



Education Note

Revisiting the Art of Portfolio Diversification

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At a glance

This Education Note continues our series on portfolio diversification. We focus here on the question of how many individual stocks make up a well-diversified portfolio within the asset class of equities.

Background

- Our previous Education Notes in this series considered portfolios comprised of different asset classes that would enable an investor to participate in the overall performance of financial markets.

Reality

- In reality, most investors have highly concentrated portfolios that are poorly diversified even within specific asset classes like equities. Our simulations show that poorly diversified portfolios underperform well-diversified portfolios in about 70% of all cases.

Advice

- We think a well-diversified equity portfolio should hold several dozen different stocks. This diversified exposure to equity markets can be accomplished through investment funds.
- Opportunities in specific stocks or markets can then be exploited by adding additional holdings of these stocks on top of the fund investments.

Asset Class: Money Market, Fixed Income, Equity, Real Estate, Hedge Fund, Commodity, Emerging Market

Table 1: Previous Education Notes in this series

Title	Publication date
Part 1: The Interplay of Asset Classes	23 Nov. 2006
Part 2: Selecting Actively Managed Funds	8 Jan. 2007
Part 3: Rebalancing to Control Risks	1 Feb. 2007
Part 4: Risk Management	1 Mar. 2007
Part 5: The Influence of Time	2 Apr. 2007
Part 6: Taxes	2 May 2007
Part 7: Putting it All Together	6 June 2007

Source: UBS WMR, as of 20 September 2007

Introduction

Over the course of the first half of 2007 we have published a series of Education Notes on portfolio diversification (see Table 1 for an overview). We think this topic is vital for investment success and in the series we have tried to demonstrate how properly diversified portfolios can help an investor achieve his or her financial goals.

Throughout the publication of this series, we have received much (positive) feedback and many questions from readers and clients, whom we thank here for their interest and engagement. As a broad response, we offer the comment that portfolio diversification is not a one-time effort; rather, it requires constant effort. In these seven Notes we were unable to touch on many important subjects brought to our attention during the numerous presentations and discussions we have had with clients since the series began. For our part, we intend to frequently revisit the art of portfolio diversification and we hope to cover the many fascinating subjects raised by readers in subsequent Notes.

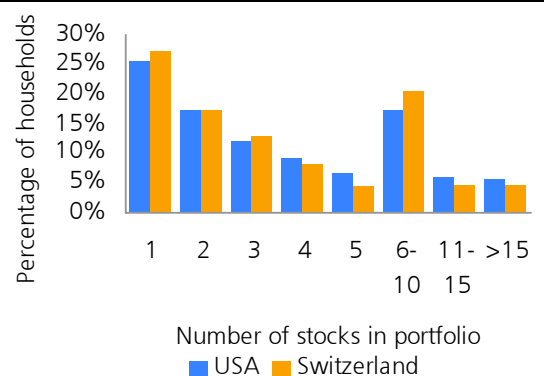
How well-diversified is your portfolio?

One of the questions frequently asked was about the degree of diversification needed within each asset class. We have been writing about the necessity to diversify across different asset classes from the assumption that the investor was already well diversified within each asset class, which is not the case in most real life portfolios.

Indeed, Fig. 1 presents the very undiversified equity portfolios from a study of 40,000 US households and about 10,000 Swiss households. The study showed that, on average, the US household is invested in

Fig. 1: Lack of diversification

Average number of stocks in portfolio: 3 to 5



Source: Goetzman and Kumar (2001), Loderer (2005) as of 20 September 2007

Past performance is no indication of future performance. The market prices provided are closing prices on the respective principle stock exchange. This applies to all performance charts and tables in this publication.

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only three to five different stocks. Even more alarming is the fact that 25% of US households invested in just one stock. Similar findings were obtained in a study of representative Swiss households.

The impact of a lack of diversification

It should be obvious that this behavior implies a lack of diversification within the equity universe. But how bad can it really be? Prompted by these studies, we have tried to find out what the impact of this portfolio over-concentration within equities really is.

To do this, we have simulated 10,000 investors who selected stock portfolios out of the 100 stocks in the S&P 100 and the 50 stocks of the StoXX 50 index at the end of the year 2000. These simulated investors selected either one or more stocks out of the basket of 150 global stocks according to the distribution in Fig. 1 (25% randomly selected one stock; 17% randomly selected two different stocks, etc.). The simulated investors then assigned a random weight to the stocks in the portfolio and selected an additional investment in USD cash and a USD Treasury bond index fund to simulate different risk profiles.

The portfolios were then held unchanged until the end of May 2007, thus over a period of more than six years. The resulting return of these simulated portfolios and the risk at which this return was achieved is shown in Fig. 2, together with the risk and return of investors who chose to invest in USD cash, Treasury bond funds and a subset of 100 stocks out of the 150 in the total sample. The results are impressive. 69.8% of all the concentrated portfolios underperformed well-diversified portfolios for a given level of risk. Or, to put it differently, for a given level of portfolio risk, only three out of ten investors with an undiversified portfolio will outperform an investor who covers the stock market through well-diversified funds or mandates.

Why do concentrated portfolios underperform?

The main reason why concentrated portfolios with only a few stocks underperform a well-diversified portfolio is simple. A portfolio of three to five stocks often puts a large part of total wealth into one single stock. If this company gets into trouble, or even fails, the investor will own a very volatile portfolio with very low returns – no matter how successful the other stocks in the portfolio are – because the loss in the one bad egg in his basket will consume a large portion of his total wealth.

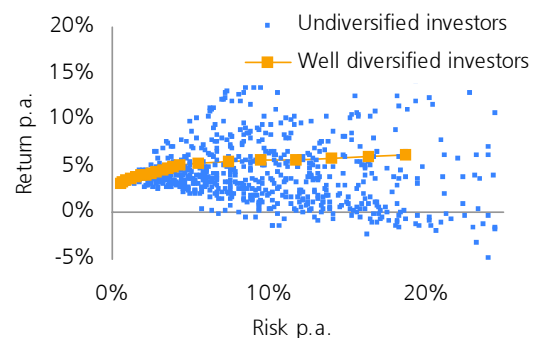
Similarly, if an investor invests too much money in cash and adds a few stocks for diversification, the result will be a portfolio that has higher risk than expected (because most of the risk comes from the stock investments), but with rather low returns, because the large investment in low-yielding cash will drag down total portfolio performance.

The situation gets worse when examined in a more holistic context. We often observe that many investors keep a large chunk of their investments in the stock of their own employer. Should the employer get into trouble, the investor suffers double. The portfolio loses value because the stock price declines and the income of the investor suffers as well, since bonuses or salaries decline rapidly.

Many investors think investing in the stock of the employer or stocks of similar companies in the given industry where one works is justifiable. After all, we probably know more about the fate of the industry we work in than we would about any other stock. The testimony of many former employees of Enron or Swissair proves this approach is

Fig. 2: Lack of diversification hurts performance

Well-diversified portfolios (orange) outperform 70% of concentrated portfolios (blue dots) between 12/2000 and 05/2007



Source: UBS WMR, as of 20 September 2007

grossly wrong-headed. In the current series of Education Notes on Behavioral Finance, we show how biases like the familiarity bias can easily trick investors into building inefficient portfolios.

How many stocks constitute a well-diversified portfolio?

Naturally, the question to be answered is how many different stocks are needed for a portfolio to be judged well-diversified. The short answer is simple: we recommend investing in equities via globally diversified stock funds. As we can see in Fig. 3, the risk of a portfolio first drops sharply and then levels off as the number of stocks in the portfolios rises. This chart is a model calculation based on the average correlation between two stocks of 0.29 (between December 2000 and May 2007) and an average 34% risk of a single stock.

But as we can see, the risk of the portfolio is rapidly reduced in the beginning and then less, once a base of 40 to 50 stocks is formed. We have calculated the number of stocks needed to achieve performance similar to that of a stock fund investor. Our estimates are shown in Table 2 for different market indices, assuming a long-term average correlation between stocks of 0.08 as calculated by academic studies.¹ All calculations assume that a stock fund investment costs about 0.25% more than a portfolio managed by the investor. This is so because a stock fund investment usually is more expensive than a pure buy and hold strategy of direct investments. In a stock fund, the manager not only has to buy and sell stocks like in a direct investment but has additional costs due to custody, constant cash in and outflows of the fund and administration cost.² We see that a global stock portfolio typically needs to invest in more than 80 stocks, while regional stock indices can be tracked with fewer. Other studies came to the conclusion that a global stock portfolio needs to consist of more than 100 stocks if the same efficiency as a stock fund investment should be achieved.

Simple Implementation tips

Since the number of stocks required to achieve similar performance to a stock fund investment is much higher than what most investors are capable of implementing and managing, in their personal portfolios, we suggest the following approach to build a stock portfolio:

- Build a globally diversified equity portfolio using well-diversified investment funds, for instance. This can be done using one globally invested fund or using several regional funds that can be combined.
- Avoid overlap in the funds you invest in, as this will give you only the illusion of diversification. For example, a fund that tracks the DAX and a fund that tracks the EuroStoXX 50 index will have many stocks in common, which reduces diversification's benefits.
- In addition to different funds, to take advantage of investment opportunities, small investments in single stocks or baskets of stocks can be made. Make sure the allocation to these single stocks is only a small percentage of the overall portfolio.

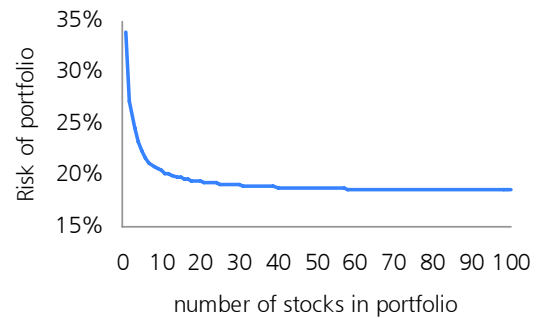
Conclusions

Empirical studies show that investors typically hold very concentrated portfolios. We have shown that, as a consequence, it is very unlikely for these investors to earn returns that are comparable or superior to broad market returns.

We estimate that an investor needs to invest in several dozens of

Fig. 3: Rising diversification reduces risks

Risk of portfolio based on the number of stocks, the average correlation of 0.29 and the average stock risk of 34% between 12/2000 and 05/2007



Source: UBS WMR, as of 20 September 2007

Table 2: How many stocks in a well-diversified portfolio?

Index	Estimated number of stocks needed to break even in efficiency with index fund incl. 0.25% added fees
SMI (26 stocks)	18 stocks
EuroStoXX 50 (50 stocks)	29 stocks
Nikkei 225 (225 stocks)	60 stocks
S&P 500 (500 stocks)	76 stocks
MSCI World (ca. 1'800 stocks)	82 stocks

Source: UBS WMR, as of 20 September 2007

¹ M. Statman, "How much diversification is enough?", October 2002

² For more information on this topic see M. Statman, "How much diversification is enough?", October 2002, where the same assumptions are applied.

stocks to gain adequate diversification within a single asset class. We therefore recommend investing within a specific asset class like equities by building a portfolio of well-diversified funds or other diversified products, and then exploit specific, additional opportunities as they arise.

This approach allows investors to exploit market opportunities while avoiding large losses in a portfolio that cannot be compensated by profits in other investments. Care has to be taken, however, that the exposure to individual stocks is only a small portion of the entire portfolio.

Appendix

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