In [1]:

```python
!pip install yfinance
import pandas as pd
import numpy as np
import yfinance as yf
import datetime as dt
import matplotlib.pyplot as plt
import seaborn as sns
import random
```

```
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: yfinance in /opt/tljh/user/lib/python3.9/site-packages (0.1.66)
Requirement already satisfied: pandas>=0.24 in /opt/tljh/user/lib/python3.9/site-packages (from yfinance) (1.3.4)
Requirement already satisfied: requests>=2.20 in /opt/tljh/user/lib/python3.9/site-packages (from yfinance) (2.26.0)
Requirement already satisfied: lxml>=4.5.1 in /opt/tljh/user/lib/python3.9/site-packages (from yfinance) (4.6.4)
Requirement already satisfied: numpy>=1.15 in /opt/tljh/user/lib/python3.9/site-packages (from yfinance) (1.19.5)
Requirement already satisfied: multitasking>=0.0.7 in /opt/tljh/user/lib/python3.9/site-packages (from yfinance) (0.0.9)
Requirement already satisfied: python-dateutil>=2.7.3 in /opt/tljh/user/lib/python3.9/site-packages (from pandas>=0.24->yfinance) (2.8.2)
Requirement already satisfied: pytz>=2017.3 in /opt/tljh/user/lib/python3.9/site-packages (from pandas>=0.24->yfinance) (2021.3)
Requirement already satisfied: idna<4,>=2.5 in /opt/tljh/user/lib/python3.9/site-packages (from requests>=2.20->yfinance) (3.1)
Requirement already satisfied: certifi>=2017.4.17 in /opt/tljh/user/lib/python3.9/site-packages (from requests>=2.20->yfinance) (2021.10.8)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in /opt/tljh/user/lib/python3.9/site-packages (from requests>=2.20->yfinance) (1.26.7)
Requirement already satisfied: charset-normalizer~=2.0.0 in /opt/tljh/user/lib/python3.9/site-packages (from requests>=2.20->yfinance) (2.0.8)
Requirement already satisfied: six>=1.5 in /opt/tljh/user/lib/python3.9/site-packages (from python-dateutil>=2.7.3->pandas>=0.24->yfinance) (1.15.0)
```

In [2]:

```python
# Step 1 - Obtain tickers of SPY, (the chosen etf) and place them in a list
state_street = list(pd.read_excel("https://www.ssga.com/us/en/intermediary/etfs/library-content/products/fund-data/etfs/us/holdings-daily-us-en-spy.xlsx", header=4).dropna().Ticker)
blackrock = list(pd.read_csv("https://www.blackrock.com/us/individual/products/239726/ishares-core-sp-500-etf/1464253357814.ajax?fileType=csv&fileName=IVV_holdings&dataType=fund", header = 9).Ticker.dropna())

tickers = list(set(state_street) & set(blackrock))
```

In [3]:

```python
# step 2 -> Obtain the data metrics we need being adj close + Volume + returns from yahoo finance
data = yf.download(tickers, period='7y')[["Adj Close", "Volume"]]
data = data.dropna(how="all", axis=1)
close = data['Adj Close']
volume = data['Volume']
returns = data['Adj Close'].pct_change().resample("M").sum().shift(-1)
```

```
[*********************100%***********************]  500 of 500 completed
```

In [4]:

```python
# step 3 -> Calculating price momentum factor scores

class Momentum_Factors():
  def __init__(self, stock_data, tickers):
    self.price = close
    self.volume = volume
    self.returns = returns
    self.tickers = tickers

    self.mom_factors_df = pd.DataFrame(index = self.tickers)

# Calculates the 52 week price trend line
  def fifty_two_trend_line(self):
    self.fifty_two_trend_line_df = pd.DataFrame(index=self.tickers)

    for i in range(1, 21):
          self.fifty_two_trend_line_df[i] = np.polyfit(range(len(self.price[-i - 252 : -i])), self.price[-i -252 : -i], 1)[0]
    return self.fifty_two_trend_line_df.mean(axis=1)


  def factors(self):

# Gives the percent increase from 252 day low
        self.roll_min = self.price.rolling(252).min()
        self.mom_factors_df["pct_above"] = ((self.price - self.roll_min) / self.roll_min)[-20:].mean()

# Gives the momentum factor of price oscillator
        self.mom_factors_df["price_oscillator"] = ((self.price.rolling(20).mean() - self.price.rolling(260).mean())
          /self.price.rolling(260).std())[-20:].mean()

# Gives the 39 week return momentum factor
        self.mom_factors_df["39_wk_ret"] = self.price.pct_change(189)[-20:].mean()

# Gives the 51 week volume momentum factor
        self.mom_factors_df["price_volume"] = (
            (self.returns * self.volume).rolling(252).sum()[-20:].mean())

# Places the 52 week trend into mom_factors_df
        self.mom_factors_df["fifty_two_trend_line"] = self.fifty_two_trend_line()

        return self.mom_factors_df

## Step 4 -> Aggregating the factor scores using z-score
  def aggregate(self):
      self.mom_factors_df = self.factors()
      self.scored = ((self.mom_factors_df - self.mom_factors_df.mean()) / self.mom_factors_df.std()).sum(axis=1)
      return self.scored

## step 5 -> Ranking the stocks
  def baskets(self):
      self.z_scored = self.aggregate()
      return self.z_scored.nlargest(10).index, self.z_scored.nsmallest(10).index
```

In [5]:

```python
# Step 6 -> 5 year backtest to validate the trading algorithm
dates_range = pd.DataFrame(pd.date_range("2017-12-18", dt.datetime.today(), freq="M"))
dates_range.rename(columns={0: "date"}, inplace=True)
long_returns, short_returns = pd.DataFrame(), pd.DataFrame()


for date in dates_range.date:
  MF = Momentum_Factors(data[data.index <= date], tickers)
  longs, short = MF.baskets()

  long_returns = long_returns.append(returns[longs].loc[date])
  short_returns = short_returns.append(returns[short].loc[date])
```

In [6]:

```python
long_returns.iloc[-1].dropna()
```

Out[6]:

```
ENPH   -0.046497
OXY    -0.101937
MPC    -0.101345
VLO    -0.108636
EQT    -0.124717
XOM    -0.060144
CAH    -0.009352
LW      0.001567
MRO    -0.110440
SLB    -0.034990
Name: 2022-11-30 00:00:00, dtype: float64
```

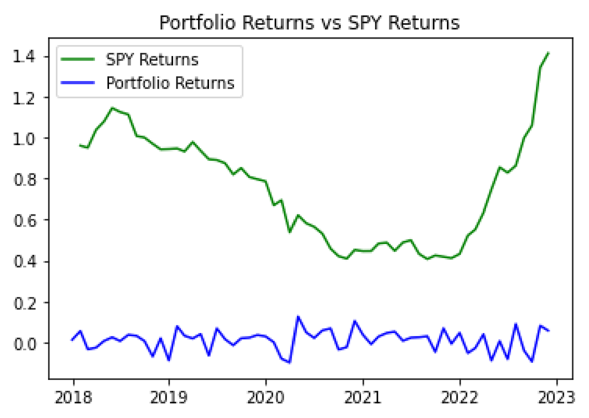
In [7]:

```python
# Step 7 -> Plotting the selected stocks and comparing them to the S&P 500

sum_returns = pd.DataFrame(long_returns.mean(axis=1) - short_returns.mean(axis=1)).shift()
sum_returns = sum_returns[-60:]

sum_returns["cum_ret"] = np.exp(np.log1p(sum_returns).cumsum())

sum_returns["SPY"] = (
    yf.download("SPY", period="7y")["Adj Close"].pct_change().resample("M").sum()
)
```

```
[*********************100%***********************]  1 of 1 completed
```

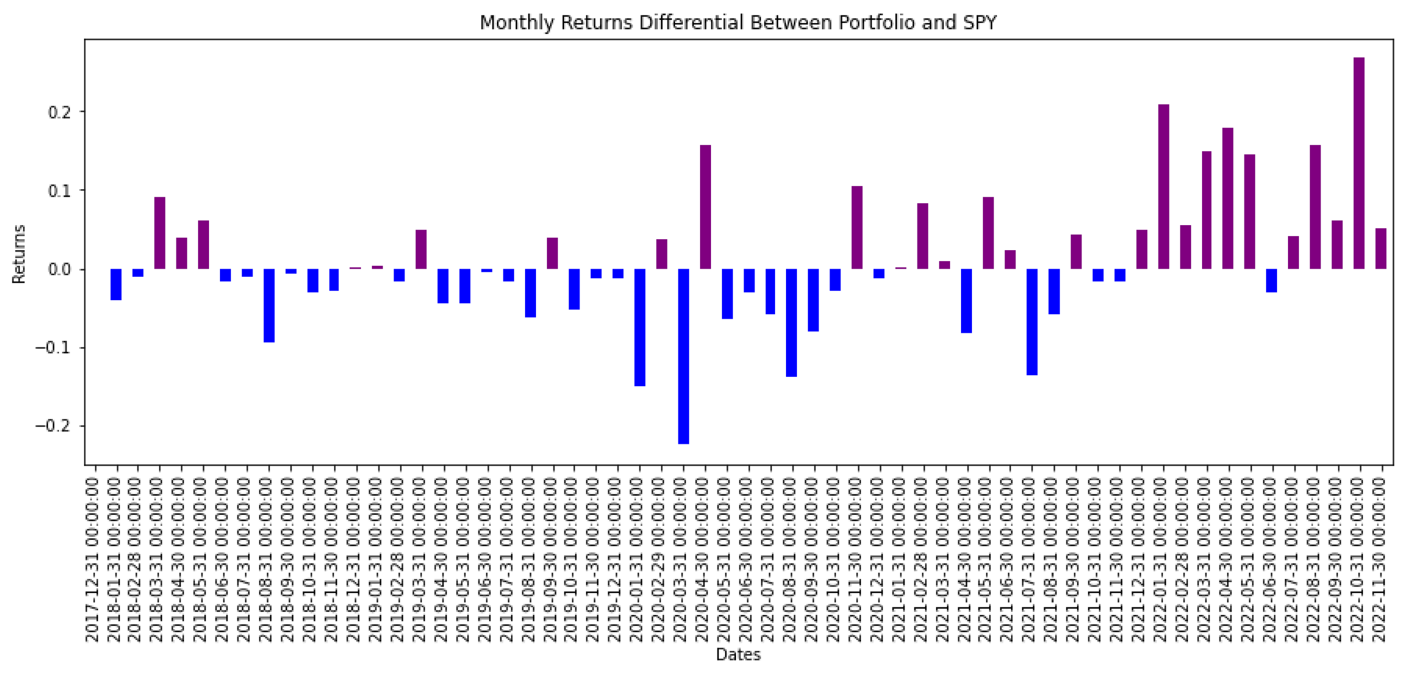
In [8]:

```python
# Plotting a Line Graph Comparing the Portfolio Returns vs the ETF SPY Returns

plt.plot(sum_returns["cum_ret"],
         label="SPY Returns",
        color="g")

plt.plot(sum_returns["SPY"],
         label="Portfolio Returns",
        color="b")

plt.legend()
plt.title('Portfolio Returns vs SPY Returns');
```



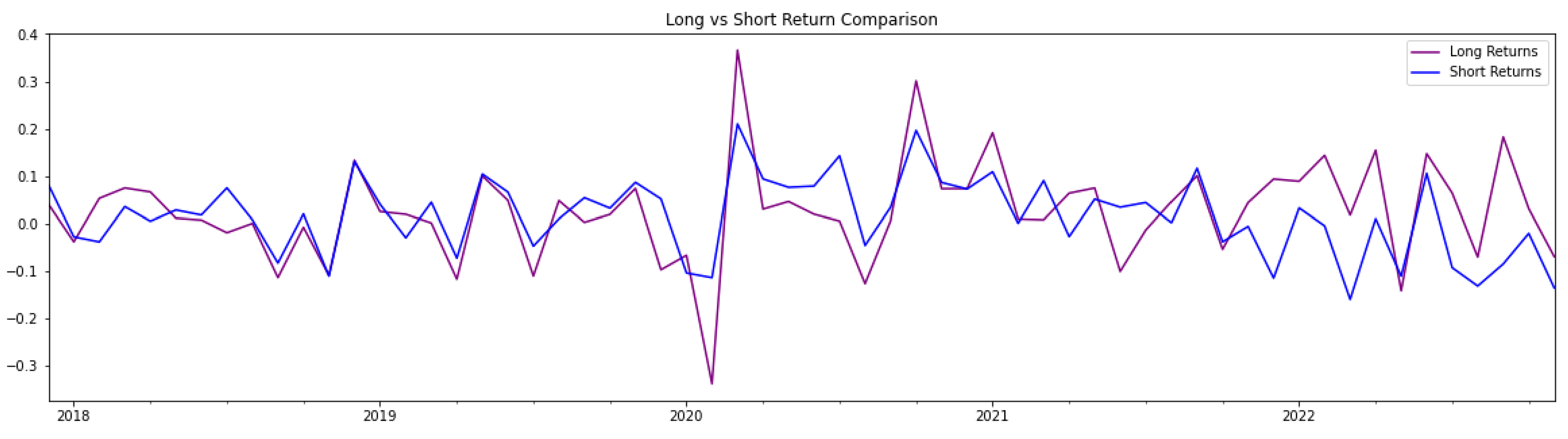
In [9]:

```python
# Plotting the Monthly Return Differential Between Our Portfolio Returns & Spy

sum_returns['colors'] = (sum_returns[0] > 0)

sum_returns[0].plot(kind='bar'
                   , figsize=(15,5)
                   , title='Monthly Returns Differential Between Portfolio and SPY'
                   , xlabel='Dates'
                   , ylabel='Returns'
                   , color=['purple' if i == True else 'blue' for i in sum_returns['colors']]);
```



In [10]:

```python
# Plotting the Long vs Short Returns

fig = plt.subplots(figsize=(20,5))
plt.title('Long vs Short Return Comparison');
long_returns.mean(axis=1).plot(
    color="purple",
    label="Long Returns"
)
short_returns.mean(axis=1).plot(
    color="blue",
    label="Short Returns"
)
plt.legend()
plt.show()
```



In [11]:

```python
# Credit
# Credit to professor John Droescher's code
#
#
```

In [ ]:

In [ ]:

In [ ]:

In [ ]: