

Diversification benefits: correlation and return gaps

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Abstract— While correlation is the common indicator of diversification benefits, this study shows that coefficient of correlation alone does not provide an intuitive indicator of diversification benefits nor do these benefits depend only on the correlation between asset returns.

Keywords: diversification, correlation, return

I. INTRODUCTION

Portfolio diversification is one of the most fundamental tenets of modern finance. The pioneering works of Harry Markowitz [3] and James Tobin [4] resulted in elegant and well-known Mean-Variance model, which demonstrates that risk reduction through portfolio diversification depends on correlations among return distributions of individual securities.

According to Bernstein and Pinkernell [1,2], even though diversification among risky assets available in a particular country leads to risk reduction, the potential is becoming increasingly limited due to the generally high correlations between financial instruments within an economy. Furthermore, in times of crises, Remy et al. [5] note that diversification opportunities diminish due to overall market effects. Correlations between stocks of varying cap size, value/growth characteristics, and across all regions and industries are close to one, therefore, investors seeking diversification may benefit from being able to at least partially hedge out market exposure through investing in regions, countries, and across different asset classes.

While correlation is the common indicator of diversification benefits, Statman and Scheid [9] argue that coefficient of correlation alone does not provide an intuitive indicator of diversification benefits nor these benefits depend only on the correlation between asset returns. Authors demonstrate that portfolio diversification also depends on the standard deviation of asset returns and introduce return gap. A return gap is a gap between the returns of a pair of assets, whether U.S. equity and international equity or other asset categories. The return gap and the diversification benefits are lower when correlation is higher, but the return gap is higher when standard deviation is higher. The purpose of this study is to explore the differences between correlation and the return gap as a measure of diversification benefits and show that diversification benefits across asset classes remain considerable even during global economic crisis.

The remainder of the paper is organized as follows. Section II summarizes the methodology and data used in this study. Section III presents the empirical results. Section IV offers some concluding remarks.

II. DATA AND METHODOLOGY

The return gap is associated with dispersion – standard deviation of an individual asset return around the mean return of all assets. In the case of two assets, dispersion can be defined as the difference between the return of each asset and the mean return of these two assets.

Solnik and Roulet [7] present correlation as a function of dispersion and the standard deviation of the returns of a market portfolio. They introduce and test the concept of cross-sectional dispersion of stock market returns as an alternative and instantaneous measure of the general level of global market correlation. They illustrate usefulness of dispersion to measure integration of global equity markets and find that equity markets become more integrated but at a slower pace than is proposed by practitioners. These findings are consistent with Solnik et al. [6] results, who stress that growth of new markets partly offsets the trend toward increasing correlation between international markets.

Statman and Scheid [8] present dispersion as a function of correlations and standard deviation of individual assets. Statman and Scheid [9] apply similar approach to an individual asset and global market portfolio. Their analysis implies that the benefits of diversification during down markets are higher compared to up markets between 1926 and 2007. Using Statman and Scheid [9] approach, Realized Return Gap is calculated on the example of two assets as:

$$\text{Realized Return Gap} = 2\sigma \sqrt{\frac{(1-\rho)}{2}} \quad (1)$$

where σ – mean standard deviation of asset returns and ρ – correlation between two assets. The return gap between the two assets is double the dispersion.

Return gap and diversification benefits are lower when correlation between assets is higher; however, return gap and diversification benefits are higher when standard deviation is higher between a pair of assets. Statman and Scheid [9] warn against confusing a return gap and covariance. Both of them combine correlation and

standard deviation; however, these two functions are different. Covariance and the return gap are higher when the standard deviation is higher. On the other hand, covariance is lower when correlation coefficient is lower but the return gap and diversification benefits are higher.

Bernstein and Pinkernell [2] find that diversification benefits diminish over the years. However, their conclusion is challenged by Statman and Scheid [9], who demonstrate that diversification benefits remain substantial when measured by return gap instead of coefficient of correlation only. They uncover that negative effects of an increase in correlation on the benefits of diversification are often mitigated by a simultaneous increase in standard deviation. Furthermore, they discover that diversification benefits are significant in both up and down markets.

Study uses weekly data for 12 broad asset classes which include US and international equity (S&P 500, Russell 3000, MSCI EAFE, MSCI EM, MSCI EM Eastern Europe, and MSCI EMU), US Treasury (Treasury Bills and Long-term Treasury Bonds) and corporate investment grade bonds (AAA-rating), real estate (NAREIT Index), gold (COMEX), and commodities (Goldman Sachs Commodity Index) between January 2001 and January 2010¹.

III. EMPIRICAL FINDINGS

Table 1 shows that correlation coefficient between 12 asset classes declined for 10 out of 12 asset classes between January 2007 and January 2010 – the worldwide weakening of international equity markets¹. Higher correlations are undeniably associated with lower benefits of diversification, but relations between the two are far from perfect since standard deviation plays a role as well. For example, the correlation coefficient between MSCI EAFE and MSCI EM Eastern Europe is 0.8976 almost identical to the correlation between MSCI EMU and S&P 500 (0.8926).

However, the benefits of diversification of two pairs of assets are quite different based on the realized return gap. The realized return gap for the first pair of assets is 27.9330% vs. 37.4334% for the latter pair. The return gap yields different results than the correlation coefficient arises from the fact that it reflects the standard deviation as well as the correlation coefficient. In contrast to the correlation coefficient alone, the return gap indicates that a portfolio including these two asset classes would have yielded diversification benefits.

Table 2 shows that the benefits-of-diversification rank of asset pairs by correlation coefficient often differs from their rank based on realized return gap. For example, the -0.5480 correlation between T-bills and COMEX index places this pair of assets first on benefits of diversification when ranked by correlation, but the pair's 16.6639% return gap places it only 53rd when ranked by return gap (Exhibit 4). In fact, findings presented in Exhibit 4, illustrate the importance of considering standard deviation along with correlation when assessing diversification benefits across asset categories. Furthermore, these findings suggest that despite of increase

in global market correlations which tend to go up especially in times of crises, the potential for further risk reduction through asset allocation and international portfolio diversification remains substantial during up and down markets.

IV. CONCLUSION

Correlation is the common indicator of portfolio diversification benefits; however, coefficient of correlation alone does not provide an intuitive indicator of diversification benefits nor do these benefits depend only on the correlation between asset returns. Results of this study show that relative rank of assets by diversification benefits is different when measured by correlation coefficient and by return gap. In addition, investors seeking diversification opportunities could go a step further and combine coefficient of correlation and return gap in practical asset allocation to at least partially hedge out market exposure and invest more granularly in regions, countries, and asset categories.

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¹ NBER recession definition

TABLE 1. Correlation among 12 asset classes

Panel A: January 2001 – January 2010

| | EAFE | EM | EM Eastern Europe | EMU | Russell 3000 | SP500 | LT Treas. | T-Bills | Corp. Bonds ¹ | Real Estate ² | Gold ³ | Commodities ⁴ |
|-------------------|--------|---------|-------------------|---------|--------------|---------|-----------|---------|--------------------------|--------------------------|-------------------|--------------------------|
| EAFE | 1 | | | | | | | | | | | |
| EM | 0.8858 | 1 | | | | | | | | | | |
| EM Eastern Europe | 0.8976 | 0.8981 | 1 | | | | | | | | | |
| EMU | 0.9941 | 0.8708 | 0.6344 | 1 | | | | | | | | |
| Russell 3000 | 0.9158 | 0.6603 | 0.6507 | 0.9186 | 1 | | | | | | | |
| SP500 | 0.8839 | 0.6183 | 0.6994 | 0.8926 | 0.9956 | 1 | | | | | | |
| LT Treas. | 0.1565 | 0.0234 | 0.4670 | 0.1658 | 0.4427 | 0.4920 | 1 | | | | | |
| T-Bills | 0.4175 | 0.0935 | 0.2929 | 0.5206 | 0.4571 | 0.4816 | 0.4677 | 1 | | | | |
| Corp. Bonds | 0.4261 | -0.0670 | 0.5200 | -0.3860 | -0.2790 | -0.2191 | 0.5187 | 0.5848 | 1 | | | |
| Real Estate | 0.9178 | 0.8440 | 0.2791 | 0.8915 | 0.9664 | 0.9636 | 0.6608 | 0.5430 | 0.0873 | 1 | | |
| Gold | 0.0309 | 0.5395 | -0.0103 | -0.0420 | -0.3236 | -0.3506 | -0.6179 | -0.5480 | -0.0337 | 0.0806 | 1 | |
| Commodities | 0.6678 | 0.5740 | 0.8263 | 0.7075 | 0.6286 | 0.6335 | 0.3974 | 0.9236 | 0.3893 | 0.8225 | -0.2573 | 1 |

Panel B: January 2007 – January 2010

| | EAFE | EM | EM Eastern Europe | EMU | Russell 3000 | SP500 | LT Treas. | T-Bills | Corp. Bonds ¹ | Real Estate ² | Gold ³ | Commodities ⁴ |
|-------------------|--------|---------|-------------------|---------|--------------|---------|-----------|---------|--------------------------|--------------------------|-------------------|--------------------------|
| EAFE | 1 | | | | | | | | | | | |
| EM | 0.8022 | 1 | | | | | | | | | | |
| EM Eastern Europe | 0.7967 | 0.7818 | 1 | | | | | | | | | |
| EMU | 0.9928 | 0.7913 | 0.6344 | 1 | | | | | | | | |
| Russell 3000 | 0.9804 | 0.7298 | 0.6507 | 0.9612 | 1 | | | | | | | |
| SP500 | 0.9812 | 0.7196 | 0.6994 | 0.9649 | 0.9994 | 1 | | | | | | |
| LT Treas. | 0.7360 | 0.3444 | 0.4670 | 0.6952 | 0.8022 | 0.8035 | 1 | | | | | |
| T-Bills | 0.4219 | 0.0805 | 0.2309 | 0.4006 | 0.3511 | 0.4510 | 0.3977 | 1 | | | | |
| Corp. Bonds | 0.1546 | -0.0560 | 0.5200 | 0.1815 | 0.1693 | 0.1835 | 0.4580 | 0.5848 | 1 | | | |
| Real Estate | 0.8378 | 0.7640 | 0.1891 | 0.7912 | 0.8964 | 0.9006 | 0.5708 | 0.5020 | 0.0783 | 1 | | |
| Gold | 0.4361 | 0.1543 | -0.0100 | -0.4510 | -0.5032 | -0.5220 | -0.6861 | -0.5700 | -0.4461 | 0.0806 | 1 | |
| Commodities | 0.6078 | 0.5642 | 0.7992 | 0.7005 | 0.6116 | 0.6035 | 0.3864 | 0.9003 | 0.3796 | 0.7925 | -0.2570 | 1 |

Note: 1 High-grade corporate bonds; 2 NAREIT Index; 3 COMEX; 4 Goldman Sachs Commodity Index.

TABLE 2. Realized return gap 12 asset classes

| | EAFE | EM | EM Eastern Europe | EMU | Russell 3000 | SP500 | LT Treas. | T-Bills | Corp. Bonds ¹ | Real Estate ² | Gold ³ |
|-------------------|--------------------------------|---------------------------------|--------------------------------|--------------------|--------------|-------|-----------|---------|--------------------------|--------------------------|-------------------|
| EM | 42.7941 28.5605- 26.1345 | | | | | | | | | | |
| EM Eastern Europe | 27.9330 5.7155- 35.5354 | 53.8904 6.1375- 69.8316 | | | | | | | | | |
| EMU | 14.1628 10.7122- 17.1916 | 65.2286 49.6849- 107.1013 | 38.3299 15.6504- 49.8964 | | | | | | | | |
| Russell 3000 | 34.2511 31.0815- | 60.0714 42.4455- | 65.7084 31.7538- | 36.7317 5.2538- | | | | | | | |

| | | | | | | | | | | | |
|------------------------------|-----------------------------------|-----------------------------------|----------------------------------|-----------------------------------|--------------------------------|--------------------------------|-------------------------------|--------------------------------|--------------------------------|---------------------------------|---------------------------------|
| | 37.9778 | 2.1647 | 77.3497 | 46.8985 | | | | | | | |
| SP500 | 35.2150 32.4044- 39.0727 | 65.1890 44.9356- 9.5538 | 66.6981 36.3596- 79.2243 | 37.4334 3.2257- 50.4118 | 7.9200 1.2923- 32.4561 | | | | | | |
| LT Treas. | 28.4126 1.4056- 71.6623 | 39.6001 2.4561- 91.0627 | 42.6953 5.2613- 99.5630 | 32.7223 2.9783- 60.5404 | 24.5626 1.0879- 66.3209 | 19.9605 0.9506- 56.1190 | | | | | |
| T-Bills | 1.0040 8.3029- 47.1136 | 4.2240 7.9213- 63.0130 | 6.3209 10.0524- 78.9123 | 1.0040 8.3029- 47.1136 | 15.7403 1.0092- 60.3925 | 9.7933 2.3306- 47.9740 | 10.6697 0.1068- 23.9964 | | | | |
| Corp. Bonds ¹ | 19.2651 1.9366- 79.009 | 26.7261 3.8365- 82.1390 | 26.7261 3.8365- 82.1390 | 19.2651 1.9366- 79.009 | 25.8826 2.5506- 58.0998 | 18.6240 3.6297- 76.0659 | 4.3981 12.6693- 23.6701 | 7.8965 15.6613- 29.9918 | | | |
| Real Estate ² | 100.1592 49.6882- 482.3614 | 153.6878 80.9447- 510.1640 | 141.1993 1.8074- 201.1348 | 115.7890 0.7502- 232.0335 | 19.6630 0.6003- 33.9651 | 14.6302 0.4097- 28.9326 | 19.5103 0.9066- 48.6415 | 31.0260 1.0087- 58.9661 | 15.006 8.6194- 62.9713 | | |
| Gold ³ | 186.4307 118.5429- 472.9755 | 250.8726 163.6840- 357.9032 | 199.9056 0.4621- 317.4413 | 220.0696 131.7634- 295.226 | 28.4925 0.3610- 152.9332 | 26.1293 1.9677- 55.6296 | 19.8066 0.8705 79.0650 | 16.6639 2.0069- 57.4591 | 18.2298 2.9416- 67.1055 | 29.0673 3.0014- 80.063 | |
| Comm odities ⁴ | 188.8715 148.6819- 310.4699 | 251.0711 210.8659- 379.9901 | 129.7525 96.9396- 344.0967 | 215.0983 124.0332- 309.8396 | 33.4893 3.1065- 169.3659 | 38.7463 4.6600- 188.3664 | 53.6931 9.1137- 200.190 | 19.8196 6.8092- 101.5006 | 23.4165 7.7750- 158.1637 | 30.8416 13.0672- 179.7261 | 33.0144 28.0663- 182.2407 |

Note: The top number in each cell is the mean return gap of a pair of assets, the bottom number is the range of realized 12-month return gaps.
1 High-grade corporate bonds; 2 NAREIT Index; 3 COMEX; 4 Goldman Sachs Commodity Index.