

cluster

December 11, 2025

```
[23]: # 1.
import pandas as pd
import numpy as np

from sklearn.preprocessing import StandardScaler
from sklearn.cluster import KMeans
from sklearn.metrics import silhouette_score

import matplotlib.pyplot as plt

#     notebook
%matplotlib inline
```

```
[24]: # 2.
monthly_path = "data/sh000016_monthly_features.csv" #
df_month = pd.read_csv(monthly_path)

df_month["month"] = pd.to_datetime(df_month["month"])
df_month["month"] = df_month["month"].dt.to_period("M").dt.to_timestamp()
df_month.head()
```

```
[24]:      month  close_month_end  ret_month  vol_month_sum  vol_month_chg \
0 2015-01-01          2405.38  -0.068249   240759567500        -0.372974
1 2015-02-01          2474.59   0.028773   113685256600        -0.527806
2 2015-03-01          2754.66   0.113178   257993309000         1.269365
3 2015-04-01          3250.49   0.179997   368238254400         0.427317
4 2015-05-01          3111.33  -0.042812   259537919800        -0.295190

      vol_20_annual_month_end  vol_60_annual_month_end  month_str
0              0.467613              0.425187   2015-01
1              0.256287              0.432385   2015-02
2              0.253355              0.347897   2015-03
3              0.269143              0.270690   2015-04
4              0.391430              0.314535   2015-05
```

```
[25]: # 3.
date_col = "month" # 'month' "month"
df_month[date_col] = pd.to_datetime(df_month[date_col])
df_month = df_month.sort_values(date_col).set_index(date_col)

df_month.head()
```

```
[25]:
```

| | close_month_end | ret_month | vol_month_sum | vol_month_chg \ |
|------------|-----------------|-----------|---------------|-----------------|
| month | | | | |
| 2015-01-01 | 2405.38 | -0.068249 | 240759567500 | -0.372974 |
| 2015-02-01 | 2474.59 | 0.028773 | 113685256600 | -0.527806 |
| 2015-03-01 | 2754.66 | 0.113178 | 257993309000 | 1.269365 |
| 2015-04-01 | 3250.49 | 0.179997 | 368238254400 | 0.427317 |
| 2015-05-01 | 3111.33 | -0.042812 | 259537919800 | -0.295190 |

| | vol_20_annual_month_end | vol_60_annual_month_end | month_str |
|------------|-------------------------|-------------------------|-----------|
| month | | | |
| 2015-01-01 | 0.467613 | 0.425187 | 2015-01 |
| 2015-02-01 | 0.256287 | 0.432385 | 2015-02 |
| 2015-03-01 | 0.253355 | 0.347897 | 2015-03 |
| 2015-04-01 | 0.269143 | 0.270690 | 2015-04 |
| 2015-05-01 | 0.391430 | 0.314535 | 2015-05 |

```
[26]: # 3. Regime
feature_cols = [
    "ret_month",
    "vol_month_sum",
    "vol_20_annual_month_end"
]

#
missing = [c for c in feature_cols if c not in df_month.columns]
if missing:
    print(" ", missing)
else:
    print(" ", feature_cols)

# 4.
X_raw = df_month[feature_cols].copy().dropna()
scaler = StandardScaler()
X = scaler.fit_transform(X_raw)

X.shape
```

```
['ret_month', 'vol_month_sum', 'vol_20_annual_month_end']
```

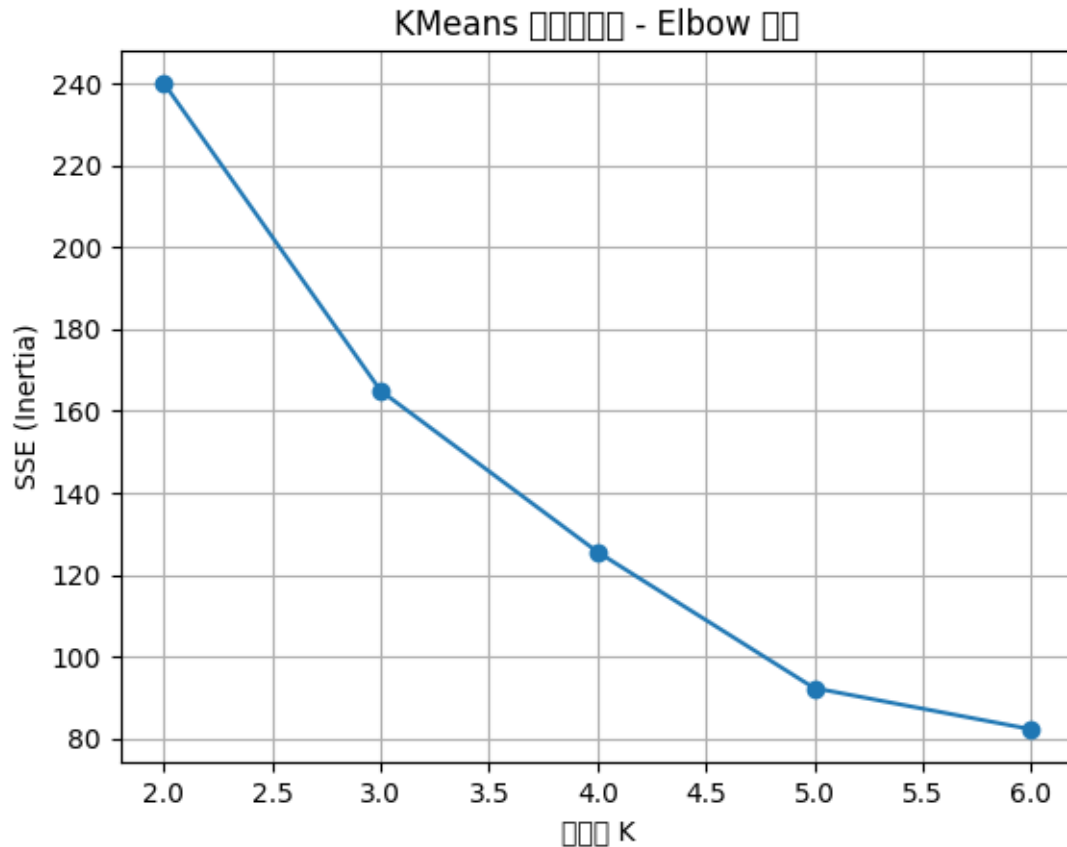
```
[26]: (120, 3)
```

```
[27]: # 5. Elbow (SSE)
sse = []
K_range = range(2, 7)

for k in K_range:
    km = KMeans(n_clusters=k, random_state=42, n_init="auto")
    km.fit(X)
    sse.append(km.inertia_)

plt.figure()
plt.plot(list(K_range), sse, marker="o")
plt.xlabel(" K")
plt.ylabel("SSE (Inertia)")
plt.title("KMeans - Elbow ")
plt.grid(True)
plt.show()
```

```
d:\university\c\anaconda\anaconda\envs\test\lib\site-
packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 32858 (\N{CJK
UNIFIED IDEOGRAPH-805A}) missing from font(s) DejaVu Sans.
    fig.canvas.print_figure(bytes_io, **kw)
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packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 31867 (\N{CJK
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packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 25968 (\N{CJK
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packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 26354 (\N{CJK
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packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 32447 (\N{CJK
UNIFIED IDEOGRAPH-7EBF}) missing from font(s) DejaVu Sans.
    fig.canvas.print_figure(bytes_io, **kw)
```



```
[28]: # 6. Silhouette Score
sil_scores = []
for k in K_range:
    km = KMeans(n_clusters=k, random_state=42, n_init="auto")
    labels = km.fit_predict(X)
    sil = silhouette_score(X, labels)
    sil_scores.append(sil)

plt.figure()
plt.plot(list(K_range), sil_scores, marker="o")
plt.xlabel(" K")
plt.ylabel(" Silhouette Score")
plt.title(" Silhouette Score")
plt.grid(True)
plt.show()

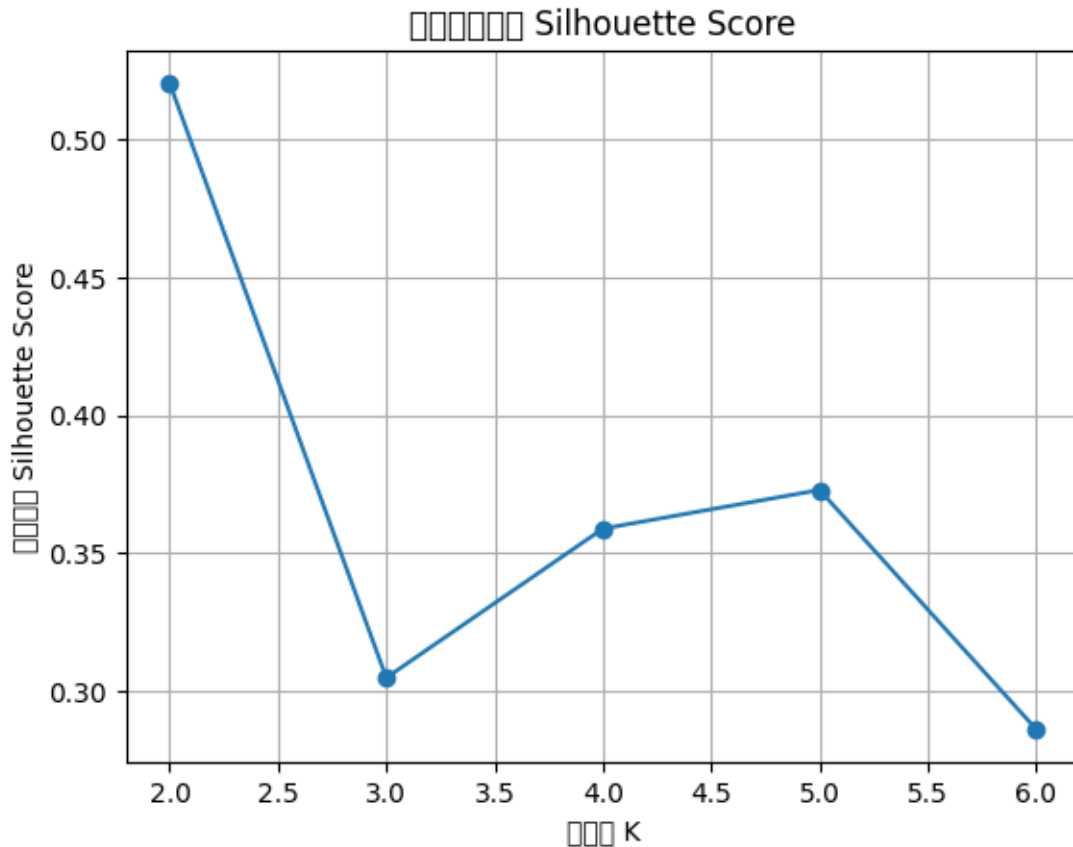
list(zip(K_range, sil_scores))
```

d:\university\c\anaconda\anaconda\envs\test\lib\site-packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 36718 (\N{CJK

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UNIFIED IDEOGRAPH-8F6E}) missing from font(s) DejaVu Sans.
    fig.canvas.print_figure(bytes_io, **kw)
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packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 24275 (\N{CJK
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packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 31995 (\N{CJK
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packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 30340 (\N{CJK
UNIFIED IDEOGRAPH-7684}) missing from font(s) DejaVu Sans.
    fig.canvas.print_figure(bytes_io, **kw)

```



```
[28]: [(2, 0.5203540742408097),
      (3, 0.304812888705872),
      (4, 0.3588605817272719),
      (5, 0.3728757902352798),
      (6, 0.2861553907304862)]
```

```
[29]: # 7. KMeans
      K = 3 # 4 4
      kmeans = KMeans(n_clusters=K, random_state=42, n_init="auto")
      cluster_labels = kmeans.fit_predict(X)

      df_cluster = df_month.loc[X_raw.index].copy()
      df_cluster["cluster"] = cluster_labels

      df_cluster.head()
```

```
[29]:      close_month_end  ret_month  vol_month_sum  vol_month_chg \
month
2015-01-01      2405.38   -0.068249   240759567500   -0.372974
2015-02-01      2474.59    0.028773   113685256600   -0.527806
```

| | | | | |
|------------|---------|-----------|--------------|-----------|
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| 2015-01-01 | 0.467613 | 0.425187 | 2015-01 |
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| 2015-03-01 | 0.253355 | 0.347897 | 2015-03 |
| 2015-04-01 | 0.269143 | 0.270690 | 2015-04 |
| 2015-05-01 | 0.391430 | 0.314535 | 2015-05 |

| | cluster |
|------------|---------|
| month | |
| 2015-01-01 | 2 |
| 2015-02-01 | 0 |
| 2015-03-01 | 2 |
| 2015-04-01 | 2 |
| 2015-05-01 | 2 |

```
[30]: # 8. cluster
cluster_profile = df_cluster.groupby("cluster")[feature_cols].mean()
cluster_profile
```

```
[30]:      ret_month  vol_month_sum  vol_20_annual_month_end
cluster
0      0.052686  7.565731e+10      0.175145
1     -0.030444  6.459630e+10      0.178653
2     -0.019967  2.975105e+11      0.453852
```

```
[31]: # 9. cluster_profile      Regime
cluster_to_regime = {
    0: "Regime_Bull",      # 0  +
    1: "Regime_Bear",      # 1  +
    2: "Regime_Sideways",  # 2
}

df_cluster["regime"] = df_cluster["cluster"].map(cluster_to_regime)

df_cluster[["cluster", "regime"]].head()
```

```
[31]:      cluster      regime
month
2015-01-01      2  Regime_Sideways
2015-02-01      0    Regime_Bull
2015-03-01      2  Regime_Sideways
2015-04-01      2  Regime_Sideways
```

```
[32]: # 10. Regime
regime_profile = df_cluster.groupby("regime")[feature_cols].mean()

for col in feature_cols:
    plt.figure()
    regime_profile[col].plot(kind="bar")
    plt.title(f" Regime  {col} ")
    plt.xlabel("Regime")
    plt.ylabel(col)
    plt.grid(axis="y", linestyle="--", alpha=0.6)
    plt.tight_layout()
    plt.show()
```

C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2730413094.py:11: UserWarning: Glyph 19981 (\N{CJK UNIFIED IDEOGRAPH-4E0D}) missing from font(s) DejaVu Sans.

plt.tight_layout()

C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2730413094.py:11: UserWarning: Glyph 21516 (\N{CJK UNIFIED IDEOGRAPH-540C}) missing from font(s) DejaVu Sans.

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C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2730413094.py:11: UserWarning: Glyph 19979 (\N{CJK UNIFIED IDEOGRAPH-4E0B}) missing from font(s) DejaVu Sans.

plt.tight_layout()

C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2730413094.py:11: UserWarning: Glyph 30340 (\N{CJK UNIFIED IDEOGRAPH-7684}) missing from font(s) DejaVu Sans.

plt.tight_layout()

C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2730413094.py:11: UserWarning: Glyph 24179 (\N{CJK UNIFIED IDEOGRAPH-5E73}) missing from font(s) DejaVu Sans.

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C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2730413094.py:11: UserWarning: Glyph 22343 (\N{CJK UNIFIED IDEOGRAPH-5747}) missing from font(s) DejaVu Sans.

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packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 19981 (\N{CJK UNIFIED IDEOGRAPH-4E0D}) missing from font(s) DejaVu Sans.

fig.canvas.print_figure(bytes_io, **kw)

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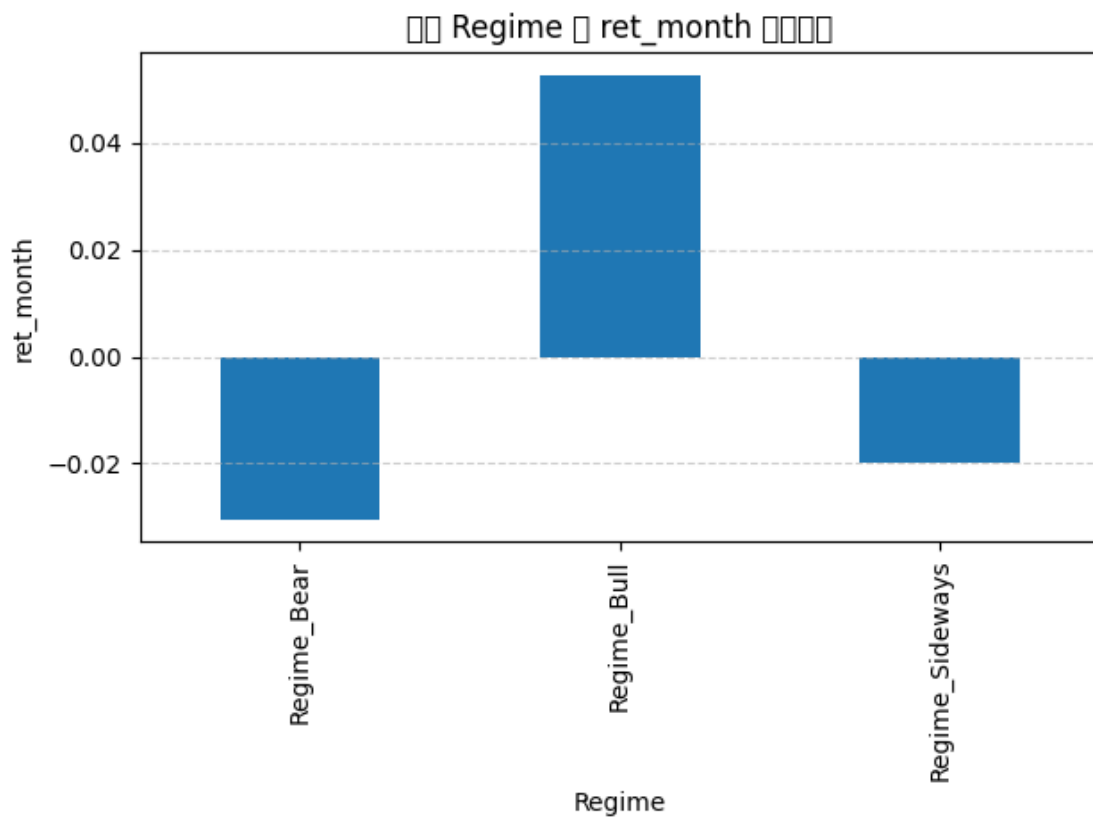
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```



```

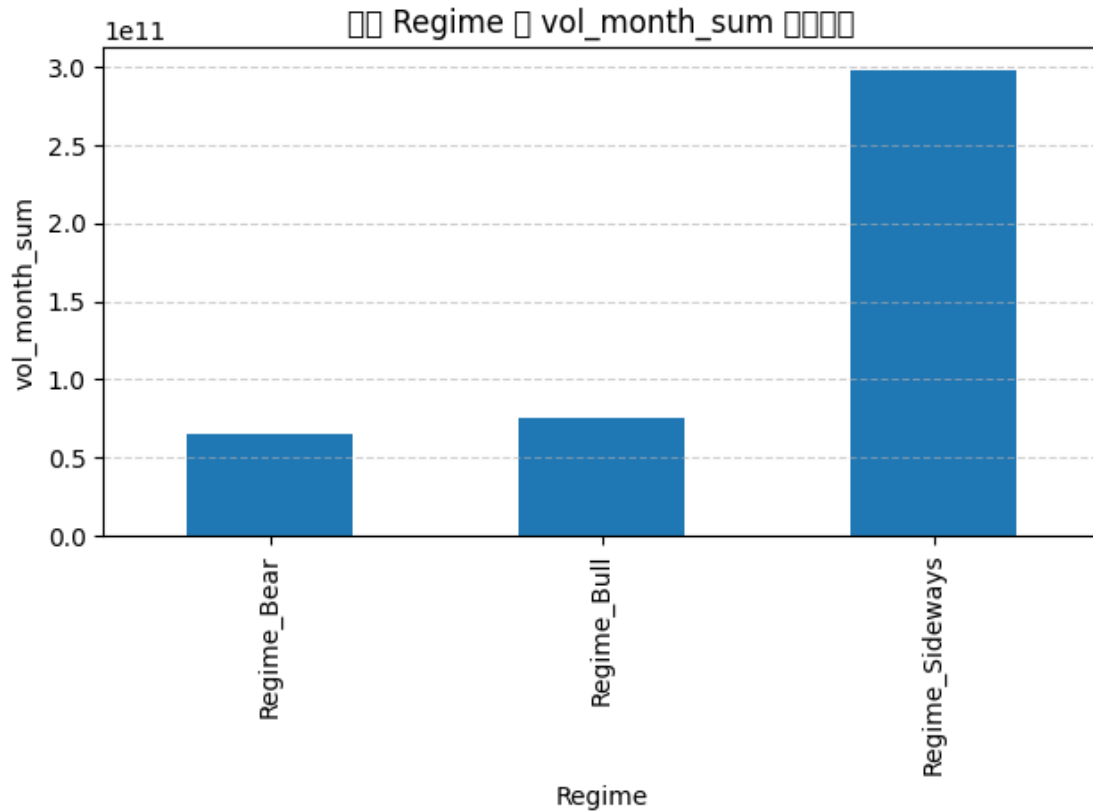
C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2730413094.py:11: UserWarning:
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```

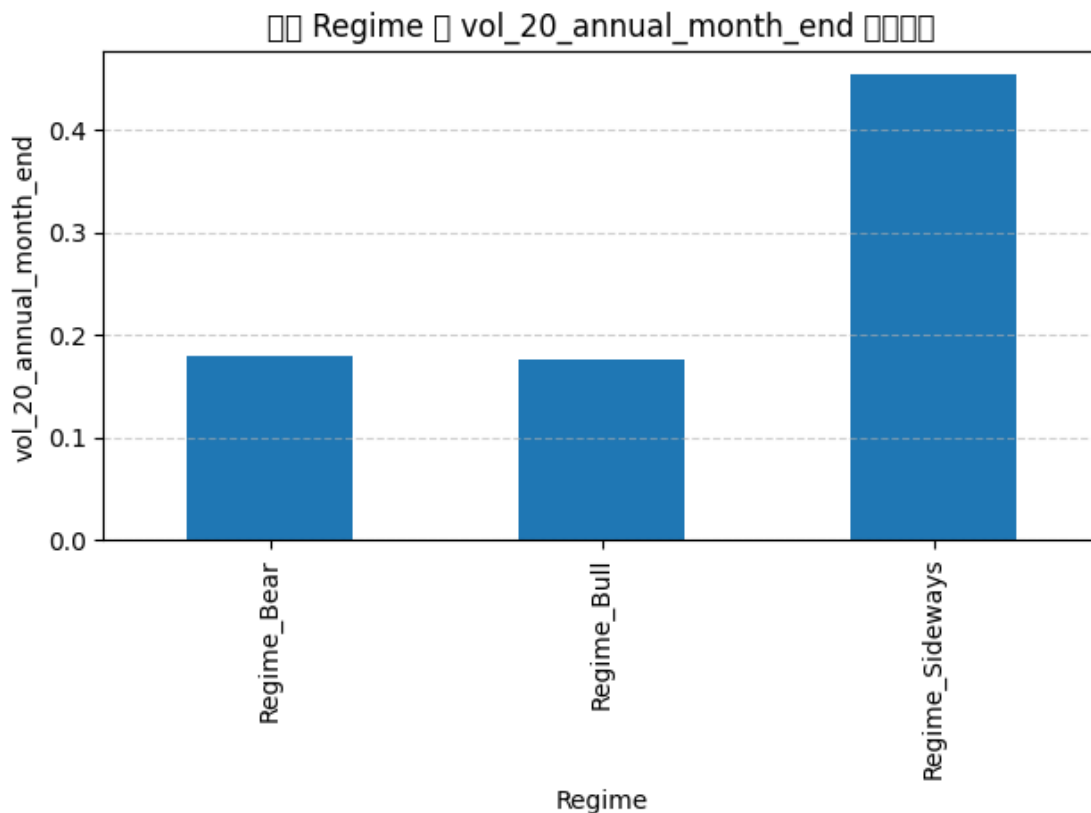
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UNIFIED IDEOGRAPH-7684}) missing from font(s) DejaVu Sans.
    fig.canvas.print_figure(bytes_io, **kw)
d:\university\c\anaconda\anaconda\envs\test\lib\site-
packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 24179 (\N{CJK
UNIFIED IDEOGRAPH-5E73}) missing from font(s) DejaVu Sans.
    fig.canvas.print_figure(bytes_io, **kw)
d:\university\c\anaconda\anaconda\envs\test\lib\site-
packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 22343 (\N{CJK
UNIFIED IDEOGRAPH-5747}) missing from font(s) DejaVu Sans.
    fig.canvas.print_figure(bytes_io, **kw)
d:\university\c\anaconda\anaconda\envs\test\lib\site-
packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 20540 (\N{CJK
UNIFIED IDEOGRAPH-503C}) missing from font(s) DejaVu Sans.
    fig.canvas.print_figure(bytes_io, **kw)

```



```
[33]: # 11. Regime
plt.figure(figsize=(12, 5))

for regime_name, sub_df in df_cluster.groupby("regime"):
    plt.plot(sub_df.index, sub_df["ret_month"], marker="o", linestyle="--",
             label=regime_name)

plt.axhline(0, linestyle="--", linewidth=1)
plt.xlabel(" ")
plt.ylabel(" 50 ret_month")
plt.title(" 50 Regime ")
plt.legend()
plt.grid(True, linestyle="--", alpha=0.5)
plt.tight_layout()
plt.show()
```

C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2043371869.py:13: UserWarning: Glyph 26102 (\N{CJK UNIFIED IDEOGRAPH-65F6}) missing from font(s) DejaVu Sans.
plt.tight_layout()

C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2043371869.py:13: UserWarning: Glyph 38388 (\N{CJK UNIFIED IDEOGRAPH-95F4}) missing from font(s) DejaVu Sans.

```

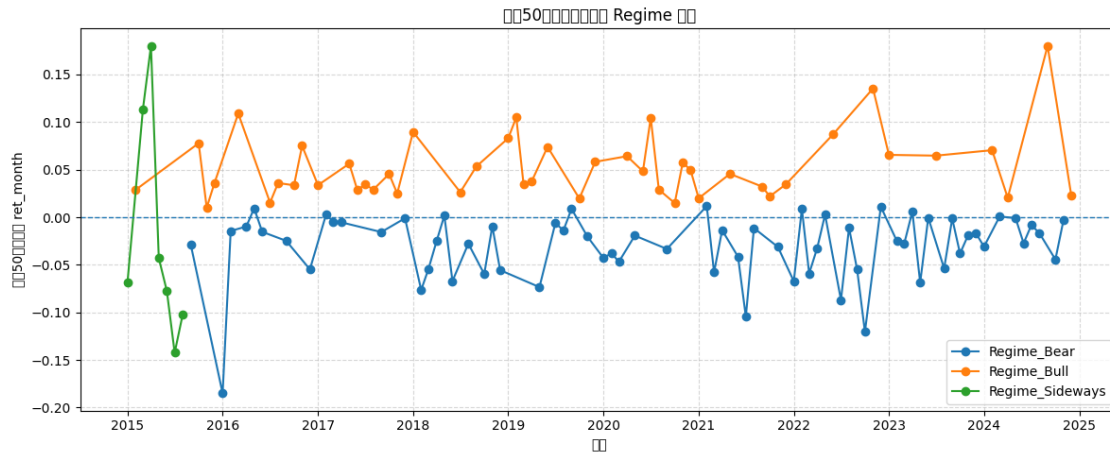
plt.tight_layout()
C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2043371869.py:13: UserWarning:
Glyph 19978 (\N{CJK UNIFIED IDEOGRAPH-4E0A}) missing from font(s) DejaVu Sans.
plt.tight_layout()
C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2043371869.py:13: UserWarning:
Glyph 35777 (\N{CJK UNIFIED IDEOGRAPH-8BC1}) missing from font(s) DejaVu Sans.
plt.tight_layout()
C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2043371869.py:13: UserWarning:
Glyph 26376 (\N{CJK UNIFIED IDEOGRAPH-6708}) missing from font(s) DejaVu Sans.
plt.tight_layout()
C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2043371869.py:13: UserWarning:
Glyph 24230 (\N{CJK UNIFIED IDEOGRAPH-5EA6}) missing from font(s) DejaVu Sans.
plt.tight_layout()
C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2043371869.py:13: UserWarning:
Glyph 25910 (\N{CJK UNIFIED IDEOGRAPH-6536}) missing from font(s) DejaVu Sans.
plt.tight_layout()
C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2043371869.py:13: UserWarning:
Glyph 30410 (\N{CJK UNIFIED IDEOGRAPH-76CA}) missing from font(s) DejaVu Sans.
plt.tight_layout()
C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2043371869.py:13: UserWarning:
Glyph 21450 (\N{CJK UNIFIED IDEOGRAPH-53CA}) missing from font(s) DejaVu Sans.
plt.tight_layout()
C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2043371869.py:13: UserWarning:
Glyph 24066 (\N{CJK UNIFIED IDEOGRAPH-5E02}) missing from font(s) DejaVu Sans.
plt.tight_layout()
C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2043371869.py:13: UserWarning:
Glyph 22330 (\N{CJK UNIFIED IDEOGRAPH-573A}) missing from font(s) DejaVu Sans.
plt.tight_layout()
C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2043371869.py:13: UserWarning:
Glyph 21010 (\N{CJK UNIFIED IDEOGRAPH-5212}) missing from font(s) DejaVu Sans.
plt.tight_layout()
C:\Users\zhou\AppData\Local\Temp\ipykernel_7596\2043371869.py:13: UserWarning:
Glyph 20998 (\N{CJK UNIFIED IDEOGRAPH-5206}) missing from font(s) DejaVu Sans.
plt.tight_layout()
d:\university\c\anaconda\anaconda\envs\test\lib\site-
packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 19978 (\N{CJK
UNIFIED IDEOGRAPH-4E0A}) missing from font(s) DejaVu Sans.
fig.canvas.print_figure(bytes_io, **kw)
d:\university\c\anaconda\anaconda\envs\test\lib\site-
packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 35777 (\N{CJK
UNIFIED IDEOGRAPH-8BC1}) missing from font(s) DejaVu Sans.
fig.canvas.print_figure(bytes_io, **kw)
d:\university\c\anaconda\anaconda\envs\test\lib\site-
packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 26376 (\N{CJK
UNIFIED IDEOGRAPH-6708}) missing from font(s) DejaVu Sans.
fig.canvas.print_figure(bytes_io, **kw)
d:\university\c\anaconda\anaconda\envs\test\lib\site-
packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 24230 (\N{CJK

```

```

UNIFIED IDEOGRAPH-5EA6}) missing from font(s) DejaVu Sans.
    fig.canvas.print_figure(bytes_io, **kw)
d:\university\c\anaconda\anaconda\envs\test\lib\site-
packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 25910 (\N{CJK
UNIFIED IDEOGRAPH-6536}) missing from font(s) DejaVu Sans.
    fig.canvas.print_figure(bytes_io, **kw)
d:\university\c\anaconda\anaconda\envs\test\lib\site-
packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 30410 (\N{CJK
UNIFIED IDEOGRAPH-76CA}) missing from font(s) DejaVu Sans.
    fig.canvas.print_figure(bytes_io, **kw)
d:\university\c\anaconda\anaconda\envs\test\lib\site-
packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 21450 (\N{CJK
UNIFIED IDEOGRAPH-53CA}) missing from font(s) DejaVu Sans.
    fig.canvas.print_figure(bytes_io, **kw)
d:\university\c\anaconda\anaconda\envs\test\lib\site-
packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 24066 (\N{CJK
UNIFIED IDEOGRAPH-5E02}) missing from font(s) DejaVu Sans.
    fig.canvas.print_figure(bytes_io, **kw)
d:\university\c\anaconda\anaconda\envs\test\lib\site-
packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 22330 (\N{CJK
UNIFIED IDEOGRAPH-573A}) missing from font(s) DejaVu Sans.
    fig.canvas.print_figure(bytes_io, **kw)
d:\university\c\anaconda\anaconda\envs\test\lib\site-
packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 21010 (\N{CJK
UNIFIED IDEOGRAPH-5212}) missing from font(s) DejaVu Sans.
    fig.canvas.print_figure(bytes_io, **kw)
d:\university\c\anaconda\anaconda\envs\test\lib\site-
packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 20998 (\N{CJK
UNIFIED IDEOGRAPH-5206}) missing from font(s) DejaVu Sans.
    fig.canvas.print_figure(bytes_io, **kw)
d:\university\c\anaconda\anaconda\envs\test\lib\site-
packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 26102 (\N{CJK
UNIFIED IDEOGRAPH-65F6}) missing from font(s) DejaVu Sans.
    fig.canvas.print_figure(bytes_io, **kw)
d:\university\c\anaconda\anaconda\envs\test\lib\site-
packages\IPython\core\pylabtools.py:152: UserWarning: Glyph 38388 (\N{CJK
UNIFIED IDEOGRAPH-95F4}) missing from font(s) DejaVu Sans.
    fig.canvas.print_figure(bytes_io, **kw)

```



```
[34]: from mpl_toolkits.mplot3d import Axes3D # 3D
import matplotlib.pyplot as plt

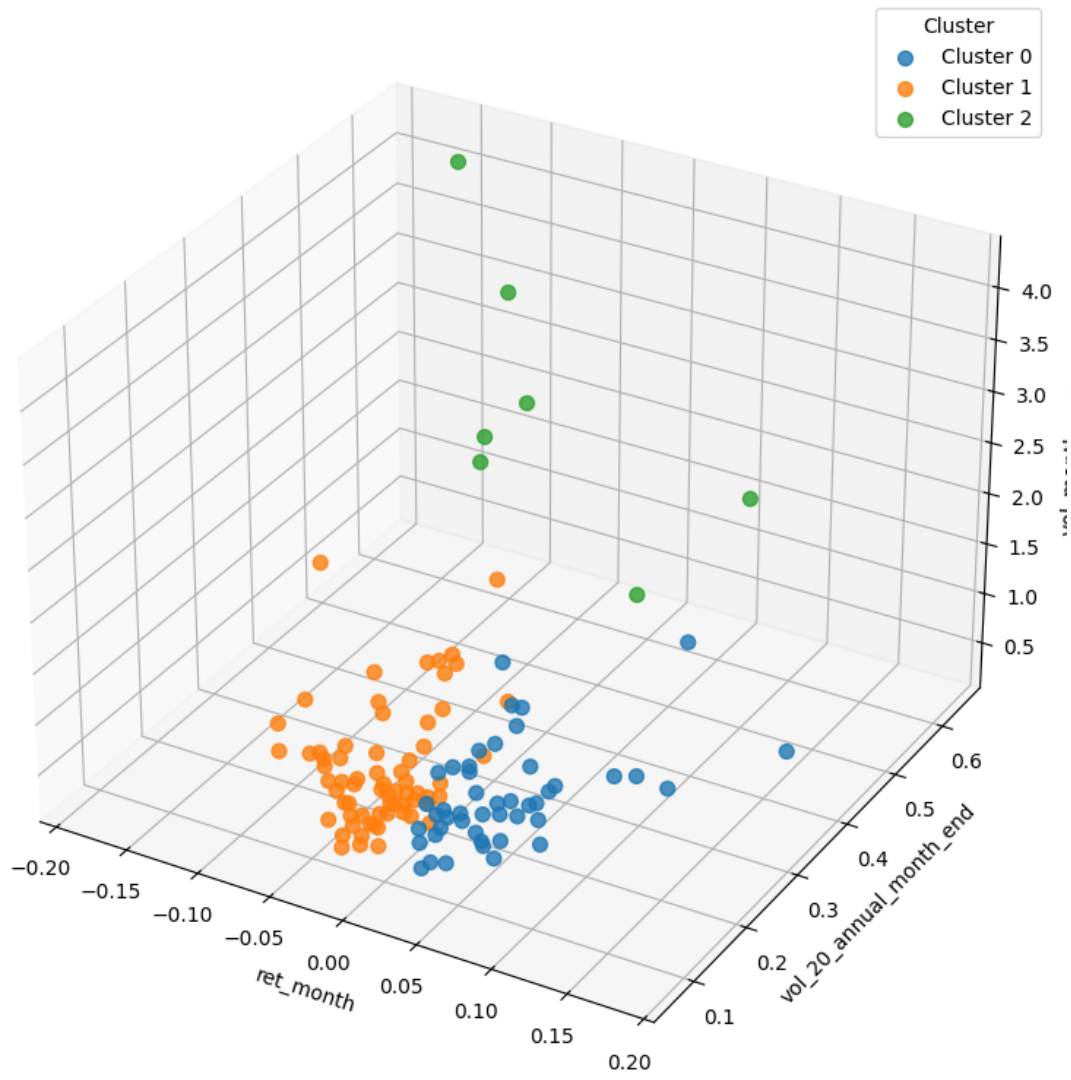
#
x_col = "ret_month"
y_col = "vol_20_annual_month_end"
z_col = "vol_month_sum"

fig = plt.figure(figsize=(10, 8))
ax = fig.add_subplot(111, projection="3d")

for c, sub in df_cluster.groupby("cluster"):
    ax.scatter(
        sub[x_col],
        sub[y_col],
        sub[z_col],
        s=50,
        label=f"Cluster {c}",
        alpha=0.8,
    )

ax.set_xlabel(x_col)
ax.set_ylabel(y_col)
ax.set_zlabel(z_col)
ax.set_title("Market Regime Clusters in 3D Feature Space")
ax.legend(title="Cluster")
plt.tight_layout()
plt.show()
```

Market Regime Clusters in 3D Feature Space



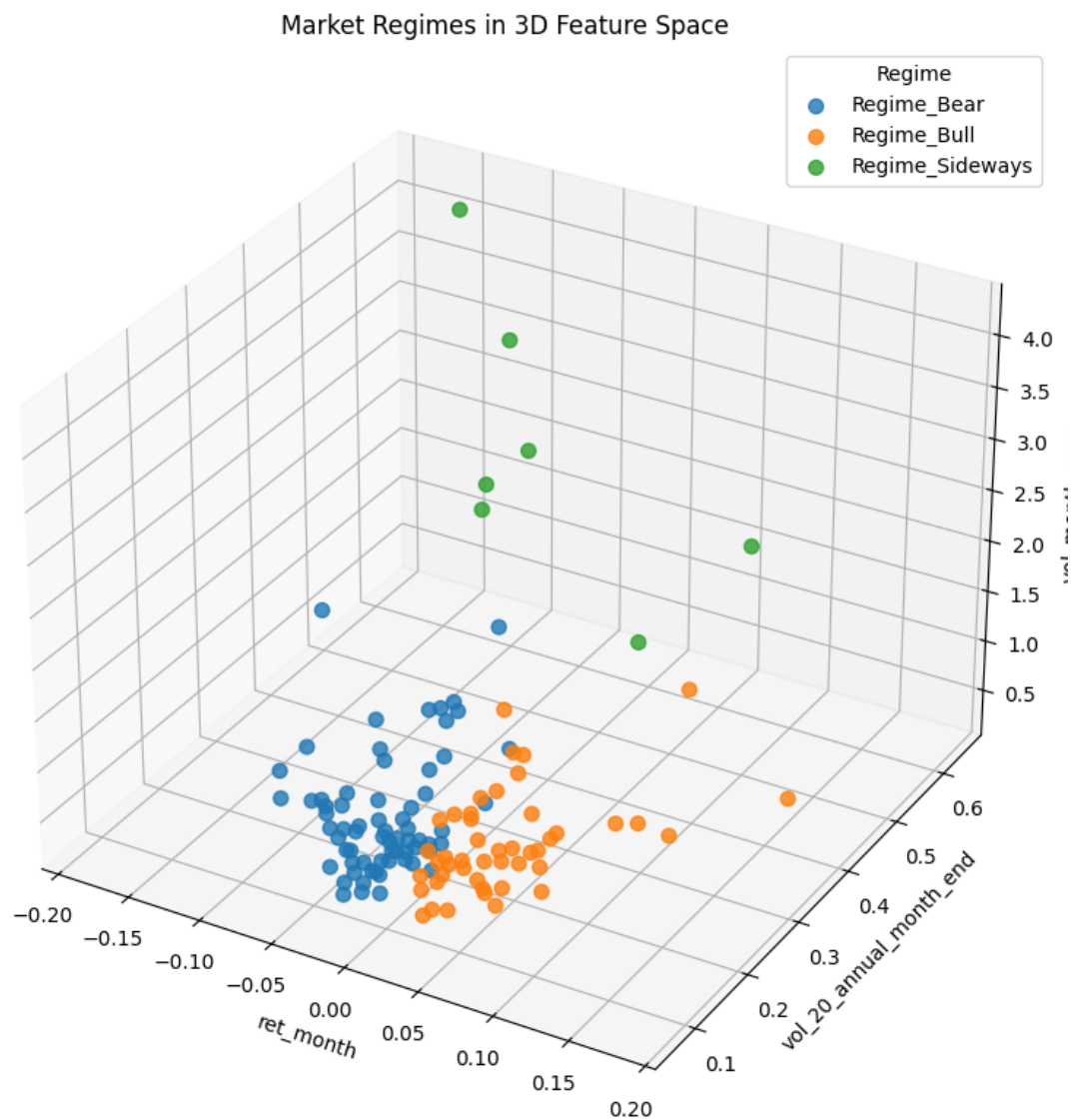
```
[35]: fig = plt.figure(figsize=(10, 8))
ax = fig.add_subplot(111, projection="3d")

for r, sub in df_cluster.groupby("regime"):
    ax.scatter(
        sub[x_col],
        sub[y_col],
        sub[z_col],
        s=50,
        label=r,
        alpha=0.8,
    )
```

```

ax.set_xlabel(x_col)
ax.set_ylabel(y_col)
ax.set_zlabel(z_col)
ax.set_title("Market Regimes in 3D Feature Space")
ax.legend(title="Regime")
plt.tight_layout()
plt.show()

```



```
[41]: df_cluster.head()
```

```
[41]:
```

| | month | close_month_end | ret_month | vol_month_sum | vol_month_chg | \ |
|---|------------|-----------------|-----------|---------------|---------------|---|
| 0 | 2015-01-01 | 2405.38 | -0.068249 | 240759567500 | -0.372974 | |
| 1 | 2015-02-01 | 2474.59 | 0.028773 | 113685256600 | -0.527806 | |
| 2 | 2015-03-01 | 2754.66 | 0.113178 | 257993309000 | 1.269365 | |
| 3 | 2015-04-01 | 3250.49 | 0.179997 | 368238254400 | 0.427317 | |
| 4 | 2015-05-01 | 3111.33 | -0.042812 | 259537919800 | -0.295190 | |

| | vol_20_annual_month_end | vol_60_annual_month_end | month_str | cluster | \ |
|---|-------------------------|-------------------------|-----------|---------|---|
| 0 | 0.467613 | 0.425187 | 2015-01 | 2 | |
| 1 | 0.256287 | 0.432385 | 2015-02 | 0 | |
| 2 | 0.253355 | 0.347897 | 2015-03 | 2 | |
| 3 | 0.269143 | 0.270690 | 2015-04 | 2 | |
| 4 | 0.391430 | 0.314535 | 2015-05 | 2 | |


```

regime
0 Regime_Sideways
1 Regime_Bull
2 Regime_Sideways
3 Regime_Sideways
4 Regime_Sideways

```

```
[37]: df_cluster.to_csv("data/cluster_info")
```

```
[38]: import pandas as pd

#
df_factor = pd.read_csv("data/factor_longshort.csv")
df_cluster = pd.read_csv("data/cluster_info")

# 1.
df_factor[" "] = pd.to_datetime(df_factor[" "])
df_cluster["month"] = pd.to_datetime(df_cluster["month"])

# 2. merge df_factor " " month
df_factor = df_factor.rename(columns={" ": "month"})

# 3. + regime
df_merged = pd.merge(
    df_factor,
    df_cluster[["month", "regime", "cluster"]],
    on="month",
    how="left"
)

# 4.
df_merged.head(), df_merged.tail(), df_merged["regime"].value_counts()
```

```
[38]: (
      month MOM20 MOM120 RSI PB PE DIV ROE PROFIT_GR VOL \
0 2015-01-01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
1 2015-02-01 -4.22 -4.22 -7.76 -4.65 -7.35 -4.72 -8.90 1.88 3.05
2 2015-03-01 1.84 1.84 3.44 -2.68 -4.02 -6.98 -0.27 9.71 -5.85
3 2015-04-01 -7.83 -7.83 -3.86 2.96 -5.44 -2.13 -9.53 -7.40 8.35
4 2015-05-01 -9.61 -9.61 -2.20 -10.82 -8.75 -8.05 -1.88 -6.20 -1.89

      BETA regime cluster
0 0.00 Regime_Sideways 2
1 2.06 Regime_Bull 0
2 -0.30 Regime_Sideways 2
3 1.45 Regime_Sideways 2
4 8.29 Regime_Sideways 2 ,
      month MOM20 MOM120 RSI PB PE DIV ROE PROFIT_GR \
115 2024-08-01 -2.42 -2.42 -0.85 -0.32 2.82 7.71 2.65 -3.12
116 2024-09-01 -5.67 -5.67 6.73 -10.52 -13.61 -8.65 0.66 0.34
117 2024-10-01 4.76 4.76 1.72 -1.96 -13.81 -12.00 -17.04 -14.21
118 2024-11-01 1.08 1.08 -0.73 1.19 -0.55 -2.54 -4.16 -3.70
119 2024-12-01 2.68 2.68 -2.88 4.91 8.07 6.38 -0.74 5.75

      VOL BETA regime cluster
115 2.52 4.74 Regime_Bear 1
116 -15.37 -23.44 Regime_Bull 0
117 -9.54 -10.56 Regime_Bear 1
118 -1.82 -2.99 Regime_Bear 1
119 8.17 8.87 Regime_Bull 0 ,
      regime
      Regime_Bear 67
      Regime_Bull 46
      Regime_Sideways 7
      Name: count, dtype: int64)
```

```
[42]: df_merged.head()
```

```
[42]:
      month MOM20 MOM120 RSI PB PE DIV ROE PROFIT_GR VOL \
0 2015-01-01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
1 2015-02-01 -4.22 -4.22 -7.76 -4.65 -7.35 -4.72 -8.90 1.88 3.05
2 2015-03-01 1.84 1.84 3.44 -2.68 -4.02 -6.98 -0.27 9.71 -5.85
3 2015-04-01 -7.83 -7.83 -3.86 2.96 -5.44 -2.13 -9.53 -7.40 8.35
4 2015-05-01 -9.61 -9.61 -2.20 -10.82 -8.75 -8.05 -1.88 -6.20 -1.89

      BETA regime cluster
0 0.00 Regime_Sideways 2
1 2.06 Regime_Bull 0
2 -0.30 Regime_Sideways 2
3 1.45 Regime_Sideways 2
4 8.29 Regime_Sideways 2
```

```
[40]: df_merged.to_csv("data/final_factor_longshort.csv")
```

```
[ ]:
```