```
In [1]:  from IPython.display import display, HTML
         display(HTML("<style>.container { width:100% !important; }</style>"))

         from IPython.display import display_html
         from itertools import chain,cycle
         def display_side_by_side(*args,titles=cycle([''])):
             html_str=''
             for df,title in zip(args, chain(titles,cycle(['</br>'])) ):
                 html_str+='<th style="text-align:center"><td style="vertical-align:top">'
                 html_str+=df.to_html().replace('table','table style="display:inline-block"')
                 html_str+='</td></th>'
             display_html(html_str,raw=True)

         import warnings
         warnings.filterwarnings('ignore')
```

```
In [2]:  from lib.equity.fundamentals import Fundamentals, Ranks, DCF, Columns
         from lib.equity.time_series import Technicals
         from lib.equity.attribution import Attribution, FammaFrench, Brinson
```

```
C:\dev\pynance\lib
```

Attribution

What factors are driving broader market returns?

```
In [3]:  atr = Attribution()
         holdings = atr.get_holdings('SPY')
         returns = atr.get_portfolio_returns()
         portf_returns = returns.resample('M').sum()
```

```
Extracting: https://www.zacks.com/funds/etf/SPY/holding

1 Failed download:
- BRK.B: No data found, symbol may be delisted

1 Failed download:
- EW: No data found for this date range, symbol may be delisted

1 Failed download:
- AME: No data found for this date range, symbol may be delisted

1 Failed download:
- BF.B: No data found for this date range, symbol may be delisted
```

Famma French

```
In [29]:  ff = FammaFrench()
          factors = ff.get_ff_three_factor()
          df = portf_returns.merge(factors,  left_index=True, right_index=True, how='inner')
          summary, results = ff.three_factor_model(df)
          print(summary)
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:            portf_ex_rtn   R-squared:                       0.987
Model:                             OLS   Adj. R-squared:                  0.985
Method:                  Least Squares   F-statistic:                     435.4
Date:                 Mon, 31 Oct 2022   Prob (F-statistic):           2.87e-16
Time:                         02:28:53   Log-Likelihood:                -17.933
No. Observations:                   21   AIC:                             43.87
Df Residuals:                       17   BIC:                             48.04
Df Model:                            3
Covariance Type:             nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
Intercept      0.7022      0.148      4.753      0.000       0.391       1.014
mkt           99.2549      2.806     35.369      0.000      93.334     105.176
smb           -9.5578      5.163     -1.851      0.082     -20.450       1.334
hml            5.1765      2.975      1.740      0.100      -1.100      11.453
==============================================================================
Omnibus:                        1.388   Durbin-Watson:                   1.665
Prob(Omnibus):                  0.500   Jarque-Bera (JB):                1.191
Skew:                           0.425   Prob(JB):                        0.551
Kurtosis:                       2.202   Cond. No.                         38.3
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```
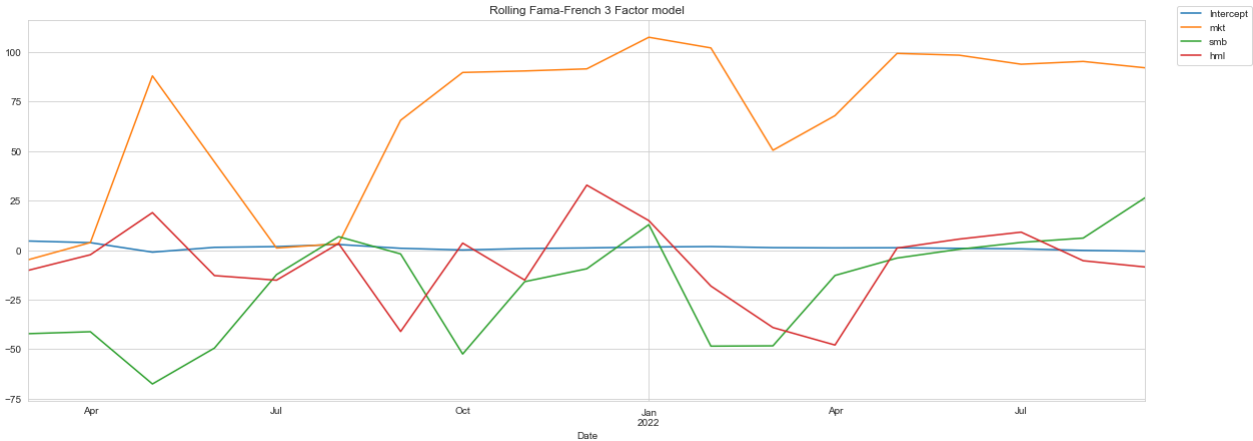
```
In [30]:  import matplotlib.pyplot as plt
          plt.figure(figsize=(20, 7))
```

```
results.plot(title=f'Rolling Fama-French 3 Factor model')
plt.legend(bbox_to_anchor=(1.1, 1.05))
```

Out[30]:   <matplotlib.legend.Legend at 0x2139d2459d0>

<Figure size 1440x504 with 0 Axes>

In [6]:
```
factors = ff.get_ff_industry_factors()
df = portf_returns.merge(factors,  left_index=True, right_index=True, how='inner')
summary, results = ff.industry_factor_model(df)
print(summary)
```

```
                        OLS Regression Results
==============================================================================
Dep. Variable:              portf_rtn   R-squared:                       0.995
Model:                            OLS   Adj. R-squared:                  0.990
Method:                 Least Squares   F-statistic:                     204.3
Date:                Mon, 31 Oct 2022   Prob (F-statistic):           3.40e-10
Time:                        02:28:00   Log-Likelihood:                -7.7484
No. Observations:                  21   AIC:                             37.50
Df Residuals:                      10   BIC:                             48.99
Df Model:                          10
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
Intercept      0.6760      0.227      2.983      0.014       0.171       1.181
NoDur          1.3359      7.108      0.188      0.855     -14.501      17.173
Durbl          5.4729      3.704      1.477      0.170      -2.781      13.727
Manuf         22.8138      8.874      2.571      0.028       3.042      42.586
Enrgy          2.2844      2.493      0.916      0.381      -3.269       7.838
HiTec         34.5196      7.554      4.570      0.001      17.689      51.350
Telcm          5.8118      7.487      0.776      0.456     -10.870      22.494
Shops         -4.5050      6.689     -0.674      0.516     -19.408      10.398
Hlth           7.5195      4.930      1.525      0.158      -3.465      18.504
Utils         14.1605      5.424      2.611      0.026       2.075      26.246
Other          8.5492      6.966      1.227      0.248      -6.972      24.071
==============================================================================
Omnibus:                        0.191   Durbin-Watson:                   1.678
Prob(Omnibus):                  0.909   Jarque-Bera (JB):                0.111
Skew:                           0.138   Prob(JB):                        0.946
Kurtosis:                       2.776   Cond. No.                         114.
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```
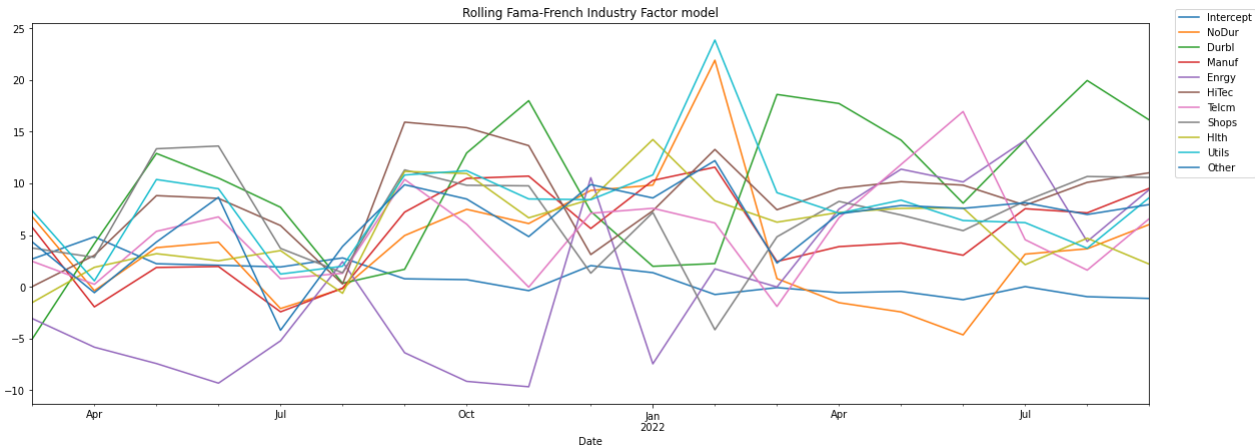
In [7]:
```
plt.rcParams["figure.figsize"] = (20,7)

results.plot(title=f'Rolling Fama-French Industry Factor model')
plt.legend(bbox_to_anchor=(1.1, 1.05))
```

Out[7]:   <matplotlib.legend.Legend at 0x2139b548d00>

Rolling Fama-French Industry Factor model

Brinson

```
In [27]:  ...
```

```
Out[27]:  Ellipsis
```

Fundamentals

Fundamental Equity Analysis

```
In [8]:  ticker = ['JNJ']
```

```
In [9]:  rank = Ranks(ticker = ticker[0])
         ranks = rank.get_ranks()
```

```
In [10]:  fun = Fundamentals( ticker = ticker)
          fun
```

```
Out[10]:  <lib.equity.fundamentals.Fundamentals at 0x2139ba32790>
```

Left Frame: Values as reported (in Millions, USD)

Middle Frame: Percent Change

Right Frame: Percentile Rank vs. Industry Peers (Higher values are assigned a lower percentile rank)

```
In [11]:  x = fun.get( columns = Columns.INCOME.value, limit = 5 ).style_jupyter(fun.df)
          y = fun.percent_change().style_jupyter(fun.pct_chg, units = '%')
          z = ranks.style_jupyter(cols = Columns.INCOME.value)

          display_side_by_side(x, y, z)
```

calendardate	2021-09-30	2021-12-31	2022-03-31	2022-06-30	2022-09-30	calendardate	2021-09-30	2021-12-31	2022-03-31	2022-06-30	2022-09-30	calendardate	2021-09-30	2021-12-31	2022-03-31	2022-06-30	2022-09-30
revenue	$23,338.0	$24,804.0	$23,426.0	$24,020.0	$23,791.0	revenue	nan%	6.28%	-5.56%	2.54%	-0.95%	revenue	12%	12%	12%	18%	25%
cogs	$7,250.0	$7,955.0	$7,598.0	$7,919.0	$7,807.0	cogs	nan%	9.72%	-4.49%	4.22%	-1.41%	cogs	12%	18%	12%	18%	25%
gp	$16,088.0	$16,849.0	$15,828.0	$16,101.0	$15,984.0	gp	nan%	4.73%	-6.06%	1.72%	-0.73%	gp	6%	12%	6%	18%	25%
opex	$10,382.0	$11,957.0	$10,080.0	$10,014.0	$9,768.0	opex	nan%	15.17%	-15.70%	-0.65%	-2.46%	opex	6%	12%	6%	12%	25%
opinc	$5,706.0	$4,892.0	$5,748.0	$6,087.0	$6,216.0	opinc	nan%	-14.27%	17.50%	5.90%	2.12%	opinc	12%	18%	12%	18%	25%
ebt	$3,849.0	$4,836.0	$5,862.0	$5,840.0	$5,822.0	ebt	nan%	25.64%	21.22%	-0.38%	-0.31%	ebt	19%	18%	12%	18%	25%
netinc	$3,667.0	$4,736.0	$5,149.0	$4,814.0	$4,458.0	netinc	nan%	29.15%	8.72%	-6.51%	-7.40%	netinc	19%	18%	12%	18%	25%
ebitda	$5,683.0	$6,739.0	$7,641.0	$7,622.0	$7,558.0	ebitda	nan%	18.58%	13.38%	-0.25%	-0.84%	ebitda	38%	18%	12%	18%	25%
depamor	$1,814.0	$1,843.0	$1,769.0	$1,744.0	$1,685.0	depamor	nan%	1.60%	-4.02%	-1.41%	-3.38%	depamor	38%	29%	25%	29%	75%

```
In [12]:  x = fun.get( columns = Columns.CASHFLOW.value, limit = 5 ).style_jupyter(fun.df)
          y = fun.percent_change().style_jupyter(fun.pct_chg, units = '%')
          z = ranks.style_jupyter(cols = Columns.CASHFLOW.value)

          display_side_by_side(x, y, z)
```

calendardate	2021-09-30	2021-12-31	2022-03-31	2022-06-30	2022-09-30
cashneq	$17,604.0	$14,487.0	$10,463.0	$10,983.0	$11,355.0
netinc	$3,667.0	$4,736.0	$5,149.0	$4,814.0	$4,458.0
depamor	$1,814.0	$1,843.0	$1,769.0	$1,744.0	$1,685.0
opex	$10,382.0	$11,957.0	$10,080.0	$10,014.0	$9,768.0
receivables	$14,911.0	$15,283.0	$15,594.0	$16,139.0	$15,890.0
payables	$8,961.0	$11,055.0	$9,309.0	$9,765.0	$10,153.0
inventory	$10,387.0	$10,387.0	$10,990.0	$11,437.0	$11,675.0
ncfo	$8,290.0	$5,732.0	$3,979.0	$5,581.0	$6,284.0
ncfbus	$12.0	$-15.0	$-4.0	$-205.0	$9.0
ncfi	$-2,719.0	$-5,360.0	$-3,634.0	$-2,639.0	$-1,701.0
ncfinv	$-1,968.0	$-3,836.0	$-2,964.0	$-1,460.0	$-720.0
ncfdiv	$-2,791.0	$-2,791.0	$-2,787.0	$-2,971.0	$-2,970.0
ncfx	$-92.0	$-53.0	$16.0	$-161.0	$-286.0
ncff	$-2,207.0	$-3,436.0	$-4,385.0	$-2,261.0	$-3,925.0
fcf	$7,543.0	$4,317.0	$3,372.0	$4,718.0	$5,332.0
ncf	$3,272.0	$-3,117.0	$-4,024.0	$520.0	$372.0

calendardate	2021-09-30	2021-12-31	2022-03-31	2022-06-30	2022-09-30
cashneq	nan%	-17.71%	-27.78%	4.97%	3.39%
netinc	nan%	29.15%	8.72%	-6.51%	-7.40%
depamor	nan%	1.60%	-4.02%	-1.41%	-3.38%
opex	nan%	15.17%	-15.70%	-0.65%	-2.46%
receivables	nan%	2.49%	2.03%	3.49%	-1.54%
payables	nan%	23.37%	-15.79%	4.90%	3.97%
inventory	nan%	0.00%	5.81%	4.07%	2.08%
ncfo	nan%	-30.86%	-30.58%	40.26%	12.60%
ncfbus	nan%	-225.00%	73.33%	-5,025.00%	104.39%
ncfi	nan%	-97.13%	32.20%	27.38%	35.54%
ncfinv	nan%	-94.92%	22.73%	50.74%	50.68%
ncfdiv	nan%	-0.00%	0.14%	-6.60%	0.03%
ncfx	nan%	42.39%	130.19%	-1,106.25%	-77.64%
ncff	nan%	-55.69%	-27.62%	48.44%	-73.60%
fcf	nan%	-42.77%	-21.89%	39.92%	13.01%
ncf	nan%	-195.26%	-29.10%	112.92%	-28.46%

calendardate	2021-09-30	2021-12-31	2022-03-31	2022-06-30	2022-09-30
cashneq	6%	6%	25%	6%	25%
netinc	19%	18%	12%	18%	25%
depamor	38%	29%	25%	29%	75%
opex	6%	12%	6%	12%	25%
receivables	6%	6%	6%	6%	25%
payables	25%	24%	25%	24%	25%
inventory	12%	6%	6%	6%	25%
ncfo	19%	18%	25%	18%	25%
ncfbus	12%	71%	56%	76%	25%
ncfi	88%	94%	100%	88%	75%
ncfinv	94%	94%	94%	82%	100%
ncfdiv	100%	100%	88%	100%	100%
ncfx	100%	82%	12%	94%	100%
ncff	81%	82%	75%	76%	50%
fcf	25%	24%	38%	24%	25%
ncf	25%	94%	100%	29%	75%

```
In [13]: x = fun.get( columns = Columns.BALANCE.value, limit = 5 ).style_jupyter(fun.df)
         y = fun.percent_change().style_jupyter(fun.pct_chg, units = '%')
         z = ranks.style_jupyter(cols = Columns.BALANCE.value)

         display_side_by_side(x, y, z)
```

calendardate	2021-09-30	2021-12-31	2022-03-31	2022-06-30	2022-09-30
assetsc	$59,889.0	$60,979.0	$60,424.0	$63,847.0	$65,236.0
assetsnc	$119,339.0	$121,039.0	$117,931.0	$113,877.0	$109,888.0
receivables	$14,911.0	$15,283.0	$15,594.0	$16,139.0	$15,890.0
inventory	$10,387.0	$10,387.0	$10,990.0	$11,437.0	$11,675.0
assets	$179,228.0	$182,018.0	$178,355.0	$177,724.0	$175,124.0
liabilitiesc	$44,561.0	$45,226.0	$43,390.0	$44,821.0	$45,543.0
liabilitiesnc	$64,395.0	$62,769.0	$60,256.0	$56,546.0	$54,982.0
payables	$8,961.0	$11,055.0	$9,309.0	$9,765.0	$10,153.0
debt	$33,928.0	$33,751.0	$33,148.0	$32,597.0	$32,027.0
equity	$70,272.0	$74,023.0	$74,709.0	$76,357.0	$74,599.0
retearn	$121,092.0	$123,060.0	$124,380.0	$126,216.0	$127,917.0

calendardate	2021-09-30	2021-12-31	2022-03-31	2022-06-30	2022-09-30
assetsc	nan%	1.82%	-0.91%	5.66%	2.18%
assetsnc	nan%	1.42%	-2.57%	-3.44%	-3.50%
receivables	nan%	2.49%	2.03%	3.49%	-1.54%
inventory	nan%	0.00%	5.81%	4.07%	2.08%
assets	nan%	1.56%	-2.01%	-0.35%	-1.46%
liabilitiesc	nan%	1.49%	-4.06%	3.30%	1.61%
liabilitiesnc	nan%	-2.53%	-4.00%	-6.16%	-2.77%
payables	nan%	23.37%	-15.79%	4.90%	3.97%
debt	nan%	-0.52%	-1.79%	-1.66%	-1.75%
equity	nan%	5.34%	0.93%	2.21%	-2.30%
retearn	nan%	1.63%	1.07%	1.48%	1.35%

calendardate	2021-09-30	2021-12-31	2022-03-31	2022-06-30	2022-09-30
assetsc	6%	6%	6%	12%	25%
assetsnc	19%	12%	12%	18%	25%
receivables	6%	6%	6%	6%	25%
inventory	12%	6%	6%	6%	25%
assets	6%	6%	12%	12%	25%
liabilitiesc	6%	6%	6%	12%	25%
liabilitiesnc	12%	12%	19%	18%	25%
payables	25%	24%	25%	24%	25%
debt	38%	24%	38%	29%	50%
equity	12%	12%	12%	12%	25%
retearn	19%	18%	12%	18%	50%

```
In [14]: x = fun.get( columns = Columns.PEERS.value, limit = 5 ).style_jupyter(fun.df, units = '%')
         z = ranks.style_jupyter(cols = Columns.PEERS.value)

         display_side_by_side(x, z)
```

calendardate	2021-09-30	2021-12-31	2022-03-31	2022-06-30	2022-09-30
divyield	2.60%	2.40%	2.40%	2.40%	2.70%
grossmargin	68.90%	67.90%	67.60%	67.00%	67.20%
netmargin	68.93%	67.93%	67.57%	67.03%	67.19%
fcfmargin	32.32%	17.40%	14.39%	19.64%	22.41%
oppmargin	24.45%	19.72%	24.54%	25.34%	26.13%
roe	5.22%	6.40%	6.89%	6.30%	5.98%
roic	nan%	nan%	nan%	nan%	nan%
ros	nan%	nan%	nan%	nan%	nan%
roc	3.52%	4.39%	4.77%	4.42%	4.18%

| calendardate	2021-09-30	2021-12-31	2022-03-31	2022-06-30	2022-09-30
divyield	62%	59%	59%	65%	50%
grossmargin	75%	71%	75%	94%	100%
netmargin	75%	71%	75%	94%	100%
fcfmargin	56%	76%	69%	59%	100%
oppmargin	44%	47%	50%	41%	50%
roe	69%	53%	50%	53%	50%
roic	53%	53%	53%	53%	62%
ros	53%	53%	53%	53%	62%
roc	50%	35%	31%	29%	50%

Peers

Selected ticker vs Industry Peers

In [15]: `fun.plot_box_plot(cols = ['pe','eps','roe','roc','grossmargin', 'oppmargin','fcfmargin', 'divyield','netinc', 'ebitda'])`
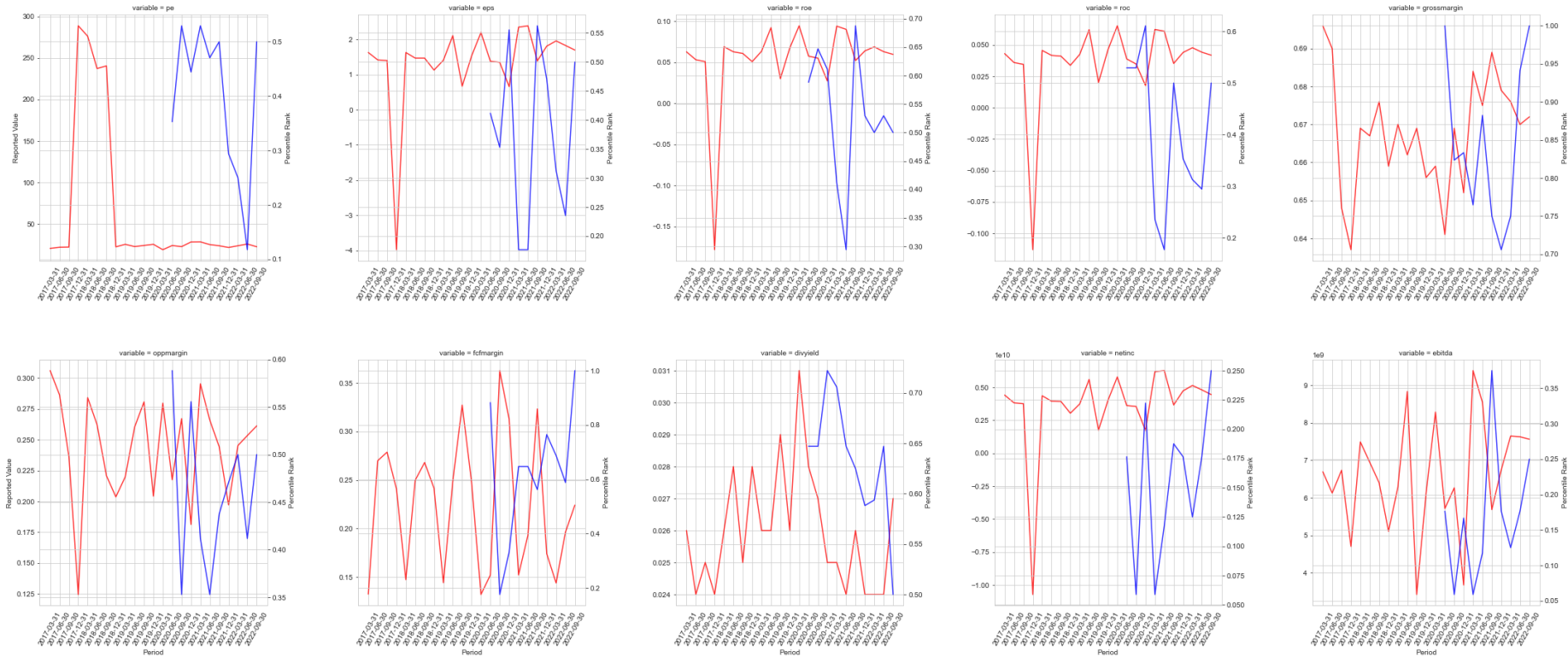
Drug Manufacturers - General

Out[15]: `<seaborn.axisgrid.FacetGrid at 0x2139c66b8e0>`
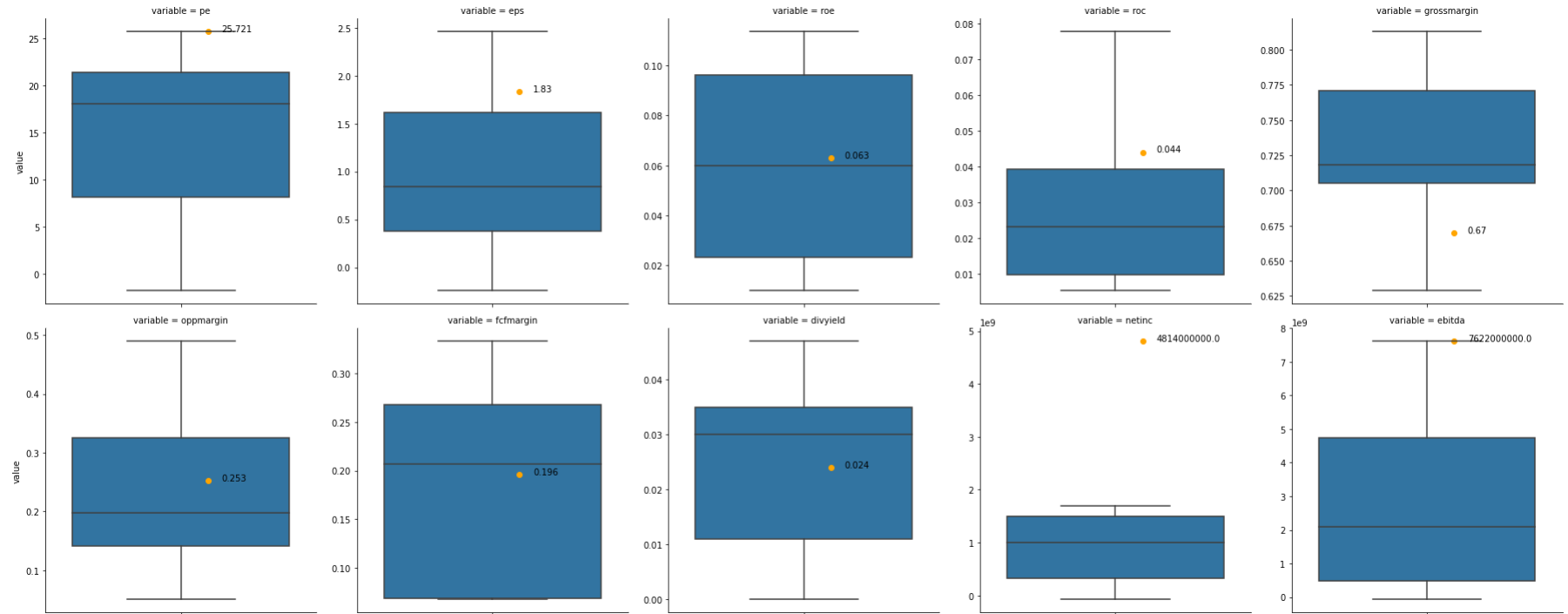
In [16]: `rank.plot_dual_axis_ranks(fun)`

Drug Manufacturers - General

```
Out[16]:   <seaborn.axisgrid.FacetGrid at 0x2139dacf220>

In [17]:   peers = fun.get_peers()
           fun = Fundamentals( ticker = peers)
           print(fun)

           x = fun.get( columns = Columns.INCOME.value, limit = 5 ).style_jupyter(fun.df)
           y = fun.get( columns = Columns.PEERS.value, limit = 5 ).style_jupyter(fun.df, units = '%')
           z = fun.get( columns = Columns.CASHFLOW_.value, limit = 5 ).style_jupyter(fun.df)

           display_side_by_side(x,y,z)

           Drug Manufacturers - General
           Fundamentals:Object:['JNJ', 'PFE', 'MRK', 'ABBV']
```

calendardate		2021-09-30	2021-12-31	2022-03-31	2022-06-30	2022-09-30
	ticker					
revenue	ABBV	$14,342	$14,886	$13,538	$14,583	$nan
	JNJ	$23,338	$24,804	$23,426	$24,020	$23,791
	MRK	$13,154	$13,521	$15,901	$14,593	$nan
	PFE	$24,094	$23,635	$25,661	$27,742	$nan
cogs	ABBV	$4,390	$4,320	$4,052	$4,170	$nan
	JNJ	$7,250	$7,955	$7,598	$7,919	$7,807
	MRK	$3,450	$3,874	$5,380	$4,216	$nan
	PFE	$9,973	$9,589	$9,984	$8,648	$nan
gp	ABBV	$9,952	$10,566	$9,486	$10,413	$nan
	JNJ	$16,088	$16,849	$15,828	$16,101	$15,984
	MRK	$9,704	$9,647	$10,521	$10,377	$nan
	PFE	$14,121	$14,046	$15,677	$19,094	$nan
opex	ABBV	$5,646	$5,492	$4,769	$7,118	$nan
	JNJ	$10,382	$11,957	$10,080	$10,014	$9,768
	MRK	$4,888	$6,072	$4,952	$5,452	$nan
	PFE	$6,283	$9,864	$6,626	$7,647	$nan
opinc	ABBV	$4,306	$5,074	$4,717	$3,295	$nan
	JNJ	$5,706	$4,892	$5,748	$6,087	$6,216
	MRK	$4,816	$3,575	$5,569	$4,925	$nan
	PFE	$7,838	$4,182	$9,051	$11,447	$nan
ebt	ABBV	$3,687	$4,270	$4,926	$1,179	$nan
	JNJ	$3,849	$4,836	$5,862	$5,840	$5,822
	MRK	$5,262	$3,843	$4,864	$4,482	$nan
	PFE	$7,816	$3,728	$9,036	$11,475	$nan
netinc	ABBV	$3,179	$4,044	$4,490	$924	$nan
	JNJ	$3,667	$4,736	$5,149	$4,814	$4,458
	MRK	$4,567	$3,758	$4,310	$3,944	$nan
	PFE	$8,147	$3,394	$7,864	$9,905	$nan
ebitda	ABBV	$6,399	$6,820	$7,518	$3,763	$nan
	JNJ	$5,683	$6,739	$7,641	$7,622	$7,558
	MRK	$6,021	$4,678	$5,984	$5,420	$nan
	PFE	$9,176	$5,005	$10,223	$12,650	$nan
depamor	ABBV	$2,127	$1,979	$2,053	$2,052	$nan
	JNJ	$1,814	$1,843	$1,769	$1,744	$1,685
	MRK	$759	$835	$1,120	$938	$nan
	PFE	$1,360	$1,277	$1,187	$1,175	$nan

calendardate		2021-09-30	2021-12-31	2022-03-31	2022-06-30	2022-09-30
	ticker					
divyield	ABBV	4.70%	3.80%	3.30%	3.50%	nan%
	JNJ	2.60%	2.40%	2.40%	2.40%	2.70%
	MRK	3.50%	3.40%	3.30%	3.00%	nan%
	PFE	3.60%	2.60%	3.00%	3.00%	nan%
grossmargin	ABBV	69.40%	71.00%	70.10%	71.40%	nan%
	JNJ	68.90%	67.90%	67.60%	67.00%	67.20%
	MRK	73.80%	71.30%	66.20%	71.10%	nan%
	PFE	58.60%	59.40%	61.10%	68.80%	nan%
netmargin	ABBV	69.39%	70.98%	70.07%	71.41%	nan%
	JNJ	68.93%	67.93%	67.57%	67.03%	67.19%
	MRK	73.77%	71.35%	66.17%	71.11%	nan%
	PFE	58.61%	59.43%	61.09%	68.83%	nan%
fcfmargin	ABBV	53.81%	32.84%	35.06%	33.34%	nan%
	JNJ	32.32%	17.40%	14.39%	19.64%	22.41%
	MRK	27.56%	28.27%	23.75%	21.74%	nan%
	PFE	42.35%	20.82%	22.98%	26.74%	nan%
oppmargin	ABBV	30.02%	34.09%	34.84%	22.59%	nan%
	JNJ	24.45%	19.72%	24.54%	25.34%	26.13%
	MRK	36.61%	26.44%	35.02%	33.75%	nan%
	PFE	32.53%	17.69%	35.27%	41.26%	nan%
roe	ABBV	23.46%	26.25%	27.57%	6.31%	nan%
	JNJ	5.22%	6.40%	6.89%	6.30%	5.98%
	MRK	12.76%	9.84%	10.54%	9.12%	nan%
	PFE	10.76%	4.40%	9.54%	11.36%	nan%
roic	ABBV	nan%	nan%	nan%	nan%	nan%
	JNJ	nan%	nan%	nan%	nan%	nan%
	MRK	nan%	nan%	nan%	nan%	nan%
	PFE	nan%	nan%	nan%	nan%	nan%
ros	ABBV	nan%	nan%	nan%	nan%	nan%
	JNJ	nan%	nan%	nan%	nan%	nan%
	MRK	nan%	nan%	nan%	nan%	nan%
	PFE	nan%	nan%	nan%	nan%	nan%
roc	ABBV	3.37%	4.39%	5.00%	1.05%	nan%
	JNJ	3.52%	4.39%	4.77%	4.42%	4.18%
	MRK	7.34%	5.27%	5.93%	5.27%	nan%
	PFE	7.05%	2.94%	6.62%	7.77%	nan%

calendardate		2021-09-30	2021-12-31	2022-03-31	2022-06-30	2022-09-30
	ticker					
cashneq	ABBV	$12,182	$9,746	$6,098	$8,521	$nan
	JNJ	$17,604	$14,487	$10,463	$10,983	$11,355
	MRK	$10,016	$8,096	$8,556	$9,675	$nan
	PFE	$1,966	$1,944	$2,470	$1,780	$nan
depamor	ABBV	$2,127	$1,979	$2,053	$2,052	$nan
	JNJ	$1,814	$1,843	$1,769	$1,744	$1,685
	MRK	$759	$835	$1,120	$938	$nan
	PFE	$1,360	$1,277	$1,187	$1,175	$nan
retearn	ABBV	$1,600	$3,127	$5,103	$3,516	$nan
	JNJ	$121,092	$123,060	$124,380	$126,216	$127,917
	MRK	$51,691	$53,696	$56,252	$58,437	$nan
	PFE	$102,252	$103,394	$111,193	$116,608	$nan
opex	ABBV	$5,646	$5,492	$4,769	$7,118	$nan
	JNJ	$10,382	$11,957	$10,080	$10,014	$9,768
	MRK	$4,888	$6,072	$4,952	$5,452	$nan
	PFE	$6,283	$9,864	$6,626	$7,647	$nan
capex	ABBV	$-217	$-187	$-162	$-143	$nan
	JNJ	$-747	$-1,415	$-607	$-863	$-952
	MRK	$-1,172	$-1,208	$-984	$-1,129	$nan
	PFE	$-624	$-993	$-643	$-751	$nan
ncfo	ABBV	$7,935	$5,075	$4,908	$5,005	$nan
	JNJ	$8,290	$5,732	$3,979	$5,581	$6,284
	MRK	$4,797	$5,031	$4,761	$4,302	$nan
	PFE	$10,829	$5,914	$6,541	$8,170	$nan
ncfdiv	ABBV	$-2,315	$-2,314	$-2,526	$-2,507	$nan
	JNJ	$-2,791	$-2,791	$-2,787	$-2,971	$-2,970
	MRK	$-1,649	$-1,643	$-1,745	$-1,770	$nan
	PFE	$-2,185	$-2,189	$-2,249	$-2,244	$nan
fcf	ABBV	$7,718	$4,888	$4,746	$4,862	$nan
	JNJ	$7,543	$4,317	$3,372	$4,718	$5,332
	MRK	$3,625	$3,823	$3,777	$3,173	$nan
	PFE	$10,205	$4,921	$5,898	$7,419	$nan
ncf	ABBV	$3,636	$-2,436	$-3,648	$2,423	$nan
	JNJ	$3,272	$-3,117	$-4,024	$520	$372
	MRK	$1,416	$-1,879	$447	$1,139	$nan
	PFE	$-384	$-50	$529	$-688	$nan

DCF

```
fun = Fundamentals( ticker = ticker)
x = fun.get( columns = Columns.INCOME.value, limit = 8 ).percent_change().style_jupyter(fun.pct_chg, units='%')
y = fun.get( columns = Columns.INCOME.value, limit = 8).describe().style_jupyter(fun.desc, units = '%')
display_side_by_side(x, y)
```

Describe % Change:

calendardate	2020-12-31	2021-03-31	2021-06-30	2021-09-30	2021-12-31	2022-03-31	2022-06-30	2022-09-30
revenue	nan%	-0.69%	4.44%	0.11%	6.28%	-5.56%	2.54%	-0.95%
cogs	nan%	-9.61%	7.42%	-4.44%	9.72%	-4.49%	4.22%	-1.41%
gp	nan%	4.07%	3.06%	2.31%	4.73%	-6.06%	1.72%	-0.73%
opex	nan%	-18.17%	9.93%	9.02%	15.17%	-15.70%	-0.65%	-2.46%
opinc	nan%	61.84%	-5.96%	-8.00%	-14.27%	17.50%	5.90%	2.12%
ebt	nan%	351.06%	-10.32%	-42.22%	25.64%	21.22%	-0.38%	-0.31%
netinc	nan%	256.56%	1.31%	-41.59%	29.15%	8.72%	-6.51%	-7.40%
ebitda	nan%	155.47%	-9.00%	-33.46%	18.58%	13.38%	-0.25%	-0.84%
depamor	nan%	-2.37%	-2.90%	-1.36%	1.60%	-4.02%	-1.41%	-3.38%

	mean	std	25%	50%	75%
revenue	0.88%	3.92%	-0.82%	0.11%	3.49%
cogs	0.20%	7.09%	-4.46%	-1.41%	5.82%
gp	1.30%	3.70%	0.50%	2.31%	3.57%
opex	-0.41%	12.86%	-9.08%	-0.65%	9.47%
opinc	8.45%	25.73%	-6.98%	2.12%	11.70%
ebt	49.24%	134.95%	-5.35%	-0.31%	23.43%
netinc	34.32%	100.28%	-6.95%	1.31%	18.94%
ebitda	20.55%	61.83%	-4.92%	-0.25%	15.98%
depamor	-1.98%	1.85%	-3.14%	-2.37%	-1.39%

Base Case

```
In [19]:  dcf = DCF(ticker=ticker, REV_GROWTH=0.025)
          dcf.forecast_as_percent_of_revenue(type = 'INCOME')
          dcf.forecast_as_percent_of_revenue(type = 'BALANCE')
          dcf.forecast_as_percent_of_revenue(type = 'CF')
          None
```

```
In [20]:  x = dcf.style_jupyter(dcf.bal_forecast)
          y = dcf.style_jupyter(dcf.inc_forecast)
          display_side_by_side(x,y)
          dcf.style_jupyter(dcf.cf_forecast)
```

	2021-09-30	2021-12-31	2022-03-31	2022-06-30	2022-09-30	T+1	T+2	T+3	T+4	T+5
assetsc	$59,889.0	$60,979.0	$60,424.0	$63,847.0	$65,236.0	$62,899.6	$64,472.09	$66,083.89	$67,735.99	$69,429.39
assetsnc	$119,339.0	$121,039.0	$117,931.0	$113,877.0	$109,888.0	$118,998.14	$121,973.09	$125,022.42	$128,147.98	$131,351.68
receivables	$14,911.0	$15,283.0	$15,594.0	$16,139.0	$15,890.0	$16,232.89	$16,638.72	$17,054.68	$17,481.05	$17,918.08
inventory	$10,387.0	$10,387.0	$10,990.0	$11,437.0	$11,675.0	$11,440.27	$11,726.27	$12,019.43	$12,319.92	$12,627.91
assets	$179,228.0	$182,018.0	$178,355.0	$177,724.0	$175,124.0	$180,430.37	$184,941.13	$189,564.66	$194,303.77	$199,161.37
liabilitiesc	$44,561.0	$45,226.0	$43,390.0	$44,821.0	$45,543.0	$45,503.53	$46,641.12	$47,807.15	$49,002.33	$50,227.38
liabilitiesnc	$64,395.0	$62,769.0	$60,256.0	$56,546.0	$54,982.0	$61,710.64	$63,253.41	$64,834.74	$66,455.61	$68,117.0
payables	$8,961.0	$11,055.0	$9,309.0	$9,765.0	$10,153.0	$9,913.7	$10,161.54	$10,415.58	$10,675.97	$10,942.87
debt	$33,928.0	$33,751.0	$33,148.0	$32,597.0	$32,027.0	$33,181.92	$34,011.47	$34,861.75	$35,733.3	$36,626.63
equity	$70,272.0	$74,023.0	$74,709.0	$76,357.0	$74,599.0	$76,463.97	$78,375.57	$80,334.96	$82,343.34	$84,401.92
retearn	$121,092.0	$123,060.0	$124,380.0	$126,216.0	$127,917.0	$128,138.01	$131,341.46	$134,625.0	$137,990.62	$141,440.39
revenue	$23,338.0	$24,804.0	$23,426.0	$24,020.0	$23,791.0	$24,385.78	$24,995.42	$25,620.3	$26,260.81	$26,917.33
depamor	$1,814.0	$1,843.0	$1,769.0	$1,744.0	$1,685.0	$1,811.92	$1,857.22	$1,903.65	$1,951.24	$2,000.03
intexp	$20.0	$60.0	$10.0	$38.0	$51.0	$38.58	$39.54	$40.53	$41.54	$42.58
taxrate	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0

	2021-09-30	2021-12-31	2022-03-31	2022-06-30	2022-09-30	T+1	T+2	T+3	T+4	T+5
revenue	$23,338.0	$24,804.0	$23,426.0	$24,020.0	$23,791.0	$24,385.78	$24,995.42	$25,620.3	$26,260.81	$26,917.33
cogs	$7,250.0	$7,955.0	$7,598.0	$7,919.0	$7,807.0	$7,909.29	$8,107.03	$8,309.7	$8,517.44	$8,730.38
gp	$16,088.0	$16,849.0	$15,828.0	$16,101.0	$15,984.0	$16,476.48	$16,888.39	$17,310.6	$17,743.37	$18,186.95
opex	$10,382.0	$11,957.0	$10,080.0	$10,014.0	$9,768.0	$10,492.98	$10,755.31	$11,024.19	$11,299.79	$11,582.29
opinc	$5,706.0	$4,892.0	$5,748.0	$6,087.0	$6,216.0	$5,983.5	$6,133.09	$6,286.41	$6,443.57	$6,604.66
ebt	$3,849.0	$4,836.0	$5,862.0	$5,840.0	$5,822.0	$5,928.93	$6,077.15	$6,229.08	$6,384.81	$6,544.43
netinc	$3,667.0	$4,736.0	$5,149.0	$4,814.0	$4,458.0	$4,656.15	$4,772.55	$4,891.86	$5,014.16	$5,139.51
ebitda	$5,683.0	$6,739.0	$7,641.0	$7,622.0	$7,558.0	$7,738.07	$7,931.52	$8,129.81	$8,333.05	$8,541.38
depamor	$1,814.0	$1,843.0	$1,769.0	$1,744.0	$1,685.0	$1,811.92	$1,857.22	$1,903.65	$1,951.24	$2,000.03

Out[20]:

	2021-09-30	2021-12-31	2022-03-31	2022-06-30	2022-09-30	T+1	T+2	T+3	T+4	T+5
netinc	$3,667.0	$4,736.0	$5,149.0	$4,814.0	$4,458.0	$4,656.15	$4,772.55	$4,891.86	$5,014.16	$5,139.51
revenue	$23,338.0	$24,804.0	$23,426.0	$24,020.0	$23,791.0	$24,385.78	$24,995.42	$25,620.3	$26,260.81	$26,917.33
cogs	$7,250.0	$7,955.0	$7,598.0	$7,919.0	$7,807.0	$7,909.29	$8,107.03	$8,309.7	$8,517.44	$8,730.38
gp	$16,088.0	$16,849.0	$15,828.0	$16,101.0	$15,984.0	$16,476.48	$16,888.39	$17,310.6	$17,743.37	$18,186.95
rnd	$3,422.0	$4,720.0	$3,462.0	$3,703.0	$3,597.0	$3,686.92	$3,779.1	$3,873.58	$3,970.41	$4,069.68
sgna	$6,000.0	$7,154.0	$5,938.0	$6,226.0	$6,089.0	$6,269.37	$6,426.11	$6,586.76	$6,751.43	$6,920.22
ebit	$3,869.0	$4,896.0	$5,872.0	$5,878.0	$5,873.0	$5,967.51	$6,116.7	$6,269.61	$6,426.36	$6,587.01
payables	$8,961.0	$11,055.0	$9,309.0	$9,765.0	$10,153.0	$9,913.7	$10,161.54	$10,415.58	$10,675.97	$10,942.87
receivables	$14,911.0	$15,283.0	$15,594.0	$16,139.0	$15,890.0	$16,232.89	$16,638.72	$17,054.68	$17,481.05	$17,918.08
inventory	$10,387.0	$10,387.0	$10,990.0	$11,437.0	$11,675.0	$11,440.27	$11,726.27	$12,019.43	$12,319.92	$12,627.91
depamor	$1,814.0	$1,843.0	$1,769.0	$1,744.0	$1,685.0	$1,811.92	$1,857.22	$1,903.65	$1,951.24	$2,000.03
ebitda	$5,683.0	$6,739.0	$7,641.0	$7,622.0	$7,558.0	$7,738.07	$7,931.52	$8,129.81	$8,333.05	$8,541.38
capex	$-747.0	$-1,415.0	$-607.0	$-863.0	$-952.0	$-876.14	$-898.05	$-920.5	$-943.51	$-967.1
fcf	$7,543.0	$4,317.0	$3,372.0	$4,718.0	$5,332.0	$4,789.85	$4,909.59	$5,032.33	$5,158.14	$5,287.09
ncfo	$8,290.0	$5,732.0	$3,979.0	$5,581.0	$6,284.0	$5,665.99	$5,807.64	$5,952.83	$6,101.65	$6,254.19
sharesbas	$2,632.48	$2,632.6	$2,629.27	$2,631.4	$2,629.18	$2,694.91	$2,762.28	$2,831.34	$2,902.12	$2,974.68

In [21]:
```
dcf.forecast_cf_from_opperations()
dcf.discount(ERM = 0.04, RFR = 0)
dcf.terminal_value(TERMINAL_GROWTH=0.05)
dcf.estimate_price_per_share()
```

```
[*********************100%***********************]  2 of 2 completed
beta:  1.0099821710703265
wacc:  0.028522862940331146
npv:  23785727738.735157
terminal value:  173923129507.96133
pv future cash flows:  75.19791917726364
```

Bull

In [22]:
```
dcf = DCF(ticker=ticker, REV_GROWTH=0.06)
dcf.forecast_as_percent_of_revenue(type = 'INCOME')
dcf.forecast_as_percent_of_revenue(type = 'BALANCE')
dcf.forecast_as_percent_of_revenue(type = 'CF')
dcf.forecast_cf_from_opperations()
dcf.discount(ERM = 0.04, RFR = 0)
dcf.terminal_value(TERMINAL_GROWTH=0.06)
dcf.estimate_price_per_share()
```

```
[*********************100%***********************]  2 of 2 completed
beta:  1.0099812716638656
wacc:  0.028586613355057574
npv:  26326701886.586563
terminal value:  207160353269.31195
pv future cash flows:  88.80604008874734
```

Bear

In [23]:
```
dcf = DCF(ticker=ticker, REV_GROWTH=0.01)
dcf.forecast_as_percent_of_revenue(type = 'INCOME')
dcf.forecast_as_percent_of_revenue(type = 'BALANCE')
dcf.forecast_as_percent_of_revenue(type = 'CF')
dcf.forecast_cf_from_opperations()
dcf.discount(ERM = 0.04, RFR = 0)
dcf.terminal_value(TERMINAL_GROWTH=0.02)
dcf.estimate_price_per_share()
```

```
[*********************100%***********************]  2 of 2 completed
beta:  1.0099819729118134
wacc:  0.02849805553429688
npv:  22765010236.517982
terminal value:  157099767701.98563
pv future cash flows:  68.4109817972359
```
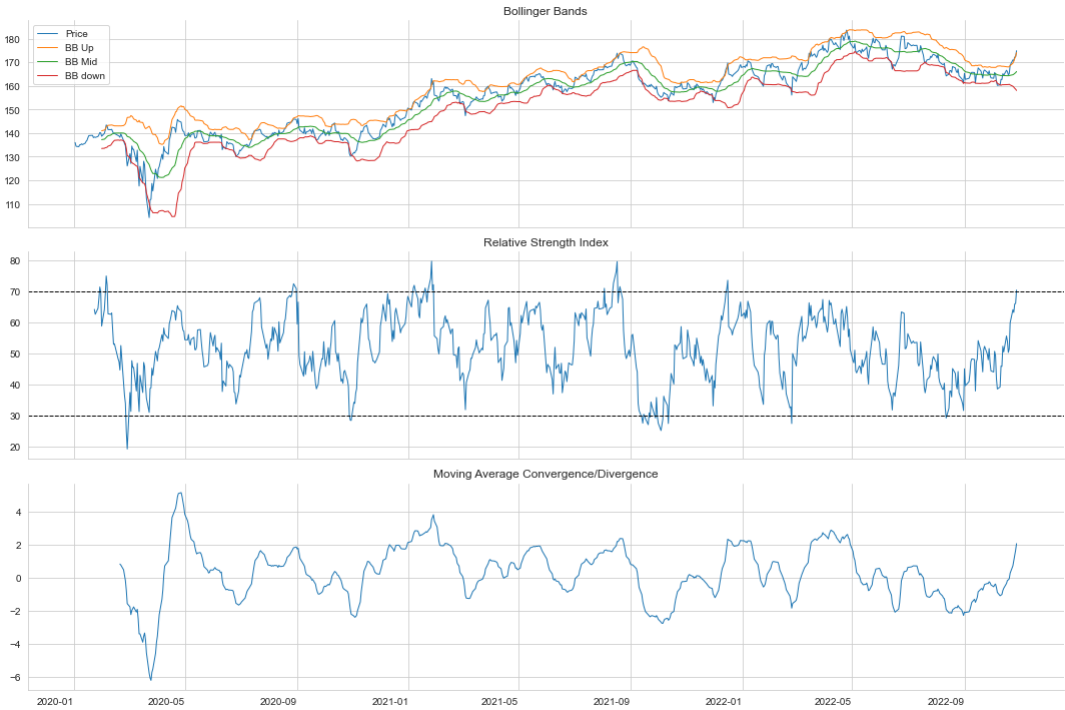
Technicals

In [24]:
```
tech = Technicals()
```

In [25]:
```
tech.ta_dashboard(fun)
```

```
[********************100%***********************]  1 of 1 completed
Adj Close    174.869995
Name: 2022-10-28 00:00:00, dtype: float64
```


Interest Rates

```
In [32]: ...
```

```
Out[32]: Ellipsis
```

Economic Activity

```
In [33]: ...
```

```
Out[33]: Ellipsis
```

```
In [ ]:
```