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clc; clear;

disp('%%-----Part1-----%%')

k = 1;
% Input the market strikes and vols, and the vendor SABR volatilities
oldMK = xlsread('swap_data.xlsx', 'Sheet1', 'C3:U3');
oldMV = xlsread('swap_data.xlsx', 'Sheet1', 'C4:U4');

% Input the Maturity (T), ATM Strike (F), ATM Vol
T = xlsread('swap_data.xlsx', 'Sheet1', 'A4');
F = xlsread('swap_data.xlsx', 'Sheet1', 'B6');

oldMV = oldMV(k,:);
T = T(k);
% Select only non-blank entries
Index = find(~isnan(oldMV));
MV = oldMV(Index);
MK = oldMK(Index);

% Create a grid of strikes for the SABR vols
MK2 = oldMK;

%beta
b = .5;

% Define the starting values and options for fminsearch

options = optimset('MaxFunEvals', 1e5, 'TolFun', 1e-8, 'TolX', 1e-10);
start = [.3 ,.3 ,.2];
[param2, feval] = fminsearch(@(par)EstimateAllParameters(par, MK, MV, F, T, b), start, options);

a = param2(1);
r = param2(2);
v = param2(3);

% Create the SABR curve based on these parameters.
for j=1:length(MK2);
    Vol2(j) = SABRvol(a, b, r, v, F, MK2(j), T);
end
% Plot the results of both SABR curves against the curve from the market.

% 'alpha parameter      ::',a
% 'beta parameter       ::',b
% 'rho parameter        ::',r
% 'vol of vol parameter::',v

X = sprintf('Beta=%f, Alpha=%f, Rho=%f, Vol=%f',b,a,r,v);
disp(X)
P=sprintf('Mean Squared Error=%f',immse(Vol2,oldMV));
disp(P)

figure
plot(MK2, Vol2, 'r-', oldMK, oldMV, 'kx-');
legend('SABR vol for 3 year maturity','Original Vol for 3 year maturity')
legend('boxoff')
title('BETA=.5')

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disp('%%-----Part2-----%%')

%-----beta=.7-----
b=.7;
start = [.3 ,.3 ,.2];
[param2, feval] = fminsearch(@(par)EstimateAllParameters(par, MK, MV, F, T, b), start, options);

a = param2(1);
r = param2(2);
v = param2(3);

% Create the SABR curve based on these parameters.
for j=1:length(MK2);
    Vol2(j) = SABRvol(a, b, r, v, F, MK2(j), T);
end
% Plot the results of both SABR curves against the curve from the market.

X = sprintf('Beta=%f, Alpha=%f, Rho=%f, Vol=%f',b,a,r,v);
disp(X)
P=sprintf('Mean Squared Error=%f',immse(Vol2,oldMV));
disp(P)

figure
plot(MK2, Vol2, 'b-', oldMK, oldMV, 'kx-');

legend('SABR vol for 3 year maturity','Original Vol for 3 year maturity')
legend('boxoff')
title('BETA=.7')

%-----beta=.4-----
b=.4;
start = [.3 ,.3 ,.2];
[param2, feval] = fminsearch(@(par)EstimateAllParameters(par, MK, MV, F, T, b), start, options);

a = param2(1);
r = param2(2);
v = param2(3);

% Create the SABR curve based on these parameters.
for j=1:length(MK2);
    Vol3(j) = SABRvol(a, b, r, v, F, MK2(j), T);
end
% Plot the results of both SABR curves against the curve from the market.

X = sprintf('Beta=%f, Alpha=%f, Rho=%f, Vol=%f',b,a,r,v);
disp(X)
P=sprintf('Mean Squared Error=%f',immse(Vol3,oldMV));
disp(P)
figure
plot(MK2, Vol3, 'b-', oldMK, oldMV, 'kx-');
legend('SABR vol for 3 year maturity','Original Vol for 3 year maturity')
legend('boxoff')
title('BETA=.4')

disp('%%-----Part3-----%%')

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figure
plot(MK2, Vol2, 'r-', MK2, Vol3, 'b-', oldMK, oldMV, 'kx-');
legend('SABR vol with Beta=.7', 'SABR vol with Beta=.4', 'Original Vol for 3 year maturity')
legend('boxoff')
title('Combined Plot with BETA=.7 and BETA=.4')

disp('%%-----Part5-----%%')

b=.7;
start = [.3 ,.3 ,.2];
[param2, feval] = fminsearch(@(par)EstimateAllParameters(par, MK, MV, F, T, b), start, options);

a = param2(1);
r = param2(2);
v = param2(3);

oldMK = xlsread('swap_data.xlsx', 'Sheet1', 'C19:U19');
oldMV = xlsread('swap_data.xlsx', 'Sheet1', 'C20:U20');
% Input the Maturity (T), ATM Strike (F), ATM Vol
T = xlsread('swap_data.xlsx', 'Sheet1', 'A20');
F = xlsread('swap_data.xlsx', 'Sheet1', 'B23');
oldMV = oldMV(k,:);
T = T(k);
Index = find(~isnan(oldMV));
MV = oldMV(Index);
MK = oldMK(Index);
MK2 = oldMK;

% Create the SABR curve based on these parameters.
for j=1:length(MK2);
    Vol2(j) = SABRvol(a, b, r, v, F, MK2(j), T);
end
% Plot the results of both SABR curves against the curve from the market.

X = sprintf('Beta=%f, Alpha=%f, Rho=%f, Vol=%f',b,a,r,v);
disp(X)
P=sprintf('Mean Squared Error=%f',immse(Vol2,oldMV));
disp(P)

figure
plot(MK2, Vol2, 'b-', oldMK, oldMV, 'kx-');

legend('SABR vol for 12 year maturity', 'Original Vol for 12 year maturity')
legend('boxoff')
title('BETA=.4')

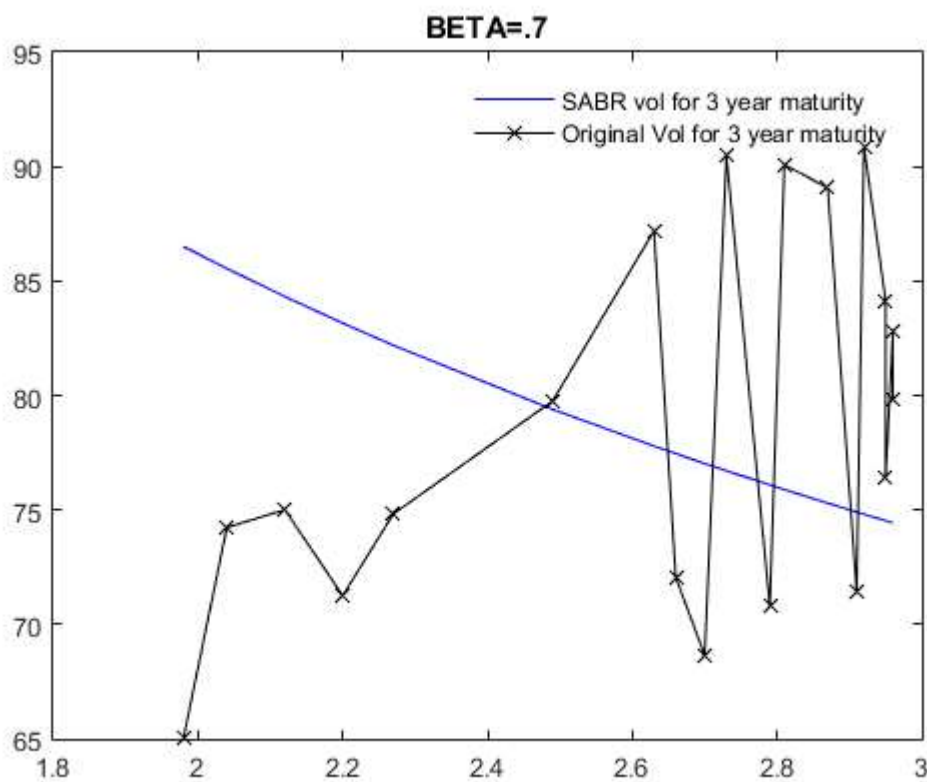
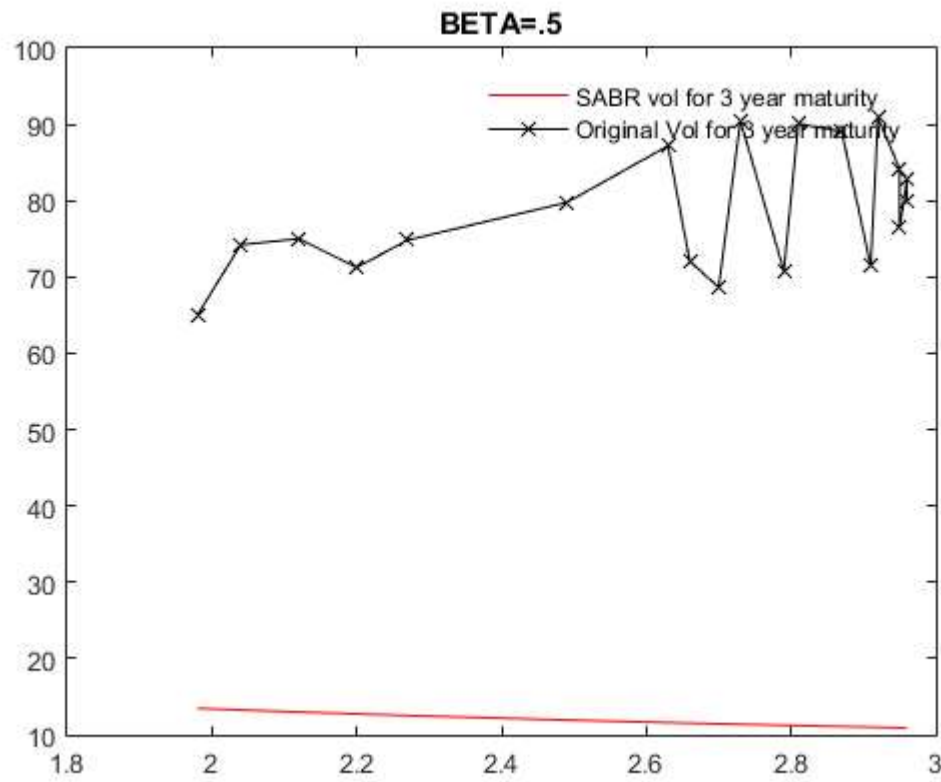
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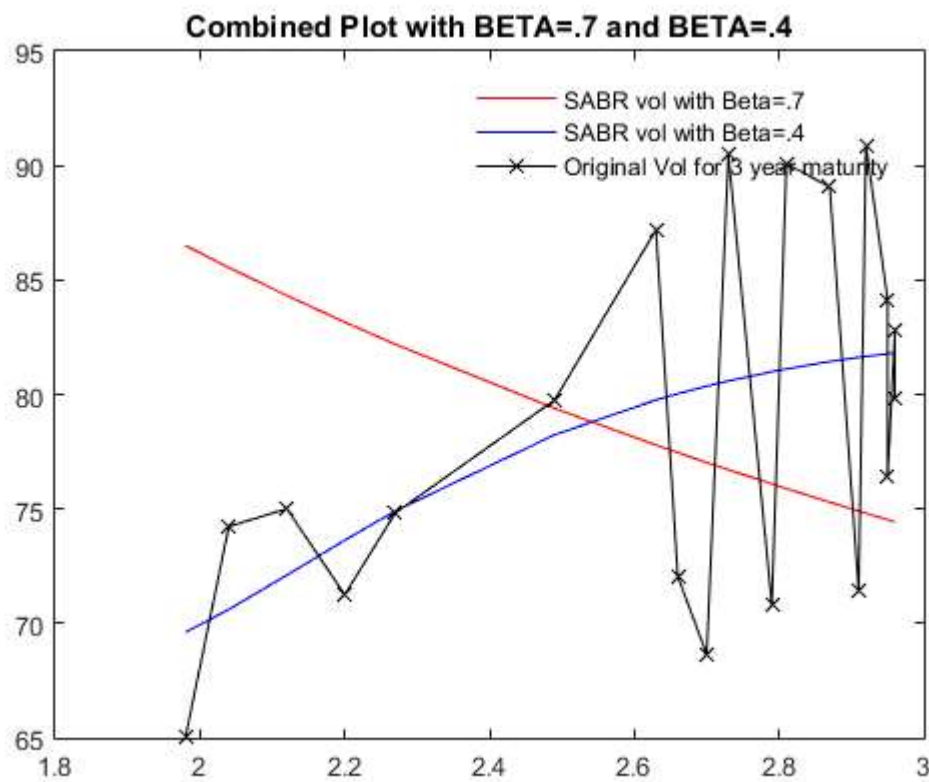
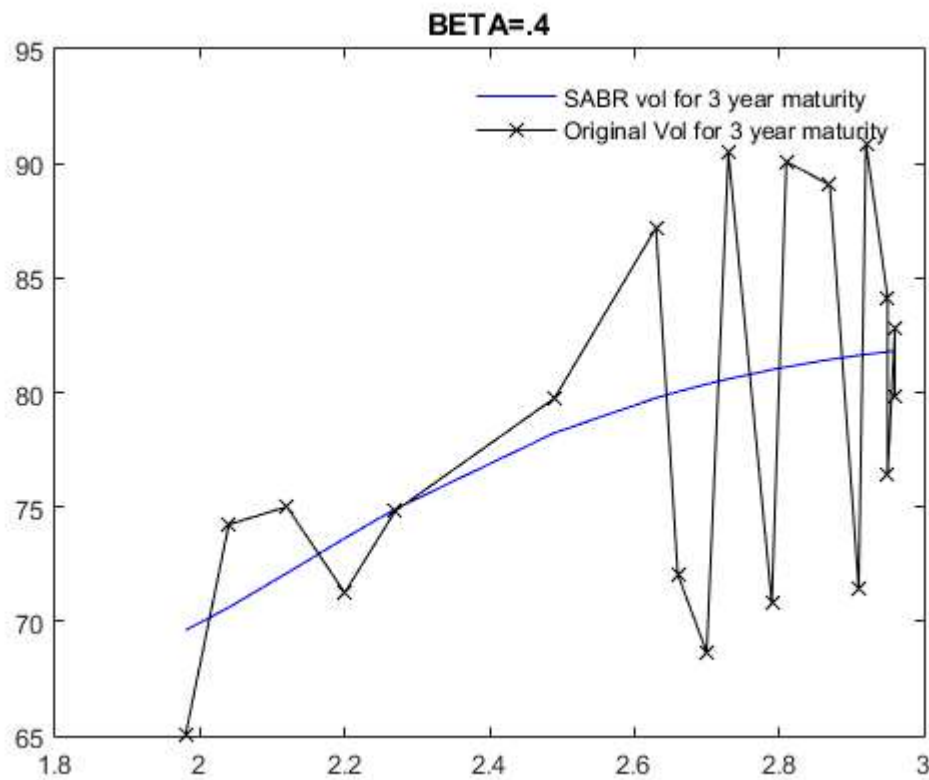
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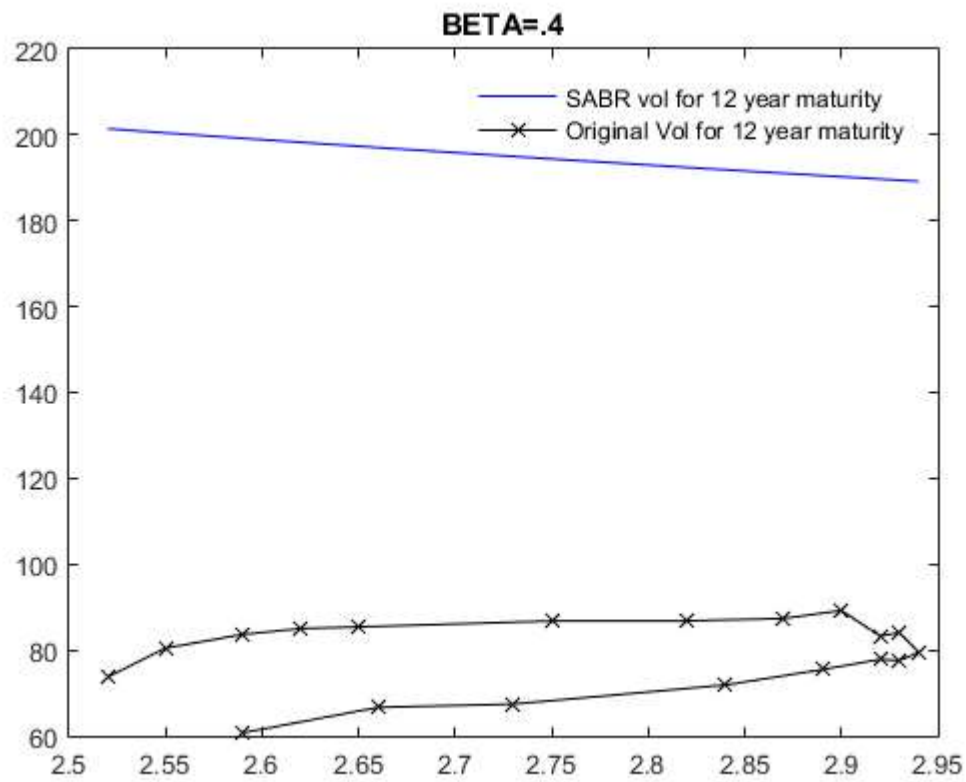
%%-----Part1-----%%
Beta=0.500000, Alpha=8.712926, Rho=-1.000000, Vol=0.000000
Mean Squared Error=4550.122419
%%-----Part2-----%%
Beta=0.700000, Alpha=20.640682, Rho=0.999997, Vol=0.049161
Mean Squared Error=112.249102
Beta=0.400000, Alpha=9.999459, Rho=0.909740, Vol=14.600069
Mean Squared Error=46.042443
%%-----Part3-----%%
%%-----Part5-----%%

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Beta=0.700000, Alpha=20.640682, Rho=0.999997, Vol=0.049161
Mean Squared Error=13305.598633







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