

## Mathematica Code

```
In[414]:= StockReturns[tickerList_, periodicity_, nPeriods_, enddate_: Today] := Module[
{tickers = tickerList, period = periodicity, nPd = nPeriods, finaldate = enddate, stockdata,
 dim, ntickers, dates, ndates, good, bad, CFs, i, returns}, ntickers = Length[tickers];
stockdata = FinancialData[#, "CumulativeReturn", {DatePlus[finaldate,
 -Quantity[nPd, period]], finaldate, period}, "DateList"] & /@ tickers;
dim = Dimensions[stockdata];
dates = If[Length[dim] == 1, DateObject[Flatten[Drop[stockdata[[1]], 0, -1], 1]],
 DateObject[stockdata[[1, All, 1]]]];
ndates = Length[dates];
bad = If[Length[dim] == 1, Flatten@Position[
Table[Length@stockdata[[i]], {i, Length[stockdata]}], _? (# < ndates &)], Nothing];
For[i = 1, i <= Length[bad], i++, stockdata[[bad[[i]]]] =
MissingStockData[stockdata[[bad[[i]]]], dates, 1.0]];
CFs = stockdata[[All, All, 2]];
returns = Transpose[Log[Drop[CFs, 0, 1]] - Log[Drop[CFs, 0, -1]]];
dates = Rest@dates;
{dates, returns}]

In[369]:= EstimateBeta[stockreturns_] := Module[{Rs = stockreturns, Rm, beta, upBeta,
downBeta, bad, betaRatio, betaConvexity, indDown, indUp}, Rm = Rs[[All, 1]];
beta = Flatten[Take[Covariance[Rs], 1] / Variance[Rm]];
indDown = Flatten@Position[Rm, _? (# < 0 &)];
downBeta = Flatten[Take[Covariance[Rs[[indDown, All]]], 1] / Variance[Rm[[indDown]]]];
indUp = Flatten@Position[Rm, _? (# > 0 &)];
upBeta = Flatten[Take[Covariance[Rs[[indUp, All]]], 1] / Variance[Rm[[indUp]]]];
betaRatio = upBeta / downBeta /. 0/0 → Indeterminate // Quiet;
betaConvexity = (upBeta - downBeta)^2 /. 0. → Indeterminate;
{beta, downBeta, upBeta, betaRatio, betaConvexity}]

In[516]:= MissingStockData[stockdata_, validdates_, missingvalue_] :=
Module[{data = stockdata, valdates = validdates, missingval = missingvalue, missingdates},
data[[All, 1]] = DateObject[data[[All, 1]]];
data = data[[Flatten@Position[data[[All, 1]], _? (MemberQ[valdates, #] &)], All]];
missingdates = Complement[valdates, data[[All, 1]]];
data =
Join[Partition[Flatten@{Riffle[missingdates, missingval], missingval}, 2], data];
data = Sort[data];
data]
```

## Data Settings

```
In[643]:= tickers = Prepend[Drop[Take[FinancialData["SP500", "Members"], 500], 0], "^SPX"];
colnames = {"Beta", "Down Beta", "Up Beta", "Beta Ratio", "Beta Convexity"};
formationPeriod = 60;
rebalancePeriod = 3;
testPeriod = 20;
```

## Rebalance

```
In[646]:= rebalanceDates = DayRound[Table[DatePlus[Today, {-i * rebalancePeriod, "EndOfMonth"}],
{i, (12 / rebalancePeriod) * testPeriod, 0, -1}],
"BusinessDay", "Preceding"];
```

## Download Stock Data & Calculate Returns

```
In[647]:= {dates, returns} = StockReturns[tickers, "Month", {formationPeriod + testPeriod * 12}, Today];
```

## Beta Estimation

```
In[648]:= b = Transpose@EstimateBeta[returns];
NumberForm[TableForm[b, TableHeadings -> {tickers, colnames}], {6, 2}]
```

Out[649]//NumberForm=

	Beta	Down Beta	Up Beta	Beta Ratio	Beta Convexity
^SPX	1.00	1.00	1.00	1.00	$4.93 \times 10^{-32}$
NASDAQ:FOXA	1.33	1.27	1.02	0.80	0.06
NASDAQ:FOX	1.35	1.23	1.13	0.92	0.01
NYSE:MMM	0.71	0.62	0.86	1.39	0.06
NYSE:ABT	0.53	0.31	0.47	1.54	0.03
NYSE:ABBV	0.17	-0.04	0.02	-0.53	0.00
NASDAQ:ABMD	1.14	2.17	0.49	0.22	2.85
NYSE:ACN	0.71	0.73	0.53	0.73	0.04
NASDAQ:ATVI	0.77	1.12	0.45	0.40	0.45
NYSE:AAP	0.43	0.19	0.56	2.91	0.14
NASDAQ:AMD	2.30	1.85	2.47	1.34	0.39
NASDAQ:ADBE	1.48	1.76	1.57	0.89	0.04
NYSE:AES	1.70	2.15	1.17	0.54	0.96
NYSE:AET	0.90	1.16	0.71	0.61	0.20
NYSE:AMG	1.84	2.57	1.42	0.55	1.32
NYSE:AFL	1.21	1.27	1.74	1.38	0.23
NYSE:A	1.38	1.11	1.42	1.28	0.10
NYSE:AIV	1.04	1.85	0.44	0.24	2.00
NYSE:APD	1.01	0.84	1.03	1.22	0.04
NASDAQ:AKAM	1.70	1.46	0.60	0.41	0.74
NYSE:ALB	1.24	1.29	1.23	0.96	0.00
NYSE:ALK	0.93	0.59	0.61	1.03	0.00
NYSE:ARE	0.72	1.18	0.11	0.09	1.17
NASDAQ:ALXN	1.03	1.01	0.68	0.68	0.11
NASDAQ:ALGN	1.58	2.41	0.92	0.38	2.22
NYSE:ALLE	0.09	0.00	0.11	35.90	0.01

NYSE:AGN	0.56	0.44	0.42	0.95	0.00
NYSE:ADS	0.91	0.97	0.88	0.91	0.01
NYSE:LNT	0.38	0.41	0.14	0.34	0.07
NYSE:ALL	1.01	1.28	0.98	0.76	0.09
NASDAQ:GOOGL	0.54	0.40	0.23	0.57	0.03
NASDAQ:GOOG	0.08	-0.02	-0.05	2.58	0.00
NYSE:MO	0.49	0.83	0.47	0.57	0.12
NASDAQ:AMZN	1.64	1.65	2.32	1.40	0.44
NYSE:AEE	0.36	0.47	0.29	0.62	0.03
NASDAQ:AAL	2.13	1.56	1.75	1.12	0.03
NYSE:AEP	0.34	0.35	0.10	0.27	0.07
NYSE:AXP	1.42	1.68	1.57	0.93	0.01
NYSE:AIG	2.07	3.14	2.10	0.67	1.08
NYSE:AMT	1.13	1.52	0.56	0.37	0.91
NYSE:AWK	0.10	-0.07	-0.09	1.37	0.00
NYSE:AMP	0.96	1.28	0.82	0.64	0.22
NYSE:ABC	0.44	0.73	0.27	0.37	0.21
NYSE:AME	0.87	1.06	0.78	0.73	0.08
NASDAQ:AMGN	0.73	0.40	0.81	2.02	0.17
NYSE:APH	1.36	1.70	1.32	0.78	0.14
NYSE:APC	1.04	0.99	1.21	1.23	0.05
NASDAQ:ADI	1.73	1.81	2.09	1.15	0.08
NYSE:ANDV	1.36	1.39	0.47	0.34	0.84
NASDAQ:ANSS	0.82	1.29	0.35	0.27	0.87
NYSE:ANTM	0.46	0.57	0.37	0.66	0.04
NYSE:AON	0.72	0.59	0.78	1.31	0.03
NYSE:AOS	0.80	0.83	1.03	1.24	0.04
NYSE:APA	0.83	0.90	1.06	1.17	0.02
NASDAQ:AAPL	1.28	0.98	1.26	1.29	0.08
NASDAQ:AMAT	1.78	1.46	2.43	1.67	0.95
NYSE:ADM	0.52	0.35	0.39	1.12	0.00
NYSE:ARNC	0.07	-0.03	0.11	-4.31	0.02
NYSE:AJG	0.65	0.56	0.79	1.41	0.05
NYSE:AIZ	0.70	1.22	0.12	0.10	1.22
NYSE:T	0.66	0.62	0.86	1.38	0.06
NASDAQ:ADSK	1.65	1.60	1.53	0.96	0.00
NASDAQ:ADP	0.82	0.70	1.00	1.43	0.09
NYSE:AZO	0.51	0.50	0.71	1.41	0.04
NYSE:AVB	0.70	1.07	0.30	0.28	0.58
NYSE:AVY	1.00	1.04	0.70	0.67	0.12
NYSE:BHGE	0.01	0.01	-0.02	-2.47	0.00
NYSE:BLL	0.43	0.29	0.40	1.38	0.01
NYSE:BAC	1.55	2.05	1.32	0.65	0.53
NYSE:BAX	0.63	0.64	0.45	0.71	0.04
NYSE:BBT	0.85	0.78	1.07	1.37	0.08
NYSE:BDX	0.59	0.91	-0.01	-0.01	0.84
NYSE:BRK-B	0.55	0.40	0.67	1.68	0.07
NYSE:BBY	1.39	1.52	1.62	1.07	0.01
NASDAQ:BIIB	1.13	0.85	1.14	1.34	0.08
NYSE:BLK	0.76	1.30	0.37	0.29	0.86
NYSE:BK	1.16	1.00	1.11	1.11	0.01
NYSE:BA	1.01	1.11	0.87	0.78	0.06
NYSE:BWA	1.28	1.41	1.50	1.06	0.01
NYSE:BXP	0.71	0.92	0.45	0.49	0.22
NYSE:BSX	0.94	0.63	0.78	1.23	0.02
NASDAQ:BHF	0.03	0.00	0.12	154.87	0.01
NYSE:BMY	0.66	0.45	0.64	1.41	0.03
NASDAQ:AVGO	0.23	-0.01	0.26	-44.18	0.07
NYSE:BR	0.40	0.44	0.28	0.64	0.02
NYSE:BF-B	0.57	0.58	0.42	0.73	0.03

NASDAQ:CA	1.48	1.19	1.44	1.21	0.06
NYSE:COG	0.85	1.08	0.80	0.74	0.08
NASDAQ:CDNS	1.54	1.94	1.16	0.60	0.61
NYSE:CPB	0.42	0.37	0.40	1.09	0.00
NYSE:COF	1.55	1.74	1.70	0.98	0.00
NYSE:CAH	0.60	0.68	0.54	0.80	0.02
NYSE:KMX	1.38	0.88	1.27	1.44	0.15
NYSE:CCL	1.15	1.20	1.22	1.02	0.00
NYSE:CAT	1.32	1.45	1.38	0.95	0.01
NASDAQ:CBOE	0.12	-0.02	-0.09	4.64	0.01
NYSE:CBG	1.35	1.27	0.90	0.71	0.14
NYSE:CBS	1.58	1.96	1.64	0.84	0.10
NASDAQ:CELG	0.90	1.17	0.71	0.61	0.21
NYSE:CNC	0.54	0.47	0.32	0.68	0.02
NYSE:CNP	0.60	0.53	0.14	0.27	0.15
NYSE:CTL	0.86	1.01	0.88	0.87	0.02
NASDAQ:CERN	0.90	1.09	0.67	0.61	0.18
NYSE:CF	0.60	0.81	0.58	0.71	0.05
NYSE:SCHW	1.75	1.48	2.02	1.36	0.29
NASDAQ:CHTR	0.23	0.17	0.12	0.71	0.00
NYSE:CVX	0.72	0.47	0.64	1.36	0.03
NYSE:CMG	0.39	0.48	0.38	0.80	0.01
NASDAQ:CHRW	0.49	0.64	0.31	0.48	0.11
NYSE:CB	0.80	0.57	1.00	1.76	0.19
NYSE:CHD	0.40	0.47	0.30	0.64	0.03
NYSE:CI	1.06	1.91	0.51	0.27	1.94
NYSE:XEC	0.68	0.46	0.63	1.36	0.03
NASDAQ:CINF	0.56	0.67	0.67	0.99	0.00
NASDAQ:CTAS	0.99	0.95	1.33	1.41	0.15
NASDAQ:CSCO	1.57	1.74	1.59	0.91	0.02
NYSE:C	2.01	2.57	2.02	0.79	0.30
NASDAQ:CTXS	1.39	1.07	2.18	2.04	1.23
NYSE:CFG	0.10	0.03	0.06	2.26	0.00
NYSE:CLX	0.45	0.38	0.36	0.94	0.00
NASDAQ:CME	0.56	0.65	0.25	0.38	0.17
NYSE:CMS	0.77	0.78	0.49	0.62	0.09
NYSE:KO	0.58	0.71	0.36	0.51	0.12
NASDAQ:CTSH	1.19	1.22	1.52	1.25	0.09
NYSE:CL	0.67	0.78	0.58	0.75	0.04
NASDAQ:CMCSA	0.99	0.97	1.02	1.05	0.00
NYSE:CMA	1.05	1.16	1.03	0.89	0.02
NYSE:CAG	0.55	0.57	0.75	1.32	0.03
NYSE:CXO	0.52	0.61	0.85	1.40	0.06
NYSE:COP	0.90	1.07	0.73	0.69	0.11
NYSE:ED	0.12	-0.20	0.23	-1.15	0.19
NYSE:STZ	0.71	1.28	0.37	0.29	0.83
NYSE:COO	0.69	1.28	-0.05	-0.04	1.77
NASDAQ:CPRT	0.95	0.60	0.75	1.24	0.02
NYSE:GLW	1.90	2.19	1.85	0.84	0.12
NYSE:COTY	0.02	-0.02	0.11	-4.75	0.02
NASDAQ:COST	0.82	0.72	0.94	1.30	0.05
NYSE:CCI	1.48	1.49	1.50	1.00	$3.34 \times 10^{-6}$
NYSE:CSX	0.94	1.01	0.88	0.87	0.02
NYSE:CMI	1.48	1.86	1.63	0.88	0.05
NYSE:CVS	0.78	0.52	0.74	1.43	0.05
NYSE:DHR	0.92	0.89	0.86	0.97	0.00
NYSE:DRI	0.58	0.66	0.63	0.95	0.00
NYSE:DVA	0.88	0.69	0.44	0.64	0.06
NYSE:DE	1.08	1.21	1.03	0.85	0.03
NYSE:DLPH	0.01	0.00	0.02	5.96	0.00

NYSE:DAL	0.40	-0.11	0.60	-5.39	0.51
NASDAQ:XRAY	0.67	0.74	0.59	0.80	0.02
NYSE:DVN	1.00	0.91	0.90	0.99	0.00
NYSE:DLR	0.44	0.68	0.10	0.14	0.34
NYSE:DFS	0.68	0.80	0.68	0.84	0.02
NASDAQ:DISCA	0.53	0.14	0.65	4.47	0.25
NASDAQ:DISCK	0.37	0.00	0.65	1302.95	0.43
NASDAQ:DISH	1.40	1.70	1.24	0.73	0.22
NYSE:DIS	1.11	1.08	0.99	0.92	0.01
NYSE:DG	0.12	-0.04	0.19	-4.27	0.05
NASDAQ:DLTR	1.10	0.79	1.57	1.98	0.60
NYSE:D	0.33	0.41	0.21	0.50	0.04
NYSE:DOV	1.11	1.10	1.13	1.02	0.00
NYSE:DWDP	1.38	1.42	1.73	1.22	0.10
NYSE:DHI	1.20	1.35	1.41	1.05	0.00
NYSE:DTE	0.32	0.28	0.24	0.86	0.00
NYSE:DUK	0.35	0.22	0.32	1.43	0.01
NYSE:DRE	1.01	1.46	0.53	0.36	0.87
NYSE:DXC	1.22	1.11	1.15	1.03	0.00
NYSE:EMN	1.21	1.13	1.46	1.30	0.11
NYSE:ETN	1.09	1.01	1.13	1.12	0.02
NASDAQ:EBAY	1.43	1.09	1.85	1.69	0.57
NYSE:ECL	0.70	0.71	0.86	1.21	0.02
NYSE:EIX	0.38	0.74	0.06	0.08	0.46
NYSE:EW	0.25	-0.01	0.18	-12.92	0.04
NASDAQ:EA	1.13	1.75	0.60	0.35	1.31
NYSE:LLY	0.60	0.79	0.33	0.42	0.21
NYSE:EMR	1.03	0.98	0.98	1.00	0.00
NYSE:ETR	0.33	0.22	0.07	0.33	0.02
NYSE:EVHC	0.41	0.59	0.08	0.14	0.26
NYSE:EOG	0.83	0.76	0.97	1.28	0.05
NYSE:EQT	0.59	0.33	0.82	2.53	0.25
NYSE:EFX	0.84	1.20	0.94	0.78	0.07
NYSE:EQR	0.72	0.86	0.56	0.65	0.09
NYSE:ESS	0.58	0.80	0.36	0.45	0.19
NYSE:EL	0.92	1.27	1.01	0.79	0.07
NASDAQ:ETFC	2.46	2.41	2.59	1.07	0.03
NYSE:RE	0.44	0.35	0.72	2.05	0.14
NYSE:ES	0.45	0.47	0.31	0.65	0.03
NYSE:EXC	0.32	0.20	0.49	2.45	0.08
NASDAQ:EXPE	0.80	1.27	1.04	0.82	0.05
NASDAQ:EXPD	0.92	0.65	1.05	1.61	0.16
NASDAQ:ESRX	0.72	0.57	0.70	1.23	0.02
NASDAQ:EQIX	1.84	1.95	0.87	0.45	1.17
NYSE:EXR	0.57	0.78	0.21	0.28	0.31
NYSE:XOM	0.56	0.40	0.42	1.04	0.00
NASDAQ:FFIV	1.78	1.70	1.98	1.17	0.08
NASDAQ:FB	0.12	0.12	0.22	1.86	0.01
NASDAQ:FAST	0.84	1.08	1.10	1.02	0.00
NYSE:FRT	0.57	0.82	0.32	0.38	0.26
NYSE:FDX	1.01	0.97	1.37	1.41	0.16
NYSE:FIS	0.57	0.98	0.19	0.19	0.63
NASDAQ:FITB	1.40	1.48	1.70	1.15	0.05
NYSE:FE	0.23	0.33	0.27	0.83	0.00
NASDAQ:FISV	0.97	0.97	0.90	0.93	0.00
NYSE:FLT	0.23	0.04	0.18	4.31	0.02
NASDAQ:FLIR	0.67	0.91	0.44	0.49	0.22
NYSE:FLS	1.46	1.92	1.61	0.84	0.10
NYSE:FLR	0.83	0.84	0.71	0.85	0.02
NYSE:FMC	1.06	1.29	0.90	0.69	0.16

NYSE:FTI	0.20	0.04	0.28	7.30	0.06
NYSE:F	1.58	1.83	2.15	1.17	0.10
NYSE:FTV	0.02	0.03	-0.02	-0.64	0.00
NYSE:FL	1.04	1.23	0.96	0.78	0.07
NYSE:FBHS	0.19	0.04	0.28	7.30	0.06
NYSE:BEN	1.43	1.48	1.39	0.94	0.01
NYSE:FCX	1.54	1.53	1.64	1.07	0.01
NYSE:GPS	1.26	1.44	1.19	0.83	0.06
NASDAQ:GRMN	0.82	0.91	0.38	0.42	0.28
NYSE:IT	1.14	1.63	0.49	0.30	1.30
NYSE:GD	0.86	0.91	0.99	1.09	0.01
NYSE:GE	1.24	1.30	1.54	1.18	0.06
NYSE:GGP	1.62	2.90	0.94	0.33	3.82
NYSE:GIS	0.26	0.05	0.26	4.78	0.04
NYSE:GM	0.27	-0.02	0.37	-18.30	0.15
NYSE:GPC	0.64	0.63	0.47	0.76	0.02
NASDAQ:GILD	0.90	0.67	1.22	1.84	0.31
NYSE:GPN	0.63	0.67	0.59	0.87	0.01
NYSE:GS	1.17	0.92	1.10	1.20	0.03
NASDAQ:GT	1.81	2.33	1.67	0.72	0.44
NYSE:HAL	1.33	1.95	1.37	0.70	0.33
NYSE:HBI	0.70	0.93	0.85	0.92	0.01
NYSE:HOG	1.45	1.85	1.90	1.03	0.00
NYSE:HRS	0.87	1.05	0.19	0.18	0.74
NASDAQ:HAS	0.87	0.64	0.66	1.04	0.00
NYSE:HCA	0.19	0.13	0.24	1.81	0.01
NYSE:HCP	0.58	0.74	0.47	0.63	0.07
NYSE:HP	1.02	0.94	1.42	1.51	0.23
NASDAQ:HSIC	0.58	0.52	0.60	1.16	0.01
NYSE:HSY	0.11	-0.09	0.13	-1.50	0.05
NYSE:HES	0.89	0.88	0.76	0.87	0.01
NYSE:HPQ	1.44	1.50	0.82	0.55	0.45
NYSE:HPE	0.05	0.04	0.12	3.32	0.01
NYSE:HLT	0.11	0.07	0.08	1.21	0.00
NYSE:HFC	0.65	0.39	0.30	0.78	0.01
NASDAQ:HOLX	1.32	1.53	0.75	0.49	0.62
NYSE:HD	1.00	0.79	0.96	1.22	0.03
NYSE:HON	1.35	1.88	1.37	0.73	0.27
NYSE:HRL	0.44	0.55	0.48	0.87	0.00
NYSE:HST	1.38	1.55	1.18	0.76	0.14
NYSE:HRB	0.56	0.64	0.29	0.45	0.12
NYSE:HUM	1.05	1.77	0.90	0.51	0.74
NASDAQ:HBAN	1.17	1.49	1.31	0.88	0.03
NYSE:HII	0.23	0.07	0.28	4.13	0.05
NYSE:IBM	1.05	0.93	1.38	1.48	0.20
NASDAQ:IDXX	0.76	1.32	0.37	0.28	0.92
NASDAQ:INFO	0.34	0.41	0.18	0.43	0.05
NYSE:ITW	1.04	1.08	0.91	0.84	0.03
NASDAQ:ILMN	1.09	1.42	-0.17	-0.12	2.53
NASDAQ:INCY	1.73	2.92	0.84	0.29	4.31
NYSE:IR	1.46	1.56	1.79	1.14	0.05
NASDAQ:INTC	1.42	1.55	1.78	1.15	0.06
NYSE:ICE	0.49	0.42	0.28	0.66	0.02
NYSE:IFF	0.75	0.62	0.77	1.25	0.02
NYSE:IP	1.44	1.80	1.52	0.85	0.08
NYSE:IPG	1.45	1.28	1.57	1.23	0.09
NASDAQ:INTU	1.16	1.04	1.44	1.38	0.16
NASDAQ:ISRG	0.89	1.76	0.69	0.39	1.15
NYSE:IQV	0.08	0.05	-0.04	-0.87	0.01
NYSE:IVZ	1.73	2.38	1.40	0.59	0.95

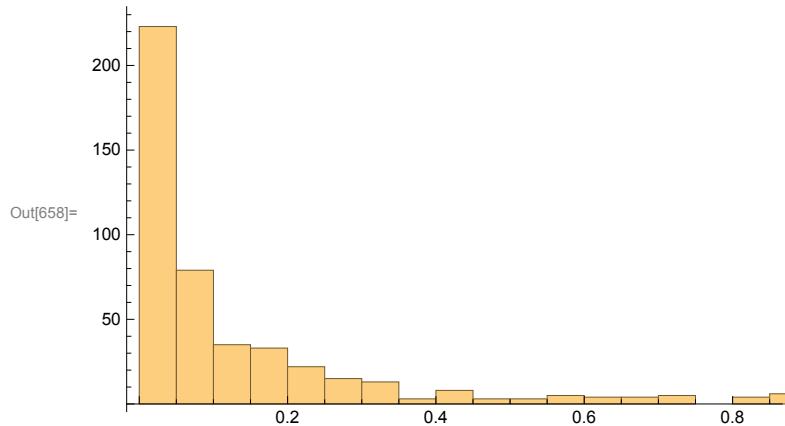
NASDAQ:IPGP	0.74	0.76	0.60	0.79	0.03
NYSE:IRM	0.66	0.74	0.68	0.92	0.00
NYSE:JEC	1.07	1.05	1.01	0.96	0.00
NASDAQ:JBHT	1.14	1.57	0.91	0.58	0.44
NYSE:SJM	0.42	0.29	0.30	1.05	0.00
NYSE:JCI	1.29	1.61	1.47	0.91	0.02
NYSE:JNJ	0.55	0.52	0.39	0.74	0.02
NYSE:JPM	1.46	1.55	1.44	0.93	0.01
NYSE:JNPR	1.36	1.51	1.33	0.88	0.03
NYSE:KSU	1.20	2.02	1.09	0.54	0.87
NYSE:K	0.32	0.39	0.18	0.47	0.04
NYSE:KEY	0.81	0.73	0.67	0.92	0.00
NYSE:KMB	0.44	0.36	0.50	1.37	0.02
NYSE:KIM	0.96	1.30	0.54	0.42	0.57
NYSE:KMI	0.12	-0.03	0.06	-2.06	0.01
NASDAQ:KLAC	1.99	1.66	2.68	1.61	1.04
NYSE:KSS	0.93	0.85	0.96	1.14	0.01
NASDAQ:KHC	0.05	0.02	0.08	4.59	0.00
NYSE:KR	0.54	0.47	0.40	0.84	0.01
NYSE:LB	1.22	1.73	1.39	0.80	0.11
NYSE:LLL	0.63	0.71	0.41	0.57	0.09
NYSE:LH	0.52	1.22	-0.01	-0.01	1.51
NASDAQ:LRCX	2.05	1.96	2.79	1.42	0.68
NYSE:LEG	1.01	1.19	0.83	0.70	0.13
NYSE:LEN	1.52	1.81	1.93	1.07	0.01
NYSE:LUK	1.12	1.33	1.07	0.81	0.07
NASDAQ:LKQ	0.50	0.79	0.45	0.57	0.12
NYSE:LNC	1.75	2.60	1.55	0.60	1.09
NYSE:LMT	0.47	0.74	0.11	0.15	0.40
NYSE:L	0.90	0.84	1.02	1.22	0.03
NYSE:LOW	1.00	0.76	1.00	1.31	0.06
NYSE:LYB	0.39	0.33	0.59	1.81	0.07
NYSE:MAC	1.05	1.60	0.41	0.26	1.40
NYSE:M	1.26	1.59	1.18	0.74	0.16
NYSE:MRO	1.10	1.10	0.91	0.83	0.04
NYSE:MPC	0.33	0.16	0.29	1.86	0.02
NASDAQ:MAR	1.05	1.27	1.08	0.85	0.03
NYSE:MMC	0.94	0.79	1.15	1.45	0.13
NYSE:MLM	0.95	0.82	0.68	0.83	0.02
NYSE:MAS	1.49	1.93	1.51	0.78	0.18
NYSE:MA	0.49	0.65	0.40	0.62	0.06
NASDAQ:MAT	0.63	0.83	0.35	0.42	0.23
NYSE:MKC	0.37	0.42	0.24	0.57	0.03
NYSE:MCD	0.71	0.75	0.54	0.72	0.05
NYSE:MCK	0.73	0.84	0.33	0.39	0.26
NYSE:MDT	0.79	0.97	0.80	0.83	0.03
NYSE:MRK	0.68	0.50	0.72	1.45	0.05
NYSE:MET	1.02	1.40	0.82	0.59	0.33
NYSE:MTD	1.06	1.36	0.89	0.65	0.22
NYSE:MGM	1.73	2.51	1.38	0.55	1.28
NYSE:KORS	0.08	0.05	-0.04	-0.94	0.01
NASDAQ:MCHP	1.30	1.79	1.76	0.99	0.00
NASDAQ:MU	1.77	1.50	1.61	1.07	0.01
NASDAQ:MSFT	1.25	1.02	1.31	1.29	0.09
NYSE:MAA	0.57	0.77	0.24	0.31	0.29
NYSE:MSCI	0.59	0.87	0.51	0.59	0.13
NYSE:MHK	1.44	1.41	1.45	1.03	0.00
NYSE:TAP	0.61	0.40	0.77	1.92	0.14
NASDAQ:MDLZ	0.37	0.38	0.30	0.78	0.01
NASDAQ:MNST	0.69	1.05	-0.00	-0.00	1.10

NYSE:MCO	0.87	0.91	0.93	1.02	0.00
NYSE:MS	1.85	1.93	1.66	0.86	0.07
NYSE:莫斯	1.03	1.60	0.25	0.16	1.81
NYSE:MSI	1.33	1.96	1.14	0.58	0.68
NYSE:MTB	0.70	0.72	0.84	1.17	0.01
NASDAQ:MYL	0.71	0.57	0.61	1.06	0.00
NASDAQ:NDAQ	0.57	0.53	0.24	0.45	0.08
NYSE:NOV	1.48	2.14	1.50	0.70	0.40
NASDAQ:NKTR	1.24	0.68	1.52	2.24	0.71
NASDAQ:NTAP	1.98	2.15	1.74	0.81	0.17
NASDAQ:NFLX	0.66	1.02	0.36	0.35	0.43
NYSE:NWL	1.00	0.85	1.04	1.22	0.03
NYSE:NFX	1.01	1.07	1.41	1.32	0.12
NYSE:NEM	0.41	0.29	0.13	0.44	0.03
NASDAQ:NWSA	0.16	-0.07	0.35	-4.84	0.17
NASDAQ:NWS	0.15	-0.06	0.34	-5.35	0.17
NYSE:NEE	0.30	0.06	0.29	4.88	0.05
NYSE:NLSN	0.15	0.03	0.17	6.21	0.02
NYSE:NKE	0.82	0.91	0.69	0.76	0.05
NYSE:NI	0.50	0.29	0.52	1.75	0.05
NYSE:NBL	0.82	0.76	0.85	1.12	0.01
NYSE:JWN	1.33	1.39	1.63	1.17	0.06
NYSE:NSC	0.88	0.86	0.88	1.01	0.00
NASDAQ:NTRS	1.07	1.18	0.99	0.84	0.04
NYSE:NOC	0.60	0.90	0.53	0.59	0.14
NASDAQ:NCLH	0.13	0.09	0.22	2.35	0.02
NYSE:NRG	0.46	0.45	-0.14	-0.32	0.35
NYSE:NUE	1.20	0.80	1.18	1.48	0.15
NASDAQ:NVDA	1.69	1.51	1.39	0.92	0.02
NYSE:OXY	0.82	0.79	0.67	0.85	0.01
NYSE:OMC	1.16	1.20	1.11	0.93	0.01
NYSE:OKE	0.78	0.55	0.82	1.48	0.07
NYSE:ORCL	1.33	1.28	1.69	1.32	0.17
NASDAQ:ORLY	0.68	0.81	0.54	0.67	0.07
NASDAQ:PCAR	1.23	1.01	1.47	1.45	0.21
NYSE:PKG	0.82	1.23	0.48	0.39	0.55
NYSE:PH	1.25	1.21	1.19	0.98	0.00
NASDAQ:PAXY	0.85	0.77	0.90	1.16	0.02
NASDAQ:PYPL	0.08	0.07	0.05	0.65	0.00
NYSE:PNR	1.10	1.10	1.28	1.16	0.03
NASDAQ:PBCT	0.64	0.77	0.47	0.61	0.09
NYSE:PEP	0.66	0.88	0.64	0.72	0.06
NYSE:PKI	1.21	1.45	1.02	0.70	0.19
NYSE:PRGO	0.59	0.67	0.65	0.98	0.00
NYSE:PFE	0.73	0.69	0.66	0.96	0.00
NYSE:PCG	0.29	0.25	-0.01	-0.05	0.07
NYSE:PM	0.38	0.47	0.43	0.92	0.00
NYSE:PSX	0.15	0.01	0.06	5.97	0.00
NYSE:PNW	0.39	0.34	0.28	0.83	0.00
NYSE:PXD	1.09	1.59	1.26	0.80	0.10
NYSE:PNC	0.99	1.21	1.03	0.84	0.04
NYSE:PPG	1.06	1.02	1.24	1.21	0.05
NYSE:PPL	0.45	0.29	0.55	1.89	0.07
NYSE:PX	0.95	0.96	0.85	0.89	0.01
NASDAQ:PCLN	1.74	1.51	1.86	1.24	0.13
NYSE:PFG	1.33	2.19	1.04	0.47	1.33
NYSE:PG	0.40	0.45	0.22	0.49	0.05
NYSE:PGR	0.91	0.81	1.23	1.52	0.18
NYSE:PLD	1.27	2.38	0.42	0.18	3.84
NYSE:PRU	1.21	1.96	0.91	0.46	1.10

NYSE:PEG	0.35	0.18	0.26	1.44	0.01
NYSE:PSA	0.45	0.60	0.23	0.39	0.13
NYSE:PHM	1.07	0.86	1.36	1.58	0.25
NYSE:PVH	1.15	1.65	1.14	0.69	0.25
NASDAQ:QCOM	1.41	1.04	1.74	1.67	0.49
NYSE:PWR	1.54	1.60	0.98	0.61	0.38
NYSE:DGX	0.44	0.70	0.32	0.46	0.14
NASDAQ:QRVO	0.06	0.02	-0.01	-0.47	0.00
NYSE:RL	1.00	1.20	0.62	0.52	0.34
NYSE:RJF	1.36	1.56	1.29	0.83	0.07
NYSE:RTN	0.62	0.87	0.32	0.37	0.30
NYSE:O	0.38	0.28	0.24	0.86	0.00
NYSE:RHT	1.28	1.32	0.86	0.65	0.21
NYSE:REG	0.75	1.06	0.23	0.21	0.70
NASDAQ:REGN	1.20	1.52	0.62	0.41	0.81
NYSE:RF	1.01	0.75	1.03	1.38	0.08
NYSE:RSG	0.68	1.02	0.27	0.27	0.56
NYSE:RMD	0.82	0.56	0.74	1.32	0.03
NYSE:RHI	1.02	0.97	1.44	1.49	0.22
NYSE:ROK	1.18	1.76	1.35	0.77	0.17
NYSE:COL	0.69	0.88	0.48	0.54	0.16
NYSE:ROP	0.90	0.97	0.81	0.83	0.03
NASDAQ:ROST	0.75	0.58	1.13	1.93	0.30
NYSE:RCL	2.00	2.42	1.87	0.77	0.30
NYSE:SPGI	0.92	0.90	1.03	1.13	0.01
NYSE:CRM	0.78	0.76	0.54	0.71	0.05
NASDAQ:SBAC	1.18	0.90	0.86	0.95	0.00
NYSE:SCG	0.30	0.23	0.32	1.38	0.01
NYSE:SLB	1.23	1.70	1.18	0.69	0.27
NASDAQ:STX	1.19	1.22	0.97	0.79	0.06
NYSE:SEE	1.24	1.43	1.41	0.98	0.00
NYSE:SRE	0.38	0.33	0.36	1.10	0.00
NYSE:SHW	0.81	0.76	0.75	0.99	0.00
NASDAQ:SIVB	1.36	1.54	1.48	0.96	0.00
NYSE:SPG	0.67	0.91	0.33	0.36	0.34
NASDAQ:SWKS	1.87	1.65	1.83	1.11	0.03
NYSE:SLG	1.15	1.70	0.54	0.32	1.35
NYSE:SNA	1.21	1.65	1.29	0.78	0.13
NYSE:SO	0.14	-0.09	0.34	-3.76	0.18
NYSE:LUV	1.06	1.25	1.10	0.88	0.02
NYSE:SWK	1.05	1.09	1.01	0.93	0.01
NASDAQ:SBUX	1.04	0.82	0.95	1.17	0.02
NYSE:STT	1.37	1.34	1.70	1.27	0.13
NASDAQ:SRCL	0.19	0.29	0.30	1.04	0.00
NYSE:SYK	0.92	0.81	1.10	1.35	0.08
NYSE:STI	1.13	1.12	1.06	0.94	0.00
NASDAQ:SYMC	1.18	1.39	1.35	0.97	0.00
NYSE:SYF	0.08	-0.03	0.04	-1.31	0.00
NASDAQ:SNPS	1.21	0.88	1.37	1.55	0.24
NYSE:SYY	0.64	0.63	0.69	1.08	0.00
NASDAQ:TTWO	1.23	1.50	0.64	0.43	0.73
NYSE:TPR	0.86	0.97	1.04	1.07	0.01
NYSE:TGT	0.97	1.00	1.14	1.14	0.02
NYSE:TEL	0.82	1.07	0.93	0.87	0.02
NASDAQ:TXN	1.48	1.40	1.69	1.21	0.09
NYSE:TXT	1.71	2.26	1.84	0.82	0.17
NYSE:HIG	2.03	3.25	1.82	0.56	2.04
NYSE:TMO	1.02	0.98	0.57	0.58	0.17
NYSE:TIF	1.65	1.98	1.85	0.94	0.02
NYSE:TJX	0.66	0.49	1.00	2.01	0.25

NYSE:TMK	1.11	1.32	1.23	0.94	0.01
NYSE:TSS	0.95	1.15	0.67	0.59	0.22
NASDAQ:TSCO	0.82	0.61	1.06	1.73	0.20
NYSE:TDG	0.32	0.34	0.24	0.70	0.01
NYSE:TRV	0.81	0.63	1.16	1.85	0.28
NASDAQ:TRIP	0.18	-0.05	0.42	-8.30	0.23
NASDAQ:TROW	1.46	1.54	1.30	0.85	0.06
NYSE:TWTR	0.06	0.09	0.11	1.16	0.00
NYSE:TSN	0.76	1.24	0.75	0.60	0.25
NYSE:UDR	0.60	0.84	0.26	0.31	0.33
NASDAQ:ULTA	0.61	0.83	0.54	0.65	0.08
NYSE:UA	-0.02	-0.07	-0.17	2.56	0.01
NYSE:UA-C	-0.02	-0.07	0.03	-0.44	0.01
NYSE:UNP	0.82	0.78	0.59	0.76	0.04
NYSE:UNH	0.87	1.16	0.87	0.75	0.08
NYSE:UAL	0.51	0.28	0.68	2.45	0.16
NYSE:UPS	0.57	0.53	0.70	1.34	0.03
NYSE:URI	1.93	2.53	1.31	0.52	1.48
NYSE:UTX	1.09	1.03	1.14	1.11	0.01
NYSE:UHS	0.77	0.50	1.09	2.17	0.34
NYSE:UNM	1.31	1.39	1.48	1.06	0.01
NYSE:USB	0.93	0.94	1.23	1.31	0.08
NYSE:VLO	1.05	1.34	0.83	0.62	0.26
NYSE:VAR	0.66	0.64	0.89	1.41	0.07
NYSE:VTR	0.62	0.85	0.14	0.17	0.50
NASDAQ:VRSN	1.63	1.48	1.58	1.07	0.01
NASDAQ:VRSK	0.10	0.05	0.11	2.45	0.00
NYSE:VZ	0.69	0.42	0.97	2.30	0.30
NASDAQ:VRTX	1.15	1.45	0.00	0.00	2.09
NYSE:VFC	0.82	0.95	0.53	0.55	0.18
NASDAQ:VIAB	0.62	0.60	0.70	1.18	0.01
NYSE:V	0.36	0.40	0.34	0.86	0.00
NYSE:VNO	0.82	1.00	0.56	0.56	0.19
NYSE:VMC	1.00	1.05	0.61	0.58	0.19
NASDAQ:WBA	0.80	0.83	0.94	1.12	0.01
NYSE:WMT	0.57	0.37	0.80	2.15	0.18
NYSE:WM	0.70	0.53	0.19	0.36	0.12
NYSE:WAT	0.95	0.92	0.58	0.63	0.12
NYSE:WFC	1.10	0.99	1.29	1.30	0.09
NYSE:WELL	0.44	0.62	0.14	0.22	0.23
NYSE:WR	0.50	0.64	0.39	0.60	0.06
NYSE:WRK	1.03	1.37	0.55	0.40	0.66
NASDAQ:WDC	1.50	1.39	1.54	1.11	0.02
NYSE:WU	0.67	1.02	0.62	0.61	0.16
NYSE:WY	1.34	1.40	1.73	1.24	0.11
NYSE:WHR	1.40	1.68	1.33	0.79	0.13
NYSE:WMB	1.44	1.90	0.95	0.50	0.89
NASDAQ:WLTW	0.40	0.47	0.24	0.52	0.05
NYSE:WEC	0.16	-0.00	0.07	-298.35	0.01
NYSE:GWN	0.77	0.78	0.98	1.25	0.04
NASDAQ:WYNN	1.11	1.34	1.11	0.82	0.06
NYSE:XEL	0.44	0.45	0.21	0.48	0.05
NYSE:XRX	1.57	1.63	1.59	0.98	0.00
NASDAQ:XLNX	1.60	1.57	1.71	1.08	0.02
NYSE:XL	1.34	1.46	2.39	1.65	0.88

```
In[658]:= Histogram[b[[All, 5]]]
```



---

## Export Data

```
In[650]:= ExportDir = SetDirectory[StringJoin[NotebookDirectory[], "\\Data"]];  
Export["dates.dat", dates]  
Export["rebaldates.dat", rebalanceDates]  
Export["tickers.dat", tickers]  
Export["returns.dat", returns]  
Export["beta.dat", Prepend[b, colnames]]
```

Out[651]= dates.dat

Out[652]= rebaldates.dat

Out[653]= tickers.dat

Out[654]= returns.dat

Out[655]= beta.dat