market

December 23, 2020

[16]:
```
import numpy as np
import pandas as pd
from pandas.tseries.offsets import MonthEnd, YearEnd
import datetime as dt
import matplotlib.pyplot as plt
import os
os.chdir("/Users/charlesrambo/Desktop/QIII/Quantitative Asset Management")
```

[17]:
```
# Load stock information
stocks = pd.read_csv("stocks.csv")
```

[18]:
```
# Record CRSP unkowns
unknowns = ["-66.0", "-77.0", "-88.0", "-99.0", "-99.99", "-999", "A", "B",␣
 ↪"C", "D", "E", "S", "T", "P"]

# Create function to convert CRISP unkowns to np.nan
convert_unknows = lambda x: np.nan if x in unknowns else x
```

[19]:
```
# Convert date column to date-time object
stocks['date'] = pd.to_datetime(stocks['date'], format = '%Y%m%d')

# Record observations where both returns and delisting returns are missing
stocks['flag'] = stocks['RET'].isna() & stocks['DLRET'].isna()

# Fill missing returns with 0
stocks['RET'] = stocks['RET'].apply(convert_unknows).astype(float).fillna(0)

# Fill missing delisting returns with 0
stocks['DLRET'] = stocks['DLRET'].apply(convert_unknows).astype(float).fillna(0)

# Compute cumulative returns from regular returns plus delisting returns
stocks['RET'] = (1 + stocks['RET']) * (1 + stocks['DLRET']) - 1

# Make 'stale' prices positive
stocks['PRC'] = stocks['PRC'].abs()

# Remove 0 priced observations
```

```
stocks = stocks.loc[stocks['PRC'] > 0]

# Remove non-positive shares outstanding
stocks = stocks.loc[stocks['SHROUT'] > 0]

# Only consider stocks listed on the big exchanges
stocks = stocks.loc[stocks['SHRCD'].isin([10, 11]) & stocks['EXCHCD'].isin([1,␣
↪2, 3, 31, 32, 33])]

# Drop unneeded columns
stocks.drop(['DLRET', 'SHRCD', 'EXCHCD', 'PERMCO'], axis = 1, inplace = True)
```

[20]:
```
# Calculate market equity
stocks['ME'] = stocks['PRC'] * stocks['SHROUT']

# Short values for shift
stocks.sort_values(by = ['PERMNO', 'date'], inplace = True)

# Record the shifts which are valid
stocks['Isvalid'] = stocks['date'] + MonthEnd(0) == stocks['date'].shift(1) +␣
↪dt.timedelta(days = 7) + MonthEnd(0)
stocks.loc[stocks['Isvalid'] == True, 'Isvalid'] = stocks.loc[stocks['Isvalid']␣
↪== True, 'PERMNO'] == stocks.loc[stocks['Isvalid'] == True, 'PERMNO'].
↪shift(1)

# Shift market equity
stocks['ME_lag'] = stocks[['PERMNO', 'ME']].groupby('PERMNO')['ME'].shift(1)

# Replace the invalids with nan
stocks.loc[stocks['Isvalid'] == False, 'ME_lag'] = np.nan

# Fill missing values with 0
stocks['ME_lag'] = stocks['ME_lag'].fillna(0)

# Remove observations where both returns and delisting returns are missing
stocks = stocks.loc[~stocks['flag'], :]

# Drop unneeded columns
stocks.drop(['ME', 'Isvalid', 'flag'], axis = 1, inplace = True)
```

[21]:
```
# Construct weighting
stocks['wt'] = stocks['ME_lag']
stocks['wt'] = stocks['wt']/stocks.groupby('date')['wt'].transform('sum')

# Calculate weighted returns
stocks['RET'] = stocks['RET'] * stocks['wt']
```

```
# Calculate market returns
mkt = stocks.groupby('date')['RET'].sum().reset_index()

# Shift date so that it's always the end of the month
mkt['date'] = mkt['date'] + MonthEnd(0)

mkt.head()
```

[21]:

```
        date       RET
0 1972-12-31  0.000000
1 1973-01-31  0.000000
2 1973-02-28 -0.044228
3 1973-03-31 -0.008450
4 1973-04-30 -0.051531
```

[22]:

```
stats = pd.DataFrame(index = mkt.columns[1:])

# Take a look at the mean
stats['mean'] = mkt.mean()

# Take a look at the sd
stats['sd'] = mkt.std()

# Take a look at the skew
stats['skew'] = mkt.skew()

stats
```

[22]:

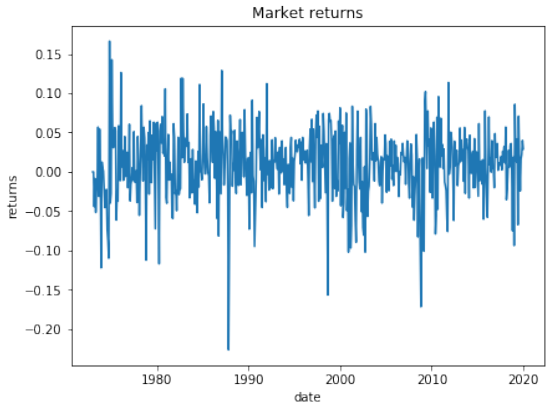
```
          mean       sd      skew
RET   0.009449  0.04494 -0.543878
```

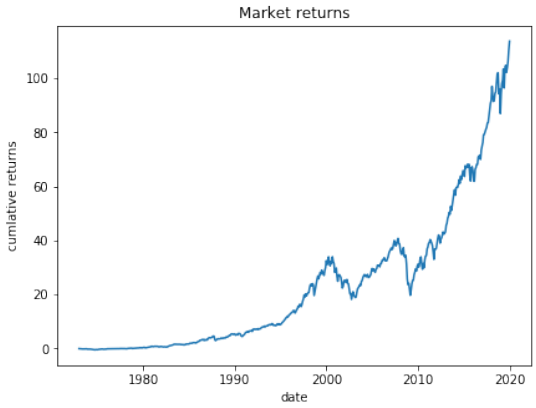
[23]:

```
# Plot returns
fig, (ax1, ax2) = plt.subplots(1, 2, figsize = (15,5))
ax1.plot(mkt['date'], mkt['RET'])
ax1.set_xlabel('date')
ax1.set_ylabel('returns')
ax1.set_title('Market returns')

ax2.plot(mkt['date'], (1 + mkt['RET']).cumprod() - 1)
ax2.set_xlabel('date')
ax2.set_ylabel('cumlative returns')
ax2.set_title('Market returns')

plt.show()
```





[24]:
```
# Load Daniel's momentum
FF3 = pd.read_csv('FF3.csv')

# Convert date to datetime object
FF3['date'] = pd.to_datetime(FF3['date'], format = '%Y%m')

# Move date to end of month
FF3['date'] = FF3['date'] + MonthEnd(0)

# Calculate Fama French market returns
FF3['mkt'] = FF3['Mkt-RF'] + FF3['RF']

# Convert to decimal
FF3['mkt'] = FF3['mkt']/100

FF3.head()
```

[24]:

	date	Mkt-RF	SMB	HML	RF	mkt
0	1926-07-31	2.96	-2.30	-2.87	0.22	0.0318
1	1926-08-31	2.64	-1.40	4.19	0.25	0.0289
2	1926-09-30	0.36	-1.32	0.01	0.23	0.0059
3	1926-10-31	-3.24	0.04	0.51	0.32	-0.0292
4	1926-11-30	2.53	-0.20	-0.35	0.31	0.0284

[25]:
```
# Merge with market construction
results = mkt.merge(FF3[['date', 'mkt']], on = 'date')

# See correlation
results['RET'].corr(results['mkt'])
```

[25]: 0.9995941576059506