

## **DIVERSIFICATION: INTERNATIONAL EQUITY INVESTMENT EXAMPLE**

### **WHAT WILL YOU LEARN?**

- ▶ Let's illustrate the benefits from diversification with an example of international equities.
- ▶ Definition of mean-variance frontier
- ▶ Definition of minimum variance and efficient portfolios

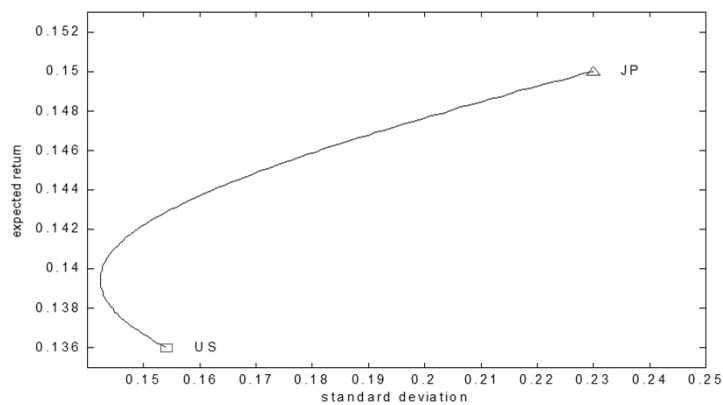
## INTERNATIONAL EQUITY INVESTMENT EXAMPLE

	US	UK	France	Germany	Japan
Mean	0.1355	0.1589	0.1519	0.1435	0.1497
$\sigma$	0.1535	0.2430	0.2324	0.2038	0.2298

► Correlation matrix:

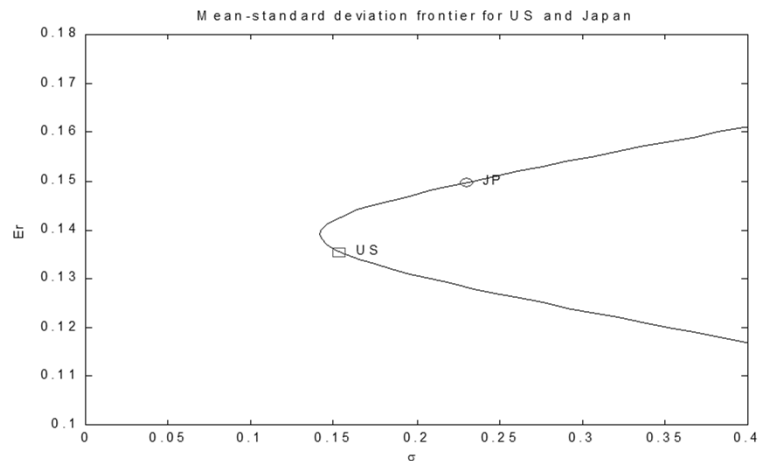
	US	UK	France	Germany	Japan
US	1.000	0.5003	0.4398	0.3681	0.2663
UK	0.5003	1.000	0.5420	0.4265	0.3581
France	0.4398	0.5420	1.000	0.6032	0.3923
Germany	0.3681	0.4265	0.6032	1.000	0.3663
Japan	0.2663	0.3581	0.3923	0.3663	1.000

## INVESTMENT OPPORTUNITY SET WITH JUST THE U.S. AND JAPAN



w	mean	volatility
0.0	0.150	0.230
0.1	0.149	0.212
0.2	0.147	0.195
0.3	0.146	0.179
0.4	0.144	0.166
0.5	0.143	0.155
0.6	0.142	0.147
0.7	0.140	0.143
0.8	0.139	0.143
0.9	0.137	0.146
1.0	0.136	0.154

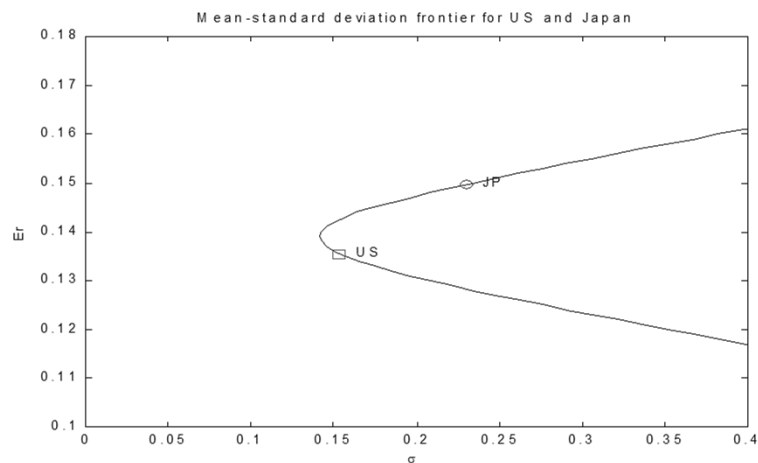
## INVESTMENT OPPORTUNITY SET WITH JUST THE U.S. AND JAPAN (SHORT SELLING ALLOWED)



## MEAN-VARIANCE FRONTIER

- Mean-variance frontier is the locus of the portfolios in expected return-standard deviation space that have the minimum variance for each expected return.
- For two assets, it consists simply of all possible portfolio combinations of the two assets.

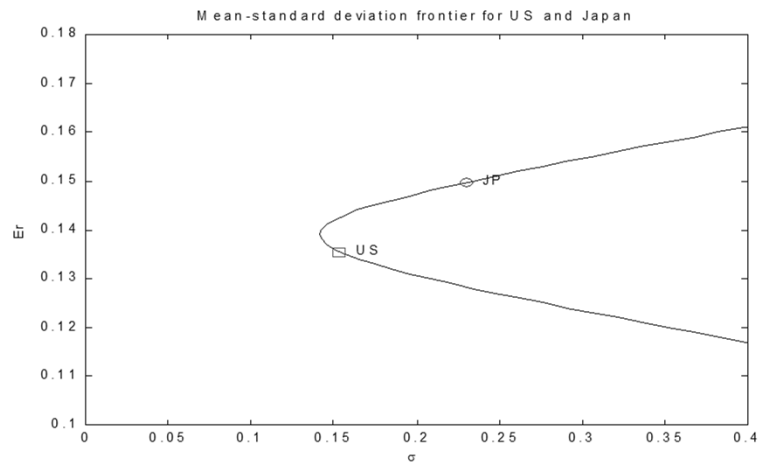
## INVESTMENT OPPORTUNITY SET WITH JUST THE U.S. AND JAPAN (SHORT SELLING ALLOWED)



## MEAN-VARIANCE FRONTIER

- The top half of the mean-variance frontier is efficient: An investor cannot obtain a higher reward – or expected return – for a given level of risk measured by volatility.
- The left-most point on the minimum variance frontier is called the minimum variance portfolio.

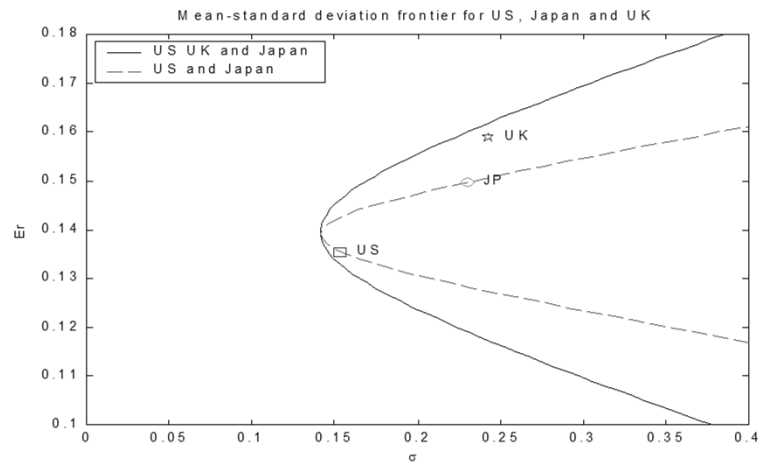
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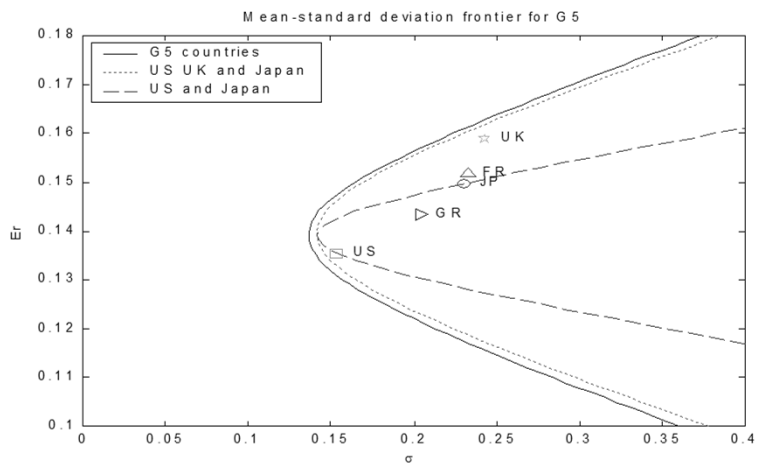
## DIVERSIFICATION

- No one should hold a 100% U.S. portfolio!

## ADD UK TO THE MIX



## INCLUDE ALL G5 COUNTRIES



## SUMMARY

- ▶ Illustrate benefits of diversification using equity data from G5 countries.
  - ▶ Large diversification benefits stem from low correlations.
- ▶ Define mean variance frontier and efficient portfolios.
- ▶ The mean variance frontier expands as we add more assets to the mix.
- ▶ All individual assets lie inside the frontier – diversified portfolios on the frontier do better than assets held individually. Diversification removes idiosyncratic risk and reduces the overall risk of the portfolio.