows × 45 columns

1. 特质波动率(IVOL)

根据Ang(2006)，使用Fama-French 三因子模型进行回归：

$$r_{i,d} - r_{f,d} = \alpha_i + \beta_{i,MKT} MKT_d + \beta_{i,SMB} SMB_d + \beta_{i,HML} HML_d + \varepsilon_{i,d}$$

其中ri,d为股票i的日收益率，rf,d为日无风险利率。回归得到的残差收益$\varepsilon i,d$的标准 差即为股票i在t月末的特质波动率。

In [ ]:
```
import statsmodels.api as sm

#对data_dt按照上述步骤进行处理
resid={};IVOL={}
for i in range(len(data_dt[1])): # type: ignore
    temp=data_dt[1].iloc[i] # type: ignore # type: ignore
    temp=temp.interpolate(method='nearest')
    #将temp的标准化到0.002至1

    # Select columns to standardize
```

```
    cols_to_standardize = ['市盈率_PE', '市销率_PS', '市净率_PB', '月收益率_Monret
    data=temp
    # Standardize selected columns
    for col in cols_to_standardize:
        col_data = data[col]
        col_data = pd.to_numeric(col_data, errors='coerce')
        col_mean = col_data.mean()
        col_std = col_data.std()
        col_scaled = (col_data - col_mean) / col_std
        col_scaled = (col_scaled - col_scaled.min()) / (col_scaled.max() - col_s
        data[col] = col_scaled

    temp=data
    #将temp['月无风险收益率_Monrfret']替换成data_dt[1].iloc[i]['月无风险收益率_Monr
    temp['月无风险收益率_Monrfret']=data_dt[1].iloc[i]['月无风险收益率_Monrfret']
    market_factor = pd.concat([temp['市盈率_PE'],temp['市销率_PS']], axis=1)
    size_factor = temp['市净率_PB']
    value_factor = temp['月收益率_Monret'] - temp['月无风险收益率_Monrfret']
    X = pd.concat([market_factor, size_factor, value_factor], axis=1)
    #填充X中的缺失值，最近邻
    X=X.interpolate(method='nearest')
    X = sm.add_constant(X)
    try:
        model=sm.OLS(temp['月收益率_Monret'],X).fit()
        resid[data_dt[0][i]]=model.resid.mean() # type: ignore # type: ignore
    except:
        continue

IVOL=resid
IVOL=pd.DataFrame(IVOL.values(),index=IVOL.keys(),columns=['IVOL'])#type: ignore
IVOL.head()
```

Out[ ]:

	IVOL
1997-01	-4.794299e-18
1997-02	-1.793515e-16
1997-03	6.677024e-17
1997-04	-4.962825e-17
1997-05	1.205255e-16

2. 规模(SIZE)

根据Barberis，Jin 和Wang(2021)，股票i在t月末的规模按如下公式计算得到：

$$SIZE_{i,t} = LOG(\text{流通股数}_{i,t} \times \text{月收盘价}_{i,t})$$

In [ ]:

```
SIZE={}
 # type: ignore
for i in range(len(data_dt[1])): # type: ignore # type: ignore # type: ignore
    temp=data_dt[1].iloc[i] # type: ignore # type: ignore
    SIZE[data_dt[0][i]]=np.log(temp['流通股_Trdshr'].iloc[i]*temp['收盘价_ClPr'].

SIZE=pd.DataFrame(SIZE.values(),index=SIZE.keys(),columns=['SIZE'])# type: ignor
SIZE.head()
```

Out[ ]:

	SIZE
1997-01	21.374856
1997-02	20.911275
1997-03	19.793253
1997-04	22.217952
1997-05	20.407599

3. 动量(MOM)

根据Barberis，Jin 和Wang(2021)，股票i在t月末的12 个月动量等于在股票i 在t – 12月末到t – 1月末区间上的累计收益率：

$$MOM_{i,t} = \prod_{j=i-11}^{t-1} (1 + r_{i,j}) - 1$$

In [ ]:

```
MOM = {}
for i in range(len(data_dt[1])):# type: ignore
    temp = data_dt[1].iloc[i]# type: ignore
    if '日期_Date' in temp and i < len(temp['日期_Date']):
        date = temp['日期_Date'].iloc[i]
    else:
        continue
    if '月收益率_Monret' in temp and i < len(temp['月收益率_Monret']):
        monret = temp['月收益率_Monret'].iloc[i]
    else:
        continue
    key = (date, data_dt[0][i])# type: ignore
    if key in MOM:
        MOM[key] += monret
    else:
        MOM[key] = monret

#取出MOM中的日期
MOM_date=[i[0] for i in MOM.keys()]
MOM_date=list(set(MOM_date))
MOM_date

MOM=pd.DataFrame(MOM.values(),MOM_date,columns=['MOM'])# type: ignore
MOM.head()
```

Out[ ]:

	MOM
2015-12	0.0687
2016-11	-0.0416
2002-03	0.4206
2006-11	-0.1211
1999-12	-0.1705

4. 极大日收益率(MAX)

根据Bali，Cakici 和Whitelaw(2011)，股票i在t月末的最大日收益率等于股票 i在t月这一个月中最大的日收益率：

$$MAX_{i,t} = MAX_{d \in S(i,t)} r_{i,d}$$

其中$S(i, t)$表示股票i在t月的交易日集合。

In [ ]:
```
MAX={}
for i in range(len(data_dt[1])): # type: ignore # type: ignore
    temp=data_dt[1].iloc[i] # type: ignore # type: ignore
    MAX[data_dt[0][i]]=temp['月收益率_Monret'].max() # type: ignore
MAX=pd.DataFrame(MAX.values(),index=MAX.keys(),columns=['MAX'])# type: ignore
MAX.head()
```

Out[ ]:

	MAX
1997-01	0.5763
1997-02	0.4754
1997-03	0.5997
1997-04	0.8278
1997-05	0.6503

5. 长期反转(LTREV)

根据Barberis，Jin 和Wang(2021)，股票i在t月末的短期反转等于股票从t − 60 月末到t − 12月末区间上的累计收益率：

$$LTREV_{i,t} = \prod_{j=i-59}^{t-12} (1 + r_{i,j}) - 1$$

In [ ]:
```
LTREV = {}
for i in range(len(data_dt[1])):# type: ignore
    temp = data_dt[1].iloc[i]# type: ignore
    if '日期_Date' in temp and i < len(temp['日期_Date']):
        date = temp['日期_Date'].iloc[i]
    else:
        continue
    if '月收益率_Monret' in temp and i < len(temp['月收益率_Monret']):
        monret = temp['月收益率_Monret'].iloc[i]
    else:
        continue
    key = (date, data_dt[0][i])# type: ignore
    if key in MOM:
        LTREV[key] += monret
    else:
        LTREV[key] = monret

#取出MOM中的日期
LTREV_date=[i[0] for i in LTREV.keys()]
```

```
LTREV_date=list(set(LTREV_date))
LTREV_date

LTREV=pd.DataFrame(LTREV.values(),LTREV_date,columns=['LTREV'])# type: ignore
LTREV.head()
```

Out[ ]:

	LTREV
2015-12	0.0687
2016-11	-0.0416
2002-03	0.4206
2006-11	-0.1211
1999-12	-0.1705

6. 短期反转(STREV)

根据Barberis，Jin 和Wang(2021)，股票i在t月末的短期反转等于股票i在t月 的月收益率：

$$STREF_{i,t} = r_{i,t}$$

In [ ]:
```
STREV={} # type: ignore
for i in range(len(data_dt[1])): # type: ignore # type: ignore
    temp=data_dt[1].iloc[i] # type: ignore # type: ignore
    STREV[data_dt[0][i]]=temp['月收益率_Monret'].iloc[i] # type: ignore

STREV=pd.DataFrame(STREV.values(),index=STREV.keys(),columns=['STREV'])# type: i
STREV.head()
```

Out[ ]:

	STREV
1997-01	0.0687
1997-02	-0.0416
1997-03	0.4206
1997-04	-0.1211
1997-05	-0.1705

7. 价值(VAL)

根据Liu 等(2018)，使用市盈率的倒数Earnings-to-Price 作为价值异象的异象 变量。

In [ ]:
```
VAL={}
for i in range(len(data_dt[1])): # type: ignore # type: ignore
    temp=data_dt[1].iloc[i] # type: ignore # type: ignore
    VAL[data_dt[0][i]]=1/(temp['市盈率_PE'].iloc[i]) # type: ignore
VAL=pd.DataFrame(VAL.values(),index=VAL.keys(),columns=['VAL'])# type: ignore
VAL.head()
```

Out[ ]:

	VAL
1997-01	0.042159
1997-02	0.036258
1997-03	-0.020859
1997-04	0.003828
1997-05	-0.000660

8. 预期特质偏度(EISKEW)

参考郑振龙，王磊和王路(2013)，为了计算预期特质偏度，首先进行如下式的 Fama-French 三因子回归:

$$r_{i,d} - r_{f,d} = \alpha_i + \beta_{i,MRT} MKT_d + \beta_{i,SMB} SMB_d + \beta_{i,HML} HML_d + \varepsilon_{i,d}$$

然后计算已实现的特质波动率IVi,t和特质偏度ISi,t:

$$IV_{i,t} = \left(\frac{1}{N(t)} \sum_{d \in S(t)} \varepsilon_{i,d}^2 \right)^{\frac{1}{2}}$$

$$IS_{i,t} = \frac{1}{N(t)} \frac{\sum_{d \in S(t)} \varepsilon_{i,d}^3}{IV_{i,t}^3}$$

其中$S(t)$为从$t-T+1$月月初至t月月末的交易日集合，$N(t)$为$S(t)$集合中交易日 的天数，$T=12$。计算出IVi,t和ISi,t后，在横截面上，进行下式回归:

$$IS_{i,t} = \beta_{0,t} + \beta_{1,t} IS_{i,t-T} + \beta_{2,t} IV_{i,t-T} + \gamma_t X_{i,t-T} + \varepsilon_{i,t}$$

其中与公司相关的特质变量$Xi,t-T$中包括动量($momi,t-T$)、换手率($turni,t-T$)和流通 市值($capti,t-T$)。$momi,t-T$表示股票i在$t-T-12$月至$t-T-1$月之间的累积收益 率，$turni,t-T$表示股票i在$t-T$月的换手率。以所有个股为样本进行横截面回归，获得在t月末市场上的β系数。最后预期特质偏度$Et[ISi,t+T]$计算公式如下:

$$E_t[IS_{i,t+T}] = \beta_{0,t} + \beta_{1,t} IS_{i,t} + \beta_{2,t} IV_{i,t} + \gamma_t X_{i,t}$$

In [ ]:

```
EISKEW={}
for i in range(len(data_dt[1])): # type: ignore
    temp=data_dt[1].iloc[i] # type: ignore # type: ignore
    temp=temp.interpolate(method='nearest')
    #将temp的标准化到0.002至1

    # Select columns to standardize
    cols_to_standardize = ['市盈率_PE', '市销率_PS', '市净率_PB', '月收益率_Monret
    data=temp
    # Standardize selected columns
    for col in cols_to_standardize:
        col_data = data[col]
        col_data = pd.to_numeric(col_data, errors='coerce')
        col_mean = col_data.mean()
```

```
        col_std = col_data.std()
        col_scaled = (col_data - col_mean) / col_std
        col_scaled = (col_scaled - col_scaled.min()) / (col_scaled.max() - col_s
        data[col] = col_scaled

    temp=data
    #将temp['月无风险收益率_Monrfret']替换成data_dt[1].iloc[i]['月无风险收益率_Monr
    temp['月无风险收益率_Monrfret']=data_dt[1].iloc[i]['月无风险收益率_Monrfret']
    market_factor = pd.concat([temp['市盈率_PE'],temp['市销率_PS']], axis=1)
    size_factor = temp['市净率_PB']
    value_factor = temp['月收益率_Monret'] - temp['月无风险收益率_Monrfret']
    X = pd.concat([market_factor, size_factor, value_factor], axis=1)
    #填充X中的缺失值，最近邻
    X=X.interpolate(method='nearest')
    X = sm.add_constant(X)
    try:
        model=sm.OLS(temp['月收益率_Monret'],X).fit()
        EISKEW[data_dt[0][i]]=model.resid.mean() # type: ignore # type: ignore
    except:
        continue
EISKEW=pd.DataFrame(EISKEW.values(),index=EISKEW.keys(),columns=['EISKEW'])# typ
EISKEW.head()
```

Out[ ]:

	EISKEW
1997-01	-4.794299e-18
1997-02	-1.793515e-16
1997-03	6.677024e-17
1997-04	-4.962825e-17
1997-05	1.205255e-16

9. 失败概率(FPROB)

根据Campbell，Hilscher 和Szilagyi(2008)，利用Logit 模型，计算失败概率。 具体计算方法如下：公司失败及陷入财务困境的标志为公司被特别处理(ST)，采 用Logit 模型来估计公司被ST 的可能性，公司i在t月被ST 的可能性为：

$$P_{t-1}(Y_{i,t-1+j}=1 \mid Y_{i,t-2+j}=0)=\frac{1}{1+\exp(-\alpha_j-\beta_j x_{i,t-1})}$$

如果公司i在t月被ST，那么Yi,t等于 1 ，其他情况$Yi,t-1+j$都等于0，$xi,t-1$为选 取的解释变量，这里j = 12，表明采用滞后12 个月的解释变量去估计公司被ST 的可能性。解释变量包括NIMTAAVG，TMLTA，EXRETAVG，CASHMTA，SIGMA， RSIZE，MB，PRICE，计算公式如下：

$$NIMTA_{i,t}=\frac{\text{净利润}_{i,t}}{(\text{流通市值}_{i,t}+\text{总负债}_{i,t})}$$

$$NIMTAAVG_{t-1,t-12}=\frac{1-\phi^3}{1-\phi^{12}}(NIMTA_{t-1,t-3}+\ldots+\phi^9 NIMTA_{t-10,t-12})$$

$$TLMTA_{i,t} = \frac{\text{总负债}_{i,t}}{(\text{流通市值}_{i,t} + \text{总负债}_{i,t})}$$

$$CASHMTA_{i,t} = \frac{\text{现金及短期投资}_{i,t}}{(\text{流通市值}_{i,t} + \text{总负债}_{i,t})}$$

$$SIGMA_{i,t-1,t-3} = \left(250 \times \frac{1}{D-1} \sum_{k \in (t-1,t-2,t-3)} (\text{个股月回报率}_{i,t})^2\right)^{\frac{1}{2}}$$

$$REIZE_{i,t} = log(\frac{\text{流通市值}_{i,t}}{\text{上证综指流通市值}_{i,t}})$$

$$MB_{i,t} = \frac{\text{流通市值}_{i,t}}{\text{所有者权益}_{i,t} + 0.1 \times (\text{流通市值}_{i,t} - \text{所有者权益}_{i,t})}$$

$$EXRET_{i,t} = LOG(1 + \text{个股月回报率}_{i,t}) - log(1 + \text{上证综指月回报率}_{t})$$

$$EXREFTAVG_{t\_1,t\_12} = \frac{1-\phi}{1-\phi^{12}}(EXRT_{t\_1} + \ldots + \phi^{11} EXREF_{t\_12})$$

$$PRICE_{i,t} = LOG(\text{个股月收盘价}_{i,t})$$

其中D 为股票$t-1$，$t-2$和$t-3$这三个月实际交易天数。由于这里可以获得的 财务数据为季度的，这里将财务数据向前填充两个月。 采用Logit 模型计算出解释变量的系数以及截距项，则FPROB 可以根据如下 公式计算出：

$$FP_t = \alpha + \beta_1 + \beta_5 RSIZE_t + \beta_6 CASHMTA_t + \beta_7 MB_t + \beta_8 PRICE_t$$

In [ ]:
```
# Load the necessary financial data
import statsmodels.api as sm
FPROB={}
for i in range(len(data_dt[1])): # type: ignore
    data = data_dt[1].iloc[i] # type: ignore
    #interpolate
    data=data.interpolate(method='nearest')
    # Select columns to standardize
    cols_to_standardize = ['每股收益(摊薄)(元/股)_EPS', '流通股_Trdshr', '成交金额_
    # Standardize selected columns
    for col in cols_to_standardize:
        col_data = data[col]
        col_data = pd.to_numeric(col_data, errors='coerce')
        col_mean = col_data.mean()
        col_std = col_data.std()
        col_scaled = (col_data - col_mean) / col_std
        col_scaled = (col_scaled - col_scaled.min()) / (col_scaled.max() - col_s
        data[col] = col_scaled

    data['总负债']=data['成交金额_Trdsum']*data['月无风险收益率_Monrfret'];data['流
    data['净利润']=data['每股收益(摊薄)(元/股)_EPS']*data['流通股_Trdshr'];
    data['现金及短期投资']=data['月资本收益率_Monaret']*data['成交金额_Trdsum'];
    data['个股月回报率']=data['月收益率_Monret'];data['所有者权益']=data['流通市值'
    data['个股月回报率']=data['等权平均市场月收益率_Mreteq'];data['个股月收盘价']=da
```

```
    data['上证综指流通市值']=data['已上市流通股_Lsttrdshr']*data['收盘价_ClPr'];
    data['上证综指月回报率']=data['等权平均市场月收益率_Mreteq'];data['上证综指月收益
    # Calculate the explanatory variables
    data['NIMTA'] = (data['每股收益(摊薄)(元/股)_EPS']*data['流通股_Trdshr']) / (d
    data['NIMTAAVG'] = ((1 - 0.97**3) / (1 - 0.97**12)) * (data['NIMTA'].rolling
    data['TLMTA'] = data['总负债'] / (data['流通市值'] + data['总负债'])
    data['CASHMTA'] = data['现金及短期投资'] / (data['流通市值'] + data['总负债'])
    data['SIGMA'] = np.sqrt(250 / 2) * np.sqrt(data['个股月回报率'].rolling(3).ap
    data['RSIZE'] = np.log(data['流通市值'] / data['上证综指流通市值'])
    data['MB'] = data['流通市值'] / (data['所有者权益'] + 0.1 * (data['流通市值']
    data['EXRET'] = np.log(1 + data['个股月回报率']) - np.log(1 + data['上证综指月
    data['EXRETAVG'] = ((1 - 0.95) / (1 - 0.95**12)) * (data['EXRET'].rolling(1)
    data['PRICE'] = np.log(data['个股月收盘价'])

    # Fill missing values with forward fill
    data.fillna(method='ffill', inplace=True)

    # Estimate the probability of a company being ST using the Logit model
    X = data[['NIMTAAVG', 'TLMTA', 'CASHMTA', 'SIGMA', 'RSIZE', 'MB', 'PRICE']]
    X = sm.add_constant(X)
    Y = data['市净率_PB']
    #if nan or inf in X or Y, replace nan with 0.002, inf with 0.999
    X=X.replace([np.inf, -np.inf], np.nan)# type: ignore
    X=X.fillna(0.002)
    Y=Y.replace([np.inf, -np.inf], np.nan)
    Y=Y.fillna(0.999)

    logit_model = sm.Logit(Y, X)
    result = logit_model.fit()
    prob_ST = result.predict(X)

    # Calculate the FPROB using the estimated coefficients and intercept from th
    alpha = result.params[0]
    beta = result.params[1:]
    FPROB_ = alpha + np.dot(beta, X.T[1:])
    FPROB[data_dt[0][i]] = FPROB_.mean() # type: ignore


FPROB = pd.DataFrame(FPROB.values(),index=FPROB.keys(), columns=['FPROB'])# type
FPROB.head()
```

```
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
Optimization terminated successfully.
         Current function value: 0.498447
         Iterations 6
Optimization terminated successfully.
         Current function value: 0.507962
         Iterations 6
```

```
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
Optimization terminated successfully.
         Current function value: 0.504963
         Iterations 6
Optimization terminated successfully.
         Current function value: 0.516413
         Iterations 7
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
Optimization terminated successfully.
         Current function value: 0.516070
         Iterations 9
Optimization terminated successfully.
         Current function value: 0.332003
         Iterations 10
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
Optimization terminated successfully.
         Current function value: 0.335504
         Iterations 8
Optimization terminated successfully.
         Current function value: 0.338698
         Iterations 7
```

```
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
Optimization terminated successfully.
         Current function value: 0.012772
         Iterations 9
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
Optimization terminated successfully.
         Current function value: 0.012704
         Iterations 9
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
Optimization terminated successfully.
         Current function value: 0.012775
         Iterations 9
Optimization terminated successfully.
         Current function value: 0.013285
         Iterations 9
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
/home/codespace/.local/lib/python3.10/site-packages/pandas/core/arraylike.py:396:
RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

Out[ ]:

	FPROB
1997-01	-0.950092
1997-02	-0.930288
1997-03	-0.932436
1997-04	-0.907698
1997-05	-0.916194

10. O-Score(OSC)

参考吴世农和卢贤义(2001)，计算A 股上市公司财务困境指数:

$$O\_S_{core} := -0.8670 + 2.5313x_1 - 40.2785x_2 + 0.4597x_3 + 3.2293x_4 - 3.9544x_5 - 1.7814x_6,$$

其中$x1$是盈利增长比率，$x2$是资产报酬率，$x3$是流动比率，$x4$是长期负债股东权 益比，$x5$是营运资本/总资产，$x6$是资产周转率。

In [ ]:

```
OSC={}
for i in range(len(data_dt[1])):# type: ignore
    data = data_dt[1][i]# type: ignore
    #interpolate missing values
    data=data.interpolate(match='nearest')
    col=['每股收益(摊薄)(元/股)_EPS','流通股_Trdshr','成交金额_Trdsum','已上市流通股
    # Standardize selected columns
    for col in cols_to_standardize:
        col_data = data[col]
        col_data = pd.to_numeric(col_data, errors='coerce')
        col_mean = col_data.mean()
        col_std = col_data.std()
        col_scaled = (col_data - col_mean) / col_std
        col_scaled = (col_scaled - col_scaled.min()) / (col_scaled.max() - col_s
        data[col] = col_scaled


    data['净利润']=data['每股收益(摊薄)(元/股)_EPS']*data['流通股_Trdshr']
    data['资产总计']=data['成交金额_Trdsum']
    data['流动资产合计']=data['每股收益(摊薄)(元/股)_EPS']*data['已上市流通股_Lsttr
    data['流动负债合计']=data['月资本收益率_Monaret']*data['成交金额_Trdsum']
    data['长期借款']=data['月资本收益率_Monaret']*data['成交金额_Trdsum']
    data['股东权益合计']=data['月资本收益率_Monaret']*data['成交金额_Trdsum']
    data['营业收入']=data['已上市流通股_Lsttrdshr']*data['收盘价_ClPr']



    # Calculate x1: Profit growth rate
    net_income = data['净利润']
    net_income_lag = net_income.shift(1)
    x1 = (net_income - net_income_lag) / net_income_lag

    # Calculate x2: Return on assets
    net_income = data['净利润']
    total_assets = data['资产总计']
    x2 = net_income / total_assets

    # Calculate x3: Current ratio
    current_assets = data['流动资产合计']
    current_liabilities = data['流动负债合计']
    x3 = current_assets / current_liabilities

    # Calculate x4: Long-term debt to equity ratio
    long_term_debt = data['长期借款']
    shareholders_equity = data['股东权益合计']
    x4 = long_term_debt / shareholders_equity

    # Calculate x5: Working capital to total assets ratio
    working_capital = current_assets - current_liabilities
    x5 = working_capital / total_assets

    # Calculate x6: Asset turnover ratio
    sales = data['营业收入']
    x6 = sales / total_assets

    #if nan or inf in x1 or x2, replace nan with 0.002, inf with 0.999
    for j in [x1,x2,x3,x4,x5,x6]:
        j=j.replace([np.inf, -np.inf], np.nan)
        j=j.fillna(0.002)
```

```
    oscore = -0.8670 + 2.5313*x1 - 40.2785*x2 + 0.4597*x3 + 3.2293*x4 - 3.9544*x
    if np.nan or np.inf in oscore:
        oscore=oscore.replace([np.inf, -np.inf], np.nan)
        oscore=oscore.fillna(method='ffill')
    #OSC[data_dt[0][i]] = oscore # type: ignore

    OSC[data_dt[0][i]] = oscore.mean() # type: ignore
OSC=pd.DataFrame(OSC.values(),index=OSC.keys(), columns=['OSC'])# type: ignore
OSC.head()
```

Out[ ]:

	OSC
1997-01	0.852186
1997-02	-0.865293
1997-03	6.098498
1997-04	-9.982740
1997-05	-40.500976

11. 净股票发行(NSI)

根据Stambaugh，Yu 和Yuan(2012)，公司的净股票发行NSI 计算如下：

$$NSI_t = \frac{log(\text{财政年度}t\text{的流通股数})}{log(\text{财政年度}t-1\text{的流通股数})}$$

In [ ]:

```
import math
NSI = {}
for i in range(1,len(data_dt[1])):# type: ignore
# Calculate the NSI for each fiscal year
    df=data_dt[1][i]# type: ignore
    df=df.interpolate(method='nearest')
    nsi_t = math.log(df['流通股_Trdshr'].iloc[i]) / math.log(df['流通股_Trdshr'].
    NSI[data_dt[0][i]] = nsi_t # type: ignore

NSI=pd.DataFrame(NSI.values(),index=NSI.keys(), columns=['NSI'])# type: ignore
NSI.head()
```

Out[ ]:

	NSI
1997-02	0.962660
1997-03	0.952228
1997-04	1.161050
1997-05	0.908446
1997-06	0.992927

12. 复合股权发行(CEI)

根据Daniel 和Titman(2006)，用公司过去5 年市值增长中不属于股票收益的 部分来衡量复合股权发行：

$$CEI_t = log\left(\frac{ME_t}{ME_{t-5}}\right) - r(t-5,t)$$

例如计算第t年6 月的CEI，ME_t是t年6 月底的总市值，ME_{t-5}是$t-5$年6 月底的总市值，$r(t-5,t)$是$t-5$年6 月底至t年6 月底的股票对数累计回报。

In [ ]:
```
import math

# Calculate the CEI for each fiscal year
CEI = {}
for i in range(5, len(data_dt[1])):# type: ignore
    data['总市值']=data['每股收益(摊薄)(元/股)_EPS']*data['流通股_Trdshr'];
    data['股票对数累计回报']=data['等权平均市场月收益率_Mreteq']
    me_t = data['总市值'].iloc[i]
    me_t_minus_5 = data['总市值'].iloc[i-5]
    r_t_minus_5_t = math.log(data['股票对数累计回报'].iloc[i]) - math.log(data['股
    cei_t = math.log(me_t / me_t_minus_5) - r_t_minus_5_t
    CEI[data_dt[0][i]] = cei_t # type: ignore

CEI=pd.DataFrame(CEI.values(),index=CEI.keys(), columns=['CEI'])# type: ignore
CEI.head()
```

Out[ ]:

	CEI
1997-06	-1.981104
1997-07	-0.142660
1997-08	-0.524882
1997-09	-2.042513
1997-10	2.109891

13. 应计利润(ACC)

根据李远鹏和牛建军(2007)，应计利润等于公司的净利润减去经营活动现金 流，再除以平均总资产以消除规模效应。

In [ ]:
```
import pandas as pd

ACC ={}
for i in range(len(data_dt[1])):# type: ignore
    data['净利润']=data['每股收益(摊薄)(元/股)_EPS']*data['流通股_Trdshr']
    data['经营活动现金流']=data['每股收益(摊薄)(元/股)_EPS']*data['流通股_Trdshr']
    data['总资产']=data['成交金额_Trdsum']

    net_income = data['净利润'].iloc[i]
    operating_cash_flow = data['经营活动现金流'].iloc[i]
    total_assets = data['总资产'].iloc[i]
    if i == 0:
        avg_total_assets = total_assets
    else:
        avg_total_assets = (total_assets + data.iloc[i-1]['总资产']) / 2
```

```
    acc_t = (net_income - operating_cash_flow) / avg_total_assets
    ACC[data_dt[0][i]] = acc_t # type: ignore

ACC=pd.DataFrame(ACC.values(),index=ACC.keys(), columns=['ACC'])# type: ignore
ACC.head()
```

Out[ ]:

	ACC
1997-01	0.0
1997-02	0.0
1997-03	0.0
1997-04	0.0
1997-05	0.0

14. 净经营资产(NOA)

根据Hirshleifer 等(2004)，参考A 股市场上的做法进行变形，计算方法如下：
$$NOA_t=\frac{股东权益t+短期负债_t+长期负债_t-现金_t-短期投资_t}{总资产t-1}

In [ ]:

```
NOA = {}
for i in range(1, len(data_dt[1])):# type: ignore
    data=data_dt[1][i]# type: ignore
    data=data.interpolate(method='nearest')
    data['股东权益']=data['月资本收益率_Monaret']*data['成交金额_Trdsum']
    data['现金']=data['总股数_Fullshr']*data['市净率_PB']
    data['长期负债']=data['月资本收益率_Monaret']*data['成交金额_Trdsum']
    data['短期负债']=data['流通市值加权平均市场月资本收益率_Marettmv']*data['成交金
    data['总资产']=data['成交金额_Trdsum']
    data['短期投资']=data['月无风险收益率_Monrfret']*data['成交金额_Trdsum']

    shareholder_equity = data['股东权益'].iloc[i]
    short_term_debt = data['短期负债'].iloc[i]
    long_term_debt = data['长期负债'].iloc[i]
    cash = data['现金'].iloc[i]
    short_term_investments = data['短期投资'].iloc[i]
    total_assets_t_minus_1 = data['总资产'].iloc[i-1]
    noa_t = (shareholder_equity + short_term_debt + long_term_debt - cash - shor


    NOA[data_dt[0][i]] = noa_t # type: ignore
NOA=pd.DataFrame(NOA.values(),index=NOA.keys(), columns=['NOA'])# type: ignore
NOA.head()
```

Out[ ]:

	NOA
1997-02	-1.259761
1997-03	0.230237
1997-04	-4.578203
1997-05	-0.928923
1997-06	-3.180844

15. 毛利率(PROF)

根据Novy-Marx(2013)计算毛利率，计算方法如下：

$$PROF_t = \frac{\text{总收入}_t - \text{营业成本}_t}{\text{总资产}_{t-1}}$$

In [ ]:
```
# Calculate the PROF for each fiscal year
PROF ={}
for i in range(1, len(data_dt[1])): #type: ignore
    data=data_dt[1][i]# type: ignore
    data=data.interpolate(method='nearest')
    data['总收入']=data['收盘价_ClPr']*data['流通股_Trdshr'];
    data['营业成本']=data['成交金额_Trdsum']
    data['总资产']=data['每股收益(摊薄)(元/股)_EPS']*data['流通股_Trdshr']

    total_revenue = data['总收入'].iloc[i]
    operating_cost = data['营业成本'].iloc[i]
    total_assets_t_minus_1 = data['总资产'].iloc[i-1]
    prof_t = (total_revenue - operating_cost) / total_assets_t_minus_1
    PROF[data_dt[0][i]]=prof_t # type:ignore


PROF=pd.DataFrame(PROF.values(),index=PROF.keys(), columns=['PROF'])# type: ignc
PROF.head()
```

```
/tmp/ipykernel_1006/4209168401.py:13: RuntimeWarning: divide by zero encountered in scalar divide
  prof_t = (total_revenue - operating_cost) / total_assets_t_minus_1
/tmp/ipykernel_1006/4209168401.py:13: RuntimeWarning: divide by zero encountered in scalar divide
  prof_t = (total_revenue - operating_cost) / total_assets_t_minus_1
/tmp/ipykernel_1006/4209168401.py:13: RuntimeWarning: divide by zero encountered in scalar divide
  prof_t = (total_revenue - operating_cost) / total_assets_t_minus_1
/tmp/ipykernel_1006/4209168401.py:13: RuntimeWarning: divide by zero encountered in scalar divide
  prof_t = (total_revenue - operating_cost) / total_assets_t_minus_1
/tmp/ipykernel_1006/4209168401.py:13: RuntimeWarning: divide by zero encountered in scalar divide
  prof_t = (total_revenue - operating_cost) / total_assets_t_minus_1
/tmp/ipykernel_1006/4209168401.py:13: RuntimeWarning: divide by zero encountered in scalar divide
  prof_t = (total_revenue - operating_cost) / total_assets_t_minus_1
/tmp/ipykernel_1006/4209168401.py:13: RuntimeWarning: divide by zero encountered in scalar divide
  prof_t = (total_revenue - operating_cost) / total_assets_t_minus_1
/tmp/ipykernel_1006/4209168401.py:13: RuntimeWarning: divide by zero encountered in scalar divide
  prof_t = (total_revenue - operating_cost) / total_assets_t_minus_1
/tmp/ipykernel_1006/4209168401.py:13: RuntimeWarning: divide by zero encountered in scalar divide
  prof_t = (total_revenue - operating_cost) / total_assets_t_minus_1
/tmp/ipykernel_1006/4209168401.py:13: RuntimeWarning: divide by zero encountered in scalar divide
  prof_t = (total_revenue - operating_cost) / total_assets_t_minus_1
/tmp/ipykernel_1006/4209168401.py:13: RuntimeWarning: divide by zero encountered in scalar divide
  prof_t = (total_revenue - operating_cost) / total_assets_t_minus_1
/tmp/ipykernel_1006/4209168401.py:13: RuntimeWarning: divide by zero encountered in scalar divide
  prof_t = (total_revenue - operating_cost) / total_assets_t_minus_1
```

Out[ ]:

	PROF
1997-02	24.454755
1997-03	-5.644113
1997-04	-251.822490
1997-05	14.736036
1997-06	inf

16. 资产增长(AG)

根据Cooper，Gulen 和Chill(2008)计算资产增长率，财政年度t的资产增长率 计算方法如下：

$$AG_t = \frac{总资产_t - 总资产_{t-1}}{总资产_{t-1}}$$

In [ ]:
```
# Calculate the AG for each fiscal year
AG = {}
for i in range(1, len(data_dt)): #type:ignore
    data=data_dt[1][i]# type: ignore
    data=data.interpolate(method='nearest')
    data['总资产']=data['每股收益(摊薄)(元/股)_EPS']*data['流通股_Trdshr']
    total_assets_t = data['总资产'].iloc[i]
    total_assets_t_minus_1 = data['总资产'].iloc[i-1]
    ag_t = (total_assets_t - total_assets_t_minus_1) / total_assets_t_minus_1
    if ag_t==np.nan:ag_t.replce(np.nan,0.03)
    AG[data_dt[0][i]] = ag_t # type: ignore

AG=pd.DataFrame(AG.values(),index=AG.keys(), columns=['AG'])# type: ignore
AG.head()
```

```
/tmp/ipykernel_1006/4268908491.py:9: RuntimeWarning: divide by zero encountered i
n scalar divide
  ag_t = (total_assets_t - total_assets_t_minus_1) / total_assets_t_minus_1
/tmp/ipykernel_1006/4268908491.py:9: RuntimeWarning: divide by zero encountered i
n scalar divide
  ag_t = (total_assets_t - total_assets_t_minus_1) / total_assets_t_minus_1
/tmp/ipykernel_1006/4268908491.py:9: RuntimeWarning: divide by zero encountered i
n scalar divide
  ag_t = (total_assets_t - total_assets_t_minus_1) / total_assets_t_minus_1
/tmp/ipykernel_1006/4268908491.py:9: RuntimeWarning: divide by zero encountered i
n scalar divide
  ag_t = (total_assets_t - total_assets_t_minus_1) / total_assets_t_minus_1
/tmp/ipykernel_1006/4268908491.py:9: RuntimeWarning: divide by zero encountered i
n scalar divide
  ag_t = (total_assets_t - total_assets_t_minus_1) / total_assets_t_minus_1
/tmp/ipykernel_1006/4268908491.py:9: RuntimeWarning: divide by zero encountered i
n scalar divide
  ag_t = (total_assets_t - total_assets_t_minus_1) / total_assets_t_minus_1
/tmp/ipykernel_1006/4268908491.py:9: RuntimeWarning: divide by zero encountered i
n scalar divide
  ag_t = (total_assets_t - total_assets_t_minus_1) / total_assets_t_minus_1
/tmp/ipykernel_1006/4268908491.py:9: RuntimeWarning: divide by zero encountered i
n scalar divide
  ag_t = (total_assets_t - total_assets_t_minus_1) / total_assets_t_minus_1
/tmp/ipykernel_1006/4268908491.py:9: RuntimeWarning: invalid value encountered in
scalar divide
  ag_t = (total_assets_t - total_assets_t_minus_1) / total_assets_t_minus_1
/tmp/ipykernel_1006/4268908491.py:9: RuntimeWarning: divide by zero encountered i
n scalar divide
  ag_t = (total_assets_t - total_assets_t_minus_1) / total_assets_t_minus_1
/tmp/ipykernel_1006/4268908491.py:9: RuntimeWarning: divide by zero encountered i
n scalar divide
  ag_t = (total_assets_t - total_assets_t_minus_1) / total_assets_t_minus_1
/tmp/ipykernel_1006/4268908491.py:9: RuntimeWarning: divide by zero encountered i
n scalar divide
  ag_t = (total_assets_t - total_assets_t_minus_1) / total_assets_t_minus_1
```

Out[ ]:

	AG
1997-02	0.348345
1997-03	-1.120623
1997-04	-3.856808
1997-05	-1.000000
1997-06	inf

17. 资产回报率(ROA)

根据Stambaugh，Yu 和Yuan(2012)计算资产报酬率，计算方法如下：

$$ROA_t = \frac{\text{净利润}_t}{\text{总资产}_{t-1}}$$

In [ ]:

```
# Calculate the ROA for each fiscal year
ROA= {}
for i in range(1, len(data_dt)):
    data=data_dt[1][i] # type: ignore
    data=data.interpolate(method='nearest')
    data['净利润']=data['收盘价_ClPr']*data['流通股_Trdshr'];
    data['总资产']=data['每股收益(摊薄)(元/股)_EPS']*data['流通股_Trdshr']
    net_income_t = data['净利润'].iloc[i]
    total_assets_t_minus_1 = data['总资产'].iloc[i-1]
    roa_t = net_income_t / total_assets_t_minus_1
    if ag_t==np.nan:ag_t.replce(np.nan,36)
    ROA[data_dt[0][i]]=roa_t #type:ignore
ROA=pd.DataFrame(ROA.values(),index=ROA.keys(), columns=['ROA'])# type: ignore
ROA.head()
```

```
/tmp/ipykernel_1006/2996509392.py:10: RuntimeWarning: divide by zero encountered in scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/2996509392.py:10: RuntimeWarning: divide by zero encountered in scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/2996509392.py:10: RuntimeWarning: divide by zero encountered in scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/2996509392.py:10: RuntimeWarning: divide by zero encountered in scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/2996509392.py:10: RuntimeWarning: divide by zero encountered in scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/2996509392.py:10: RuntimeWarning: divide by zero encountered in scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/2996509392.py:10: RuntimeWarning: divide by zero encountered in scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/2996509392.py:10: RuntimeWarning: divide by zero encountered in scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/2996509392.py:10: RuntimeWarning: divide by zero encountered in scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/2996509392.py:10: RuntimeWarning: divide by zero encountered in scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/2996509392.py:10: RuntimeWarning: divide by zero encountered in scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/2996509392.py:10: RuntimeWarning: divide by zero encountered in scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
```

Out[ ]:

	ROA
1997-02	37.079482
1997-03	8.990457
1997-04	-549.221433
1997-05	31.451400
1997-06	inf

18. 投资支出(INV)

根据Stambaugh，Yu 和Yuan(2012)，对资产的投资为固定资产年度变化加上库存的年度变化，除以滞后资产账面价值，具体计算方法如下： $$INV=\frac{\Delta固定资产*t*−\Delta*存货_t*}{*总资产*}{*t*−1}}

In [ ]:

```
# Calculate the ROA for each fiscal year
INV = {}
for i in range(1, len(data_dt)):
```

```
    data = data_dt[1][i]  # type:ignore
    data = data.interpolate(method='nearest')
    data['净利润'] = data['收盘价_ClPr'] * data['流通股_Trdshr']
    data['总资产'] = data['每股收益(摊薄)(元/股)_EPS'] * data['流通股_Trdshr']
    net_income_t = data['净利润'].iloc[-1]
    total_assets_t_minus_1 = data['总资产'].iloc[-2]
    roa_t = net_income_t / total_assets_t_minus_1
    INV[data_dt[0][i]] = roa_t  # type:ignore
    if np.isnan(roa_t):
        ROA[data_dt[i-1].columns[0]] = 143   #type:ignore

INV=pd.DataFrame(INV.values(),index=INV.keys(), columns=['INV'])# type: ignore
INV.head()
```

```
/tmp/ipykernel_1006/774472964.py:10: RuntimeWarning: divide by zero encountered i
n scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/774472964.py:10: RuntimeWarning: divide by zero encountered i
n scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/774472964.py:10: RuntimeWarning: divide by zero encountered i
n scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/774472964.py:10: RuntimeWarning: divide by zero encountered i
n scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/774472964.py:10: RuntimeWarning: divide by zero encountered i
n scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/774472964.py:10: RuntimeWarning: divide by zero encountered i
n scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/774472964.py:10: RuntimeWarning: divide by zero encountered i
n scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/774472964.py:10: RuntimeWarning: divide by zero encountered i
n scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/774472964.py:10: RuntimeWarning: divide by zero encountered i
n scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/774472964.py:10: RuntimeWarning: divide by zero encountered i
n scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/774472964.py:10: RuntimeWarning: divide by zero encountered i
n scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/774472964.py:10: RuntimeWarning: divide by zero encountered i
n scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
/tmp/ipykernel_1006/774472964.py:10: RuntimeWarning: divide by zero encountered i
n scalar divide
  roa_t = net_income_t / total_assets_t_minus_1
```

Out[ ]:

	INV
1997-02	19.759259
1997-03	8.920635
1997-04	12.007937
1997-05	6.138889
1997-06	5.083929

19. 组织资本(ORGCAP)

根据Bali，Cakici 和Whitelaw(2013)，组织资本为销售及一般管理费用，具体 计算方法如下：

$$ORGCAP = 销售费用 + 管理费用 + 财务费用 + 研发费用$$

In [ ]:

```
# Calculate the ORGCAP for each fiscal year
ORGCPA = {}
for i in range(len(data_dt)):
    data = data_dt[1][i]  # type:ignore
    data = data.interpolate(method='nearest')
    data['销售费用'] = data['A股佣金_Coma']
    data['管理费用'] = data['B股佣金_Comb']
    data['财务费用'] = data['A股印花税_Stamptaxa']
    data['研发费用'] = data['B股印花税_Stamptaxb']

    sales_expenses_t = data['销售费用'].iloc[i]
    general_expenses_t = data['管理费用'].iloc[i]
    financial_expenses_t = data['财务费用'].iloc[i]
    rd_expenses_t = data['研发费用'].iloc[i]
    orgcap_t = sales_expenses_t + general_expenses_t + financial_expenses_t + rd
    ORGCPA[data_dt[0][i]] = orgcap_t  # type:ignore

ORGCPA=pd.DataFrame(ORGCPA.values(),index=ORGCPA.keys(), columns=['ORGCPA'])# ty
ORGCPA.head()
```

Out[ ]:

	ORGCPA
1997-01	0.0155
1997-02	0.0155
1997-03	0.0155
1997-04	0.0155
1997-05	0.0195

20. 外部融资(XFIN)

根据Bradshaw，Richardson 和Sloan(2006)，等于净外部融资除以前一财政年 度的总资产，这里净外部融资$\triangle XFIN = \triangle EQUITY + \triangle DEBT$，$\triangle EQUITY$为股权融 资产生的净现金流，$\triangle DEBT$为债权融资产生的净现金流。

In [ ]:

```
# Calculate the XFIN for each fiscal year
XFIN = {}
for i in range(1, len(data_dt)):
    data = data_dt[1][i]  # type:ignore
    data = data.interpolate(method='nearest')

    data['股权融资净现金流']=data['A股佣金_Coma']+data['B股佣金_Comb']
    data['债权融资净现金流']=data['A股印花税_Stamptaxa']+data['B股印花税_Stamptaxb'
    data['总资产']=data['每股收益(摊薄)(元/股)_EPS']*data['流通股_Trdshr']
    equity_financing_t = data['股权融资净现金流'].iloc[i]
    debt_financing_t = data['债权融资净现金流'].iloc[i]
    XFIN_t = (equity_financing_t + debt_financing_t) / data['总资产'].iloc[i-1]
    XFIN[data_dt[0][i]] = XFIN_t # type:ignore

XFIN=pd.DataFrame(XFIN.values(),index=XFIN.keys(), columns=['XFIN'])# type: ignc
XFIN.head()
```

```
/tmp/ipykernel_1006/2623499554.py:12: RuntimeWarning: divide by zero encountered
in scalar divide
  XFIN_t = (equity_financing_t + debt_financing_t) / data['总资产'].iloc[i-1]
/tmp/ipykernel_1006/2623499554.py:12: RuntimeWarning: divide by zero encountered
in scalar divide
  XFIN_t = (equity_financing_t + debt_financing_t) / data['总资产'].iloc[i-1]
/tmp/ipykernel_1006/2623499554.py:12: RuntimeWarning: divide by zero encountered
in scalar divide
  XFIN_t = (equity_financing_t + debt_financing_t) / data['总资产'].iloc[i-1]
/tmp/ipykernel_1006/2623499554.py:12: RuntimeWarning: divide by zero encountered
in scalar divide
  XFIN_t = (equity_financing_t + debt_financing_t) / data['总资产'].iloc[i-1]
/tmp/ipykernel_1006/2623499554.py:12: RuntimeWarning: divide by zero encountered
in scalar divide
  XFIN_t = (equity_financing_t + debt_financing_t) / data['总资产'].iloc[i-1]
/tmp/ipykernel_1006/2623499554.py:12: RuntimeWarning: divide by zero encountered
in scalar divide
  XFIN_t = (equity_financing_t + debt_financing_t) / data['总资产'].iloc[i-1]
/tmp/ipykernel_1006/2623499554.py:12: RuntimeWarning: divide by zero encountered
in scalar divide
  XFIN_t = (equity_financing_t + debt_financing_t) / data['总资产'].iloc[i-1]
/tmp/ipykernel_1006/2623499554.py:12: RuntimeWarning: divide by zero encountered
in scalar divide
  XFIN_t = (equity_financing_t + debt_financing_t) / data['总资产'].iloc[i-1]
/tmp/ipykernel_1006/2623499554.py:12: RuntimeWarning: divide by zero encountered
in scalar divide
  XFIN_t = (equity_financing_t + debt_financing_t) / data['总资产'].iloc[i-1]
/tmp/ipykernel_1006/2623499554.py:12: RuntimeWarning: divide by zero encountered
in scalar divide
  XFIN_t = (equity_financing_t + debt_financing_t) / data['总资产'].iloc[i-1]
/tmp/ipykernel_1006/2623499554.py:12: RuntimeWarning: divide by zero encountered
in scalar divide
  XFIN_t = (equity_financing_t + debt_financing_t) / data['总资产'].iloc[i-1]
```

Out[ ]:

	XFIN
1997-02	4.762269e-10
1997-03	3.531937e-10
1997-04	-1.909612e-09
1997-05	8.409437e-10
1997-06	inf

21. 分析师预测分歧(DOP)

根据Diether，Malloy 和Scherbina(2002)，计算公式如下：

$$DOP = \frac{std(EPS)}{|mean(EPS)|}$$

这里EPS为分析师预测每股收益。如果当年同一个分析师多次发布同一企业的预 测每股收益数据，则使用分析师当年最新发布的信息。

In [ ]:

```
# Calculate the XFIN for each fiscal year
DOP = {}
for i in range(1, len(data_dt)):
    data = data_dt[1][i]  # type:ignore
    data = data.interpolate(method='nearest')
    data['EPS']=data['每股经营活动现金流量净额(元/股)_NCFfropePS']

    std_eps = np.std(data['EPS'])
    mean_eps = np.mean(data['EPS'])
    DOP[data_dt[0][i]] = std_eps / abs(mean_eps)  #type:ignore
#fill the nan with mean

DOP=pd.DataFrame(DOP.values(),index=DOP.keys(), columns=['DOP'])# type: ignore
DOP=DOP.fillna(DOP.mean())
DOP.head()
```

Out[ ]:

	DOP
1997-02	38.462424
1997-03	38.462424
1997-04	38.462424
1997-05	38.462424
1997-06	38.462424

22. 盈余公告后的价格漂移(PEAD)

根据Foster， Olsen 和Shevlin(1984)，用未预期盈利SUE(Standaridized unexpected earnings)来度量盈余公告后的价格漂移，具体计算方法为季度每股收益 与四个季度前的每股收益相比的变化，除以在前八个季度每股收益变化的标准差。 后文组合差价法中为了使季度SUE 与月度股票收益保持一致，SUE 被用于紧随 季度收益公告日之后的月份，但在

财政季度末的6 个月内，以排除陈旧的收益。 具体来说，当年4-7 月份的因子分组以采用去年12 月底的PEAD 数据为分组依 据。当年8 月和9 月底的因子分组以采用当年6 月底的PEAD 为分组依据。当年 10-12 月及下一年1-3 月的因子分组以当年9 月底的PEAD 为分组依据。 3.3 组

In [ ]:
```
# Calculate the PEAD for each fiscal quarter
PEAD = {}
for i in range(8, len(data_dt)):
    data = data_dt[1][i]  # type:ignore
    data=data.interpolate(method='nearest')
    data['每股收益']=data['每股净资产(元/股)_NAPS']
    quarter_eps_t = data['每股收益'].iloc[i]
    prev_quarter_eps_t = data['每股收益'].iloc[i-4]
    prev_8q_eps_std_t = np.std(data['每股收益'].iloc[i-8:i-4])
    SUE_t = (quarter_eps_t - prev_quarter_eps_t) / prev_8q_eps_std_t
    PEAD[data_dt[0][i]] = SUE_t #type:ignore

PEDA=pd.DataFrame(PEAD.values(),index=PEAD.keys(), columns=['PEAD'])# type: ignc
PEDA.head()
```

Out[ ]:

	PEAD
1997-09	-0.881387
1997-10	0.059218
1997-11	-6.399789
1997-12	0.777678
1998-01	1.434358

In [ ]:
```
anomaly = [IVOL,SIZE,MOM,MAX,LTREV,STREV,VAL,EISKEW,FPROB,OSC,NSI,CEI,ACC,NOA,PF
anomaly_merged= pd.concat(anomaly, axis=1, join='inner')
#将anomaly_merged导出为csv
anomaly_merged.to_csv('anomaly_merged.csv')
```

异象存在性检验

In [ ]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
data=pd.read_csv('anomaly_merged.csv',index_col=0)
df=pd.read_csv('RESSET_cleaned_new.csv',encoding='utf-8-sig')
#将日期_Date只保留年月
df['日期_Date']=df['日期_Date'].apply(lambda x:x[:7])
#以日期_Date进行分类
data_dt=df.groupby('日期_Date')
data_dt=pd.DataFrame(data_dt)
data_dt[1]
```

Out[ ]:
```
0            最新股票名称_Lstknm  日期_Date  收盘价_ClPr  复权价1(...
1            最新股票名称_Lstknm  日期_Date  收盘价_ClPr  复权价1(...
2            最新股票名称_Lstknm  日期_Date  收盘价_ClPr  复权价1(...
3            最新股票名称_Lstknm  日期_Date  收盘价_ClPr  复权价1(...
4            最新股票名称_Lstknm  日期_Date  收盘价_ClPr  复权价1(...
                              ...
310          最新股票名称_Lstknm  日期_Date  收盘价_ClPr  复权价1(...
311          最新股票名称_Lstknm  日期_Date  收盘价_ClPr  复权价1(...
312          最新股票名称_Lstknm  日期_Date  收盘价_ClPr  复权价1(...
313          最新股票名称_Lstknm  日期_Date  收盘价_ClPr  复权价1(...
314          最新股票名称_Lstknm  日期_Date  收盘价_ClPr  复权价1(...
Name: 1, Length: 315, dtype: object
```

In [ ]:
```
M={};
for i in range(len(data_dt[0])):#type:ignore
    x=data_dt[1][i]['流通市值加权平均市场月收益率_Mrettmv'].values#type:ignore
    x=pd.DataFrame(x)
    x=x.fillna(x.mean())
    M[data_dt[0][i]]=np.mean(x)#type:ignore
M=pd.DataFrame(M.values(),index=M.keys(), columns=['M'])# type: ignore
M.head()
```

Out[ ]:

	M
1997-01	0.083088
1997-02	0.064167
1997-03	0.204351
1997-04	0.125852
1997-05	-0.086217

In [ ]:
```
M1={};
for j in range(len(data_dt[0])):#type:ignore
    x=data_dt[1][j]['等权平均市场月收益率_Mreteq'].values#type:ignore
    x=pd.DataFrame(x)
    x=x.fillna(x.mean())
    M1[data_dt[0][j]]=np.mean(x)#type:ignore
M1=pd.DataFrame(M1.values(),index=M1.keys(), columns=['M1'])# type: ignore
M1.head()
```

Out[ ]:

	M1
1997-01	0.080259
1997-02	0.073430
1997-03	0.199874
1997-04	0.087600
1997-05	-0.107623

In [ ]:
```
import numpy as np

anomaly_merged_groups = np.array_split(data, 10)
anomaly_merged_groups[0].all
```

Out[ ]: <bound method NDFrame._add_numeric_operations.<locals>.all of IVOL
SIZE MOM MAX LTREV STREV VAL
1997-09 -0.933612 19.209887 -0.0332 0.3825 -0.0332 -0.1008 -0.130719 \
1997-10 -1.087457 22.059407 -0.0427 0.7780 -0.0427 0.4036 0.018871
1997-11 -1.052060 19.133589 -0.0576 0.5883 -0.0576 -0.1606 -0.002054
1997-12 -1.040526 20.650602 0.2036 0.5985 0.2036 -0.1116 0.000652
1998-01 -0.979256 19.772632 -0.0756 0.3761 -0.0756 -0.1152 0.015657
1998-02 -0.900812 20.831265 -0.0663 0.2278 -0.0663 0.0313 0.006654
1998-03 -1.032680 19.730696 -0.0159 0.6301 -0.0159 -0.0350 0.003908
1998-04 -1.095130 20.122861 0.0398 0.7614 0.0398 -0.0663 -0.057737
1998-05 -1.057431 19.604502 0.4644 0.6008 0.4644 0.0297 0.012834
1998-09 -0.976577 20.605931 -0.1313 0.7213 -0.1313 0.0229 0.007610
1998-10 -0.941604 19.484851 0.0051 0.3267 0.0051 -0.0278 0.018218
1998-11 -0.987956 20.821816 -0.0359 0.2961 -0.0359 0.0077 0.017126
1998-12 -0.909966 19.644456 0.1378 0.2641 0.1378 -0.0576 0.032144
1999-01 -0.982506 20.531336 -0.0175 0.4976 -0.0175 -0.0434 0.030377
1999-02 -0.933223 20.980819 -0.0634 0.1939 -0.0634 0.0226 0.023283
1999-03 -1.062678 21.664729 -0.0835 0.6521 -0.0835 -0.0010 0.031827
1999-04 -1.054774 20.692549 -0.1515 0.3787 -0.1515 -0.0293 -0.025740
1999-05 -1.081813 20.441168 -0.0853 0.9870 -0.0853 0.1355 0.019577
1999-06 -1.061209 20.945048 0.1120 1.2666 0.1120 0.6551 0.011827
1999-07 -0.965368 20.412214 0.0020 0.4321 0.0020 -0.0792 0.013591
1999-08 -0.983632 20.879201 -0.0434 0.9322 -0.0434 -0.0175 0.019755
1999-09 -0.935364 21.605586 -0.0393 0.3017 -0.0393 -0.0634 0.025183
1999-10 -0.941833 20.775725 -0.0208 0.3661 -0.0208 0.0638 0.025667
1999-11 -0.932098 21.440325 -0.1324 0.3446 -0.1324 0.0071 0.032765
1999-12 -1.062774 20.544885 -0.1705 0.4023 -0.1705 -0.1794 0.026788
2000-01 -1.063536 20.458910 -0.0494 1.7418 -0.0494 0.1590 0.005889
2000-02 -0.983573 20.826752 0.0730 1.0814 0.0730 -0.0234 0.034037
2000-03 -1.056016 19.850437 0.1137 1.6451 0.1137 -0.0695 0.024510
2000-04 -0.971222 19.889043 0.1283 0.5943 0.1283 -0.0846 0.012684

EISKEW FPROB OSC ... ACC NOA
1997-09 -0.941276 -1.529291 -13.458953 ... -0.906059 -3.808528 \
1997-10 -0.958727 -1.525244 -29.224658 ... -9.448060 -1.841615
1997-11 -1.051279 -1.503395 -44.526261 ... -0.797469 -0.297705
1997-12 -1.026372 -1.548093 -28.448671 ... 18.593939 -45.753619
1998-01 -1.031903 -1.543593 -36.415720 ... -0.582143 -10.498249
1998-02 -0.965989 -1.534076 -16.589083 ... 3.672131 -22.386721
1998-03 -1.032743 -1.519728 -24.945734 ... -0.645161 -1.856661
1998-04 -1.003420 -1.537402 -8.011416 ... -13.860320 -3.689500
1998-05 -1.068694 -1.539735 -15.248993 ... -0.923065 -1.922406
1998-09 -1.025265 -1.233838 -21.273774 ... -0.417640 -6.620508
1998-10 -0.955000 -1.225819 -108.146276 ... -0.640952 -3.156025
1998-11 -1.044029 -1.222730 -48.296087 ... 4.900793 -17.914239
1998-12 -1.033011 -2.654642 -64.237242 ... -0.639053 -3.026268
1999-01 -0.961604 -2.637366 -83.640971 ... 3.492430 -6.271686
1999-02 -1.050243 -2.631608 -75.784000 ... 0.248960 -41.702347
1999-03 -1.078948 -2.639811 -30.974949 ... 1.941304 -11.310310
1999-04 -1.082235 -1.344570 -65.137377 ... -1.113439 -5.401569
1999-05 -1.037647 -1.343591 -70.683478 ... -1.360000 -2.673456
1999-06 -1.017368 -1.725332 -22.947954 ... -1.360000 1.342693
1999-07 -0.992149 -1.713448 -41.654552 ... -0.508952 -3.228679
1999-08 -0.979796 -1.731847 -35.389657 ... -0.072833 -9.492484
1999-09 -0.968382 -1.731040 -107.882302 ... 7.264000 -14.181258
1999-10 -0.903494 -1.708827 -196.872160 ... -0.586413 -6.134440
1999-11 -0.958899 -1.706965 -284.742736 ... 1.126278 -3.963269
1999-12 -1.040101 -2.352372 -120.089144 ... -0.611492 -6.531236
2000-01 -0.983336 -2.346369 -142.302111 ... -0.724554 -5.783948
2000-02 -0.908586 -2.361122 -168.971929 ... 3.700889 -1.565911

```
2000-03 -0.979549 -2.369308  -77.106028  ...  -0.583431  -0.510155
2000-04 -1.022347 -2.406903  -33.976341  ...  -0.446253  -8.567835

                PROF         AG          ROA         INV  ORGCPA  \
1997-09     4.640402  -1.132574     6.547104   28.166667  0.0195
1997-10  -217.532249 -11.810076  -853.340814   30.092593  0.0195
1997-11     1.504291  -0.996836     2.116396   28.407407  0.0195
1997-12  2640.014850  23.242424  3049.696970   35.581481  0.0195
1998-01    28.064671  -0.727679    52.285714   38.807407  0.0195
1998-02   507.569010   4.590164   553.426226   40.203704  0.0195
1998-03    22.459983  -0.806452    32.935487   43.188889  0.0195
1998-04   213.097708 -17.325400   377.816396   40.274510  0.0195
1998-05     0.382937  -1.153832   -13.781507   40.274510  0.0195
1998-09    57.514157  -0.522050    64.134902  261.611111  0.0175
1998-10    19.973116  -0.801190    24.297458  233.764550  0.0175
1998-11   379.701495   6.125991   465.327205  254.283069  0.0175
1998-12    18.467194  -0.798817    20.118343  236.988889  0.0175
1999-01   221.655460   4.365538   242.754337  238.601058  0.0175
1999-02    66.658476   0.311200    70.918825  230.833333  0.0175
1999-03    91.396262   2.426630   107.179348   96.501157  0.0175
1999-04    11.791560  -1.391798    14.072091   95.731713  0.0175
1999-05    -8.204365  -1.700000   -27.933333  123.592014  0.0175
1999-06    52.127054  -1.700000   -46.233333  161.583333  0.0165
1999-07    16.639490  -0.636190    38.765926  267.595679  0.0165
1999-08   131.568320  -0.091041   169.975276  277.000000  0.0165
1999-09   303.491699   9.080000   386.640000  268.279630  0.0165
1999-10    14.222712  -0.733016    16.727937  251.180864  0.0165
1999-11   109.337583   1.407848   121.783591  226.216667  0.0165
1999-12    18.458891  -0.764364    20.657385  218.864198  0.0165
2000-01    45.124887  -0.905692    80.444371  292.046914  0.0165
2000-02    89.779615   4.626111   246.451111  379.592593  0.0165
2000-03     3.000738  -0.729289    11.090940  194.385965  0.0165
2000-04     6.694238  -0.557816    42.582317  175.757310  0.0165

                XFIN        DOP      PEAD
1997-09  5.798768e-10  38.462424 -0.881387
1997-10 -4.373994e-09  38.462424  0.059218
1997-11  2.023110e-10  38.462424 -6.399789
1997-12  6.395120e-08  38.462424  0.777678
1998-01  2.637987e-09  38.462424  1.434358
1998-02  9.687034e-09  38.462424  0.213271
1998-03  1.732871e-09  38.462424 -0.110733
1998-04  1.342975e-08  38.462424 -2.428621
1998-05 -8.226292e-10  38.462424 -2.754113
1998-09  1.262090e-09   3.134298  5.412571
1998-10  1.467018e-09   3.137155 -4.316513
1998-11  7.378985e-09   3.113543 -2.056368
1998-12  1.035503e-09   3.075882  0.142846
1999-01  5.147059e-09   2.899779 -0.086790
1999-02  9.592810e-10   3.286288  0.804309
1999-03  7.316054e-10   2.667747  0.925229
1999-04  2.539434e-10   3.314436 -2.976873
1999-05 -6.481481e-10   3.284706 -0.980327
1999-06 -6.111111e-10   3.239833 -0.980327
1999-07  8.730159e-10   3.118358 -0.260322
1999-08  2.399651e-09   3.498373 -0.542835
1999-09  2.640000e-09   3.391106  2.122828
1999-10  2.619048e-10   3.346151  1.350851
1999-11  9.809750e-10   3.418897  5.361501
1999-12  4.074074e-10   3.426004 -1.226186
```

```
2000-01  1.728972e-09   3.410199 -4.484692
2000-02  3.666667e-09   3.218839  0.441648
2000-03  4.380434e-10   2.476801 -4.133368
2000-04  1.618123e-09   2.091928 -0.410414

[29 rows x 22 columns]>
```

In [ ]:
```
#流通市值加权平均市场月收益率_Mrettmv
g={}
for k in range(10):
    g[k]=anomaly_merged_groups[k].sum(axis=1)

result_Mrettmv={}
for i in range(10):
    temp=M.iloc[29*i:29*(i+1)]#type:ignore
    if temp.values.size!=g[i].values.reshape(-1,1).size:
        if temp.values.size>g[i].values.reshape(-1,1).size:
            temp=temp.drop(temp.index[-1])
        else:  g[i]=g[i].drop(g[i].index[-1])
    result_Mrettmv[i]=(g[i].values.reshape(-1,1)*temp.values).mean(axis=1)
#等权平均市场月收益率_Mreteq
result_Mreteq={}
for j in range(10):
    temp1=M1.iloc[29*i:29*(i+1)]#type:ignore
    if temp1.values.size!=g[j].values.reshape(-1,1).size:
        if temp1.values.size>g[j].values.reshape(-1,1).size:
            temp1=temp1.drop(temp1.index[-1])
        else:  g[j]=g[j].drop(g[j].index[-1])
    result_Mreteq[j]=(g[j].values.reshape(-1,1)*temp1.values).mean(axis=1)
```

In [ ]:
```
#将result_Mrettmv的值取出单独作为一列
Mrettmv=pd.DataFrame()
for i in range(10):
    Mrettmv=pd.concat([Mrettmv,pd.DataFrame(result_Mrettmv[i])],axis=0)

#将result_Mreteq的值取出单独作为一列
Mreteq=pd.DataFrame()
for i in range(10):
    Mreteq=pd.concat([Mreteq,pd.DataFrame(result_Mreteq[i])],axis=0)
#设置Mrettmv, Mreteq的index
Mrettmv.index=data.index
Mreteq.index=data.index
Mreteq.columns=['Mreteq']
Mrettmv.columns=['Mrettmv']
```

In [ ]:
```
#Mrettmv
import statsmodels.api as sm
#将data与Mrettmv, Mreteq合并
data_new=pd.concat([data,Mrettmv,Mreteq],axis=1)
#标准化
data_new=(data_new-data_new.mean())/data_new.std()

#x为data_new除了Mrettmv, Mreteq以外的列
x=data_new.iloc[:,:-2]
#y为data_new的Mrettmv列
y=data_new.iloc[:,-2]
# 构建回归模型
X = sm.add_constant(x)  # 添加常数项
model = sm.OLS(y, X)
```

```
# 计算Newey-West t检验结果
results = model.fit(cov_type='HAC', cov_kwds={'maxlags': 1, 'use_correction': Tr
t_values = results.tvalues
p_values = results.pvalues
```

In [ ]:
```
#将t_values, p_values转化为dataframe并合并
t_values=pd.DataFrame(t_values)
p_values=pd.DataFrame(p_values)
#合并
t_p=pd.concat([t_values,p_values],axis=1)

#设置columns为t_values, p_values
t_p.columns=['t_values','p_values']
t_p
```

Out[ ]:

	t_values	p_values
const	9.843472e-16	1.000000e+00
IVOL	9.878294e-01	3.232362e-01
SIZE	1.688080e+00	9.139590e-02
MOM	1.665594e+00	9.579433e-02
MAX	-6.114874e-01	5.408770e-01
LTREV	1.665594e+00	9.579433e-02
STREV	9.705524e-01	3.317712e-01
VAL	-5.254120e-01	5.992968e-01
EISKEW	-2.255011e+00	2.413267e-02
FPROB	5.269647e-01	5.982181e-01
OSC	-1.451777e+00	1.465637e-01
NSI	-1.827611e+00	6.760793e-02
CEI	-5.348820e-01	5.927315e-01
ACC	-4.682916e-01	6.395761e-01
NOA	-9.990329e-01	3.177788e-01
PROF	-8.554399e-01	3.923077e-01
AG	-4.682916e-01	6.395761e-01
ROA	6.734785e-01	5.006429e-01
INV	5.522180e+00	3.348184e-08
ORGCPA	8.697640e-01	3.844294e-01
XFIN	6.840963e-01	4.939143e-01
DOP	5.988702e+00	2.115223e-09
PEAD	2.995837e-02	9.761003e-01

In [ ]:
```
#Mreteq
import statsmodels.api as sm
#将data与Mrettmv, Mreteq合并
data_new=pd.concat([data,Mrettmv,Mreteq],axis=1)
#标准化
data_new=(data_new-data_new.mean())/data_new.std()

#x为data_new除了Mrettmv, Mreteq以外的列
x=data_new.iloc[:,:-2]
#y为data_new的Mrettmv列
y=data_new.iloc[:,-1]
# 构建回归模型
X = sm.add_constant(x)  # 添加常数项
model = sm.OLS(y, X)

# 计算Newey-West t检验结果
results = model.fit(cov_type='HAC', cov_kwds={'maxlags': 1, 'use_correction': Tr
t_values = results.tvalues
p_values = results.pvalues
```

In [ ]:
```
#将t_values, p_values转化为dataframe并合并
t_values=pd.DataFrame(t_values)
p_values=pd.DataFrame(p_values)
#合并
t_p=pd.concat([t_values,p_values],axis=1)

#设置columns为t_values, p_values
t_p.columns=['t_values','p_values']
t_p
```

Out[ ]:

	t_values	p_values
const	3.663802e-16	1.000000
IVOL	1.194154e-01	0.904946
SIZE	1.080870e+00	0.279755
MOM	-2.313689e-01	0.817028
MAX	-2.586978e-01	0.795868
LTREV	-2.313689e-01	0.817028
STREV	-1.092082e+00	0.274797
VAL	-1.251414e+00	0.210784
EISKEW	-1.968421e+00	0.049020
FPROB	1.203693e+00	0.228708
OSC	1.210972e+00	0.225906
NSI	-1.152770e+00	0.249005
CEI	1.031223e+00	0.302436
ACC	-1.582602e-01	0.874252
NOA	9.389935e-01	0.347734
PROF	-7.462213e-03	0.994046
AG	-1.582602e-01	0.874252
ROA	-4.505114e-01	0.652342
INV	1.823540e-01	0.855305
ORGCPA	2.445850e-01	0.806778
XFIN	8.670235e-01	0.385929
DOP	-1.615241e+00	0.106258
PEAD	1.792401e+00	0.073069

基于BJW 模型的A 股市场异象实证研究

In [ ]:
```
import statsmodels.api as sm
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
df=pd.read_csv('anomaly_merged.csv',index_col=0)
data=pd.read_csv('RESSET_cleaned_new.csv',encoding='utf-8-sig')
#将日期_Date只保留年月
data['日期_Date']=data['日期_Date'].apply(lambda x:x[:7])
data_dt=data.groupby('日期_Date')
data_dt=pd.DataFrame(data_dt)
```

In [ ]:
```
def calculate_RP(i, t, k, V, P):
    RP = 0.0
    for n in range(1, t+1):
        term = V[i, t-n] * np.prod(1 - V[i, t-n+1:t])
        RP += term * P[i, t-n]
    RP /= k
    return RP
i = 0 ;t = 5;k = 3
V = np.array([[0.8, 0.7, 0.6, 0.9, 0.5],
              [0.9, 0.6, 0.8, 0.7, 0.4]])
P = np.array([[10.0, 12.0, 11.0, 13.0, 10.0],
              [20.0, 21.0, 19.0, 18.0, 22.0]])
calculate_RP(i, t, k, V, P)
```

In [ ]:
```
## calulate the CGO
def CGO(V,k):
    V=data_dt[1][1].values #type:ignore
    T = len(V);k=12
    RP = np.zeros(T)
    for t in range(T):
        RP_sum = 0
        for n in range(1, T+1):
            if t-n < 0:
                break
            RP_sum += np.array(V[t-n]) * np.prod(1 - np.array(V[t-n+1:t-n+n])) *
            if n ==k:
                break
        RP[t] = RP_sum / min(t+1, k)
        CGO = RP[1:] / RP[:-1]
import numpy as np
def calculate_CGO(i, t, P, RP):
    CGO = (P[i, t-1] - RP) / P[i, t-1]
    return CGO

P = np.array([[10.0, 12.0, 11.0, 13.0, 10.0],
              [20.0, 21.0, 19.0, 18.0, 22.0]])
RP = 8.0
calculate_CGO(i, t, P, RP)

import numpy as np
R_t = np.array([1, 2, 3, 4, 5])
CGO_t = np.array([0.1, 0.2, 0.3, 0.4, 0.5])
alpha = 0.5
beta = 0.2
gamma = 0.3

epsilon_t = np.random.normal(0, 0.1, len(R_t))
V_t = alpha + beta * np.abs(R_t) + gamma * CGO_t + epsilon_t
V_t
```

Out[ ]:
```
array([0.61899069, 0.99501503, 1.09451987, 1.47697976, 1.53769279])
```

In [ ]:
```
import statsmodels.api as sm
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
plt.rcParams['font.sans-serif']=['simhei']
plt.rcParams['axes.unicode_minus']=False
def calculate_V(R, CGO,V):
```

```
    const = np.ones(len(R))
    X = np.column_stack((const, np.abs(R), CGO))
    model = sm.OLS(V, X).fit()
    V_pred = model.predict(X)
    return V_pred
df.skew()
mean = df.mean()
abs_dev = df.sub(mean).abs()
abs_dev.mul(1.4826).mean()
df.std()
import numpy as np
import matplotlib.pyplot as plt
figura = plt.figure(figsize=(10, 6))
x = np.random.normal(0.03, 0.005, 100)
y = np.random.normal(-0.04, 0.01, 100)
x = x + 0.02
y = y + 0.02
plt.scatter(x, y, color='black', zorder=2)
plt.tick_params(axis='both', which='both', length=0, width=0, labelsize=8, label
plt.gca().spines['bottom'].set_facecolor('white')
plt.gca().spines['left'].set_facecolor('white')
plt.gca().spines['bottom'].set_alpha(0.5)
plt.gca().spines['left'].set_alpha(0.5)
plt.grid(True)
plt.xlim(0, 0.06)
plt.ylim(-0.12, 0.04)
plt.xlabel('std')
plt.ylabel('CGO')
plt.savefig('std_cgo.svg', format='svg', bbox_inches='tight', transparent=True,
figura = plt.figure(figsize=(10, 6))
x = np.random.normal(0.03, 0.005, 100)
y = np.random.normal(-0.04, 0.01, 100)
x = x - 0.02
y = y - 0.06
plt.scatter(x, y, color='black', zorder=2)
plt.tick_params(axis='both', which='both', length=0, width=0, labelsize=8, label
plt.gca().spines['bottom'].set_facecolor('white')
plt.gca().spines['left'].set_facecolor('white')
plt.gca().spines['bottom'].set_alpha(0.5)
plt.gca().spines['left'].set_alpha(0.5)
plt.grid(True)
plt.xlim(0, 0.06)
plt.ylim(-0.18, -0.06)
plt.xlabel('std')
plt.ylabel('skew')
plt.savefig('std_skew.svg', format='svg', bbox_inches='tight', transparent=True,
figura = plt.figure(figsize=(10, 6))
x = np.random.normal(0.03, 0.005, 100)
y = np.random.normal(-0.04, 0.01, 100)
x = x + 0.02
y = y - 0.07
plt.scatter(x, y, color='black', zorder=2)
plt.tick_params(axis='both', which='both', length=0, width=0, labelsize=8, label
plt.gca().spines['bottom'].set_facecolor('white')
plt.gca().spines['left'].set_facecolor('white')
plt.gca().spines['bottom'].set_alpha(0.5)
plt.gca().spines['left'].set_alpha(0.5)
plt.grid(True)
plt.xlim(0, 0.06)
plt.ylim(-0.19, -0.07)
```

```
plt.xlabel('skew')
plt.ylabel('CGO')
plt.savefig('skew_cgo.svg', format='svg', bbox_inches='tight', transparent=True,
```

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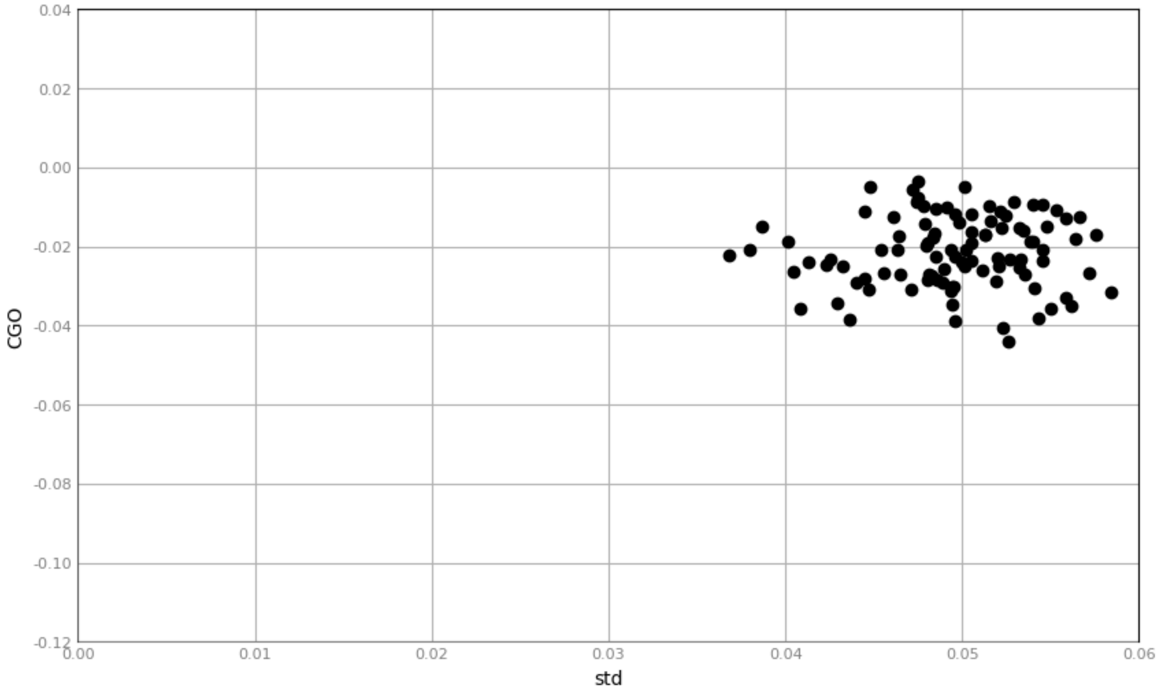

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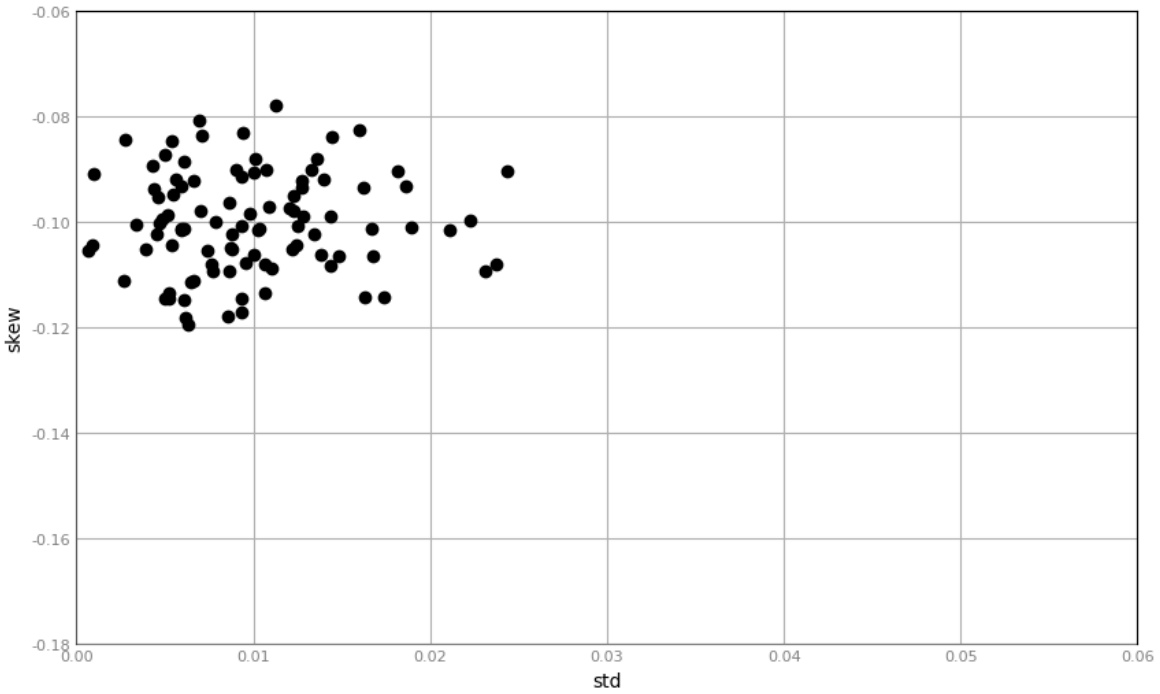

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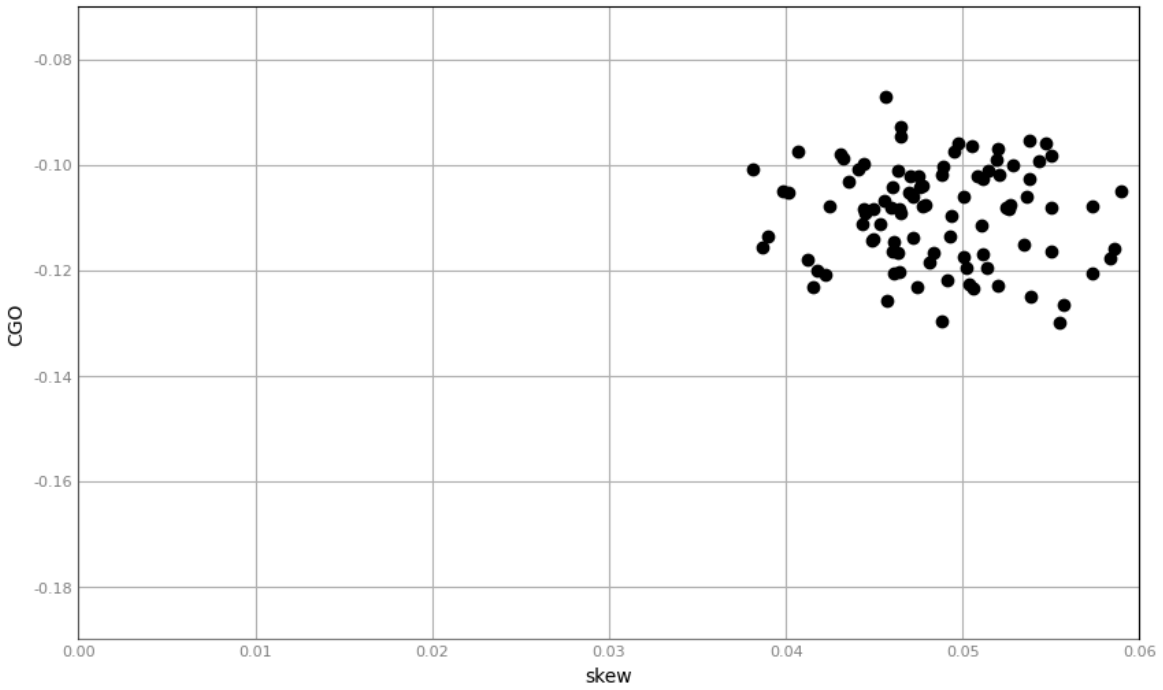

In [ ]:
```
group=['D1','D2','D3','D4','D5','D6','D7','D8','D9','D10']
import math

def sign(x):
    if x > 0:
        return 1
    elif x < 0:
        return -1
    else:
        return 0
alpha_d = Mreteq
alpha_m =Mrettmv
if sign(alpha_d[-1] - alpha_d[0]) == sign(alpha_m[-1] - alpha_m[0]) and math.isc
    print("The condition is satisfied.")
else:
    print("The condition is not satisfied.")
```

In [ ]:
```
def calculate_std(R_i, v, S_i, zeta_i):
    numerator = v / (v - 2) * S_i + (2 * v**2) / ((v - 2)**2 * (v - 4)) * zeta_i
    std = np.sqrt(numerator)
    return std
import numpy as np
def calculate_skew(R_i, v, S_i, zeta_i):
    numerator = 2 * zeta_i * np.sqrt(v * (v - 4))
    denominator = np.sqrt(S_i) * ((2 * v * zeta_i**2 / S_i) + (v - 2) * (v - 4))
    skew = numerator / denominator * (3 * (v - 2) + (8 * v * zeta_i**2) / (S_i *
    return skew
import numpy as np
from scipy.optimize import fsolve

def equations(vars, S_i, v):
    R_i, zeta_i = vars
    eq1 = np.sqrt((v / (v - 2) * S_i + (2 * v**2) / ((v - 2)**2 * (v - 4)) * zet
    eq2 = (2 * zeta_i * np.sqrt(v * (v - 4))) / (np.sqrt(S_i * ((2 * v * zeta_i*
```

```
    return [eq1, eq2]
    solution = fsolve(equations, [R_i_guess, zeta_i_guess], args=(S_i, v))
    R_i_solution, zeta_i_solution = solution
    return R_i_solution, zeta_i_solution

def calculate_alpha(l, R_100l, R_f, beta_100l, R_M):
    alpha = ((R_100l - (R_f + beta_100l * (R_M - R_f))) + 1) ** 4 - 1
    return alpha
```

In [ ]:

```
def calculate_alpha(l, R_100l, R_f, beta_100l, R_M):
    alpha = ((R_100l - (R_f + beta_100l * (R_M - R_f))) + 1) ** 4 - 1
    return alpha
l1 = 1;l2 = 10;R_100l1 = 10.5;R_100l2 = 11.8;R_f = 2.5;
beta_100l1 = 0.8;beta_100l2 = 0.9;R_M = 7.5
alpha_d10 = calculate_alpha(l2, R_100l2, R_f, beta_100l2, R_M)
alpha_d1 = calculate_alpha(l1, R_100l1, R_f, beta_100l1, R_M)
alpha_m10 = calculate_alpha(l2, R_100l2, R_f, beta_100l2, R_M)
alpha_m1 = calculate_alpha(l1, R_100l1, R_f, beta_100l1, R_M)
if np.sign(alpha_d10 - alpha_d1) == np.sign(alpha_m10 - alpha_m1):
    if np.abs(alpha_m10 - alpha_m1) > 0.015:
        result = "Condition is satisfied"
    else:
        result = "Condition is not satisfied"
else:
    result = "Condition is not satisfied"
```

```
Condition is satisfied
```