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Hedge Fund Returns: You Can Make Them Yourself!

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This paper is a non-technical introduction to the following papers, which can also be obtained from AIRC/SSRN:

H. Kat and H. Palaro – *Who Needs Hedge Funds: A Copula-Based Approach to Hedge Fund Return Replication*, AIRC Working Paper 27.

H. Kat and H. Palaro – *Replication and Evaluation of Fund of Hedge Funds Returns*, AIRC Working Paper 28.

H. Kat and H. Palaro – *Superstars or Average Joes? A Replication-Based Performance Evaluation of 1917 Individual Hedge Funds*, AIRC Working Paper 30.

H. Kat and H. Palaro – *Tell Me What You Want, What You Really, Really Want! An Exercise in Tailor-Made Synthetic Fund Creation,* AIRC Working Paper 36.

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Introduction

Over the last 10 years hedge funds have become very popular with high net worth investors and are currently well on their way to acquire a significant allocation from many institutional investors as well. The growing popularity of hedge funds and the availability of various hedge fund databases have spawned several hundreds of academic research papers on various aspects of the hedge fund industry and especially the risk-return performance of hedge funds and fund of funds. Many of these papers apply methods, like standard mean-variance and Sharpe ratio analysis for example, which are ill-suited for the analysis of hedge funds returns and have, as a result, produced incorrect conclusions. Fortunately, some studies have taken a more sophisticated approach and have made it clear that hedge fund returns are not really superior to the returns on traditional asset classes, but primarily just different.

With hedge fund performance getting worse every year, the hedge fund industry has come to more or less the same conclusion. Unlike in the early days, hedge funds are no longer sold on the promise of superior performance, but more and more on the back of a diversification argument: due to their low correlation with stocks and bonds, hedge funds can significantly reduce the risk (as measured by the standard deviation) of a traditional investment portfolio without giving up expected return.

Once we accept that hedge fund returns are not superior, but just different, the obvious next question is: is it possible to generate hedge fund-like returns ourselves by mechanically trading stocks and bonds (either in the cash or futures markets)? Although hedge fund managers typically put a lot of effort into generating their returns, maybe it is possible to generate very similar returns in a much more mechanical way and with a lot less effort. If it is, we may be able to do without expensive hedge fund managers and all the hassle, including the due diligence, the lack of liquidity, the lack of transparency, the lack of capacity, and the fear for style drift, which comes with investing in hedge funds. There might well be more than one road leading to Rome.

Based on earlier work on hedge fund return replication by Amin and Kat (2003), we have done a lot of research in this area, which has lead to the development of a

general procedure that allows us to design simple trading strategies in stock index, bond, currency and interest rate futures that generate returns with statistical properties that are very similar to those of hedge funds, or any other type of managed fund for that matter. In what follows, we briefly describe this procedure as well as provide some examples of the procedure's amazing results.

The General Idea

In theory at least, there are several ways to replicate hedge fund returns. One popular approach is to estimate a so-called factor model, i.e. a model which explains fund returns from a number of "risk factors", such as changes in the S&P 500, interest rates, credit spreads, volatility, etc. Once these factors have been identified and the fund's sensitivity to these factors has been determined, one can construct a portfolio of stocks, bonds, and other securities with the same factor sensitivities as the fund in question. Since it has the same factors sensitivities, the resulting portfolio will generate returns that are similar to those of the fund.

The main problem with the above approach is that in practice we have little idea how hedge fund returns are actually generated. In other words, we don't really know which risk factors to use. As a result, factor models for hedge funds typically explain only a small portion (15-20%) of a hedge fund's total return, compared to 90-95% for mutual funds. Although the procedure works a little bit better for portfolios of hedge funds and hedge fund indices, obviously this is not enough to call it proper "replication".

Given the failure of the factor model approach, one could say that by trying to replicate hedge funds' month-to-month returns we are aiming too high. Fortunately, this is not really a problem. When investors like a hedge fund it is (hopefully) not because of the fund manager's smooth sales rap, his expensive Armani suit or his big Rolex. It is because of the manager's track record. In fact, it is (or should be at least) because of the statistical properties of that track record, i.e. the average, standard deviation, etc. of the hedge fund return and the correlation with the investor's existing portfolio. This implies that we do not necessarily have to replicate a fund's month-to-month returns. It is enough if we can generate returns with the same statistical

properties as the returns generated by the fund. This is exactly what the replication procedure that we have developed does.

The Procedure

Our replication procedure is an extension of the hedge fund return replication procedure initially introduced by Amin and Kat (2003), based on the earlier theoretical work of Dybvig (1988). Amin and Kat developed mechanical trading strategies, trading the S&P 500 and cash, generating returns with the same marginal distribution, i.e. the same mean, standard deviation, skewness, and kurtosis, as a given hedge fund. Although interesting from a theoretical perspective, from a practical perspective only replicating the marginal distribution is not enough, though. Investors are attracted to hedge funds because of their relatively low correlation with traditional asset classes and their own portfolio in particular. To properly replicate hedge fund returns we therefore not only have to replicate the marginal distribution, but also the correlation between a fund and the investor's existing portfolio. If we can design strategies that generate returns which not only have the same mean, standard deviation, skewness and kurtosis as the hedge fund in question, but also the same correlation with the investor's portfolio as the fund, then we will have truly replicated (in the statistical sense) that hedge fund.

Of course, designing trading strategies that generate returns with the same statistical properties as hedge fund returns may sound easy, but it is not. It requires a lot of highly sophisticated mathematics and econometrics, the details of which we will not discuss here. The procedure, however, follows a number of distinct steps. The first step consists of a thorough analysis of the available return data on the hedge fund in question as well as the investor's portfolio, and the selection of a statistical model that best describes these data. Since hedge fund returns often have very challenging statistical properties, the set of models to choose from needs to be sufficiently flexible to allow for a good fit, whatever the actual fund strategy. Once the statistical model is chosen, an optimal trading strategy is derived. This is done in very much the same way as investment banks derive hedging strategies for their OTC option positions. In essence, this means our strategies go back to the famous Black-Scholes option pricing

model, which is well-tested in practice and which forms the foundation of today's trillion dollar derivatives industry.

A Real-Life Example

Since the proof is always in the eating, let's see how our replication procedure does in reality. George Soros is generally considered one of our time's great investors so if we can replicate (the statistical properties of) his returns we may really be on to something. Let's therefore take Soros' Quantum Emerging Growth Fund as the fund to replicate. This fund is included in the well-known TASS database where it is classified as "global macro", with monthly return data starting in January 1992 and ending in June 2000.

The investor's portfolio could contain just about anything, but let's for simplicity assume it consisted of 70% stocks (in the form of the S&P 500 tracking portfolio) and 30% bonds (in the form of long-dated T-bonds). To be able to generate the desired returns, we also need to choose what we call a 'reserve asset'. The task of this reserve asset is to provide us with some flexibility in the form of an extra source of uncertainty, i.e. in addition to the uncertainty already present in the investor's portfolio. Although in principle anything that moves will do, in this example we will use 3-month Eurodollar futures as the reserve asset. Figure 1 shows a scatter plot of the monthly returns on the investor's portfolio versus the Quantum Fund returns. From the plot it is clear that the degree of correlation is relatively low. The correlation coefficient between the investor's portfolio and the Quantum Fund is 0.42.

<< Insert Figure 1 and 2 here >>

Given the investor's portfolio and the reserve asset, our goal is to design a mechanical trading strategy, trading S&P 500, T-Bond and 3-month Eurodollar futures, which generates returns that have the same statistical properties as those of George Soros' Quantum Emerging Growth Fund. As said before, the derivation of the strategy and its exact workings are too complex too discuss here. The results, however, are not. Figure 2 shows a scatter plot of the monthly returns on the investor's portfolio versus

the replicated returns. Comparing this with figure 1, we see that both plots are very similar, which indicates that the replication strategy is indeed able to successfully replicate the Fund returns' statistical properties.

A better indication of the success of the replication strategy comes from comparing the actual means, standard deviations, skewness and kurtosis figures of the Quantum Fund and our replicating returns. The latter statistics, as well as the correlation with the investor's portfolio, can be found in Table 1.

	Mean (monthly)	St. Dev (monthly)	Skewness	Excess Kurtosis	Corr. with Portfolio
Quantum	1.84%	7.58%	-0.14	0.21	0.42
Replica	1.66%	7.96%	-0.01	0.47	0.41

Table 1: Comparison statistics Quantum Emerging Growth Fund and replicating strategy.

Comparing the entries in Table 1, it is clear that the statistical properties of Quantum's returns have been quite successfully replicated. All statistics are very similar. The mean of the replicated returns is 18bps per month lower than that of the Quantum fund itself. This could be because of George Soros' special skills, but (part of) this difference could also be due to the specifics of the sampling period, so one should be careful not to give too much weight to it.

The standard deviation of the replicated returns is slightly higher than that of the Quantum Fund, which is the result of hedging error. The replication is based on a theoretical trading strategy, which is derived from a model similar to the Black-Scholes model. As is the case with derivatives, within the model the desired payoff can be obtained with 100% accuracy. In practice, however, one has to deal with several "imperfections" that cause the outcome of the trading process to deviate somewhat from the theoretical payoff. These 'hedging errors' typically average out over time (i.e. their expected value is zero), but they do cause a slight rise in the standard deviation of the returns generated.

Even with an expected return on the replicating strategy that is somewhat lower than that of the Quantum Fund itself, the replicated returns offer a number of advantages over the Fund itself, which might very well compensate for this shortcoming. Since they are generated in a completely different way, the replicated returns do not suffer from the typical drawbacks that hedge funds and other alternative investments tend to suffer from.

1. Since we trade three of the most liquid futures markets in the world, we are not confronted with **liquidity** or **capacity problems**. Want to add or take out a couple of hundred million? It won't be a problem.

2. We don't have any **transparency problems** either. All we do is trade futures and anyone who wants to see what the portfolio looks like can do so at any point in time.

3. Investors do not have to be afraid of **style drift**. Real-life managers can and do change their strategy over time, which changes the statistical properties of the fund return. Taking a fund's historical track record as our point of departure, we aim to extrapolate the past into the future, i.e. we aim to generate returns with exactly those properties that attracted investors to the fund in question in the first place.

Another benefit of the replicated returns is that they are not directly exposed to the potential consequences of the tremendous influx of money that the hedge fund industry has experienced over the last couple of years. Hedge funds have absorbed an estimated $700 billion in assets under management over the past 10 years. As a result, profitability in various strategy classes is under serious pressure, with hedge funds currently accounting for 50% of daily volume on the New York and London stock exchanges and for more than 80% in convertibles and distressed debt. If pension funds start pouring large sums into hedge funds, the 'money machine' will almost surely come to a halt as there simply are not enough profit opportunities in the market to handle such inflows. In general economic terms, hedge funds' function is to ensure the smooth operation of the global capital markets. When there are to many of them, however, they will get in each other's way and things will go wrong. In that respect,

hedge funds are like oil in a machine. A little will make it work better, too much will suffocate it.

Taking the replication results in combination with the above benefits, many investors will prefer the replicated returns over the real thing, despite the somewhat lower expected return. Does it require superior skills? Yes, it does, but this time in applied mathematics and econometrics, not trading and investment.

Another Example

Just to emphasize that the above is not a special case, let's look at another example. Vega Asset Management in Madrid is one of the world's largest and fastest growing hedge fund managers. Following mainly global macro and fixed income strategies, Vega has won numerous awards and has currently around $11 billion under management. Vega's success makes it an interesting candidate for replication. Let's look at the Vega Global Fund, a global macro fund for which the TASS database contains data from November 1996 onwards.

As before, let's assume that the investor's portfolio consists of 70% S&P 500 and 30% long-dated T-bonds and that we use 3-month Eurodollar futures as the reserve asset. Figure 3 shows a scatter plot of the monthly returns on the investor's portfolio versus the Vega Fund. The scatter plot shows that Vega's returns are quite unusual. Most observations lie within a narrow band between 0% and 3% and appear to be more or less independent of the portfolio return. The correlation coefficient between the investor's portfolio and the Vega Fund is no more than 0.17. Figure 4 shows a scatter plot of the monthly returns on the investor's portfolio versus the replicated returns. Again, both plots are very similar, which is quite an accomplishment given the extraordinary nature of the Vega Fund returns.

<< Insert Figure 3 and 4 here >>

Table 2 shows the actual means, standard deviations, skewness and kurtosis figures and the correlation with the investor's portfolio of the Vega Fund as well as our

replicating returns. We see that the statistics of the replicated returns match those of the Fund returns very well. The mean of the replicated returns is slightly higher than that of the Vega Fund returns, but, as before, one should realize that (part of) this difference might be due to the choice of sampling period. The standard deviation of the replicated returns is again slightly higher than that of the original returns due to the small hedging errors that unavoidably occur during the execution of the theoretical replication strategy.

	Mean (monthly)	St. Dev (monthly)	Skewness	Excess Kurtosis	Corr. with Portfolio
Vega	0.68%	1.23%	-0.51	0.27	0.17
Replica	0.72%	1.45%	0.03	-0.13	0.06

Table 2: Comparison statistics Vega Global Fund and replicating strategy.

Tailor-Made Returns Are Now a Reality

It is important to realize that we do not have to wait for a fund with the right returns to come by before we can put our replication skills into practice. We can use the same methodology as before to design trading strategies that generate returns with certain predefined statistical characteristics, without there being a fund generating similar returns. Since in that case we do not have a historical track record to go by, we can use stochastic simulation methods to generate a "synthetic track record" with all the desired properties. Given this self-made track record, we can then apply the exact same procedure as before.

The Quantum Fund has a correlation with the investor's portfolio of 0.42, but wouldn't it be great if we could improve on that by creating a 'Fund' ourselves, that generated returns which were statistically very similar to those of the Quantum Fund but completely uncorrelated with the investor's existing portfolio?! Being able to design trading strategies that generate returns with predefined statistical properties opens up a whole new range of possibilities. Basically, it means that investors no

longer have to go through the usual process of finding and combining individual assets and funds into portfolios in a costly and often unsuccessful attempt to construct an overall investment portfolio with the exact characteristics they require. Investors can simply tell us what it is they are after and the replication system will design the strategy to match. No more do-it-yourself portfolio building, no more beauty parades, no more ALM hassle. Buy exactly and directly what you need, sit back and relax.

Conclusion

By dynamically trading futures in very much the same way as investment banks hedge their OTC option positions it is possible to generate returns that are statistically very similar to the returns generated by hedge funds without any of the usual drawbacks surrounding alternative investments, i.e. without liquidity, capacity, transparency or style drift problems and without paying over-the-top management fees. Hedge fund returns may be different, but they are certainly not unique. There is more than one road leading to Rome!

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Dybvig, P., Inefficient Dynamic Portfolio Strategies or How to Throw Away a Million Dollars in the Stock Market, *Review of Financial Studies*, Vol. 1, No. 1, 1988, pp. 67-88.

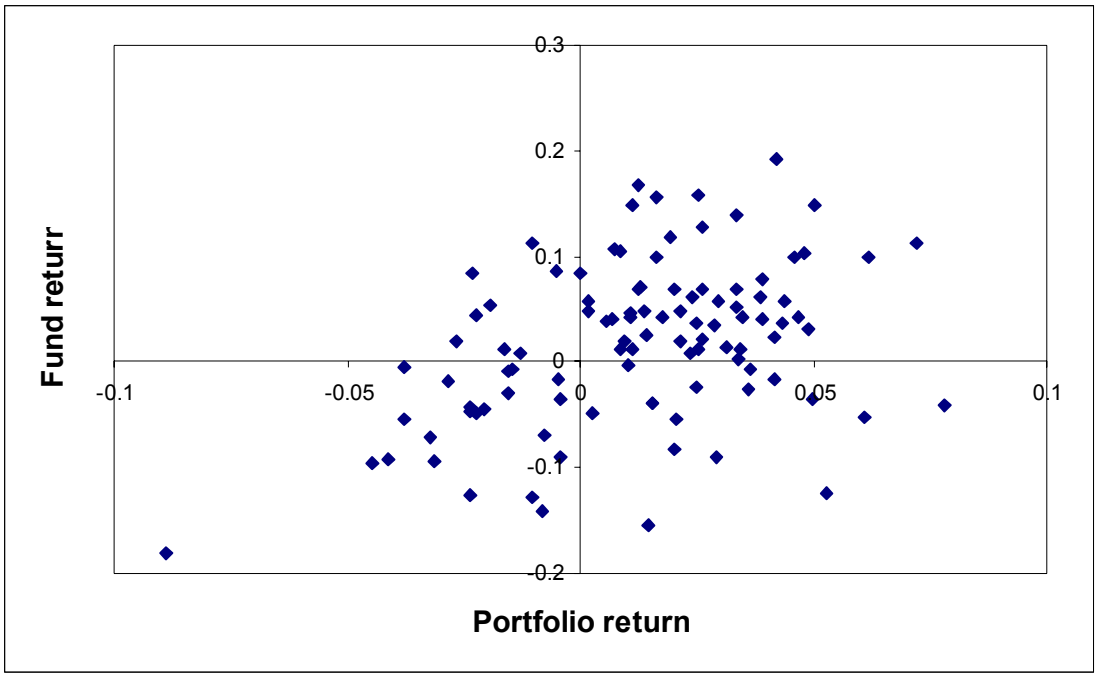

Figure 1: Scatterplot Quantum Fund returns versus portfolio returns

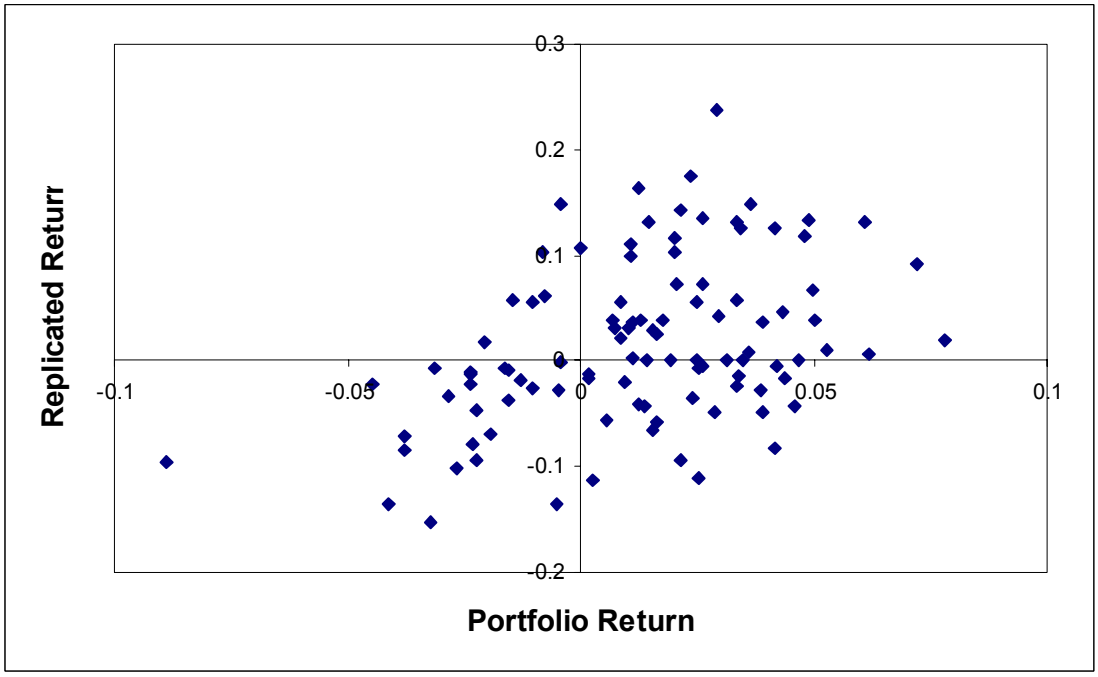

Figure 2: Scatterplot replicated returns versus portfolio returns

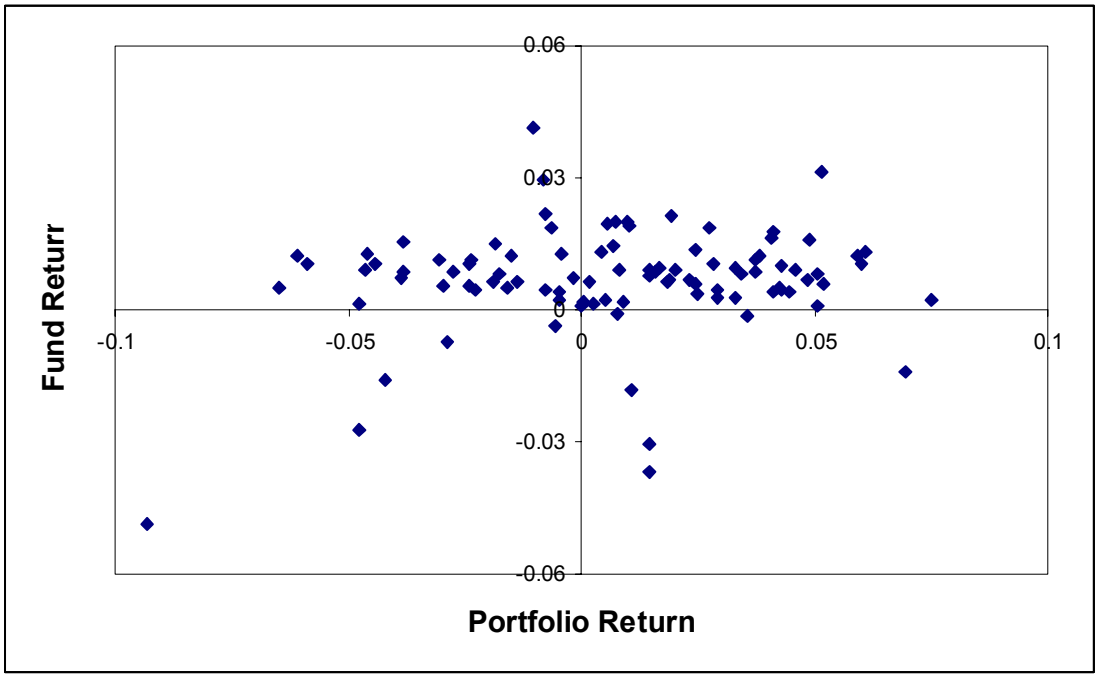

Figure 3: Scatterplot Vega Fund returns versus portfolio returns

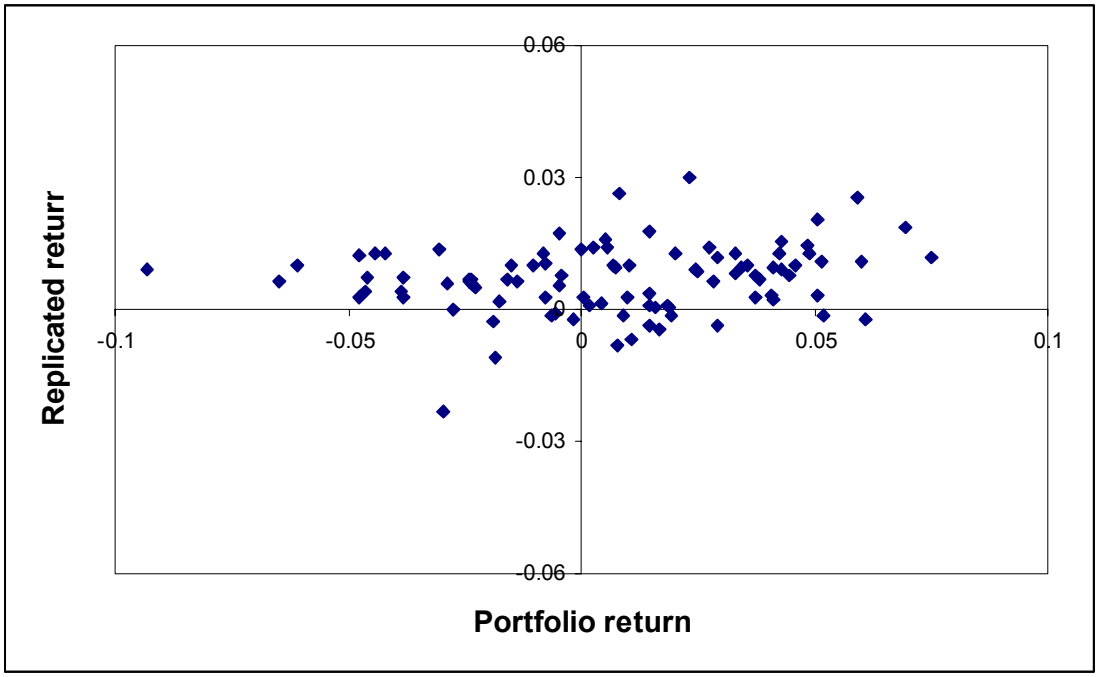

Figure 4: Scatterplot replicated returns versus portfolio returns