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The Essential Financial Toolkit[1]

Tool 4 - Diversification and Correlation

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This article discusses the issue of diversification, something that academics preach and most investors practice. It is often said that putting all your eggs in one basket is not a good strategy. Diversification, at the end of the day, consists of following that simple advice when building investment portfolios, a process in which the correlation between assets plays a critical role.

Witty Professor (WP): We discussed in our last session two measures of risk, standard deviation and beta, and although my plan for today was to discuss the relationship between beta and required returns, I'm going to change that plan a bit.

Insightful Student (IS): Why?

WP: Because some of you wanted to discuss the concept of diversification a bit further, and so we'll do that today. And we'll postpone our discussion about the relationship between beta and required returns for our next session.

IS: Sounds good. I actually did have some doubts about the concept of diversification, particularly regarding the role of the correlation coefficient, which you didn't mention and I never seem to quite understand.

WP: That's a very common doubt, and we'll certainly talk about that today. But let's walk before we run, and so first consider the returns of the three hypothetical assets in Table 1. It shows their returns over 10 periods, as well as their arithmetic mean and standard deviation, both of which you know how to calculate by now.

[1] All calculations in this note have been performed in Excel and the results reported are taken directly from the spreadsheet. If you want to reproduce the numbers discussed accurately and avoid rounding errors, you should also perform all calculations in a spreadsheet.

This technical note was prepared by Professor Javier Estrada. Gabriela Giannattasio provided research assistance. September 2008.

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Table 1

Period	Asset 1	Asset 2	Asset 3
1	25.0%	21.3%	32.5%
2	5.0%	24.3%	22.5%
3	22.5%	21.6%	31.3%
4	6.0%	24.1%	23.0%
5	17.5%	22.4%	28.8%
6	4.0%	24.4%	22.0%
7	31.0%	20.4%	35.5%
8	5.5%	24.2%	22.8%
9	24.0%	21.4%	32.0%
10	4.0%	24.4%	22.0%
AM	**14.5%**	**22.9%**	**27.2%**
SD	**10.0%**	**1.5%**	**5.0%**

IS: Yes, we do! So, what's the story with these three assets?

WP: Well, since diversification is all about combining assets into a portfolio, let's consider a combination between assets 1 and 2. Let's assume that given whatever capital we have to invest, we put 13% of our money in asset 1 and 87% in asset 2. How would you calculate, period by period, the return of that portfolio?

IS: That's easy. For period 1, for example, the return of the portfolio (R_p) would be

$R_p = (0.13)(0.250) + (0.87)(0.213) = 21.8\%$

and the only thing that would change from period to period would be the return delivered by each asset.

WP: Great. Now, what do you think we would get if we do the same thing for the second period?

IS: I don't know, but we can just calculate it. The return of the portfolio in the second period would be

$R_p = (0.13)(0.050) + (0.87)(0.243) = 21.8\%$

which is kind of funny; that's the same return as in the previous period!

WP: Well, it may be funny, but it's also right. And if you find that curious, let me surprise you: if you calculate period by period the return of a portfolio invested 13% in asset 1 and 87% in asset 2, you will find that the return of the portfolio, give or take a small rounding error, is always … 21.8%!

IS: No way!!! You're cheating somewhere!

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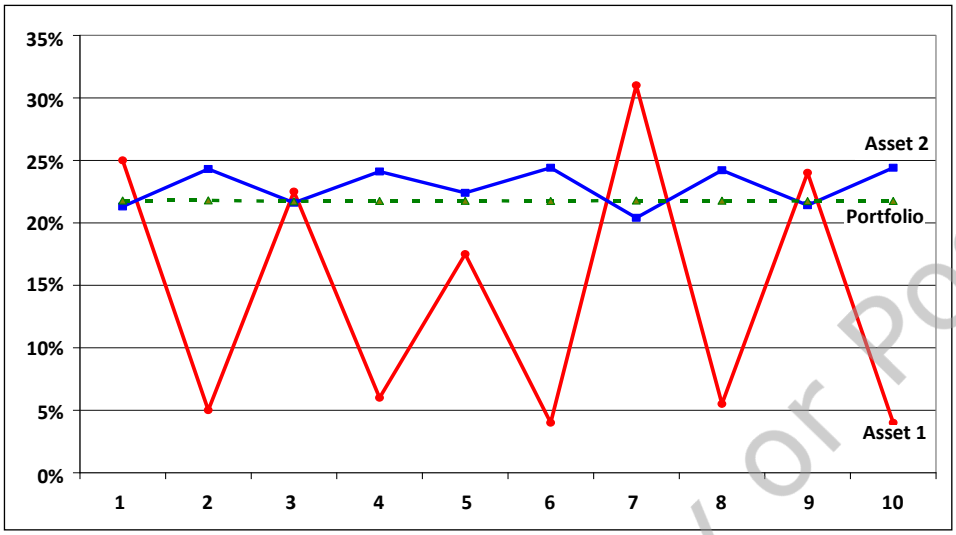
WP: I'm not. You can crunch the numbers yourself if you don't believe me, but let me save you some time. Take a look at Figure 1.

Figure 1



IS: I'm looking but I'm not sure I understand it.

WP: Well, the picture shows the returns of assets 1 and 2 over the ten periods we're considering, as well as the return of the 13-87 portfolio. And as you can see, the return of this portfolio is just a straight line at 21.8%.

IS: I can hardly believe it! We combine two risky assets and we end up with a riskless portfolio?! What's going on here?!

WP: Well, let's rule out cheating to start with! And before I answer your question, let me ask you to consider another combination of assets. Consider now a portfolio invested 50% in asset 1 and 50% in asset 3. If we were to calculate the return of this portfolio over the ten periods we're considering, what do you think we would get?

IS: Please don't tell me another portfolio with a riskless 21.8% return!

WP: Nope, quite different from that actually. Take a look at Figure 2, which plots the returns of asset 1, asset 3, and the 50-50 portfolio.

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