Applied Economics ›
Volume 47, 2015 - Issue 1

Original Articles

Isolating the systematic and unsystematic components of a single stock's (or portfolio's) standard deviation

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Pages 1-11 | Published online: 13 Oct 2014

Cite this article https://doi.org/10.1080/00036846.2014.959652 Check for updates

Abstract

This article revisits the roots of modern portfolio theory. Instead of isolating the systematic component of risk by recasting the risk in terms of a stock's beta coefficient, I decompose the SD directly into its systematic and unsystematic components. From this decomposed SD, an 'adjusted capital market line (CML)' can be derived. It is easily shown th (SML). I evaluate unsyster m my system risk. This alter accessible insights utational complex ilitating sophistic ving risk-

adjusted performance measurement. This article offers new ideas that may influence the teaching of economics and finance.

Keywords: systematic risk unsystematic risk capital asset pricing model dispersion trading beta

JEL Classification: G10 G11 A20

Notes

[1] The 'degree of diversification' is a function of both the number of stocks included in the portfolio and how the value of the portfolio is divided among them (i.e. the weighting scheme). Generally, to be well diversified, a portfolio must contain many stocks and the weights allocated to each must be small.

[2] Unsystematic risk is also known as idiosyncratic risk and as company specific risk.

[3] Systematic risk is also known as market risk since it is that portfolio of portfolio risk explained by the movements of the broad market.

[4] Technically, for this result to hold when leverage is applied, the investor must be able to both borrow and lend at the risk-free rate. To the degree that the borrowing and lending rates differ, there will be a 'kink' in the otherwise linear efficient frontier.

[5] The phrase 'thoroughly diversified' implies that the degree of diversification is sufficient to virtually eliminate unsystematic risk.

[6] Because unsystematic risk will diversify away for all investors, it was soon realized that investors should only be compensated for the systematic risk that they bear. That is, in an efficient market, an asset's expected return should be directly related to the asset's c … risk.

[7] Other … d Mossin (1966) …

[8] Sharp…

[9] Reilly a… data is a cause fo… firm

increases.

[10] Despite the ease with which the result in Section III can be derived, it does not seem to have been emphasized anywhere in the literature.

[11] Technically, a stock’s volatility is the SD of the annual percentage price change measured on a continuously compounded basis. In order to use volatility in lieu of SD, we must assume that the stock is nondividend paying so that ‘price return’ and ‘total return’ are identical.

[12] This statement assumes that the weighting scheme used in the portfolio will converge to the weighting scheme employed in the broad market (as defined by the market proxy).

[13] Note that the SD of the market is purely systematic risk and may, in this context, be taken as a constant in the sense that, at a given moment in time, it is the same irrespective of which particular stock one is looking at.

[14] This can be calculated from the stock’s recent historic returns, or it can be taken as the implied volatility of return as extracted from equity options on the stock (the latter approach implicitly assumes that the stock is not dividend paying so that price return and total return are equivalent).

[15] Again, this can be derived from recent historic market data or extracted from index options.

[16] Computed from raw returns.

[17] The DJIA actually returned a 13.981% continuously compounded over the study period.

[18] The c… are only concern… t lie on the principal… metric, this numb…

[19] The… returns or they car…

20 This is an oversimplification. An option on a portfolio is not equivalent to a portfolio of options, necessitating continuous rebalancing to maintain equivalence. For a more thorough discussion of dispersion trading in the context of the risk measure proposed in this article, see Marshall (2008).

21 I would have preferred to call this either the 'adjusted Sharpe ratio' or the 'modified Sharpe ratio' but both of these terms are already in use for other purposes. The 'adjusted Sharpe ratio' attributable to Johnson et al. (2002) is defined as the Sharpe ratio that would be implied by the 'downside deviation if returns were distributed normally'. The term 'modified Sharpe ratio' is often used to mean the ratio of a portfolio's excess return to its modified value at risk and has been employed in the 'alternative investments' sphere. Both terms have also been used in other contexts.

22 A different measure of risk-adjusted performance sometimes used in the alternatives investment literature that also considers correlation of return with the market is the BAVAR (Beta And Volatility Adjusted Return) Ratio. This is discussed in Horowitz (2004, p. 257).

International Journal of Hospitality & Tourism Administration
Published online: 11 Oct 2008

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