PART-A:

Use the mean-variance optimization model to generate an efficient frontier of the three assets SPDR S&P 500 ETF (SPY), iShares Core US Treasury Bond (GOVT) and iShares MSCI Emerging Markets Mini Vol (EEMV).

Let,

X_i (Decision Variables) = fraction of total investment on asset i
μ_i = Expected Return of asset i
σ_{ij} = Covariance of return of assets i and j
r_p = Desired Expected Return of Portfolio
σ_p = Standard Deviation of Portfolio

Asset Details:

Asset	SPDR S&P 500 ETF (SPY)	iShares Core US Treasury Bond (GOVT)	iShares MSCI Emerging Markets Mini Vol (EEMV)
Expected Return	0.008323	0.002543	0.002318

Covariance	SPDR S&P 500 ETF (SPY)	iShares Core US Treasury Bond (GOVT)	iShares MSCI Emerging Markets Mini Vol (EEMV)
SPY	0.001049006	-9.13E-05	0.000637574
GOVT	-9.13E-05	9.04E-05	5.04E-06
EEMV	0.000637574	5.04E-06	0.000979649

Table 1: Asset Details

Finding Minimum Risk Possible with the above three assets (Without Short Sell)

Cost Function:
$\sigma_{11}X_1^2 + \sigma_{22}X_2^2 + \sigma_{33}X_3^2 + 2\sigma_{12}X_1X_2 + 2\sigma_{13}X_1X_3 + 2\sigma_{23}X_2X_3$
i.e.
$0.001049006X_1^2 + 0.0000904X_2^2 + 0.000979649X_3^2 + 2*(-0.0000913)X_1X_2 + 2*(0.000637574)X_1X_3 + 2*(0.00000504)X_2X_3$

Constraints:
Objective is to **minimize** the cost function subject to the following constraints:

1. The sum of fractions total investments in different assets = 1
   i.e. $X_1 + X_2 + X_3 = 1$

2. No Short Selling
   i.e. $X_1 \geq 0, X_2 \geq 0, X_3 \geq 0$

MATLAB Code and Output
Please refer Appendix 1.

Results:
Minimum Possible Risk: 0.0081
Return at Minimum Risk: 0.0033

Finding Maximum Return Possible with the above three assets (Without Short Sell)

Cost Function:
$\mu_1 X_1 + \mu_2 X_2 + \mu_3 X_3$
i.e.
$0.008323X_1 + 0.002543X_2 + 0.002318 X_3$

Constraints:
Objective is to **maximize** the cost function subject to the following constraints:

1. The sum of fractions total investments in different assets = 1
   i.e. $X_1 + X_2 + X_3 = 1$

2. No Short Selling
   i.e. $X_1 \geq 0, X_2 \geq 0, X_3 \geq 0$

MATLAB Code and Output
Please refer Appendix 2.

Results:
Maximum Possible Return: 0.0083
Risk at Max Return: 0.0324

Conclusion:
The Return of the portfolio of above three assets varies from 0.0033 to 0.0083

Generate an Efficient Frontier of the Three Assets

Cost Function:
$\sigma_{11}X_1^2 + \sigma_{22}X_2^2 + \sigma_{33}X_3^2 + 2\sigma_{12}X_1X_2 + 2\sigma_{13}X_1X_3 + 2\sigma_{23}X_2X_3$
i.e.
$0.001049006X_1^2 + 0.0000904X_2^2 + 0.000979649X_3^2 + 2*(-0.0000913)X_1X_2 + 2*(0.000637574)X_1X_3 + 2*(0.00000504)X_2X_3$

Constraints:
Objective is to **minimize** the cost function subject to the following constraints:

1. The sum of fractions total investments in different assets = 1
   i.e. $X_1 + X_2 + X_3 = 1$

2. Expected Return of portfolio = r_p
   i.e. $\mu_1 X_1 + \mu_2 X_2 + \mu_3 X_3 = r_p$

3. No Short Selling

i.e. $X_1 \geq 0$, $X_2 \geq 0$, $X_3 \geq 0$

MATLAB Code and Output

Please refer Appendix 3.

Results:

Expected Return	X_1	X_2	X_3 (*10^{-3})	Risk(std)
0.0033	0.1310	0.8687	0.2577	0.0081
0.0035	0.1656	0.8344	0.0014	0.0082
0.0037	0.2002	0.7998	0.0001	0.0084
0.0039	0.2348	0.7652	0.0116	0.0088
0.0041	0.2694	0.7306	0.0048	0.0094
0.0043	0.3040	0.6960	0.0007	0.0101
0.0045	0.3386	0.6614	0.0004	0.0109
0.0047	0.3732	0.6268	0.0002	0.0118
0.0049	0.4078	0.5922	0.0001	0.0127
0.0051	0.4424	0.5576	0.0001	0.0137
0.0053	0.4770	0.5230	0.0000	0.0148
0.0055	0.5116	0.4884	0.0000	0.0158
0.0057	0.5462	0.4537	0.0254	0.0169
0.0059	0.5808	0.4192	0.0148	0.0180
0.0061	0.6154	0.3846	0.0088	0.0192
0.0063	0.6500	0.3500	0.0053	0.0203
0.0065	0.6846	0.3154	0.0033	0.0215
0.0067	0.7192	0.2808	0.0021	0.0226
0.0069	0.7538	0.2462	0.0013	0.0238
0.0071	0.7884	0.2116	0.0008	0.0250
0.0073	0.8230	0.1770	0.0004	0.0262
0.0075	0.8576	0.1424	0.0002	0.0274
0.0077	0.8922	0.1078	0.0000	0.0286
0.0079	0.9268	0.0732	0.0000	0.0298
0.0081	0.9614	0.0386	0.0006	0.0310
0.0083	0.9960	0.0040	0.0000	0.0322

Table 2: Portfolio

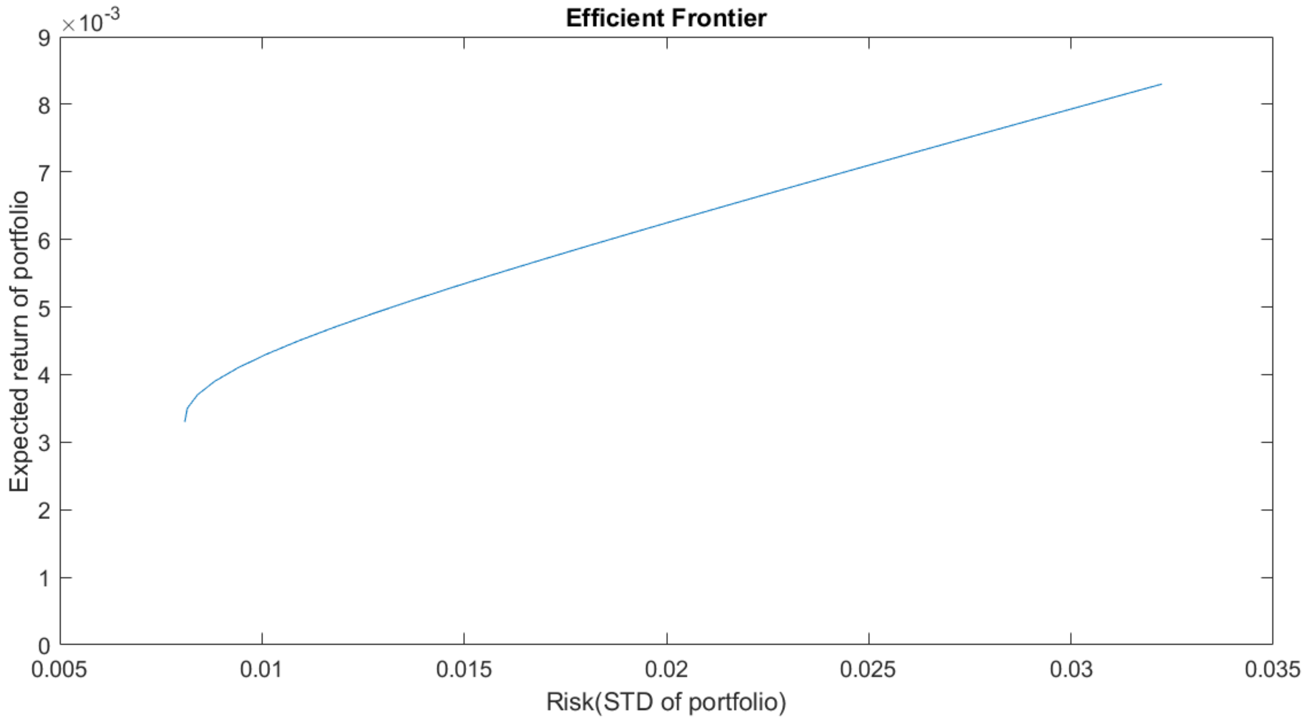

Figure 1: Efficient Frontier

PART-B:

Use the mean-variance optimization model to generate an efficient frontier of the three assets SPDR S&P 500 ETF (SPY), iShares Core US Treasury Bond (GOVT), iShares MSCI Emerging Markets Mini Vol (EEMV), CME Group (CME), Broadridge Financial Solutions (BR), Cboe Global Markets (CBOE), Intercontinental Exchange (ICE) and Accenture (ACN)

Let,

X_i (Decision Variables) = fraction of total investment on asset i
μ_i = Expected Return of asset i
σ_{ij} = Covariance of return of assets i and j
r_p = Desired Expected Return of Portfolio
σ_p = Standard Deviation of Portfolio

Asset Details:

Asset	**SPY**	**GOVT**	**EEMV**	**CME**	**BR**	**CBOE**	**ICE**	**ACN**
Expected Return	0.008323	0.002543	0.002318	0.014734	0.01709	0.011271	0.013602	0.014154

Covariance	**SPY**	**GOVT**	**EEMV**	**CME**	**BR**	**CBOE**	**ICE**	**ACN**
SPY	0.001049006	-9.13E-05	0.000637574	0.000167	0.000829	0.000155	0.000466	0.001056
GOVT	-9.13E-05	9.04E-05	5.04E-06	-5.65E-05	8.59E-05	4.90E-05	-9.54E-05	-2.48E-05
EEMV	0.000637574	5.04E-06	0.000979649	-0.00021	0.000551	-0.00012	1.29E-05	0.0005
CME	0.000167	-5.65E-05	-0.00021	0.001942	0.00082	0.00108	0.000969	0.000254
BR	0.000829	8.59E-05	0.000551	0.00082	0.002788	0.000429	0.000566	0.001178
CBOE	0.000155	4.90E-05	-0.00012	0.00108	0.000429	0.00338	0.000745	0.000272
ICE	0.000466	-9.54E-05	1.29E-05	0.000969	0.000566	0.000745	0.002011	0.000801
ACN	0.001056	-2.48E-05	0.0005	0.000254	0.001178	0.000272	0.000801	0.002065

Table 3: Asset Details

Finding Minimum Risk Possible with the above eight assets (Without Short Sell)

Cost Function:

$$\sigma_{11}X_1^2 + \sigma_{22}X_2^2 + \sigma_{33}X_3^2 + \sigma_{44}X_4^2 + \sigma_{55}X_5^2 + \sigma_{66}X_6^2 + \sigma_{77}X_7^2 + \sigma_{88}X_8^2 + 2\sigma_{12}X_1X_2 + 2\sigma_{13}X_1X_3 + 2\sigma_{14}X_1X_4 + 2\sigma_{15}X_1X_5 + 2\sigma_{16}X_1X_6 + 2\sigma_{17}X_1X_7 + 2\sigma_{18}X_1X_8 + 2\sigma_{23}X_2X_3 + 2\sigma_{24}X_2X_4 + 2\sigma_{25}X_2X_5 + 2\sigma_{26}X_2X_6 + 2\sigma_{27}X_2X_7 + 2\sigma_{28}X_2X_8 + 2\sigma_{34}X_3X_4 + 2\sigma_{35}X_3X_5 + 2\sigma_{36}X_3X_6 + 2\sigma_{37}X_3X_7 + 2\sigma_{38}X_3X_8 + 2\sigma_{45}X_4X_5 + 2\sigma_{46}X_4X_6 + 2\sigma_{47}X_4X_7 + 2\sigma_{48}X_4X_8 + 2\sigma_{56}X_5X_6 + 2\sigma_{57}X_5X_7 + 2\sigma_{58}X_5X_8 + 2\sigma_{67}X_6X_7 + 2\sigma_{68}X_6X_8 + 2\sigma_{78}X_7X_8$$

i.e.

$$0.001049006X_1^2 + (0.0000904)X_2^2 + 0.000979649X_3^2 + 0.001942X_4^2 + 0.002788X_5^2 + 0.00338X_6^2 + 0.002011X_7^2 + 0.002065X_8^2 + 2*(-0.0000913)X_1X_2 + 2*(0.000637574)X_1X_3 + 2*(0.000167)X_1X_4 + 2*0.000829*X_1X_5 + 2*0.000155*X_1X_6 + 2*0.000466*X_1X_7 + 2*0.001056*X_1X_8 + 2*0.00000504*X_2X_3 + 2*-0.0.0000565*X_2X_4 + 2*0.0000859*X_2X_5 + 2*0.000049*X_2X_6 + 2*-0.0000954*X_2X_7 + 2*-0.0000248*X_2X_8 + 2*-0.00021*X_3X_4 + 2*0.000551*X_3X_5 + 2*-0.00012*X_3X_6 + 2*0.0000129*X_3X_7 + 2*0.0005*X_3X_8 + 2*00082*X_4X_5 + 2*0.00108*X_4X_6 + 2*000969*X_4X_7 + 2*000254*X_4X_8 + 2*0.000429*X_5X_6 + 2*0.000566*X_5X_7 + 2*0.001178*X_5X_8 + 2*0.000745*X_6X_7 + 2*0.000272*X_6X_8 + 2*0.002011*X_7X_8$$

Constraints:

Objective is to **minimize** the cost function subject to the following constraints:

1. The sum of fractions total investments in different assets = 1

   i.e. $X_1 + X_2 + X_3 + X_4 + X_5 + X_6 + X_7 + X_8 = 1$

2. No Short Selling

   i.e. $X_1 \geq 0, X_2 \geq 0, X_3 \geq 0, X_4 \geq 0, X_5 \geq 0, X_6 \geq 0, X_7 \geq 0, X_8 \geq 0$

MATLAB Code and Output

Please refer Appendix 4.

Results:

Minimum Possible Risk: 0.0078

Return at Minimum Risk: 0.0039

Finding Maximum Return Possible with the above eight assets (Without Short Sell)

Cost Function:

$$\mu_1 X_1 + \mu_2 X_2 + \mu_3 X_3 + \mu_4 X_4 + \mu_5 X_5 + \mu_6 X_6 + \mu_7 X_7 + \mu_8 X_8$$

i.e.

$$0.008323X_1 + 0.002543X_2 + 0.002318X_3 + 0.014734X_4 + 0.01709X_5 + 0.011271X_6 + 0.013602X_7 + 0.014154X_8$$

Constraints:

Objective is to **maximize** the cost function subject to the following constraints:

1. The sum of fractions total investments in different assets = 1

   i.e. $X_1 + X_2 + X_3 + X_4 + X_5 + X_6 + X_7 + X_8 = 1$

2. No Short Selling

   i.e. $X_1 \geq 0, X_2 \geq 0, X_3 \geq 0, X_4 \geq 0, X_5 \geq 0, X_6 \geq 0, X_7 \geq 0, X_8 \geq 0$

MATLAB Code and Output

Please refer Appendix 5.

Results:

Maximum Possible Return: 0.0171

Risk at Max Return: 0.0528

Conclusion:

The Return of the portfolio of above three assets varies from 0.0039 to 0.0171

<u>Generate an Efficient Frontier of the Eight Assets</u>

Cost Function:

$\sigma_{11}X_1^2 + \sigma_{22}X_2^2 + \sigma_{33}X_3^2 + \sigma_{44}X_4^2 + \sigma_{55}X_5^2 + \sigma_{66}X_6^2 + \sigma_{77}X_7^2 + \sigma_{88}X_8^2 + 2\sigma_{12}X_1X_2 + 2\sigma_{13}X_1X_3 + 2\sigma_{14}X_1X_4 + 2\sigma_{15}X_1X_5 + 2\sigma_{16}X_1X_6 + 2\sigma_{17}X_1X_7 + 2\sigma_{18}X_1X_8 + 2\sigma_{23}X_2X_3 + 2\sigma_{24}X_2X_4 + 2\sigma_{25}X_2X_5 + 2\sigma_{26}X_2X_6 + 2\sigma_{27}X_2X_7 + 2\sigma_{28}X_2X_8 + 2\sigma_{34}X_3X_4 + 2\sigma_{35}X_3X_5 + 2\sigma_{36}X_3X_6 + 2\sigma_{37}X_3X_7 + 2\sigma_{38}X_3X_8 + 2\sigma_{45}X_4X_5 + 2\sigma_{46}X_4X_6 + 2\sigma_{47}X_4X_7 + 2\sigma_{48}X_4X_8 + 2\sigma_{56}X_5X_6 + 2\sigma_{57}X_5X_7 + 2\sigma_{58}X_5X_8 + 2\sigma_{67}X_6X_7 + 2\sigma_{68}X_6X_8 + 2\sigma_{78}X_7X_8$

i.e.

$0.001049006X_1^2 + (0.0000904)X_2^2 + 0.000979649X_3^2 + 0.001942X_4^2 + 0.002788X_5^2 + 0.00338X_6^2 + 0.002011X_7^2 + 0.002065X_8^2 + 2*(-0.0000913)X_1X_2 + 2*(0.000637574)X_1X_3 + 2*(0.000167)X_1X_4 + 2*0.000829*X_1X_5 + 2*0.000155*X_1X_6 + 2*0.000466*X_1X_7 + 2*0.001056*X_1X_8 + 2*0.00000504*X_2X_3 + 2*-0.0.0000565*X_2X_4 + 2*0.0000859*X_2X_5 + 2*0.000049*X_2X_6 + 2*-0.0000954*X_2X_7 + 2*-0.0000248*X_2X_8 + 2*-0.00021*X_3X_4 + 2*0.000551*X_3X_5 + 2*-0.00012*X_3X_6 + 2*0.0000129*X_3X_7 + 2*0.0005*X_3X_8 + 2*00082*X_4X_5 + 2*0.00108*X_4X_6 + 2*000969*X_4X_7 + 2*000254*X_4X_8 + 2*0.000429*X_5X_6 + 2*0.000566*X_5X_7 + 2*0.001178*X_5X_8 + 2*0.000745*X_6X_7 + 2*0.000272*X_6X_8 + 2*0.002011*X_7X_8$

Constraints:

Objective is to **minimize** the cost function subject to the following constraints:

1. The sum of fractions total investments in different assets = 1

   i.e. $X_1 + X_2 + X_3 + X_4 + X_5 + X_6 + X_7 + X_8 = 1$

2. Expected Return of portfolio = r_p

   i.e. $\mu_1 X_1 + \mu_2 X_2 + \mu_3 X_3 + \mu_4 X_4 + \mu_5 X_5 + \mu_6 X_6 + \mu_7 X_7 + \mu_8 X_8 = r_p$

3. No Short Selling

   i.e. $X_1 \geq 0, X_2 \geq 0, X_3 \geq 0, X_4 \geq 0, X_5 \geq 0, X_6 \geq 0, X_7 \geq 0, X_8 \geq 0$

MATLAB Code and Output

Please refer Appendix 6.

Results:

Expected Return	X_1	X_2	$X_3 * 10^{-5}$	X_4	X_5	X_6	X_7	X_8	Risk(std)
0.0039	0.1123	0.8269	0.3512	0.0321	0.0000	0.0000	0.0286	0.0000	0.0078
0.0044	0.124	0.7760	0.0264	0.0584	0.0000	0.0001	0.0408	0.0000	0.0080
0.0050	0.136	0.7255	0.0264	0.0846	0.0000	0.0000	0.0528	0.0010	0.0086
0.0055	0.123	0.6870	0.0114	0.1062	0.0000	0.0000	0.0569	0.0259	0.0095
0.0060	0.109	0.6501	0.0898	0.1258	0.0029	0.0002	0.0610	0.0500	0.0105
0.0065	0.094	0.6164	0.0028	0.1394	0.0159	0.0000	0.0666	0.0678	0.0116
0.0071	0.078	0.5826	0.0222	0.1528	0.0289	0.0002	0.0721	0.0854	0.0128
0.0076	0.062	0.5485	0.0384	0.1657	0.0420	0.0012	0.0775	0.1029	0.0141
0.0081	0.046	0.5142	0.0072	0.1780	0.0552	0.0034	0.0827	0.1204	0.0154
0.0087	0.030	0.4795	0.0804	0.1898	0.0683	0.0064	0.0878	0.1377	0.0167
0.0092	0.015	0.4448	0.2472	0.2019	0.0814	0.0089	0.0929	0.1549	0.0180
0.0097	0.001	0.4094	0.0176	0.2141	0.0944	0.0114	0.0980	0.1715	0.0193
0.0102	0.000	0.3672	0.0656	0.2269	0.1067	0.0143	0.1022	0.1824	0.0207
0.0108	0.000	0.3247	0.0073	0.2397	0.1190	0.0171	0.1064	0.1931	0.0221
0.0113	0.000	0.2821	0.0008	0.2525	0.1312	0.0199	0.1106	0.2037	0.0234
0.0118	0.000	0.2394	0.0003	0.2653	0.1434	0.0228	0.1147	0.2143	0.0248
0.0123	0.000	0.1968	0.0001	0.2782	0.1557	0.0256	0.1189	0.2249	0.0262
0.0129	0.000	0.1542	0.0001	0.2910	0.1679	0.0284	0.1230	0.2354	0.0277
0.0134	0.000	0.1115	0.0004	0.3038	0.1802	0.0313	0.1272	0.2460	0.0291
0.0139	0.000	0.0689	0.0193	0.3166	0.1924	0.0341	0.1314	0.2566	0.0305
0.0145	0.000	0.0262	0.0003	0.3294	0.2047	0.0370	0.1355	0.2672	0.0320
0.0150	0.000	0.0000	0.0058	0.3522	0.2488	0.0099	0.1308	0.2583	0.0335
0.0155	0.000	0.0000	0.0049	0.3424	0.4106	0.0000	0.0769	0.1701	0.0361
0.0160	0.000	0.0000	0.0000	0.3251	0.5827	0.0000	0.0175	0.0747	0.0402
0.0166	0.000	0.0000	0.0000	0.2200	0.7800	0.0000	0.0000	0.0000	0.0455
0.0171	0.000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0528

Table 4: Portfolio

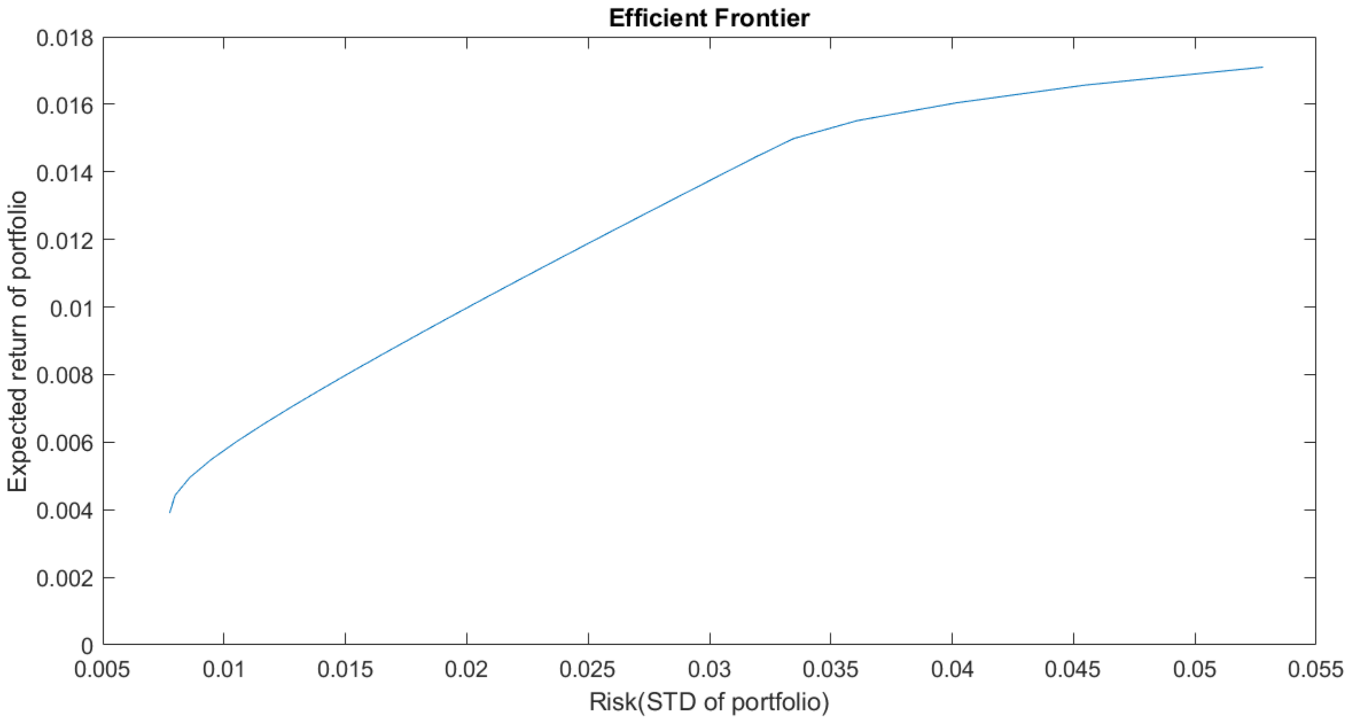

Figure 2: Efficient Frontier

Comparison:

Including stocks in second part, reduces the risk associated with the portfolio with the same expected mean. In other words, for the same risk the portfolio has higher expected return. This is concurrent with the fact that holding a portfolio of assets is advantageous as compared to investing in few assets.

APPENDIX 1

```
%Finding Minimum Risk Possible with the above three assets (Without Short Sell)

clc;
clear all;

%Objective Function's Coefficient
H = [0.001049006,-9.13e-05,0.000637574;
     -9.13e-05,9.04e-05,5.04e-06;
     0.000637574,5.04e-06,0.000979649];

%Expected Return of Assets
m = [0.008322946,0.002542663,0.002317918];


%Inequality Constraints
A=[];
b=[];

% Linear Term Coefficients
c=[]';

%Equality Constraints
Aeq=[1,1,1];
beq = [1];

%Variable Bound
ub = [inf; inf; inf;];
lb = [0; 0;0]; % without short selling

%Calling quadprog library to optimize
[x, fval2] = quadprog(H, c, A, b, Aeq, beq, lb, ub);

%Calculating Risk(std)
v=sqrt(x'*H*x);

%Calculating Return
r=m*x;

%Displaying Results
fprintf('Minimum Possible Risk of Portolio:');
disp(v)
fprintf('Return at Minimum Risk:')
disp(r)
```

```
Minimum Possible Risk of Portolio:    0.0081

Return at Minimum Risk:    0.0033
```

APPENDIX 2

```
%Finding Maximum Return Possible with the above three assets (Without Short Sell)

clc;
clear all;

%Objective Function's Coefficient
f = [0.008322946,0.002542663,0.002317918].*(-1);

%Covariances
H = [0.001049006,-9.13e-05,0.000637574;
     -9.13e-05,9.04e-05,5.04e-06;
     0.000637574,5.04e-06,0.000979649];

%Inequality Constraints
A=[];
b=[];


%Equality Constraints
Aeq=[1,1,1];
beq = [1];

%Variable Bound
ub = [inf; inf; inf;];
lb = [0; 0;0]; % without short selling

%Calling quadprog library to optimize
[x,val]=linprog(f,A,b,Aeq,beq,lb,ub);

%Calculating Risk
risk = sqrt(x'*H*x);

%Displaying Results
fprintf('Maximum Possible Return:');
disp(-val)
fprintf('Risk at Max Return:')
disp(risk)
```

```
Optimal solution found.

Maximum Possible Return:    0.0083

Risk at Max Return:    0.0324
```

APPENDIX 3

```
%Use the mean-variance optimization model to generate an efficient
%frontier of the three assets SPDR S&P 500 ETF (SPY), iShares Core US Treasury Bond (GOVT)
%and iShares MSCI Emerging Markets Mini Vol (EEMV).

clc;
clear all;

%Objective Function's Coefficient
H = [0.001049006,-9.13e-05,0.000637574;
     -9.13e-05,9.04e-05,5.04e-06;
     0.000637574,5.04e-06,0.000979649];

%Inequality Constraints
A=[];
b=[];

% Linear Term Coefficients
c=[]';

%Equality Constraints
Aeq=[0.008322946, 0.002542663, 0.002317918;
    1,1,1];

%Variable Bound
ub = [inf; inf; inf;];
lb = [0; 0;0]; % without short selling


std=[]; %To store std deviations
weights=[] %To store weights

% Running Loop for different Expected Return of Portfolio
for r=[0.0033:0.0002:0.0083]

    beq = [r;1];

    %Calling quadprog library to optimize
    [x, fval2] = quadprog(H, c, A, b, Aeq, beq, lb, ub);
    v= (x'*H*x );
    weights=[weights;x'];
    std=[std,sqrt(v)];
end

% Plotting Effiecient Frontier
plot(std,[0.0033:0.0002:0.0083]);
ylim([0 0.009]);
xlabel('Risk(STD of portfolio)')
ylabel('Expected return of portfolio')
title('Efficient Frontier')

% Displaying Results
result=array2table([[0.0033:0.0002:0.0083]',weights,std'],...
    'VariableNames',{'Expected_Return_of_Portfolio','X1','X2','X3','STD_of_Portfolio'})
```

APPENDIX 4

```
%Finding Minimum Risk Possible with the above eight assets (Without Short Sell)

clc;
clear all;

%Objective Function's Coefficient
H = [0.001049006,-9.13e-05,0.000637574,0.000167142,0.000829194,0.000155484,0.000465748,0.001055922;
-9.13e-05,9.04e-05,5.04e-06,-5.65e-05,8.59e-05,4.90e-05,-9.54e-05,-2.48e-05;
0.000637574,5.04e-06,0.000979649,-0.000209242,0.000551047,-0.000120595,1.29e-05,0.0004995;
0.000167142,-5.65e-05,-0.000209242,0.001941622,0.00082004,0.001080395,0.000968508,0.000254312;
0.000829194,8.59e-05,0.000551047,0.00082004,0.002787938,0.000429,0.000565742,0.00117817;
0.000155484,4.90e-05,-0.000120595,0.001080395,0.000429,0.003380142,0.000744647,0.000272206;
0.000465748,-9.54e-05,1.29e-05,0.000968508,0.000565742,0.000744647,0.002011436,0.000801188;
0.001055922,-2.48e-05,0.0004995,0.000254312,0.00117817,0.000272206,0.000801188,0.002065123];

%Expected Return of Assets
m = [0.008322946,0.002542663,0.002317918,0.014734132,0.017090435,0.011271019,0.013601989,0.014154253];

 %Inequality Constraints
A=[];
b=[];

% Linear Term Coefficients
c=[]';

%Equality Constraints
Aeq=ones(1,8);
beq = [1];

%Variable Bound
ub = Inf(8,1);
lb = zeros(8,1); % without short selling

%Calling quadprog library to optimize
[x, fval2] = quadprog(H, c, A, b, Aeq, beq, lb, ub);

%Calculating Risk
v=sqrt(x'*H*x);

%Calculating Return
r=m*x;

%Displaying Results
fprintf('Minimum Possible Risk of Portolio:');
disp(v)
fprintf('Return at Minimum Risk:')
disp(r)
```

```
Minimum Possible Risk of Portolio:    0.0078

Return at Minimum Risk:    0.0039
```

APPENDIX 5

```
%Finding Maximum Return Possible with the above eight assets (Without Short Sell)

clc;
clear all;

%Objective Function's Coefficient
f = [0.008322946,0.002542663,0.002317918,0.014734132,0.017090435,0.011271019,0.013601989,0.014154253].*(-1);

%Covariances
H = [0.001049006,-9.13e-05,0.000637574,0.000167142,0.000829194,0.000155484,0.000465748,0.001055922;
-9.13e-05,9.04e-05,5.04e-06,-5.65e-05,8.59e-05,4.90e-05,-9.54e-05,-2.48e-05;
0.000637574,5.04e-06,0.000979649,-0.000209242,0.000551047,-0.000120595,1.29e-05,0.0004995;
0.000167142,-5.65e-05,-0.000209242,0.001941622,0.00082004,0.001080395,0.000968508,0.000254312;
0.000829194,8.59e-05,0.000551047,0.00082004,0.002787938,0.000429,0.000565742,0.00117817;
0.000155484,4.90e-05,-0.000120595,0.001080395,0.000429,0.003380142,0.000744647,0.000272206;
0.000465748,-9.54e-05,1.29e-05,0.000968508,0.000565742,0.000744647,0.002011436,0.000801188;
0.001055922,-2.48e-05,0.0004995,0.000254312,0.00117817,0.000272206,0.000801188,0.002065123];


 %Inequality Constraints
A=[];
b=[];


%Equality Constraints
Aeq=ones(1,8);
beq = [1];

%Variable Bound
ub = Inf(8,1);
lb = zeros(8,1); % without short selling

%Calling quadprog library to optimize
[x,val]=linprog(f,A,b,Aeq,beq,lb,ub);

%Calculating Risk
risk=sqrt(x'*H*x);

%Displaying Results
fprintf('Maximum Possible Return:');
disp(-val)
fprintf('Risk at Max Return:')
disp(risk)
```

```
Optimal solution found.

Maximum Possible Return:    0.0171

Risk at Max Return:    0.0528
```

APPENDIX 6

```
%Use the mean-variance optimization model to generate an efficient frontier of the three assets
%SPDR S&P 500 ETF (SPY), iShares Core US Treasury Bond (GOVT), iShares MSCI Emerging Markets Mini Vol (EEMV),
%CME Group (CME), Broadridge Financial Solutions (BR), Cboe Global Markets (CBOE), Intercontinental Exchange (ICE)
%and Accenture (ACN)
clc;
clear all;

%Objective Function's Coefficient
H = [0.001049006,-9.13e-05,0.000637574,0.000167142,0.000829194,0.000155484,0.000465748,0.001055922;
-9.13e-05,9.04e-05,5.04e-06,-5.65e-05,8.59e-05,4.90e-05,-9.54e-05,-2.48e-05;
0.000637574,5.04e-06,0.000979649,-0.000209242,0.000551047,-0.000120595,1.29e-05,0.0004995;
0.000167142,-5.65e-05,-0.000209242,0.001941622,0.00082004,0.001080395,0.000968508,0.000254312;
0.000829194,8.59e-05,0.000551047,0.00082004,0.002787938,0.000429,0.000565742,0.00117817;
0.000155484,4.90e-05,-0.000120595,0.001080395,0.000429,0.003380142,0.000744647,0.000272206;
0.000465748,-9.54e-05,1.29e-05,0.000968508,0.000565742,0.000744647,0.002011436,0.000801188;
0.001055922,-2.48e-05,0.0004995,0.000254312,0.00117817,0.000272206,0.000801188,0.002065123];

%Inequality Constraints
A=[];
b=[];
% Linear Term Coefficients
c=[]';
%Equality Constraints
Aeq=[0.008322946,0.002542663,0.002317918,0.014734132,0.017090435,0.011271019,0.013601989,0.014154253;
    1,1,1,1,1,1,1,1];

%Variable Bound
ub = [inf; inf; inf;inf;inf;inf;inf;inf;];
lb = zeros(8,1); % without short selling

std=[];%To store STD
weights=[]; %To store weights

% Running Loop for different Expected Return of Portfolio
for r=[0.0039:0.000528:0.0171]
    beq = [r;1];

    %Calling quadprog library to optimize
    [x, fval] = quadprog(H, c, A, b, Aeq, beq, lb, ub);

    v= (x'*H*x );
    weights=[weights;x'];
    std=[std,sqrt(v)];
end
% Plotting Effiecient Frontier
plot(std,[0.0039:0.000528:0.0171])
ylim([0 0.018]);
xlabel('Risk(STD of portfolio)')
ylabel('Expected return of portfolio')
title('Efficient Frontier')

% Displaying Results
result=array2table([[0.0039:0.000528:0.0171]',weights,std'],...
    'VariableNames',{'Expected_Return_of_Portfolio','X1',...
    'X2','X3','X4','X5','X6','X7','X8','STD_of_Portfolio'})
```

APPENDIX 7: ASSETS DETAILS

SPY											
Date	Adj Close	Date	Adj Close	Date	Adj Close	Date	Adj Close	Month	Return	Month	Return
1/2/2014	163.3833	10/1/2015	177.517	7/3/2017	232.0807	4/1/2019	283.139	Jan-14	-0.02591	Jul-17	0.018827
1/31/2014	159.1496	10/30/2015	192.1152	7/31/2017	236.45	4/30/2019	291.2519	Feb-14	0.069587	Aug-17	0.000687
2/3/2014	155.5679	11/2/2015	194.3881	8/1/2017	236.977	5/1/2019	289.0627	Mar-14	0.015436	Sep-17	0.018709
2/28/2014	166.3934	11/30/2015	192.8174	8/31/2017	237.1399	5/31/2019	272.6784	Apr-14	0.000319	Oct-17	0.019142
3/3/2014	165.2233	12/1/2015	194.6561	9/1/2017	237.4753	6/3/2019	271.985	May-14	0.023098	Nov-17	0.029205
3/31/2014	167.7737	12/31/2015	189.4851	9/29/2017	241.9181	6/28/2019	291.6531	Jun-14	0.019481	Dec-17	0.014233
4/1/2014	168.8862	1/4/2016	186.8362	10/2/2017	242.9678	7/1/2019	294.3009	Jul-14	-0.02	Jan-18	0.048852
4/30/2014	168.94	1/29/2016	180.0512	10/31/2017	247.6187	7/31/2019	296.0628	Aug-14	0.042649	Feb-18	-0.03527
5/1/2014	168.9579	2/1/2016	179.9861	11/1/2017	247.9461	8/1/2019	293.4847	Sep-14	-0.0133	Mar-18	-0.01306
5/30/2014	172.8605	2/29/2016	179.9025	11/30/2017	255.1874	8/30/2019	291.1057	Oct-14	0.037613	Apr-18	0.027343
6/2/2014	173.0579	3/1/2016	184.1315	12/1/2017	254.6578	9/3/2019	289.4035	Nov-14	0.026912	May-18	0.022492
6/30/2014	176.4292	3/31/2016	192.0039	12/29/2017	258.2823	9/30/2019	296.77	Dec-14	0.004444	Jun-18	-0.00403
7/1/2014	177.6101	4/1/2016	193.3118	1/2/2018	260.131	10/1/2019	293.24	Jan-15	-0.02911	Jul-18	0.034834
7/31/2014	174.0584	4/29/2016	192.7606	1/31/2018	272.8389	10/31/2019	303.33	Feb-15	0.043285	Aug-18	0.033647
8/1/2014	173.5266	5/2/2016	194.2927	2/1/2018	272.5291			Mar-15	-0.02188	Sep-18	0.007681
8/29/2014	180.9274	5/31/2016	196.0397	2/28/2018	262.9184			Apr-15	0.013418	Oct-18	-0.07233
9/2/2014	180.8372	6/1/2016	196.4415	3/1/2018	259.0953			May-15	0.001993	Nov-18	0.007824
9/30/2014	178.4312	6/30/2016	196.7211	3/29/2018	255.7117			Jun-15	-0.0223	Dec-18	-0.09997
10/1/2014	176.0131	7/1/2016	197.1344	4/2/2018	250.1922			Jul-15	0.014458	Jan-19	0.078943
10/31/2014	182.6335	7/29/2016	203.8958	4/30/2018	257.0332			Aug-15	-0.05777	Feb-19	0.031919
11/3/2014	182.7331	8/1/2016	203.7268	5/1/2018	257.4899			Sep-15	0.004465	Mar-19	0.011783
11/28/2014	187.6508	8/31/2016	204.1399	5/31/2018	263.2814			Oct-15	0.082236	Apr-19	0.028653
12/1/2014	186.3466	9/1/2016	204.1494	6/1/2018	265.8663			Nov-15	-0.00808	May-19	-0.05668
12/31/2014	187.1748	9/30/2016	204.1518	6/29/2018	264.7955			Dec-15	-0.02656	Jun-19	0.072313
1/2/2015	187.0746	10/3/2016	203.661	7/2/2018	265.3617			Jan-16	-0.03631	Jul-19	0.005987
1/30/2015	181.6289	10/31/2016	200.6124	7/31/2018	274.6053			Feb-16	-0.00046	Aug-19	-0.00811
2/2/2015	183.8782	11/1/2016	199.1589	8/1/2018	274.1465			Mar-16	0.042754	Sep-19	0.025454
2/27/2015	191.8373	11/30/2016	208.0027	8/31/2018	283.3706			Apr-16	-0.00285	Oct-19	0.034409
3/2/2015	193.0485	12/1/2016	207.2382	9/4/2018	282.8826			May-16	0.008992		
3/31/2015	188.8244	12/30/2016	212.2193	9/28/2018	285.0555			Jun-16	0.001423		
4/1/2015	188.1567	1/3/2017	213.8428	10/1/2018	286.0458			Jul-16	0.034299		
4/30/2015	190.6813	1/31/2017	216.0169	10/31/2018	265.3569			Aug-16	0.002028		
5/1/2015	192.7485	2/1/2017	216.1023	11/1/2018	268.1808			Sep-16	1.19E-05		
5/29/2015	193.1327	2/28/2017	224.5045	11/30/2018	270.2791			Oct-16	-0.01497		
6/1/2015	193.526	3/1/2017	227.647	12/3/2018	273.8579			Nov-16	0.044405		
6/30/2015	189.2097	3/31/2017	224.7851	12/31/2018	246.4814			Dec-16	0.024036		
7/1/2015	190.7264	4/3/2017	224.3942	1/2/2019	246.7378			Jan-17	0.010167		
7/31/2015	193.4839	4/28/2017	227.0164	1/31/2019	266.2161			Feb-17	0.038881		
8/3/2015	192.8312	5/1/2017	227.5885	2/1/2019	266.3443			Mar-17	-0.01257		
8/31/2015	181.691	5/31/2017	230.2202	2/28/2019	274.8457			Apr-17	0.011686		
9/1/2015	176.2679	6/1/2017	232.051	3/1/2019	276.5618			May-17	0.011564		
9/30/2015	177.0549	6/30/2017	231.6879	3/29/2019	279.8206			Jun-17	-0.00156		

GOVT											
Date	Adj Close	Date	Adj Close	Date	Adj Close	Date	Adj Close	Month	Return	Month	Return
½/2014	22.25642	11/2/2015	23.60197	9/1/2017	24.36528	7/1/2019	25.57659	Jan-14	0.012346	Sep-17	-0.00708
1/31/2014	22.5312	11/30/2015	23.57389	9/29/2017	24.19276	7/31/2019	25.6064	Feb-14	-0.00122	Oct-17	-0.00159
2/3/2014	22.62562	12/1/2015	23.63763	10/2/2017	24.1678	8/1/2019	25.79749	Mar-14	-0.00567	Nov-17	-0.00199
2/28/2014	22.59812	12/31/2015	23.51389	10/31/2017	24.1294	8/30/2019	26.46433	Apr-14	0.007755	Dec-17	-0.00134
3/3/2014	22.63574	¼/2016	23.57018	11/1/2017	24.16401	9/3/2019	26.50719	May-14	0.007293	Jan-18	-0.0104
3/31/2014	22.50728	1/29/2016	24.02058	11/30/2017	24.11595	9/30/2019	26.248	Jun-14	-0.00121	Feb-18	-0.00325
4/1/2014	22.50178	2/1/2016	23.9642	12/1/2017	24.20739	10/1/2019	26.30891	Jul-14	0	Mar-18	0.004475
4/30/2014	22.67628	2/29/2016	24.24602	12/29/2017	24.17484	10/31/2019	26.249	Aug-14	0.008468	Apr-18	-0.00972
5/1/2014	22.69007	3/1/2016	24.07693	½/2018	24.10737			Sep-14	-0.00201	May-18	0.00902
5/30/2014	22.85556	3/31/2016	24.23663	1/31/2018	23.85675			Oct-14	0.006024	Jun-18	0.004896
6/2/2014	22.8399	4/1/2016	24.20845	2/1/2018	23.76697			Nov-14	0.010004	Jul-18	-0.00326
6/30/2014	22.8123	4/29/2016	24.15208	2/28/2018	23.68975			Dec-14	0.001835	Aug-18	0.009434
7/1/2014	22.78927	5/2/2016	24.11446	3/1/2018	23.76225			Jan-15	0.023725	Sep-18	-0.00775
7/31/2014	22.78927	5/31/2016	24.1803	3/29/2018	23.86859			Feb-15	-0.01512	Oct-18	-0.00206
8/1/2014	22.86764	6/1/2016	24.16335	4/2/2018	23.91506			Mar-15	0.011485	Nov-18	0.007858
8/29/2014	23.06129	6/30/2016	24.70952	4/30/2018	23.68269			Apr-15	-0.00937	Dec-18	0.01397
9/2/2014	22.95515	7/1/2016	24.79436	5/1/2018	23.65263			May-15	0	Jan-19	0.002012
9/30/2014	22.90899	7/29/2016	24.82265	5/31/2018	23.86598			Jun-15	-0.00596	Feb-19	0
10/1/2014	23.00415	8/1/2016	24.73771	6/1/2018	23.81061			Jul-15	0.013644	Mar-19	0.02269
10/31/2014	23.14272	8/31/2016	24.64332	6/29/2018	23.92718			Aug-15	-0.00316	Apr-19	0.001597
11/3/2014	23.11221	9/1/2016	24.68018	7/2/2018	23.88728			Sep-15	0.007135	May-19	0.023544
11/28/2014	23.34342	9/30/2016	24.64237	7/31/2018	23.80944			Oct-15	-0.00433	Jun-19	0.004278
12/1/2014	23.26658	10/3/2016	24.61211	8/1/2018	23.76364			Nov-15	-0.00119	Jul-19	0.001166
12/31/2014	23.30928	10/31/2016	24.37563	8/31/2018	23.98782			Dec-15	-0.00523	Aug-19	0.025849
½/2015	23.43904	11/1/2016	24.37469	9/4/2018	23.95169			Jan-16	0.019109	Sep-19	-0.00978
1/30/2015	23.99513	11/30/2016	23.66447	9/28/2018	23.76617			Feb-16	0.01176	Oct-19	-0.00228
2/2/2015	23.93852	12/1/2016	23.61517	10/1/2018	23.71825			Mar-16	0.006633		
2/27/2015	23.57667	12/30/2016	23.65699	10/31/2018	23.66934			Apr-16	-0.00233		
3/2/2015	23.44943	1/3/2017	23.65699	11/1/2018	23.69286			May-16	0.00273		
3/31/2015	23.71875	1/31/2017	23.7329	11/30/2018	23.87903			Jun-16	0.022603		
4/1/2015	23.79778	2/1/2017	23.69966	12/3/2018	23.90259			Jul-16	0.001141		
4/30/2015	23.57467	2/28/2017	23.82315	12/31/2018	24.2365			Aug-16	-0.00382		
5/1/2015	23.50024	3/1/2017	23.68811	½/2019	24.43315			Sep-16	-0.00153		
5/29/2015	23.50024	3/31/2017	23.82124	1/31/2019	24.48231			Oct-16	-0.00961		
6/1/2015	23.43507	4/3/2017	23.89741	2/1/2019	24.41927			Nov-16	-0.02914		
6/30/2015	23.2954	4/28/2017	23.99262	2/28/2019	24.41927			Dec-16	0.001771		
7/1/2015	23.22644	5/1/2017	23.95735	3/1/2019	24.35217			Jan-17	0.003209		
7/31/2015	23.54333	5/31/2017	24.13848	3/29/2019	24.90473			Feb-17	0.00521		
8/3/2015	23.59745	6/1/2017	24.1423	4/1/2019	24.76238			Mar-17	0.00562		
8/31/2015	23.5228	6/30/2017	24.11367	4/30/2019	24.80193			Apr-17	0.003984		
9/1/2015	23.56764	7/3/2017	24.06874	5/1/2019	24.81678			May-17	0.007561		
9/30/2015	23.73578	7/31/2017	24.15476	5/31/2019	25.40105			Jun-17	-0.00119		
10/1/2015	23.77132	8/1/2017	24.20741	6/3/2019	25.50621			Jul-17	0.003574		
10/30/2015	23.66845	8/31/2017	24.40842	6/28/2019	25.61534			Aug-17	0.008303		

EEMV											
Date	Adj Close	Date	Adj Close	Date	Adj Close	Date	Adj Close	Month	Return	Month	Return
1/2/2014	49.50182	11/2/2015	47.88791	9/1/2017	55.51883	7/1/2019	59.08	Jan-14	-0.05708	Sep-17	-0.00599
1/31/2014	46.67614	11/30/2015	45.52564	9/29/2017	55.18637	7/31/2019	57.81	Feb-14	0.059836	Oct-17	0.018761
2/3/2014	45.62087	12/1/2015	45.88768	10/2/2017	55.18637	8/1/2019	57	Mar-14	0.041894	Nov-17	-0.00286
2/28/2014	48.35062	12/31/2015	44.62762	10/31/2017	56.22171	8/30/2019	56.79	Apr-14	0.008659	Dec-17	0.044011
3/3/2014	47.87967	1/4/2016	43.5821	11/1/2017	56.39269	9/3/2019	56.56	May-14	0.020548	Jan-18	0.046081
3/31/2014	49.88556	1/29/2016	43.10518	11/30/2017	56.23121	9/30/2019	57.09	Jun-14	0.021278	Feb-18	-0.043
4/1/2014	50.35651	2/1/2016	43.02264	12/1/2017	56.20271	10/1/2019	56.69	Jul-14	0.002314	Mar-18	0.020629
4/30/2014	50.79257	2/29/2016	43.1327	12/29/2017	58.67625	10/31/2019	58.36	Aug-14	0.023541	Apr-18	-0.00682
5/1/2014	50.93211	3/1/2016	44.24242	1/2/2018	59.51642			Sep-14	-0.0458	May-18	-0.00148
5/30/2014	51.97866	3/31/2016	47.11305	1/31/2018	62.25902			Oct-14	0.024184	Jun-18	-0.04846
6/2/2014	51.90889	4/1/2016	47.08553	2/1/2018	61.76651			Nov-14	-0.01838	Jul-18	0.043569
6/30/2014	53.01338	4/29/2016	47.19559	2/28/2018	59.11082			Dec-14	-0.01746	Aug-18	-0.00588
7/1/2014	53.40169	5/2/2016	47.2873	3/1/2018	58.98528			Jan-15	0.020481	Sep-18	0.014369
7/31/2014	53.52524	5/31/2016	46.01249	3/29/2018	60.20206			Feb-15	0.014155	Oct-18	-0.07301
8/1/2014	53.98416	6/1/2016	45.98497	4/2/2018	59.44881			Mar-15	0.006138	Nov-18	0.023372
8/29/2014	55.255	6/29/2016	47.46724	4/30/2018	59.04322			Apr-15	0.041855	Dec-18	-0.01904
9/2/2014	55.30795	7/1/2016	48.16378	5/1/2018	58.8887			May-15	-0.03857	Jan-19	0.065112
9/30/2014	52.7751	7/29/2016	49.30612	5/31/2018	58.80179			Jun-15	-0.02246	Feb-19	-0.00659
10/1/2014	52.18381	8/1/2016	49.29683	6/1/2018	59.20739			Jul-15	-0.03897	Mar-19	0.007137
10/31/2014	53.44582	8/31/2016	49.47329	6/29/2018	56.33821			Aug-15	-0.07407	Apr-19	0.005369
11/3/2014	53.28697	9/1/2016	49.70548	7/2/2018	55.89016			Sep-15	0.004233	May-19	-0.04066
11/28/2014	52.30736	9/30/2016	50.20699	7/31/2018	58.32525			Oct-15	0.0468	Jun-19	0.032517
12/1/2014	51.63665	10/3/2016	50.4113	8/1/2018	57.97459			Nov-15	-0.04933	Jul-19	-0.0215
12/31/2014	50.73496	10/31/2016	49.06466	8/31/2018	57.63368			Dec-15	-0.02746	Aug-19	-0.00368
1/2/2015	50.30493	11/1/2016	48.8139	9/4/2018	56.94211			Jan-16	-0.01094	Sep-19	0.009371
1/30/2015	51.33522	11/30/2016	46.64067	9/28/2018	57.7603			Feb-16	0.002558	Oct-19	0.029458
2/2/2015	51.89964	12/1/2016	46.36206	10/1/2018	57.77005			Mar-16	0.064884		
2/27/2015	52.63428	12/30/2016	46.10173	10/31/2018	53.55247			Apr-16	0.002337		
3/2/2015	52.54469	1/3/2017	46.28082	11/1/2018	54.59469			May-16	-0.02696		
3/31/2015	52.86721	1/31/2017	47.81723	11/30/2018	55.87067			Jun-16	0.032234		
4/1/2015	53.51226	2/1/2017	47.80781	12/3/2018	56.33821			Jul-16	0.023718		
4/30/2015	55.75202	2/28/2017	48.74096	12/31/2018	55.26537			Aug-16	0.00358		
5/1/2015	55.97599	3/1/2017	49.22168	1/2/2019	55.14667			Sep-16	0.01009		
5/29/2015	53.81687	3/31/2017	50.42819	1/31/2019	58.73739			Oct-16	-0.02671		
6/1/2015	53.40475	4/3/2017	50.77694	2/1/2019	58.49999			Nov-16	-0.04452		
6/30/2015	52.20514	4/28/2017	51.15398	2/28/2019	58.1142			Dec-16	-0.00562		
7/1/2015	52.25946	5/1/2017	51.26709	3/1/2019	58.21312			Jan-17	0.033198		
7/31/2015	50.22302	5/31/2017	52.12484	3/29/2019	58.62858			Feb-17	0.019519		
8/3/2015	49.73427	6/1/2017	52.5113	4/1/2019	58.95501			Mar-17	0.024512		
8/31/2015	46.05059	6/30/2017	52.62178	4/30/2019	59.27154			Apr-17	0.007425		
9/1/2015	44.90114	7/3/2017	52.78325	5/1/2019	58.87587			May-17	0.016731		
9/30/2015	45.0912	7/31/2017	54.23652	5/31/2019	56.48206			Jun-17	0.002104		
10/1/2015	45.25411	8/1/2017	54.46449	6/3/2019	57.00633			Jul-17	0.027533		
10/30/2015	47.37201	8/31/2017	55.22437	6/28/2019	58.86			Aug-17	0.013952		

CME											
Date	Adj Close	Date	Adj Close	Date	Adj Close	Date	Adj Close	Month	Return	Month	Return
1/2/2014	61.93405	11/2/2015	81.51242	9/1/2017	117.6812	7/1/2019	195.929	Jan-14	-0.04105	Sep-17	0.080245
1/31/2014	59.39187	11/30/2015	82.54368	9/29/2017	127.1245	7/31/2019	193.7663	Feb-14	0.008745	Oct-17	0.005645
2/3/2014	58.13665	12/1/2015	82.71275	10/2/2017	127.7991	8/1/2019	199.9256	Mar-14	0.004966	Nov-17	0.098428
2/28/2014	58.64508	12/31/2015	79.40276	10/31/2017	128.5206	8/30/2019	216.5594	Apr-14	-0.03124	Dec-17	-0.00382
3/3/2014	58.87548	1/4/2016	77.71129	11/1/2017	127.5555	9/3/2019	217.0278	May-14	0.018676	Jan-18	0.060018
3/31/2014	59.16787	1/29/2016	78.74545	11/30/2017	140.1105	9/30/2019	211.34	Jun-14	-0.00719	Feb-18	0.045623
4/1/2014	58.08077	2/1/2016	78.38612	12/1/2017	141.2817	10/1/2019	210.72	Jul-14	0.041555	Mar-18	0.000952
4/30/2014	56.26624	2/29/2016	80.13894	12/29/2017	140.7418	10/31/2019	205.75	Aug-14	0.03195	Apr-18	-0.00013
5/1/2014	56.49806	3/1/2016	81.12051	1/2/2018	139.5276			Sep-14	0.048269	May-18	0.040895
5/30/2014	57.5532	3/31/2016	84.72238	1/31/2018	147.9017			Oct-14	0.055542	Jun-18	-0.01759
6/2/2014	57.51322	4/1/2016	85.51624	2/1/2018	153.1344			Nov-14	-0.00177	Jul-18	-0.0297
6/30/2014	57.09995	4/29/2016	81.07063	2/28/2018	160.1209			Dec-14	0.076549	Aug-18	0.082389
7/1/2014	57.13216	5/2/2016	82.57898	3/1/2018	156.3626			Jan-15	-0.03222	Sep-18	-0.03474
7/31/2014	59.50629	5/31/2016	86.3454	3/29/2018	156.5114			Feb-15	0.101631	Oct-18	0.051593
8/1/2014	59.69942	6/1/2016	86.45124	4/2/2018	152.602			Mar-15	-0.01975	Nov-18	0.034449
8/29/2014	61.60681	6/30/2016	86.45331	4/30/2018	152.5827			Apr-15	-0.03799	Dec-18	0.013498
9/2/2014	61.76776	7/1/2016	85.50355	5/1/2018	151.4408			May-15	0.037673	Jan-19	-0.01778
9/30/2014	64.7492	7/29/2016	90.74932	5/31/2018	157.6339			Jun-15	-0.00619	Feb-19	-0.00834
10/1/2014	64.29572	8/1/2016	91.50378	6/1/2018	162.1142			Jul-15	0.024864	Mar-19	-0.09474
10/31/2014	67.86681	8/31/2016	96.17264	6/29/2018	159.2634			Aug-15	-0.02609	Apr-19	0.074152
11/3/2014	68.66038	9/1/2016	96.48328	7/2/2018	159.3314			Sep-15	0.023314	May-19	0.09595
11/28/2014	68.53892	9/30/2016	93.2928	7/31/2018	154.5997			Oct-15	0.007358	Jun-19	0.00952
12/1/2014	68.51463	10/3/2016	92.89114	8/1/2018	156.8441			Nov-15	0.012652	Jul-19	-0.01104
12/31/2014	73.75935	10/31/2016	89.34759	8/31/2018	169.7663			Dec-15	-0.04002	Aug-19	0.0832
1/2/2015	73.335	11/1/2016	88.937	9/4/2018	172.0203			Jan-16	0.013308	Sep-19	-0.02621
1/30/2015	70.97205	11/30/2016	100.7816	9/28/2018	166.0446			Feb-16	0.022361	Oct-19	-0.02359
2/2/2015	72.45306	12/1/2016	102.5757	10/1/2018	169.9857			Mar-16	0.044401		
2/27/2015	79.81652	12/30/2016	106.3445	10/31/2018	178.7557			Apr-16	-0.05199		
3/2/2015	80.80662	1/3/2017	105.4687	11/1/2018	179.2532			May-16	0.04561		
3/31/2015	79.2105	1/31/2017	111.6272	11/30/2018	185.4283			Jun-16	2.39E-05		
4/1/2015	79.03486	2/1/2017	111.4612	12/3/2018	183.5065			Jul-16	0.061352		
4/30/2015	76.03237	2/28/2017	111.9775	12/31/2018	185.9836			Aug-16	0.051024		
5/1/2015	75.92365	3/1/2017	117.085	1/2/2019	183.4724			Sep-16	-0.03307		
5/29/2015	78.78395	3/31/2017	110.1133	1/31/2019	180.2099			Oct-16	-0.03815		
6/1/2015	78.7254	4/3/2017	108.9084	2/1/2019	181.3567			Nov-16	0.13318		
6/30/2015	78.23822	4/28/2017	107.6942	2/28/2019	179.8441			Dec-16	0.036742		
7/1/2015	78.7847	5/1/2017	108.1113	3/1/2019	180.5164			Jan-17	0.058392		
7/31/2015	80.74358	5/31/2017	108.7137	3/29/2019	163.4143			Feb-17	0.004632		
8/3/2015	81.52548	6/1/2017	109.205	4/1/2019	165.3703			Mar-17	-0.05954		
8/31/2015	79.39845	6/30/2017	116.7397	4/30/2019	177.6328			Apr-17	-0.01115		
9/1/2015	76.60721	7/3/2017	117.7278	5/1/2019	174.0584			May-17	0.005573		
9/30/2015	78.39326	7/31/2017	114.2976	5/31/2019	190.7592			Jun-17	0.068996		
10/1/2015	79.27238	8/1/2017	115.3882	6/3/2019	191.633			Jul-17	-0.02914		
10/30/2015	79.85563	8/31/2017	117.2617	6/28/2019	193.4574			Aug-17	0.016237		

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Date	Adj Close	Date	Adj Close	Date	Adj Close	Date	Adj Close	Month	Return	Month	Return
1/2/2014	35.19246	11/2/2015	55.54849	9/1/2017	75.22567	7/1/2019	128.8096	Jan-14	-0.07636	Sep-17	0.040797
1/31/2014	32.50533	11/30/2015	51.20818	9/29/2017	78.29462	7/31/2019	126.5693	Feb-14	0.070294	Oct-17	0.059433
2/3/2014	31.60067	12/1/2015	51.42239	10/2/2017	78.56587	8/1/2019	127.9135	Mar-14	-0.01439	Nov-17	0.044434
2/28/2014	33.82201	12/31/2015	50.33116	10/31/2017	83.23527	8/30/2019	128.8793	Apr-14	0.01161	Dec-17	0.009109
3/3/2014	33.93845	1/4/2016	49.07592	11/1/2017	83.71964	9/3/2019	127.794	May-14	0.072979	Jan-18	0.061784
3/31/2014	33.45018	1/29/2016	50.17191	11/30/2017	87.43966	9/30/2019	124.43	Jun-14	0.007299	Feb-18	0.043668
4/1/2014	34.13467	2/1/2016	50.45293	12/1/2017	87.31371	10/1/2019	124.9	Jul-14	-0.03166	Mar-18	0.106249
4/30/2014	34.53096	2/29/2016	52.57935	12/29/2017	88.10906	10/31/2019	125.22	Aug-14	0.049852	Apr-18	-0.00279
5/1/2014	34.43189	3/1/2016	53.90951	1/2/2018	88.32305			Sep-14	-0.02119	May-18	0.068882
5/30/2014	36.94471	3/31/2016	55.8537	1/31/2018	93.78001			Oct-14	0.067039	Jun-18	-0.00702
6/2/2014	37.42205	4/1/2016	55.95729	2/1/2018	93.55629			Nov-14	0.028851	Jul-18	-0.02528
6/30/2014	37.69519	4/29/2016	56.35281	2/28/2018	97.64172			Dec-14	0.030344	Aug-18	0.200604
7/1/2014	37.74046	5/2/2016	57.42637	3/1/2018	96.776			Jan-15	0.052412	Sep-18	-0.03077
7/31/2014	36.54552	5/31/2016	60.44932	3/29/2018	107.0583			Feb-15	0.098205	Oct-18	-0.10095
8/1/2014	36.68131	6/1/2016	60.43047	4/2/2018	104.9306			Mar-15	0.012222	Nov-18	-0.09288
8/29/2014	38.50994	6/30/2016	61.68835	4/30/2018	104.6378			Apr-15	-0.01785	Dec-18	-0.07578
9/2/2014	38.7453	7/1/2016	61.84921	5/1/2018	105.4186			May-15	-0.00294	Jan-19	0.060475
9/30/2014	37.92439	7/29/2016	64.03479	5/31/2018	112.6801			Jun-15	-0.07387	Feb-19	-0.0168
10/1/2014	37.50533	8/1/2016	64.90525	6/1/2018	113.4902			Jul-15	0.050726	Mar-19	0.026488
10/31/2014	40.01967	8/31/2016	65.56754	6/29/2018	112.6939			Aug-15	-0.02781	Apr-19	0.125155
11/3/2014	40.10164	9/1/2016	66.37177	7/2/2018	113.487			Sep-15	0.091332	May-19	0.066718
11/28/2014	41.2586	9/30/2016	64.44289	7/31/2018	110.6182			Oct-15	0.083864	Jun-19	0.040877
12/1/2014	41.0764	10/3/2016	64.24326	8/1/2018	110.207			Nov-15	-0.07814	Jul-19	-0.01739
12/31/2014	42.3228	10/31/2016	61.46743	8/31/2018	132.315			Dec-15	-0.02122	Aug-19	0.00755
1/2/2015	41.79125	11/1/2016	60.96359	9/4/2018	133.7641			Jan-16	0.022333	Sep-19	-0.02632
1/30/2015	43.98163	11/30/2016	61.54347	9/28/2018	129.6483			Feb-16	0.042147	Oct-19	0.002562
2/2/2015	44.42153	12/1/2016	61.02064	10/1/2018	127.8011			Mar-16	0.036064		
2/27/2015	48.78395	12/30/2016	63.34433	10/31/2018	114.9001			Apr-16	0.007068		
3/2/2015	50.06702	1/3/2017	62.99083	11/1/2018	114.6741			May-16	0.05264		
3/31/2015	50.67893	1/31/2017	63.56407	11/30/2018	104.0232			Jun-16	0.020815		
4/1/2015	50.57759	2/1/2017	62.93351	12/3/2018	102.8245			Jul-16	0.035337		
4/30/2015	49.67474	2/28/2017	66.23925	12/31/2018	95.03197			Aug-16	0.010204		
5/1/2015	50.06168	3/1/2017	67.45262	1/2/2019	93.87678			Sep-16	-0.02906		
5/29/2015	49.91427	3/31/2017	65.23449	1/31/2019	99.55401			Oct-16	-0.04321		
6/1/2015	50.0064	4/3/2017	64.93687	2/1/2019	101.6768			Nov-16	0.009512		
6/30/2015	46.31236	4/28/2017	67.14497	2/28/2019	99.9687			Dec-16	0.03808		
7/1/2015	47.83111	5/1/2017	67.10657	3/1/2019	100.2057			Jan-17	0.0091		
7/31/2015	50.25739	5/31/2017	72.85718	3/29/2019	102.8599			Feb-17	0.052527		
8/3/2015	50.28517	6/1/2017	74.29723	4/1/2019	104.1495			Mar-17	-0.03288		
8/31/2015	48.88681	6/30/2017	72.86311	4/30/2019	117.1843			Apr-17	0.034004		
9/1/2015	47.23842	7/3/2017	72.52561	5/1/2019	116.1229			May-17	0.085694		
9/30/2015	51.5528	7/31/2017	73.15242	5/31/2019	123.8704			Jun-17	-0.0193		
10/1/2015	51.19886	8/1/2017	73.75028	6/3/2019	122.1344			Jul-17	0.008643		
10/30/2015	55.49261	8/31/2017	75.34138	6/28/2019	127.1269			Aug-17	0.021574		

CBOE											
Date	Adj Close	Date	Adj Close	Date	Adj Close	Date	Adj Close	Month	Return	Month	Return
1/2/2014	47.33776	11/2/2015	65.04208	9/1/2017	98.68632	7/1/2019	106.3798	Jan-14	0.0204	Sep-17	0.066277
1/31/2014	48.30346	11/30/2015	68.74545	9/29/2017	105.227	7/31/2019	108.982	Feb-14	0.103423	Oct-17	0.04511
2/3/2014	45.61993	12/1/2015	67.06036	10/2/2017	105.7647	8/1/2019	114.7247	Mar-14	0.021661	Nov-17	0.098341
2/28/2014	50.33808	12/31/2015	61.98858	10/31/2017	110.5357	8/30/2019	119.16	Apr-14	-0.05256	Dec-17	0.002736
3/3/2014	51.61446	1/4/2016	61.1194	11/1/2017	110.1153	9/3/2019	119.09	May-14	-0.04863	Jan-18	0.094827
3/31/2014	52.73248	1/29/2016	63.63142	11/30/2017	120.9442	9/30/2019	114.91	Jun-14	-0.0207	Feb-18	-0.17977
4/1/2014	52.47161	2/1/2016	63.17294	12/1/2017	121.7477	10/1/2019	115.58	Jul-14	-0.01041	Mar-18	0.024605
4/30/2014	49.71386	2/29/2016	59.69623	12/29/2017	122.0808	10/31/2019	115.15	Aug-14	0.070961	Apr-18	-0.05068
5/1/2014	49.80703	3/1/2016	60.46992	1/2/2018	120.2779			Sep-14	0.002435	May-18	-0.0882
5/30/2014	47.38479	3/31/2016	62.62681	1/31/2018	131.6835			Oct-14	0.102919	Jun-18	0.057407
6/2/2014	46.98276	4/1/2016	64.12225	2/1/2018	133.8098			Nov-14	-0.0064	Jul-18	-0.06381
6/30/2014	46.01038	4/29/2016	59.39625	2/28/2018	109.7542			Dec-14	0.054364	Aug-18	0.049305
7/1/2014	45.79533	5/2/2016	60.46032	3/1/2018	109.381			Jan-15	0.017519	Sep-18	-0.0774
7/31/2014	45.31849	5/31/2016	61.01632	3/29/2018	112.0723			Feb-15	-0.05873	Oct-18	0.163042
8/1/2014	46.47787	6/1/2016	60.83352	4/2/2018	110.4811			Mar-15	-0.0348	Nov-18	-0.02321
8/29/2014	49.77597	6/30/2016	64.09503	4/30/2018	104.8823			Apr-15	-0.00793	Dec-18	-0.06944
9/2/2014	50.12326	7/1/2016	63.37346	5/1/2018	105.3833			May-15	0.058002	Jan-19	-0.02732
9/30/2014	50.24529	7/29/2016	66.19242	5/31/2018	96.0882			Jun-15	-0.01447	Feb-19	0.023145
10/1/2014	50.1608	8/1/2016	65.82681	6/1/2018	96.93524			Jul-15	0.059849	Mar-19	-0.0079
10/31/2014	55.32331	8/31/2016	66.32663	6/29/2018	102.5			Aug-15	0.014595	Apr-19	0.049365
11/3/2014	56.79697	9/1/2016	66.57768	7/2/2018	102.1848			Sep-15	0.075862	May-19	0.077341
11/28/2014	56.43337	9/30/2016	62.61874	7/31/2018	95.6647			Oct-15	-0.00312	Jun-19	-0.05049
12/1/2014	56.65945	10/3/2016	63.49742	8/1/2018	94.90631			Nov-15	0.056938	Jul-19	0.024461
12/31/2014	59.73968	10/31/2016	61.03517	8/31/2018	99.58569			Dec-15	-0.07563	Aug-19	0.038661
1/2/2015	59.68317	11/1/2016	60.9386	9/4/2018	102.757			Jan-16	0.0411	Sep-19	-0.0351
1/30/2015	60.72876	11/30/2016	66.77203	9/28/2018	94.804			Feb-16	-0.05503	Oct-19	-0.00372
2/2/2015	60.27661	12/1/2016	67.33412	10/1/2018	95.86111			Mar-16	0.035669		
2/27/2015	56.73646	12/30/2016	71.6079	10/31/2018	111.4905			Apr-16	-0.0737		
3/2/2015	56.21664	1/3/2017	70.75509	11/1/2018	109.1688			May-16	0.009196		
3/31/2015	54.26021	1/31/2017	77.16094	11/30/2018	106.6347			Jun-16	0.053614		
4/1/2015	53.60807	2/1/2017	76.02707	12/3/2018	104.1675			Jul-16	0.044482		
4/30/2015	53.18276	2/28/2017	75.63943	12/31/2018	96.93432			Aug-16	0.007593		
5/1/2015	52.46446	3/1/2017	77.09778	1/2/2019	95.01208			Sep-16	-0.05946		
5/29/2015	55.50752	3/31/2017	78.8186	1/31/2019	92.41606			Oct-16	-0.03878		
6/1/2015	55.0712	4/3/2017	78.42973	2/1/2019	93.18893			Nov-16	0.095726		
6/30/2015	54.27444	4/28/2017	80.12141	2/28/2019	95.34583			Dec-16	0.063471		
7/1/2015	55.46958	5/1/2017	80.36446	3/1/2019	95.63413			Jan-17	0.090536		
7/31/2015	58.7894	5/31/2017	84.2144	3/29/2019	94.8786			Feb-17	-0.0051		
8/3/2015	59.14036	6/1/2017	84.65318	4/1/2019	96.26043			Mar-17	0.02232		
8/31/2015	60.00351	6/30/2017	89.11887	4/30/2019	101.0123			Apr-17	0.021569		
9/1/2015	59.35852	7/3/2017	89.61613	5/1/2019	100.4457			May-17	0.047906		
9/30/2015	63.86157	7/31/2017	92.17076	5/31/2019	108.2143			Jun-17	0.052753		
10/1/2015	64.02342	8/1/2017	92.83378	6/3/2019	108.8125			Jul-17	0.028506		
10/30/2015	63.82349	8/31/2017	98.63743	6/28/2019	103.319			Aug-17	0.062517		

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1/31/2014	33.43459	11/30/2015	46.47626	9/29/2017	66.79089	7/31/2019	87.59243	Feb-14	0.026493	Oct-17	-0.04659
2/3/2014	32.57948	12/1/2015	46.6748	10/2/2017	67.4034	8/1/2019	88.92835	Mar-14	-0.04299	Nov-17	0.078979
2/28/2014	33.4426	12/31/2015	46.55152	10/31/2017	64.26315	8/30/2019	93.19532	Apr-14	0.058507	Dec-17	-0.01541
3/3/2014	33.62515	1/4/2016	45.66685	11/1/2017	64.37981	9/3/2019	93.48443	May-14	-0.04419	Jan-18	0.057122
3/31/2014	32.17959	1/29/2016	47.92122	11/30/2017	69.46448	9/30/2019	92.27	Jun-14	-0.01016	Feb-18	-0.02299
4/1/2014	31.41668	2/1/2016	48.49162	12/1/2017	70.06726	10/1/2019	92.33	Jul-14	0.031666	Mar-18	0.009612
4/30/2014	33.25478	2/29/2016	43.31802	12/29/2017	68.9873	10/31/2019	94.32	Aug-14	-0.01655	Apr-18	0.019128
5/1/2014	33.42396	3/1/2016	42.15905	1/2/2018	68.29312			Sep-14	0.053841	May-18	-0.02004
5/30/2014	31.94697	3/31/2016	43.49829	1/31/2018	72.19418			Oct-14	0.073217	Jun-18	0.023225
6/2/2014	31.58749	4/1/2016	43.60187	2/1/2018	73.13281			Nov-14	0.07722	Jul-18	0.002441
6/30/2014	31.26654	4/29/2016	44.40287	2/28/2018	71.45114			Dec-14	-0.00591	Aug-18	0.03475
7/1/2014	30.8395	5/2/2016	45.26307	3/1/2018	70.45387			Jan-15	-0.05472	Sep-18	-0.02869
7/31/2014	31.81606	5/31/2016	50.15418	3/29/2018	71.13105			Feb-15	0.129312	Oct-18	0.023787
8/1/2014	31.80944	6/1/2016	49.7768	4/2/2018	69.73825			Mar-15	-0.01136	Nov-18	0.077248
8/29/2014	31.28309	6/30/2016	48.13489	4/30/2018	71.07221			Apr-15	-0.02767	Dec-18	-0.06862
9/2/2014	31.16723	7/1/2016	47.52934	5/1/2018	70.95449			May-15	0.048534	Jan-19	0.018983
9/30/2014	32.84529	7/29/2016	49.68447	5/31/2018	69.53227			Jun-15	-0.03571	Feb-19	-0.00477
10/1/2014	32.68197	8/1/2016	49.76533	6/1/2018	70.72891			Jul-15	0.010189	Mar-19	-0.00993
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11/3/2014	35.32744	9/1/2016	53.4738	7/2/2018	72.54869			Sep-15	0.063516	May-19	0.01909
11/28/2014	38.05543	9/30/2016	51.43091	7/31/2018	72.72581			Oct-15	0.080757	Jun-19	0.044806
12/1/2014	37.69001	10/3/2016	51.10822	8/1/2018	72.48965			Nov-15	-0.00578	Jul-19	0.019731
12/31/2014	37.46729	10/31/2016	51.62758	8/31/2018	75.00863			Dec-15	-0.00264	Aug-19	0.047982
1/2/2015	37.18538	11/1/2016	50.2261	9/4/2018	76.10085			Jan-16	0.049366	Sep-19	-0.01299
1/30/2015	35.15047	11/30/2016	52.88968	9/28/2018	73.91722			Feb-16	-0.10669	Oct-19	0.021553
2/2/2015	35.60837	12/1/2016	53.79662	10/1/2018	74.27255			Mar-16	0.031766		
2/27/2015	40.21298	12/30/2016	54.17257	10/31/2018	76.03928			Apr-16	0.018371		
3/2/2015	40.88957	1/3/2017	53.98054	11/1/2018	74.87461			May-16	0.10806		
3/31/2015	40.4252	1/31/2017	56.03529	11/30/2018	80.6585			Jun-16	-0.03299		
4/1/2015	40.01796	2/1/2017	56.02568	12/3/2018	80.07616			Jul-16	0.045343		
4/30/2015	38.91057	2/28/2017	54.85429	12/31/2018	74.58098			Aug-16	0.065714		
5/1/2015	39.13413	3/1/2017	56.58259	1/2/2019	74.58098			Sep-16	-0.0382		
5/29/2015	41.03347	3/31/2017	57.67613	1/31/2019	75.99676			Oct-16	0.010162		
6/1/2015	40.81858	4/3/2017	57.14629	2/1/2019	76.74921			Nov-16	0.053032		
6/30/2015	39.36108	4/28/2017	57.99404	2/28/2019	76.38288			Dec-16	0.006988		
7/1/2015	39.73602	5/1/2017	58.18671	3/1/2019	76.42249			Jan-17	0.038065		
7/31/2015	40.14087	5/31/2017	57.9844	3/29/2019	75.66393			Feb-17	-0.02091		
8/3/2015	40.46476	6/1/2017	58.12891	4/1/2019	76.51854			Mar-17	0.019326		
8/31/2015	40.206	6/30/2017	63.70208	4/30/2019	80.84134			Apr-17	0.014835		
9/1/2015	39.52126	7/3/2017	64.43651	5/1/2019	80.16559			May-17	-0.00348		
9/30/2015	42.03148	7/31/2017	64.46549	5/31/2019	81.69597			Jun-17	0.095876		
10/1/2015	41.77211	8/1/2017	65.01632	6/3/2019	82.00403			Jul-17	0.00045		
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1/2/2014	71.37465	11/2/2015	100.2863	9/1/2017	124.9914	7/1/2019	186.0706	Jan-14	-0.01541	Sep-17	0.038201
1/31/2014	70.27494	11/30/2015	99.93218	9/29/2017	129.7662	7/31/2019	191.7561	Feb-14	0.067358	Oct-17	0.061273
2/3/2014	68.70018	12/1/2015	100.7803	10/2/2017	130.1217	8/1/2019	193.3294	Mar-14	-0.0337	Nov-17	0.035324
2/28/2014	73.32772	12/31/2015	97.39706	10/31/2017	138.0947	8/30/2019	197.3222	Apr-14	0.020674	Dec-17	0.044484
3/3/2014	72.57992	1/4/2016	94.90853	11/1/2017	138.6767	9/3/2019	194.9126	May-14	0.020165	Jan-18	0.044592
3/31/2014	70.13419	1/29/2016	98.36635	11/30/2017	143.5753	9/30/2019	191.5271	Jun-14	-0.00529	Feb-18	0.003428
4/1/2014	69.97584	2/1/2016	99.05606	12/1/2017	142.1785	10/1/2019	188.8088	Jul-14	-0.02425	Mar-18	-0.01697
4/30/2014	71.42249	2/29/2016	93.44525	12/29/2017	148.5031	10/31/2019	185.42	Aug-14	0.029987	Apr-18	0.030776
5/1/2014	71.08416	3/1/2016	96.41842	1/2/2018	149.2307			Sep-14	0.002466	May-18	0.025145
5/30/2014	72.51758	3/31/2016	107.5562	1/31/2018	155.8851			Oct-14	0.031373	Jun-18	0.02958
6/2/2014	72.35732	4/1/2016	108.4416	2/1/2018	155.6523			Nov-14	0.066198	Jul-18	-0.02389
6/30/2014	71.9745	4/29/2016	106.2666	2/28/2018	156.1859			Dec-14	0.038488	Aug-18	0.058606
7/1/2014	72.33954	5/2/2016	107.6594	3/1/2018	151.4715			Jan-15	-0.05414	Sep-18	0.00413
7/31/2014	70.58558	5/31/2016	111.9601	3/29/2018	148.9009			Feb-15	0.048934	Oct-18	-0.08328
8/1/2014	70.06919	6/1/2016	111.9978	4/2/2018	143.5462			Mar-15	0.027528	Nov-18	0.037458
8/29/2014	72.17037	6/30/2016	106.6148	4/30/2018	147.964			Apr-15	0.011897	Dec-18	-0.15472
9/2/2014	72.22379	7/1/2016	106.8313	5/1/2018	148.6686			May-15	0.028706	Jan-19	0.092183
9/30/2014	72.40186	7/29/2016	106.1631	5/31/2018	152.4069			Jun-15	0.006134	Feb-19	0.042911
10/1/2014	70.97733	8/1/2016	106.229	6/1/2018	155.4895			Jul-15	0.051499	Mar-19	0.071985
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11/3/2014	73.06871	9/1/2016	108.2805	7/2/2018	159.7366			Sep-15	0.064688	May-19	-0.01787
11/28/2014	77.90568	9/30/2016	114.9716	7/31/2018	155.92			Oct-15	0.100689	Jun-19	0.054864
12/1/2014	77.60786	10/3/2016	113.7388	8/1/2018	156.2919			Nov-15	-0.00353	Jul-19	0.030556
12/31/2014	80.59486	10/31/2016	110.5289	8/31/2018	165.4516			Dec-15	-0.03357	Aug-19	0.020653
1/2/2015	80.17074	11/1/2016	110.4338	9/4/2018	165.8724			Jan-16	0.036433	Sep-19	-0.01737
1/30/2015	75.8301	11/30/2016	113.5622	9/28/2018	166.5574			Feb-16	-0.05664	Oct-19	-0.01795
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2/27/2015	81.2446	12/30/2016	111.3752	10/31/2018	155.6564			Apr-16	-0.02006		
3/2/2015	82.28239	1/3/2017	110.7381	11/1/2018	156.6045			May-16	0.039948		
3/31/2015	84.54746	1/31/2017	108.2754	11/30/2018	162.4705			Jun-16	-0.04806		
4/1/2015	84.43014	2/1/2017	107.6478	12/3/2018	164.7418			Jul-16	-0.00625		
4/30/2015	85.43457	2/28/2017	116.4814	12/31/2018	139.2533			Aug-16	0.018781		
5/1/2015	86.08927	3/1/2017	117.9742	1/2/2019	138.8386			Sep-16	0.061794		
5/29/2015	88.56057	3/31/2017	113.9901	1/31/2019	151.6371			Oct-16	-0.02822		
6/1/2015	88.69889	4/3/2017	111.8601	2/1/2019	152.8123			Nov-16	0.028328		
6/30/2015	89.24294	4/28/2017	116.5369	2/28/2019	159.3696			Dec-16	-0.0045		
7/1/2015	90.42325	5/1/2017	116.4889	3/1/2019	162.1545			Jan-17	-0.02224		
7/31/2015	95.07996	5/31/2017	119.5825	3/29/2019	173.8272			Feb-17	0.08206		
8/3/2015	95.17217	6/1/2017	120.3703	4/1/2019	174.1235			Mar-17	-0.03377		
8/31/2015	86.92841	6/30/2017	118.8235	4/30/2019	181.8885			Apr-17	0.041809		
9/1/2015	85.10261	7/3/2017	119.0637	5/1/2019	180.5343			May-17	0.026557		
9/30/2015	90.60769	7/31/2017	123.7617	5/31/2019	177.3082			Jun-17	-0.01285		
10/1/2015	90.77365	8/1/2017	124.7608	6/3/2019	174.4107			Jul-17	0.039458		
10/30/2015	99.91353	8/31/2017	125.6255	6/28/2019	183.9796			Aug-17	0.00693		

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