```
marketsharpe = .6;
libor = 1.13; (*% per year*)
startdate = "Dec. 31 2009";
tradingdays = 252;
enddate = Take[Date[], 3](*-{0,0,1}*);
```

$$\text{dlibor} = \sqrt[365.25]{\left(1 + \frac{\text{libor}}{100}\right)} - 1;$$

```
quotes[symbols_, startdate_] :=
  Table[FinancialData[symbols[[i, 1]], startdate][[All, 2]], {i, Length[symbols]}];
returns[values_] := Table[Log[values[[i, j]] / values[[i, j - 1]]] - dlibor,
   {i, Length[values]}, {j, 2, Length[values[[1]]]}];
returns1[values_] := Table[Log[values[[j]] / values[[j - 1]]] - dlibor,
   {j, 2, Length[values]}];


worldstocks = {{"VT", 1}};
worldbonds = {{"PZA", 110}, {"SHY", 25}, {"IEF", 22}, {"TLT", 22}, {"MBB", 100},
   {"LQD", 50}, {"JNK", 32}, {"AGZ", 30}, {"USY", 150}, {"PCY", 350}, {"BWX", 100}};
 (*no int'l corp or us asset-backed etfs*)
worldother = {{"DJP", 1}};

worldsquotes = quotes[worldstocks, {startdate, enddate}];
worldbquotes = quotes[worldbonds, {startdate, enddate}];
worldoquotes = quotes[worldother, {startdate, enddate}];
worldsvals = worldsquotes * worldstocks[[All, 2]];
worldbvals = worldbquotes * worldbonds[[All, 2]];
worldovals = worldoquotes * worldother[[All, 2]];
(*worldsreturns=returns[worldsvals];
worldbreturns=returns[worldbvals];
worldoreturns=returns[worldovals];*)
worldsportvals = Total[worldsvals];
worldbportvals = Total[worldbvals];
worldoportvals = Total[worldovals];
worldsportreturns = returns1[worldsportvals];
worldbportreturns = returns1[worldbportvals];
worldoportreturns = returns1[worldoportvals];
worldreturns =
  .55 worldsportreturns + .4 worldbportreturns + .05 worldoportreturns;


(*what world anualized standard deviation of excess returns was/is*)
worldsd = 100 StandardDeviation[worldreturns] Sqrt[tradingdays]
```

```
13.6336
```

```
(*what world annualized excess return WAS *)
annworldret = 100 * (Exp[Total[worldreturns] * tradingdays / Length[worldreturns]] - 1)
```

```
2.45413
```

```
(*Assuming market sharpe as stated in line 1,
expected annualized excess world return going forward*)
eworldret = marketsharpe worldsd
```

```
8.18019
```

```
worldbvals[[All, -1]] / Total[worldbvals[[All, -1]]]
 (*might want to mess around with this...also
  add other stuff to "other" besides commodities?*)
```

```
{0.0548316, 0.0426202, 0.0432855, 0.0458409, 0.220956,
 0.112272, 0.0254412, 0.0673085, 0.0759562, 0.195678, 0.115809}
```

```
go[stocks_, bonds_, other_] := Module[{},
  squotes = quotes[stocks, {startdate, enddate}];
  bquotes = quotes[bonds, {startdate, enddate}];
  oquotes = quotes[other, {startdate, enddate}];
  svals = squotes * stocks[[All, 2]];
  bvals = bquotes * bonds[[All, 2]];
  ovals = oquotes * other[[All, 2]];
  sreturns = returns[svals];
  breturns = returns[bvals];
  oreturns = returns[ovals];
  sportvals = Total[svals];
  bportvals = Total[bvals];
  oportvals = Total[ovals];
  portvals = sportvals + bportvals + oportvals;
  catwts = {sportvals[[-1]], bportvals[[-1]], oportvals[[-1]]} / portvals[[-1]];
  swts = Table[svals[[i, -1]] / sportvals[[-1]], {i, Length[stocks]}];
  bwts = Table[bvals[[i, -1]] / bportvals[[-1]], {i, Length[bonds]}];
  owts = Table[ovals[[i, -1]] / oportvals[[-1]], {i, Length[other]}];
  totwts = Flatten[{swts, bwts, owts} * catwts];
  sportreturns = returns1[sportvals];
  bportreturns = returns1[bportvals];
  oportreturns = returns1[oportvals];
  portreturns = returns1[portvals];
  portsd = StandardDeviation[portreturns] 100 Sqrt [tradingdays];
  ireturns = Join[sreturns, breturns, oreturns];
  rho = Table[Correlation[ireturns[[i]], portreturns], {i, Length[totwts]}];
  sigma = Table[StandardDeviation[ireturns[[i]]], {i, Length[totwts]}];
  rhosigma = rho sigma;
  riskwt =
   Table[rhosigma[[i]] totwts[[i]] / Total[rhosigma totwts], {i, Length[totwts]}];
  rhoworld = Table[Correlation[ireturns[[i]], worldreturns],
    {i, Length[ireturns]}];
  betas = (1 / 3) + ((2 / 3) * (rhoworld sigma 100 Sqrt[tradingdays] / worldsd));
  (*ereturns=100 Sqrt[tradingdays]marketsharpe rhoworld sigma;*)
  ereturns = betas eworldret;
  portret = Total[ereturns totwts];
  portsharpe = portret / portsd;
  {portret, portsd, portsharpe}
 ]
```

```
scottstocks = {{"AAPL", 35}, {"APWR", 250}, {"COST", 125}, {"FMCN", 150},
   {"GOOG", 10}, {"HANS", 52}, {"HMC", 75}, {"IBM", 30}, {"PBD", 200}, {"PWR", 50},
   {"PZD", 100}, {"SIRI", 2500}, {"STEM", 250}, {"TAN", 200}, {"VEA", 50},
   {"VWO", 150}, {"fbt", 200}, {"PSJ", 75}, {"QCLN", 100}, {"EPI", 150}, {"IXJ", 50}};
scottbonds = {{"BWX", 50}, {"LQD", 50}, {"PCY", 200},
   {"PZA", 200}, {"TIP", 25}, {"jnk", 100}};
scottother = {{"RJI", 500}, {"fxa", 50}, {"gcc", 200}};

scottout = go[scottstocks, scottbonds, scottother]
```

```
{8.93603, 16.3679, 0.54595}
```

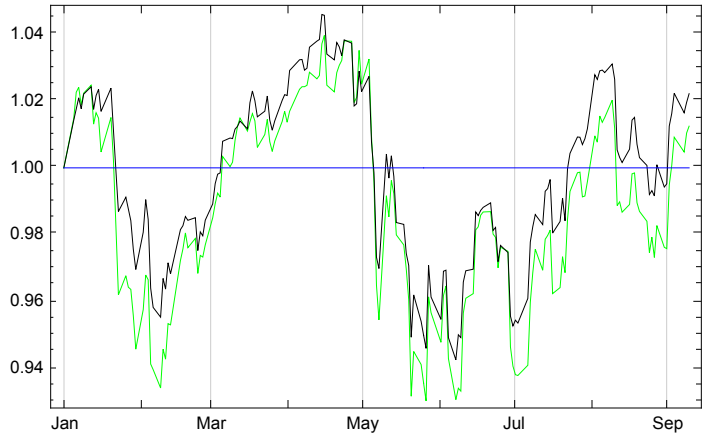
```
dates = FinancialData["VT", {startdate, enddate}][[All, 1]];

worldindex =
  Table[Exp[Total[Take[worldreturns + dlibor, i]]], {i, Length[worldreturns]}];

(*using scottout*)

a = {dates, portvals / portvals[[1]]};
b = {dates, Prepend[worldindex, 1]};
at = Table[{a[[1, i]], a[[2, i]]}, {i, Length[a[[1]]]}];
bt = Table[{b[[1, j]], b[[2, j]]}, {j, Length[b[[1]]]}];
ax = Table[{dates[[k]], 1}, {k, Length[dates]}];

DateListPlot[{at, bt, ax}, PlotStyle → {Green, Black, Blue}, Joined → True]
```



```
Prepend[Transpose[
   {Join[scottstocks, scottbonds, scottother][[All, 1]],
    Round[rho, .01], Round[100 sigma Sqrt[tradingdays]],
    Round[100 rhosigma Sqrt[tradingdays]], Round[ereturns, 1],
    Round[100 totwts, .1], Round[100 riskwt, .1], Round[ riskwt / totwts, .1],
    Round[ ereturns / (100 Sqrt[tradingdays] rhosigma), .01]}],
  {"Name", "rho", "sigma", "rhosigma", "~Ereturn", "wt   ",
   "riskwt", "riskwt/wt", "ret/risk"}] // TableForm
```

Name	rho	sigma	rhosigma	~Ereturn	wt	riskwt	riskwt/wt	ret/risk
AAPL	0.77	29	23	11	8.5	12.	1.4	0.48
APWR	0.7	74	52	21	1.5	4.7	3.2	0.4
COST	0.6	18	11	7	6.8	4.6	0.7	0.64
FMCN	0.59	50	29	14	2.7	5.	1.8	0.47
GOOG	0.7	28	20	10	4.4	5.4	1.2	0.52
HANS	0.47	28	13	7	2.2	1.8	0.8	0.56
HMC	0.59	25	15	9	2.3	2.2	0.9	0.6
IBM	0.75	19	14	8	3.5	3.2	0.9	0.58
PBD	0.93	31	29	14	2.4	4.3	1.8	0.5
PWR	0.57	32	18	10	0.8	1.	1.1	0.54
PZD	0.94	28	27	13	2.1	3.5	1.7	0.5
SIRI	0.54	61	33	14	2.4	4.9	2.	0.43
STEM	0.54	43	23	12	0.2	0.3	1.4	0.5
TAN	0.86	43	37	17	1.4	3.3	2.3	0.47
VEA	0.93	27	25	13	1.5	2.4	1.6	0.53
VWO	0.93	27	25	13	5.9	9.2	1.6	0.52
fbt	0.78	26	20	10	6.3	7.8	1.2	0.51
PSJ	0.87	22	20	10	1.5	1.8	1.2	0.52
QCLN	0.89	33	30	14	1.3	2.4	1.9	0.48
EPI	0.86	25	22	12	3.4	4.6	1.4	0.54
IXJ	0.85	17	15	9	2.3	2.	0.9	0.6
BWX	0.3	9	3	4	2.6	0.5	0.2	1.45
LQD	-0.01	6	0	3	5.1	0	0	-65.42
PCY	0.51	7	4	4	5.1	1.2	0.2	1.12
PZA	0.17	9	1	3	4.6	0.4	0.1	2.3
TIP	-0.28	5	-1	2	2.5	-0.2	-0.1	-1.62
jnk	0.76	12	9	6	3.6	2.1	0.6	0.69
RJI	0.76	19	15	9	3.5	3.2	0.9	0.59
fxa	0.84	15	13	8	4.3	3.4	0.8	0.61
gcc	0.65	14	9	6	5.	2.8	0.6	0.71

```
Needs["LinearRegression`"]
```

```
r = Regress[Transpose[{worldreturns, portreturns}], x, x]
```

```
{ParameterTable → | Estimate | SE | TStat | PValue
                  1 | -0.0000703107 | 0.000211434 | -0.332542 | 0.739888,
                  x | 1.15633 | 0.0246885 | 46.8366 | 0.

 RSquared → 0.927685, AdjustedRSquared → 0.927262, EstimatedVariance → 7.7329 × 10^-6,

 ANOVATable → | | DF | SumOfSq | MeanSq | FRatio | PValue
              | Model | 1 | 0.0169634 | 0.0169634 | 2193.67 | 0.
              | Error | 171 | 0.00132233 | 7.7329 × 10^-6 | |
              | Total | 172 | 0.0182857 | | |
}
```

```
beta = r[[1, 2, 1, 2, 1]]
```

```
1.15633
```

```
annportret = 100 * (Exp[Total[portreturns] * tradingdays / Length[portreturns]] - 1)
```

```
1.03703
```

```
annportret / portsd (*sharpe achieved over the period*)
```

```
0.0633576
```

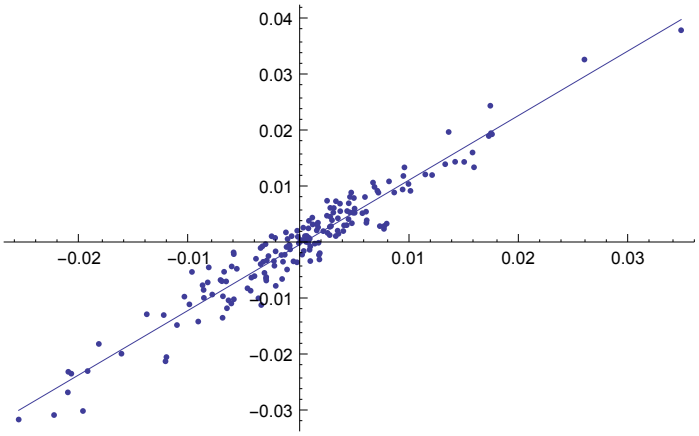
```
(*ex-post alpha achieved, had you held this portfolio*)
jensen = annportret - ( beta * (annworldret)) (*Returns are already excess*)
```

```
-1.80075
```

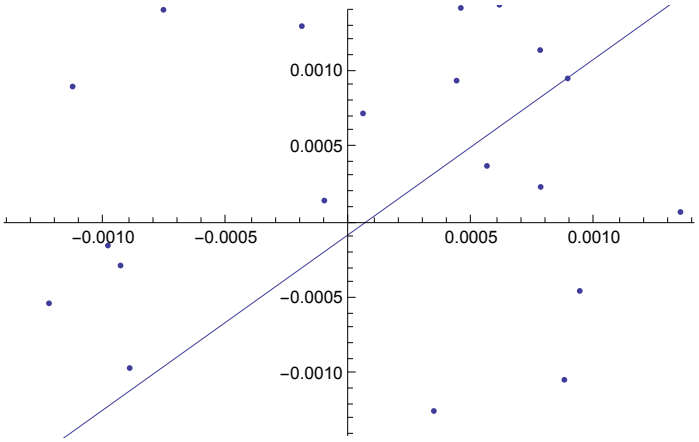
```
(*regress portfolio vs stocks only - more traditional*)
Regress[Transpose[{worldsportreturns, portreturns}], x, x]
```

```
{ParameterTable →
   |  Estimate      SE            TStat     PValue
 1 |  0.0000806504  0.000218602   0.368937  0.712631,
 x |  0.67301       0.0148975     45.1762   0.
 RSquared → 0.92269, AdjustedRSquared → 0.922238, EstimatedVariance → 8.26702 × 10^-6,
 ANOVATable →
          |  DF   SumOfSq       MeanSq            FRatio    PValue
 Model    |  1    0.0168721     0.0168721         2040.89   0.
 Error    |  171  0.00141366    8.26702 × 10^-6
 Total    |  172  0.0182857 }
```

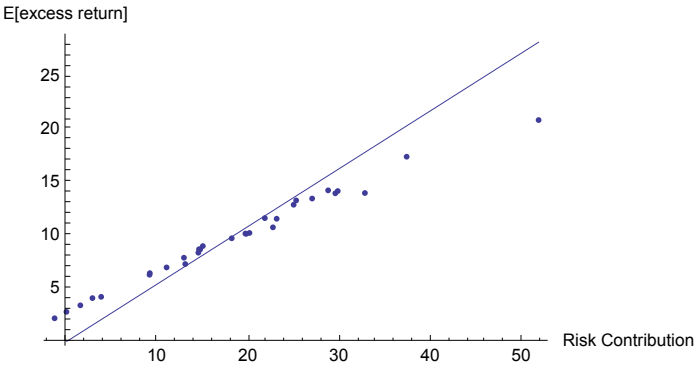
```
portline = Plot[r[[1, 2, 1, 1, 1]] + r[[1, 2, 1, 2, 1]] x,
   {x, Min[worldreturns], Max[worldreturns]}];
scatter = ListPlot[Transpose[{worldreturns, portreturns}]];
Show[scatter, portline, PlotRange → All]
```



```
f = 20; use = r[[1, 2, 1, 1, 1]];
Show[scatter, portline, PlotRange → {f {-use, use}, f {-use, use}}]
```

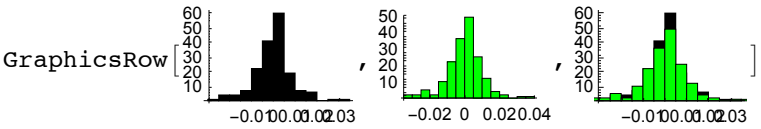



```
psline = Plot[scottout[[3]] x, {x, 0, Max[100 rhosigma Sqrt[tradingdays]]}];
mispricing = ListPlot[Tooltip[Transpose[{100 rhosigma Sqrt[tradingdays], ereturns}],
    Join[scottstocks, scottbonds, scottother][[All, 1]]]];
Show[psline, mispricing, PlotRange → All, AxesLabel →
  {"Risk Contribution", "E[excess return]"}]
```

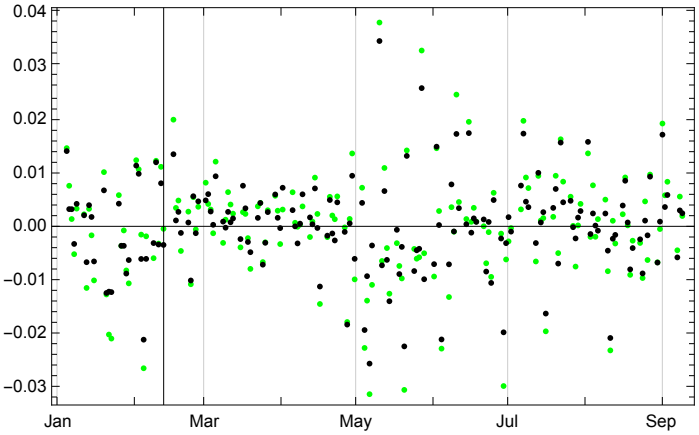



```
Needs["Histograms`"];

{miw, maw} = {Floor[Min[worldreturns]], Ceiling[Max[worldreturns]]};
whist = Histogram[worldreturns,
    HistogramCategories → Table[miw + i, {i, 0, maw - miw, .005}],
    ApproximateIntervals → False, BarStyle → Black];
{mip, map} = {Floor[Min[portreturns]], Ceiling[Max[portreturns]]};
phist = Histogram[portreturns,
    HistogramCategories → Table[mip + i, {i, 0, map - mip, .005}],
    ApproximateIntervals → False, BarStyle → Green];
GraphicsRow[whist, phist, Show[ whist, phist]]
```

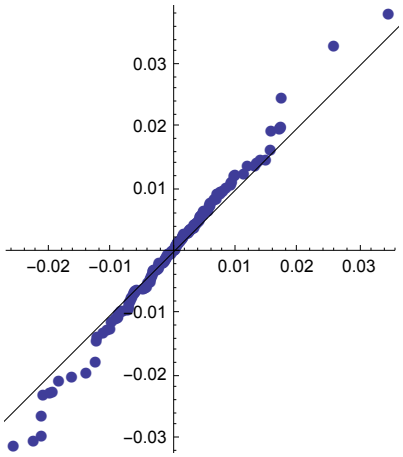


```
DateListPlot[{Transpose[{Drop[dates, 1], portreturns}],
  Transpose[{Drop[dates, 1], worldreturns}]},
 PlotStyle → {Green, Black}, Axes → True, PlotRange → All]
```

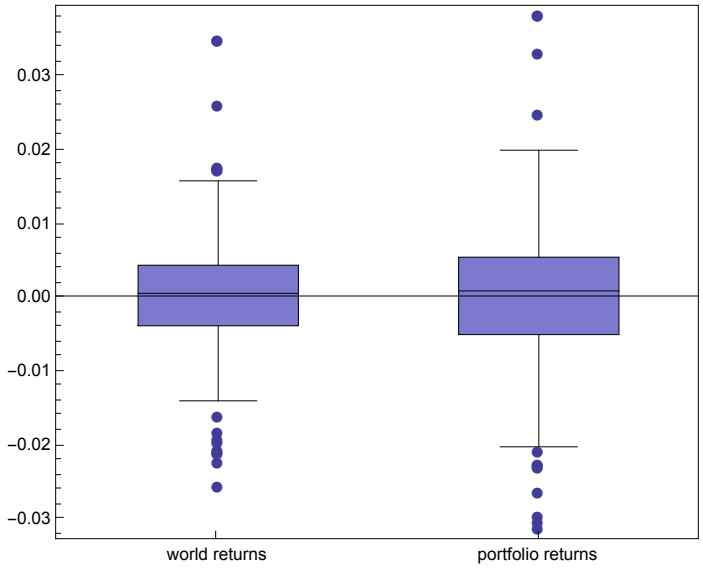



```
Needs["StatisticalPlots`"];
```

```
QuantilePlot[worldreturns, portreturns]
```

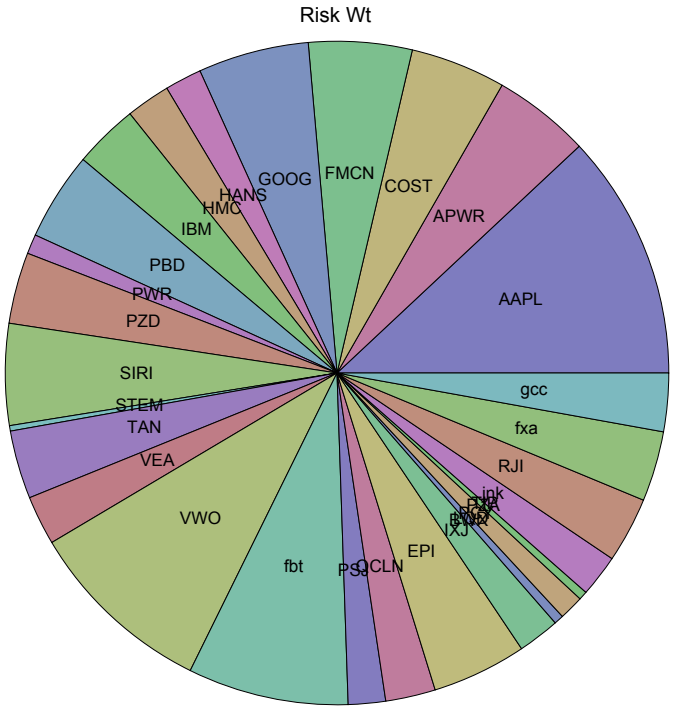


```
BoxWhiskerPlot[worldreturns, portreturns, BoxOutliers → True,
 Axes → True, BoxLabels → {"world returns", "portfolio returns"}]
```

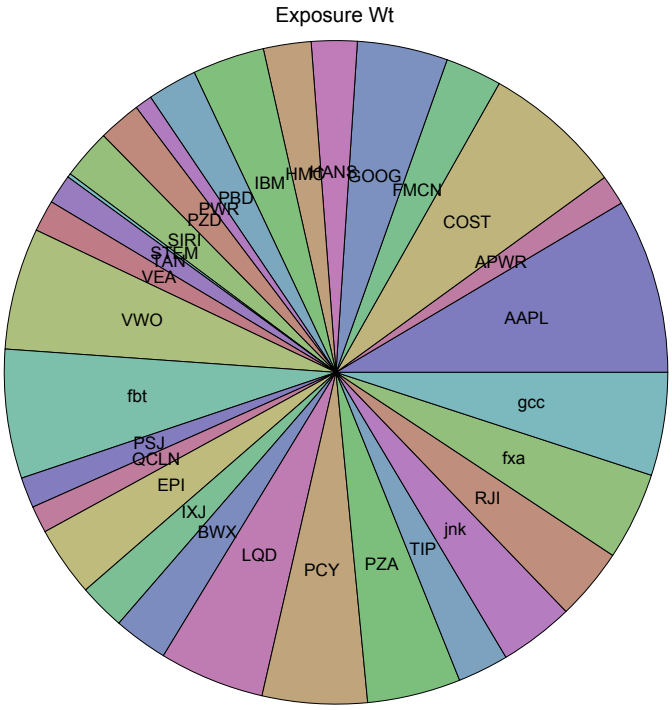



```
Needs["PieCharts`"]
```

```
PieChart[Map[Max[#, 0] &, riskwt], PieLabels ->
  Join[scottstocks, scottbonds, scottother][[All, 1]], PlotLabel → "Risk Wt"]
```



```
PieChart[Map[Max[#, 0] &, totwts],
 PieLabels -> Join[scottstocks, scottbonds, scottother][[All, 1]],
 PlotLabel → "Exposure Wt"]
```




```
(*below this line, other portfolios*)
```