Diversification: does it really fail, when you need it most?

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Abstract

Diversification has been labeled as the “only free lunch in investment management.” This conventional knowledge has been under attack for many years as investors observed that correlations of risky assets have been rising during periods of increasing systematic risks. Higher correlations are painful, but they usually do not happen *ceteris paribus*. In times of very volatile markets, even high correlations will proof to be useful and diversification benefits might increase rather than decrease. What are the conditions for this to happen?

Keywords Diversification · Market crisis · Security equivalent

Problem

Diversification has been labeled as the “only free lunch in investment management.”¹ This conventional knowledge has been under attack for many years as investors observed that correlations of risky assets have been rising during periods of increasing systematic risks. Higher correlations are painful, but they usually do not happen *ceteris paribus*. In times of very volatile markets, even high correlations will proof to be useful and diversification benefits might increase rather than decrease. What are the conditions for this to happen?

Framework

Without loss of too much generality, we assume two risky assets, e.g., home equities and foreign equities. Both offer equal return ($\mu_{\text{home}} = \mu_{\text{foreign}}$) and equal volatility ($\sigma_{\text{home}} = \sigma_{\text{foreign}} = \sigma$). How large is the diversification benefit of an optimally diversified portfolio (minimum variance portfolio with $w^* = \frac{1}{2}$) versus an investment into the home market? We start by defining the utility difference (ΔU)

between these two portfolios for an investor with risk aversion λ as²

$$\Delta U = \Delta \mu - \lambda \Delta \sigma^2$$

Note that ΔU represents the security equivalent (risk-free return that would create the same utility difference) has a return dimension. We already assumed $\Delta \mu = 0$. How large is $\Delta \sigma^2 = \sigma_{\text{minvar}}^2 - \sigma^2$? From basic portfolio theory, we can express this as

$$\begin{aligned} \Delta \sigma^2 = \sigma_{\text{minvar}}^2 - \sigma^2 &= \left(\frac{1}{2}\right)^2 \sigma^2 \\ &+ \left(1 - \frac{1}{2}\right)^2 \sigma^2 + 2\left(\frac{1}{2}\right)\left(1 - \frac{1}{2}\right) \rho \sigma^2 - \sigma^2 \end{aligned} \quad (1)$$

From here it follows, that

$$\Delta \sigma^2 = \frac{1}{2} \sigma^2 (\rho - 1)$$

and finally we can compute the benefits of diversification from

$$\Delta U = -\lambda \frac{1}{2} \sigma^2 (\rho - 1) \geq 0 \quad (2)$$

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¹ Attributed to Harry Markowitz by Berntein (1998).

² The following section derives the results provided in Wilcox (1999), probably the most overlooked book in investment management. The framework looks at expected utility gains from diversification (which by definition are always positive), rather than realized gains. The later are highly sample dependent and noisy.

Intuitively, this shows that a pure diversification benefit in our model is always positive. It also means that the diversification benefit does not necessarily fall in crisis periods. Focusing on correlation is highly misleading. While correlations will rise during periods of market turbulence, so will volatility. The net effect on utility remains unclear. In times of higher volatility, even increased correlations might still translate into sizable diversification gains. Assume $\lambda = 5$. For $\sigma = 0.2$ and $\rho = 0.8$, we arrive at $\Delta U = 2\%$. If an increase in correlation toward 0.95 is accompanied by an increase in volatility to 0.4, ΔU increases to 3.125%. The increase in correlation has been overcompensated by the increase in volatility.

Evidence

We can illustrate the above framework with an empirical example. Let us assume an investor into European equities (proxied by the MSCI Europe index) that diversifies into

Emerging market equities (proxied by the MSCI Emerging markets index). How well does the diversification into Emerging markets work across time? Using weekly returns for the period January 2000 to July 2020, we calculate rolling (26 weeks) volatilities and correlations as inputs for Eq. (2). For $\lambda = 5$, we arrive at Fig. 1.³ Contrary to conventional wisdom, we find that diversification benefits increase during market turmoil. This has been true for every mayor crisis in the past 20 years. Diversification benefits rise sharply during the 2000 market selloff, the 2008 credit crisis, the 2012 Euro crisis and the most recent COVID-19 market selloff. This makes intuitive sense as increased correlations usually occur in crisis periods. High volatilities make even high correlations still valuable. In contrast, diversification benefits are low in normal times (for example, the tranquil 2004 to 2007 period). In calm markets, volatilities are also low and there is less to be gained from diversification. Ex ante expectations are broadly matched ex post, as can be seen in Fig. 2.

Fig. 1 *Diversification gain.* We plot $\Delta U = -\lambda \frac{1}{2} \sigma_{\text{EUR}}^2 (\rho_{\text{EUR,EM}} - 1)$ for $\lambda = 5$ and rolling historical estimates (from 26 equally weighted weekly returns) for volatility and correlation. We assume an investor in European equities (EUR) venturing into Emerging market equities (EM). The time period is from July 2000 to July 2020 as it takes 26 weeks to calculate the first volatility and correlation

³ Results scale directly with risk aversion.

Fig. 2 *Realized diversification gain.* We plot $\Delta U = -\lambda \frac{1}{2} (\sigma_{\text{minvar}}^2 - \sigma_{\text{EUR}}^2)$ for $\lambda = 5$ and rolling historical estimates (from 26 equally weighted weekly returns) for volatilities and correlation. We assume an investor in European equities (EUR) venturing into Emerging market equities (EM). The time period is from July 2000 to July 2020 as it takes 26 weeks to calculate the first volatility and correlation

Conclusion

Contrary to conventional wisdom, diversification works well in crisis periods once we shift our narrow focus on correlation toward changes in expected investor utility. Higher correlations are painful, but they usually do not happen *ceteris paribus*. Instead they are accompanied by higher volatility. In contrast, diversification is less useful, when you do not need it, i.e., in period of market calm. Investors should take note.

References

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