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HW3 - Portfolio Optimization
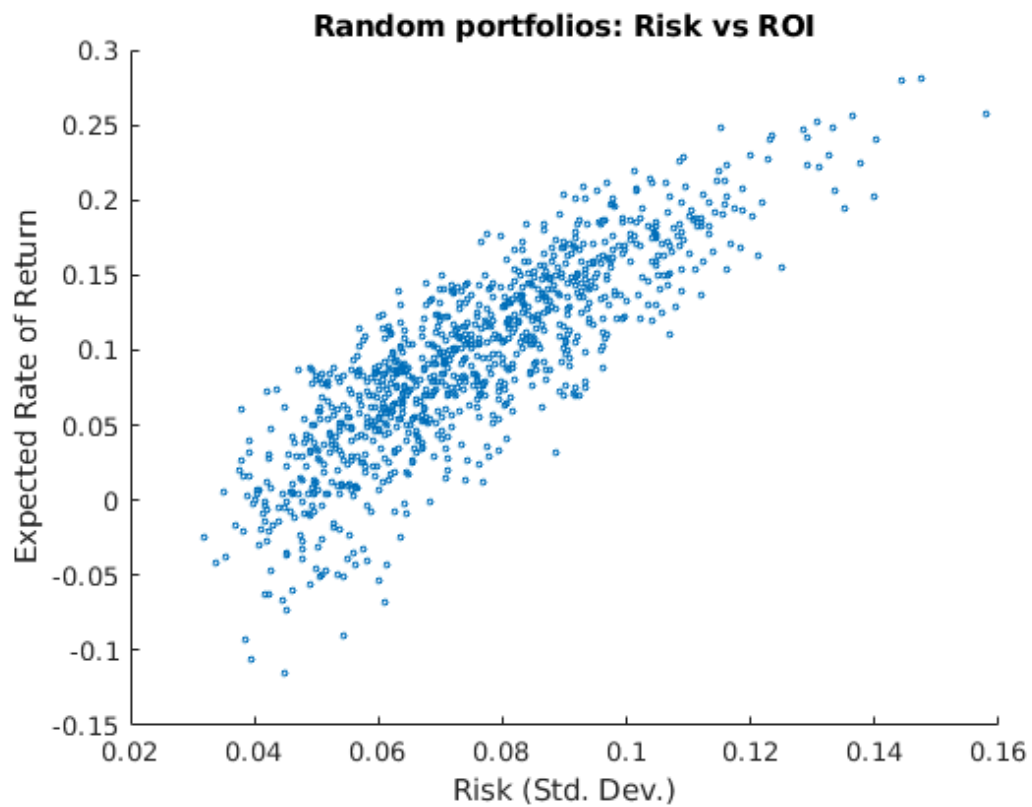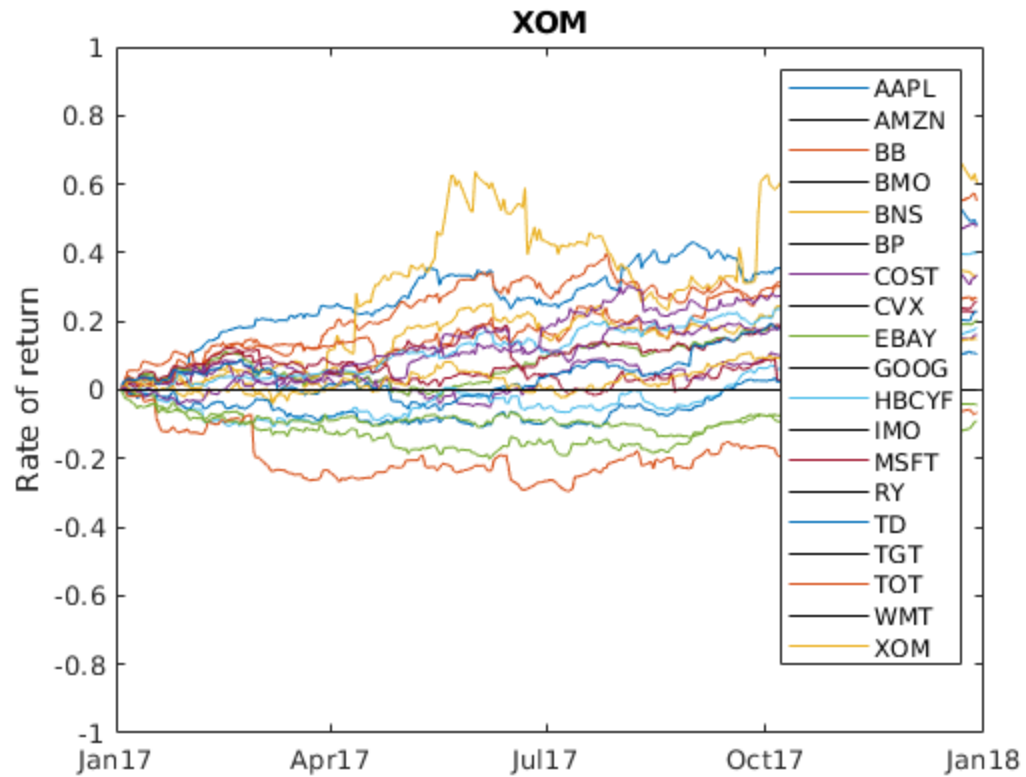
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```matlab
% *Supplementary files:*
sup_code = [
"load_stocks"
"load_stock"
"portfolio_scatter"
"meancov"
"return_range"
"efficient_frontier"
"market_portfolio"
];
for i = 1:length(sup_code)
    publish(sup_code(i), 'format', 'pdf', 'evalCode', false);
end

clear all
close all

warning('off', 'MATLAB:table:ModifiedAndSavedVarnames');
% rng(1); % Random seed for testing\debugging
```
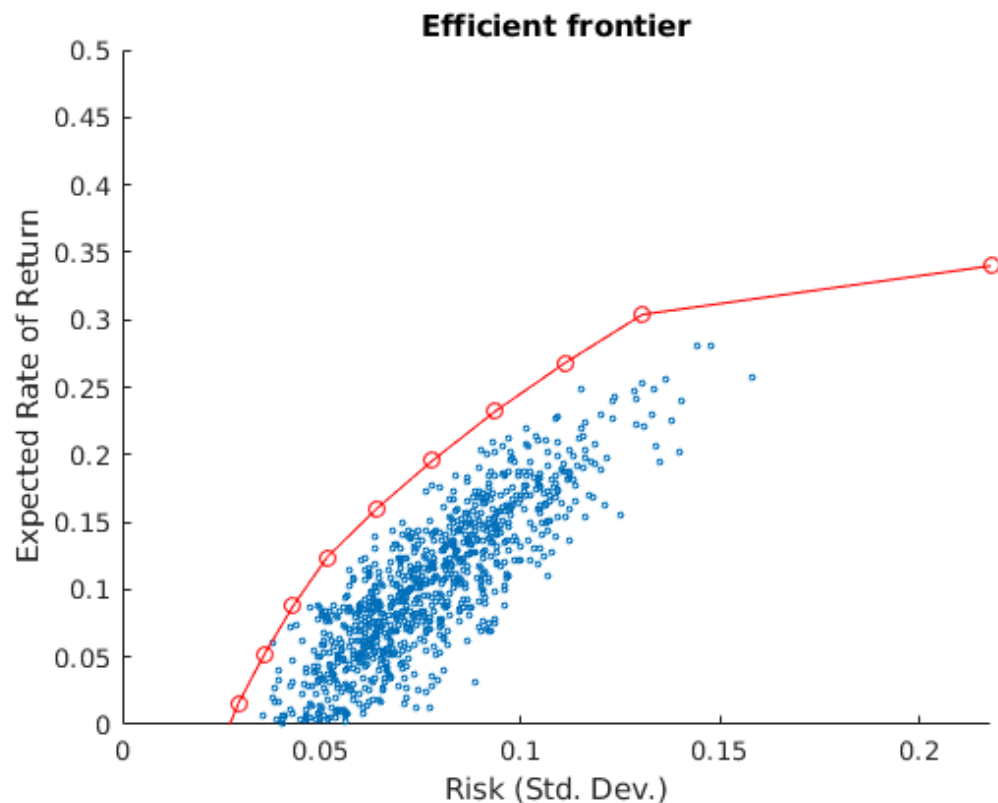
Q1

```matlab
[X, dates, names] = load_stocks("data", "2017-01-03","2017-12-29");
disp_stocks(X, dates, names);
[r, Sig] = meancov(X);
h = portfolio_scatter(r, Sig, 1000);
```

XOM

Random portfolios: Risk vs ROI

Q2

```
num = 12;
[Y,rates,sigs]= efficient_frontier(r,Sig,num);
figure(h);
hold on;
title("Efficient frontier");
plot(sigs, rates, 'ro-');
ylim([0 0.5]);
xlim([0 max(sigs)]);
```
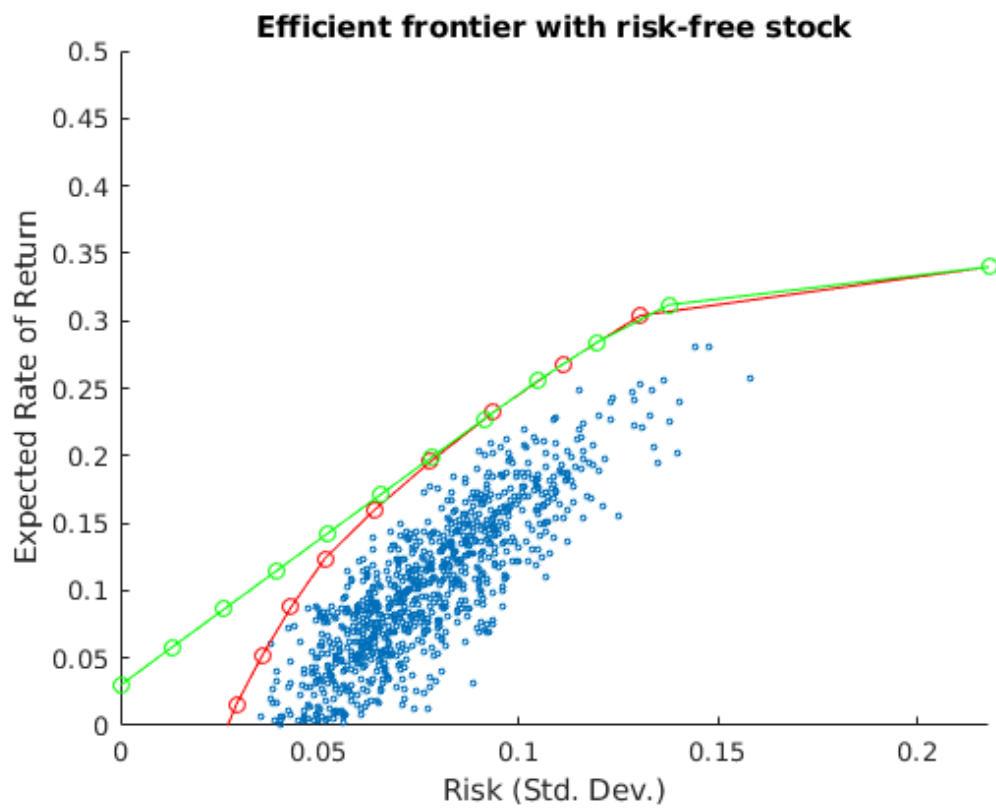

Q3

```
f = 0.03;
r_= [r, f]; % add risk free return
Sig_ = [Sig , zeros(19,1)] ;
Sig_ = [Sig_; zeros(1,20)]; % build risk free Sig
[Y_,rates_,sigs_]=efficient_frontier(r_,Sig_,num); %calculate
 coresponding efficient frontier
plot(sigs_,rates_,'go-');
title("Efficient frontier with risk-free stock")
market_x = market_portfolio(f,r',Sig);

Binary search:
Iter          x    |f(x)|
```

```
 1   1.20e-01   3.28e-02
 2   7.09e-02   3.14e-02
 3   9.54e-02   5.54e-04
 4   1.08e-01   1.99e-02
 5   1.01e-01   1.10e-02
 6   9.84e-02   5.67e-03
 7   9.69e-02   2.68e-03
 8   9.61e-02   1.09e-03
 9   9.57e-02   2.78e-04
10   9.56e-02   1.36e-04
11   9.57e-02   7.13e-05
12   9.56e-02   3.23e-05
13   9.56e-02   1.96e-05
14   9.56e-02   6.35e-06
15   9.56e-02   6.61e-06
16   9.56e-02   1.29e-07
Done.
```


Efficient frontier with risk-free stock

- Q3 - Meaning of linear part*

The linear half-line (Before the tangent point) represents the new extended region of the fficient frontier thanks to the addition of the risk free stock. This stock has no variance by definetion thus including in the portfolio results in a linear gain in rate of return

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