STOCKHOLM SCHOOL OF ECONOMICS
Master's Thesis in Finance

Performance, Benefits and Risks of Active-extension Strategies

CARL ARMFELT[a] DANIEL SOMOS[b]

Abstract

How are long-only managers' performance limited by the fact that they are constrained to no short selling? Applying a bootstrap statistical technique, we analyze the performance of active-extension strategies using 25 Fama-French portfolios formed on size and book-to-market. We show that a pool of active-extension portfolios outperform long-only portfolios, when the same alpha model is used. Active-extension is defined as an investment strategy that allows for both long and short positions in the portfolio, with a gross exposure above 100% of NAV, while maintaining a beta of one. The paper gathers and assesses previous research on the benefits and shortcoming of active-extension strategies. It also compares active-extension strategies to other investment vehicles. Our study shows that a pool of active-extension 130/30 portfolios outperform a pool of long-only portfolio, over the full sample period from 1927-2007. Looking at shorter ten-year periods, the active-extension portfolios predominantly outperform the long-only portfolios (i.e. have a better risk-adjusted return). The results are especially robust for the second half of the 1927-2007 period. Further, we show that within the range from 100/0 to 150/50, a portfolio with a leverage of 150/50 will on average have the highest improvement in performance.

Tutor: Professor Peter Högfeldt
Date: 8 February 2008, 13.15-15.00
Location: Room 750
Discussants: Johan Bergström 20038, Victor Sundén 19512

[a]20109@student.hhs.se [b]20099@student.hhs.se

CONTENTS

1 INTRODUCTION

Are long-only portfolio managers limited in their ability to generate performance by the fact that they are constrained to no short selling? A number of authors have suggested that traditional long-only managers could enhance portfolio returns with limited short selling. Active-extension strategies, such as 120/20 and 130/30 long-short portfolios, try to take advantage of this in search of new ways to expand alpha opportunities from active portfolio management. The idea is to have a portfolio with both long and short positions, while having the same beta-one net exposure to the market, as a traditional long-only fund.

The task of the long-only manager is to invest in stocks that outperform the benchmark index. The manager cannot express a negative view on a stock, other than underweighting it relative to the benchmark. By including short as well as long positions, managers expand their investment universe, giving them two sources of alpha: namely the long leg and the short leg of the portfolio. A manager that can distinguish outperforming stocks should be able to use this knowledge to also distinguish underperforming stocks, but if constraints like no short selling hamper the stock selection process into non-optimal portfolios, the expected value of the manager's strategy would decrease. By adding the freedom of limited short selling to the portfolio, the idea is that managers should be able to construct more efficient portfolios, since the talent of the manager is fully utilized. We aim to investigate if active-extension strategies can help long-only investors in their hunt for superior risk-adjusted returns.

The fund industry is responsible for investing a great part of the world's wealth and pensions. As the industry jumps on the bandwagon of financial innovation it is important to have a theoretical understanding of the new investment vehicles and what performance we can expect from them. It is particularly interesting to investigate active-extension strategies, as these products are in large parts aimed to take share from the dominating pool of capital allocated to long-only funds. Active-extension funds might appear to be somewhere in-between long-only funds and long-short hedge funds in terms of attributes, but as vehicles, we argue that active-extension funds should instead be closely compared with long-only funds (i.e. in terms of risk and return).

Our ambition is to improve the field of theoretical knowledge about active-extension funds, which should give investors insight whether the strategy is something for them, and also give the industry as a whole a better understanding of the mechanics involved. This study aims to investigate both in theory and empirically the expected performance of active-extension strategies, highlight on the characteristics, shortcomings and benefits, and expand on the usefulness. Our thesis delivers three main contributions: 1) It gathers and assesses previous research on the benefits and shortcomings of active-extension strategies. 2) It compares active-extension strategies to other investment vehicles. 3) We apply a bootstrap statistical technique to empirically analyze the performance of active-extension strategies using Fama-French portfolios formed on size and book-to-market, during the 1929 to 2007 period.

1.2 OUTLINE

We begin our thesis by presenting an overview of active-extension strategies and why long-only managers could enhance portfolio returns with this strategy. Thereafter, we develop a theoretical framework for our study in order to understand the theoretical rationale behind active-extension strategies and the various implications from a portfolio theory perspective. Based on the theoretical framework, we then study how they behave in reality and then present the empirical findings of our study. We conclude the thesis with a discussion of our findings and suggestions for further research.

2 WHAT ARE ACTIVE-EXTENSION FUNDS

The first thing that springs to mind when you think about a fund that is both long and short stocks might be a hedge fund. The term hedge fund is a very broad definition of investment vehicles that are using an array of investment strategies. Most hedge funds are unregulated and for this reason are free to use trading strategies that traditional, regulated investment funds are not allowed to use. The underlying investment techniques often consist of short selling, leverage and the use of derivatives. In addition, hedge funds usually focus on absolute returns and have a performance-linked compensation. Their investment strategies can be divided into many categories, such as arbitrage strategies, event-driven strategies, and directional or market neutral strategies. In many countries hedge funds are prohibited to market themselves to the public. Often investors, such as pension funds, are either not allowed to invest in them, or typically do not allocated more than 5-10 percent of their total assets to these investments (Stewart, 2007).

Active-extension strategies share three investment techniques with hedge funds; they are allowed to use short selling, they are leveraged vehicles and they typically have a performance-linked compensation. There are also vast differences, firstly they do not seek absolute returns regardless of the performance of the market. Instead active-extension strategies aim at outperforming an index or another benchmark just like a traditional investment fund. Johnson et al. (2007) argue that despite the similarities to hedge funds, an active-extension strategy is more like a long-only strategy because it is managed to a benchmark and has a 100 percent exposure to the market. Therefore, an active-extension strategy's performance should be evaluated similar to a long-only strategy and compared to its benchmark. Market exposure is also called beta, and 100 percent exposure equals a beta of one. For this reason both long-only and active-extension are often referred to as beta-one strategies. In contrast, hedge funds with a market-neutral long-short strategy, by definition, have a beta of zero. Secondly, active-extension funds are typically regulated under the jurisdiction of traditional investment funds, and for this reason they are allowed to market themselves to the general public. This, in combination with the fact that the risk and return profile of active-extension structures is similar to the long-only framework, makes them suitable to attract long-only money. The above is illustrated in table 2.1a.

The primary purpose of the active-extension funds is to tap into the large pool of assets allocated to long-only managers, while the primary rationale of the strategy is to attempt to construct more efficient portfolios by allowing limited short selling. The world's 500 largest long-only fund managers have a total of assets under management of $63.7 trillion (Pension & Investments, 2007a). In comparison global hedge fund assets are estimated to $2.48 trillion, or 3.9 percent of that (Hedge Fund Intelligence, 2007). It is obvious that the long-only funds manage a large chunk of money that everyone is interested in. The global assets of active-extension funds are in perspective very small, approximately $53.3 billion (Pension & Investments, 2007b). Nevertheless, the fund segment is growing rapidly; assets increased with 78.5 percent over the first nine months of 2007. The fee structure of active-extension funds is, as mentioned above, closer related to that of hedge funds than that of long-only funds. In general, the performance fee is on average very similar to the hedge fund average, while the management fee is typically lower, and in-between long-only and hedge funds. The table below gives an overview of all the differences discussed above, between long-only, active-extension and hedge funds running a market neutral long-short strategy:

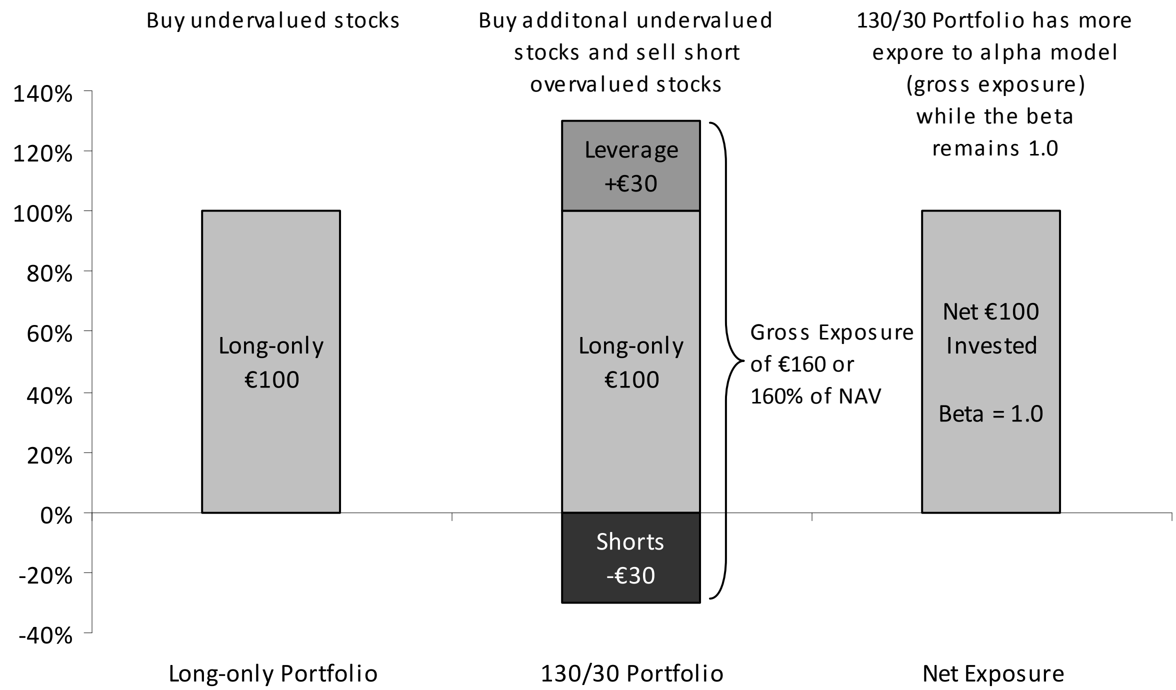
Table 2.1a: Overview of a Range of Investment Vehicles

	Long-only	**Active-extension**	**Market Neutral Long-Short**
Investment style	Relative Return	Relative Return	Absolute Return
Short selling allowed	No	Yes	Yes
Beta	1	1	By definition 0 (In reality –0.1 to 0.3)
Leverage	No	0% - 100% of NAV*	Not restricted
Benchmark	Index	Index	Risk-free rate
Global Assets	$63.7 trillion	$53.3 billion	$2.48 trillion
Management Fee	Typically 30-80 basis points	Typically 60-150 basis points	Average above 150 basis points
Performance Fee	0%	Average 20%	Typically 20%

** Net Asset Value*

An active-extension portfolio is set up in the following way. The beta is, as mentioned above, always close to or at one. To maintain a beta of one, while adding a short leg to the portfolio, the manager must leverage up the long leg by an equal figure. If a manager decides to set up a portfolio that will have 30 percent of the portfolio value in the short positions, then the long positions must be leveraged up by 30 percent, to 130 percent of the portfolio value. For example, a portfolio with an initial capital of €100 sells short €30, and uses the €30 of proceeds from the short sales plus the initial €100, to buy stocks for €130. The result is a portfolio that is long 130 percent of net asset value, and short 30 percent of net asset value. Often, such a structure would be referred to as a 130/30 portfolio. The net exposure of the portfolio (i.e. beta) is calculated by subtracting the short leg from the long leg: €130 - € 30 = € 100, which is a beta of one. This is illustrated below:

Figure 2.1b: Setting Up an Active-extension Portfolio



The leverage can by definition be set from the lower bound of a long-only portfolio (100/0) long 100% and short 0%, to the upper bound of 200/100, long 200% and short 100%. However, to comply with investment fund legislations in both US and Europe, the maximum leverage allowed is 100% of net asset value. This limits the leverage in practice to an interval between 100/0 to 150/50.

The gross exposure, another risk measure, is calculated by adding the short leg to the long leg, in the example above: €130 + €30 = €160. While the net exposure is always 100 percent for all levels of leverage, the gross exposure increases with the leverage of the portfolio. A 110/10 portfolio has a lower gross exposure of 120 compared to a 150/50 portfolio, which adds up to gross exposure of 200. Further, the net exposure is always equal to a long-only portfolio, while the gross exposure is higher. For this reason, an active-extension portfolio will have higher risk then a long-only portfolio, ceteris paribus. Among active-extension funds 130/30 is by far the most common leverage. For this reason, 130/30 has become a label for the whole array of active-extension strategies, even though it actually only refers to a specific level of leverage. We will later analyze if there is any rationale behind a leverage of 130/30. In addition to the label active-extension and 130/30, the strategy goes under a multitude of names, amongst them enhanced active equity, short-extension, and constrained long-short, just to mention a few.

Active-extension managers can, like long-only managers, choose between a quantitative or fundamental approach for stock selection. Quantitative managers typically use a proprietary multi-factor model to rank all the stocks in order of their attractiveness, within their investment universe. An example of this is a model that determines rational valuation for all securities based on their exposure to a number of stock characteristics (i.e., price-to-earnings ratio, market-to-book, or momentum) with the belief that those have a proven impact on returns. In the fundamental approach portfolio managers examine companies and conduct comparative analyses with economic sectors. They try to distinguish undervalued companies with favorable long-term economics and strong management, which are trading at prices that are lower than the perceived value of the company. The same process is used to distinguish companies that are trading at a price that is actually higher than the perceived value. A majority of active-extension funds that have been launched are quantitative funds. There has been some discussion on the scalability of long-only strategies to be used for making short-sell decisions and how the two principal investment approaches differ in opportunity.

Active-extension strategies can be confused with hedge funds that run market-neutral long-short strategies because of the short leg, but it is important to remember that active-extension strategies aim to have a market exposure of beta equal to one, and therefore it does not provide protection in a market downturn. Consequently, investors participating should have a positive view on the general market over time. In a bear market, investing in a market-neutral hedge fund is a more attractive alternative. The absolute return goals of hedge funds vary, but are usually stated as a target annualized return regardless of market conditions. In a bull market, market-neutral hedge funds may not perform as well as active-extension funds and long-only funds.

Since active-extension funds have only been around for a relatively short time period, it is difficult to perform sensible empirical analysis on the performance. Also, few funds disclose their performance. Nonetheless, we have manually collected performance figures from active-extension funds which provided us with performance figures for 14 funds, for the six months period from April 2007 – October 2007. During that period the funds in our data-set have on average declined with 1.45 percent, compared to their respective benchmarks which, on average, rose with 6.1 percent. Looking at the three months from August 2007 to October 2007, we have performance figures for 30 funds. On average, those have gained 3.2 percent over the period, compared to an average of their respective benchmarks which rose with 6.8 percent. The funds in our dataset clearly underperform their benchmark, over both periods observed. It is important to underline that the market conditions in the period have been extraordinary, and especially quantitative funds have had a difficult time to generate alpha. 2007 YTD is the first year since 2000, in which the Russel1000 growth index outperformed the Russel1000 value index.

3 THEORETICAL FRAMEWORK

In this section, we first introduce the measures used to evaluate the performance of active portfolios as the core framework to analyze active-extension strategies. Second, we will go through the benefits of short selling, the cost of active-extension, appropriate level of active-extension and other specific issues related to the management of active-extension portfolios.

3.1 PERFORMANCE EVALUATION MODELS

3.1.1 JENSEN'S ALPHA

William Sharpe (1963), expanding on the work of Markowitz (1952), postulated that stock market returns were driven by their common participation in the economy and the broad equity market. Since then, financial theory has in large parts assumed efficient capital markets; beta has come to represent the sensitivity to a broad market portfolio and as the most important driver of investment performance and differences in stock prices. Stock indexes measure beta and have become the standard against which the performance of funds are benchmarked.

To evaluate active funds, the concept of alpha was developed by Treynor (1965), Sharpe (1966) and Jensen (1968), and has become a widely used measure of active fund performance. Technically, alpha is measured as the intercept from a regression with the excess return of the managed portfolio relatively the risk-free interest rate as independent variable and the excess return of a benchmark portfolio relatively the risk-free interest rate as the dependent variable.

Let R_P represent the return on the portfolio, R_B the return on the benchmark portfolio, R_f is the risk-free rate, and β_P is the beta of the portfolio. α_P is Jensen's alpha. The regression is based on the Sharpe-Linter version of CAPM and written as following, where ε_P is the error term:

(1) $$R_P - R_f = \alpha_P + \beta_P(R_B - R_f) + \varepsilon_P$$

The beta (β_P) of the portfolio is:

(2) $$\beta_P = \frac{Cov(r_P, r_B)}{Var(r_B)}$$

The intercept of the regression α_P, is the Jensen's alpha. Therefore, a positive intercept is equivalent to positive alpha, meaning that the fund manager has outperformed his benchmark on a risk-adjusted basis. A negative alpha indicates that the manager has underperformed the index and that a passive index investment, given certain conditions, would have been better for the investor.

3.1.2 INFORMATION RATIO

The performance measure information ratio (IR) is actually the same as the Sharpe ratio, initially developed by Sharpe (1966). It is one of the most common performance metrics and measures the excess return per unit of risk in an investment asset or investment strategy. Specifically, the Sharpe ratio is defined as annualized excess return divided by the standard deviation of the excess return. The only difference between Sharpe ratio and information ratio, is that for the information ratio, the standard deviation of the excess returns is typically referred to as tracking error. Excess return is the difference between the performance of an investment strategy and the performance of the benchmark which the strategy is compared against. The excess return, which is also called differential return, can either be positive or negative. The Sharpe ratio is not independent of the time period over which it is measured. Therefore, it is advised to measure risks and returns using fairly short (e.g. monthly) periods to maximize information content. For purposes of standardization it is then desirable to annualize the results. The ex-post Sharpe ratio and the information ratio is derived as follows:

R_{Pt} is the return on the portfolio in period t. R_{Bt} is the return on the benchmark portfolio in period t, and D_t is the differential return.

(2) $$D_t \equiv R_{Pt} - R_{Bt}$$

Let $\overline{D}$ be the average value of excess return D_t over the historic period from t=1 through T:

(3) $$\overline{D} \equiv \frac{1}{T}\sum_{t=1}^{T} D_t$$

Then let σ_D be the standard deviation over the period, which is the same as tracking error (TE_D):

(4) $$\sigma_D \equiv \sqrt{\frac{\sum_{t=1}^{T}(D_t - \overline{D})^2}{T-1}} \equiv TE_D$$

The ex post Sharpe Ratio (S_h) is:

(5) $$S_h \equiv \frac{\overline{D}}{\sigma_D}$$

The ex post information ratio (IR_h) is:

(6) $$IR_h \equiv \frac{\overline{D}}{\sigma_D},\ alternatively \equiv \frac{\overline{D}}{TE_D}$$

3.1.3 TRANSFER COEFFICIENT

Transfer coefficient (TC) is a measure that was introduced by Clarke, de Silva, & Thorley (2002) along with information coefficient to illustrate how investment constrains hamper portfolio managers ability to construct efficient portfolios and generate returns. The transfer coefficient can best be described as a measure of the information transfer from an investment conviction into active portfolio weights. The transfer coefficient is an important measure in previous research of active-extension strategies since it illustrate the potential efficiency gains of relaxing the shorts selling constraints. The ideas initially build on the work from Grinold (1989) and others, who emphasized that portfolio performance does not only depend on the skill of the portfolio manager, but also depends on breadth of application of the manager's skill (i.e. how the skill is actually reflected in active investment positions of the portfolio). This can be limited by a number of constraints such as short sale restrictions, positions size, and market capitalization. Starting with an ex ante information ratio, in contrast to ex post information ratio presented above, the measures can be derived as following:

R_P represents the return on portfolio in the forthcoming period, and R_B the return on the benchmark. The tildes over the variables represent that the exact values may not be know in advance. The differential return d is defined as:

(7) $$\tilde{d} \equiv \tilde{R}_P - \tilde{R}_B$$

Let the $E(\bar{d})$ be the expected value of d and σ_D be the predicted standard deviation of d. The ex ante information ratio (IR) is:

(8) $$IR \equiv \frac{E(\bar{d})}{\sigma_D}$$

Let TC be transfer coefficient, and IC the expected information coefficient. N is the number of securities in the investor's forecast universe:

(9) $$IR \equiv \frac{E(\bar{d})}{\sigma_D} \equiv (IC)(TC)\sqrt{n}$$

The transfer coefficient is the correlation between forecasted risk-adjusted returns and the risk-weighted exposures of securities in the portfolio. Normally, the higher the coefficient, the more efficient the portfolio. A portfolio with transfer coefficient of 1.0 represents a portfolio with risk-adjusted active weights that are perfectly proportional to risk-adjusted expected returns. Clarke, et al. (2002) concluded that among the constraints examined, the short sales restriction has the largest effect on portfolio performance.

3.2 BENEFITS OF ACTIVE-EXTENSION

There are a multitude of reasons for allowing active managers to put their money and skill to work on the short side. In general, the option to go short gives the manager a new set of investment opportunities, and the manager gets increased possibilities to express investment views. The enlarged array of investment opportunities should improve the efficient frontier and set of optimal portfolios in a mean-variance framework. Moreover, given that the manager has an ex-ante investment model which generates excess returns, an increase ability to express investment views should increase the expected excess returns. Below in figure 3.2, a brief overview of previous research is presented:

Figure 3.2: Overview of Previous Research

Jacobs, B., Levy, K., & Starer, D. (1998)	Found that it is suboptimal for constraining long–short portfolios to have zero net holdings or zero betas in general.
Jacobs, B., Levy, K., & Starer, D. (1999)	Showed through an integrated optimization process that given the added flexibility that a long-short portfolio affords the manager, it can be expected to perform better than a long-only portfolio based on the same set of insights.
Grinold, R., & Kahn, R. (2000)	Found that the efficiency advantage of long-short investing arises from loosening the long-only constraint and that long-short implementations offer the most improvement over long-only when the universe of assets is large, asset volatility is low, and the strategy has high active risk.
Clarke, R., de Silva, H., & Thorley, S. (2002)	Restated the fundamental law of active management formulated by Grinold (1989), to include the transfer coefficient.
Clarke, R. de Silva, H., & Sapra, S. (2004)	Established that lifting the long-only constraint is critical to improving information transfer from a security valuation model to active portfolio weights and that relaxing this constraint even modestly can lead to a significant improvement in information efficiency.
Clarke, R., De Silva, H., & Thorley, S. (2006)	Extended the fundamental law of active management to allow for a full covariance matrix and show that the resulting ex-ante and ex-post return equations are exact in contrast to the approximate equality of previous derivations.
Jacobs, B., & Levy, K. (2007)	Argued that active-extension strategies are not always well understood by the financial community and shed light on how such strategies increase managers' flexibility, how they compare with market-neutral long-short strategies and if they are significantly riskier than long-only.
Clarke, R., de Silva, H., Sapra, S., & Thorley, S. (2007)	Found that for optimal portfolios leverage increases with the active risk target chosen by the manager, and decreases with the estimated costs of shorting.
Sorensen, et al. (2007)	Found that portfolios with higher ex-ante tracking error targets require higher leverage ratios to achieve the same information ratio and that when taking higher transaction into consideration the benefits from active-extension are still positive.
Johnson, G., Ericson, S., & Srimurthy, V. (2007)	Constructed a model for historical back-testing of 130/30 portfolios which generated annualized active returns of 11 percent compared to their long-only portfolio which returns 7.6 percent.

3.2.1 ADVANTAGE OF SHORT SELLING: ACTIVE UNDERWEIGHTING

The problem of expressing negative views relative a benchmark for a long-only portfolio can be illustrated by examining the stock weightings in benchmarks. Stocks with the largest weightings in a capitalization-weighted index usually provide substantial opportunity for underweighting in a long-only portfolio. The problem is that most of the stocks in a capitalization-weighted index represent such small weights that there is little opportunity to underweight them. Clarke, de Silva and Sapra (2004) found that the inability to short stocks with small weights restricts the investment manager's ability to take full advantage of the value of the information and to implement their stock picking ability. A long-only portfolio managed relative to the S&P 500 index illustrates the problem. The 255 smallest stocks each have an index weight of less than 10 basis points (0.10 percent). While these stocks make up more than half the index by number, they represent only 14 percent of the index by weight. Investment managers with a negative view on one of these stocks can underweight the stocks by, at most, 10 basis points in a long-only portfolio. But, if short positions are allowed, the same manager can underweight the stock by a much larger amount. Poor relative performance in one of these stocks could add significantly to a portfolio's return (Alford, 2006).

This can sometimes mean that active-extension will have large benefits to a manager who focuses on small cap securities to find shorting opportunities, because small cap securities have low weights in the benchmark. Research by Martelli (2005), based on the S&P 500 composition in 2003, showed that a long-only manager with an extremely tight active weight restriction of 0.25 percent can only fully underweight 88 stocks of the 500 stocks in the S&P 500 Index. Martelli pointed out that at an active weight restriction of 1 percent, which is comparable to a typical structured equity approach, a long-only manager can only fully underweight 15 stocks of the 500 stocks in the index. As table A.1 illustrates, with the current weightings for S&P 500, a manager with a weight restriction of 0.25 percent can fully underweight 96 stocks. If the weight restriction is 1 percent, the manager can only fully underweight 20 stocks. It is important to underline that most managers in search of shorting opportunities will benefit as the number of stocks with large weights is very small.

3.2.2 PORTFOLIO EFFICIENCY

Grinold and Kahn (2000) studied how the information ratio changed when the long-only constraint is relaxed. They found that a fully leveraged (200/100) long-short portfolio shows the most improvement in information ratio over long-only strategies when the universe of assets is large, asset volatility is low and the strategy has high active risk. Their conclusion is that the most important aspect of short extension relative to a long-only fund is that portfolio efficiency improves as the manager's ability to express a negative view increases. Similar results were obtained by Levy and Ritov (2001). They investigated the properties of mean-variance efficient portfolios when the number of assets is large. The authors showed analytically and empirically that the proportion of assets held short converges to 50% as the number of assets grows. The cost of the no short selling constraint increases dramatically with the number of assets. They found that for about 100 assets the Sharpe ratio can be more than doubled with the removal of short selling constraint.

The measure transfer coefficient was introduced by Clarke, de Silva and Thorley (2002), which is more thoroughly described in section 2.1.3 Transfer Coefficient above. Briefly, the transfer coefficient can best described as a measure of how the investment ideas (i.e. talent) of the manager can be actualized into positions in the portfolio. To give an example of both the transfer coefficient and short selling: a manager has S&P 500 as the benchmark index, and thinks that Texas Instruments Inc is overvalued. The maximum passive negative exposure the manager can achieve by not holding the stock is equal to Texas Instruments benchmark weight in S&P 500, which is 0.35 percent. If short selling is allowed, the manager can put on a much larger short position, say 5 percent of the portfolio. The transfer coefficient is higher if short selling is allowed, since the managers idea of shorting Texas Instruments is reflected to a higher degree in the portfolio. If Texas Instruments underperforms the S&P 500 over the next 12 months by 7 percent, then the manager was right and outperformed the benchmark, ceteris paribus. If Texas Instruments outperforms the S&P 500 then the portfolio obviously underperforms the index and the manager was wrong about the investment idea. If the manager is very skillful at finding underperformers to short, then obviously short selling adds value to the performance of the fund. On the other hand, if the manager does not have any talent whatsoever to pick overvalued stocks, then the portfolio will most likely do worse if short selling is allowed. Nevertheless, the idea is that in the process of finding undervalued stocks to buy, the manager must identify stock that are not undervalued, and can hence use that same skill-set to identify overvalued stocks.

Conclusively, active-extension should improve the possibility of a manager to express investment views, which can be measured by the transfer coefficient. As portfolio constraints are introduced, such as restriction on short selling, the manager can no longer fully reflect his views in the portfolio weights. For example, the manager will not be able to distinguish between stocks he has a negative view on in the portfolio weights. They will all be weighted at zero even if some stocks rank more negative than others, which in turn gives a transfer coefficient of less than one as the correlation between stock rankings and portfolio weights decreases. So, the more narrow the portfolio constraints, the less the manager’s ability to reflect his views in the portfolio and thus the transfer coefficient is lower.

Clarke, de Silva and Sapra (2004) looked at a broad range of portfolio constraints evaluating their impact on information loss relative to the benchmark. The constraints they focus on are market capitalization, industry, sector, position size and short sale restrictions. Each constraint is evaluated by how much the transfer coefficient improves when they are relaxed. They run two series of optimizations to show the impact of the long-only constraint on information transfer with a beta-one constraint and a targeted tracking error. Running the optimization for successively higher levels of ex ante active risk they trace out a transfer coefficient curve. They then allow for short positions, but do not restrict the degree of shorting. As the tracking error rises, the effect of the long-only constraint intensifies, thus resulting in a lower transfer coefficient, which means that the optimal level of shorting depends on the targeted level of tracking error. The result indicates that short sale restrictions are the most significant constraint in a long-only portfolio in terms of information loss.

Sorensen, et al. (2007) look at the added costs and benefits that are associated with an active-extension structure relative a long-only structure. They perform a simulation of active-extension portfolios and find that portfolios with higher ex-ante tracking error targets require higher leverage ratios to achieve the same information ratio. They also conclude that when taking transaction costs into consideration the benefits from active-extension are still positive.

Johnson, et al. (2007) constructed a model for historical back-testing of 130/30 portfolios. They looked at stock returns over the period from 1994-2006 for their model. The authors selected stocks using a six-factor ranking methodology based on two factors of analyst estimate revisions, long-term momentum, twelve-month share decrease, and some common valuation metrics, namely Cash-Flow/Price, Book/Price and Sales/Price. The model was rebalanced each month, selling stocks that fall in the rankings and buying stocks that rank higher. The authors found that the 130/30 portfolio generated annualized active returns of 11 percent compared to their long-only portfolio which returned 7.6 percent. The excess return increased more than the risk of the 130/30 portfolio, thus giving it a better information ratio in comparison to the long-only portfolio.

3.3 RISKS AND COSTS OF ACTIVE-EXTENSION

Active-extension entails some added risks and costs. Foremost, an unleveraged long position cannot lose more than the invested amount, whereas a short position can generate unlimited losses without proper risk controls. Short selling can also be costly as it increases transaction costs. On average, active-extension funds have higher management fees compared to long-only funds and also charge a performance fee. The drawback is that higher management fees can be very costly for investors. The other side of the coin is that the performance fees can help align managers' incentives with investors. Also fees can help to attain talent and talent can be indispensable in active management.

3.3.1 RISKS OF SHORT POSITIONS

It has been argued that active-extension portfolios are inherently much more risky than long-only portfolios because they contain short positions (Patterson, 2006). An active portfolio manager with restricted short selling can express negative views of a stock by underweighting it relative to its benchmark index. A manager of an active-extension fund can extend the underweighting by selling the security short. In either situation the portfolio is in a risky position exposed to potential negative alpha and a tracking-error above zero. The risk that stocks included in the benchmark index, but not held in the portfolio, outperform, can be defined as non-holding risk. One way to think about it is that a long-only investor is short all the stocks that are included in the benchmark, but not held in the portfolio, on a relative basis. Thus, underweighting is not a new risk that is introduced in a portfolio that allows short selling. The difference is that a long-only portfolio uses passive underweighting, while an active-extension portfolio also uses active underweighting. An active risk is always higher than a passive risk. The question is if the difference is moderate and also if the risk-return for adding active underweighting is positive or negative for the performance of the portfolio as a whole.

Still, short selling has some unique risk not present in a long-only portfolio. An unleveraged long-only portfolio cannot lose more than the invested capital, whilst losses on short positions can become unlimited because there is no limit on how much a stock price can rise. However, in a 130/30 portfolio, it is very unlikely that a short position would wipe out the portfolio. With proper diversification, losses in some positions should be mitigated by gains in others. Moreover, the use of techniques to contain possible losses on the short leg, like stop/loss strategies and reducing position sizes as prices change, reduces the risk of unlimited losses (Jacobs & Levy, 2007). One should underline that the total size of short positions are limited. In case of a 130/30 portfolio, the short leg is only 23 percent in size compared to the long leg. This figure increases with leverage. For a 150/50 portfolio, the short leg is 33 percent in size compared to the long leg, and for a 200/100 portfolio the figure is 50 percent (also see table 6.2a).

3.3.2 TRANSACTION COSTS AND COSTS OF SHORT SELLING

One can argue that active-extension portfolios have higher expense ratios and higher turnover ratios. These transaction costs stem from part financing costs, such as the cost of shorting and the cost of leverage, and part from increased management costs. Further, a portfolio with a gross exposure of above 100 percent will on average result in a higher turnover. An active-extension portfolio is also expected to require more monitoring effort in the process of trading due the nature of short-positions, increased number of stocks to cover and additional research, particularly for fundamental managers (Sorensen et al., 2007).

3.3.3 MANAGEMENT FEES

Fees are an important aspect of investing, especially for long-term investors, as high fees can severely reduce the effect of compounding returns over a long investment period. The active-extension funds that have emerged have fee structures more similar to hedge-funds than long-only funds. Studies have found that fees charged by active-extension funds are higher than those typically charged by long-only funds. Where a typical US long-only manager will charge 30-50 basis points management fee, an active-extension can typically charge 60-150 basis points (Collins, 2007). Partly, the higher management fees charged by active-extension funds are motivated by higher transaction costs and expense ratios of active-extension strategies. To put this in a perspective, the average hedge fund management fee is above 150 basis points (Hennesse, 2005).

3.3.4 PERFORMANCE FEES

Besides the management fee, active-extension funds will typically charge performance fees, on average close to 20 percent in combination with a high-water mark (Sorensen et al., 2007). This figure is inline with the average performance fee that hedge funds charge. The performance fee for active-extension funds should not be much of a negative drag as the purpose of the performance fee is to align managerial interest with the interest of the investors.

The concept of high-water mark is that the manager does not receive performance fee unless the value of the fund exceeds the highest net asset value it has previously achieved. In case of a hedge fund with an absolute benchmark: if the benchmark has returned 1 percent over an investment period, while the fund is down 3 percent, then a performance fee is obviously not paid out. In the next investment period, the benchmark again returns 1 percent, while the fund is up 6 percent. No performance fee is paid out because of the high-water mark. However, if the fund is up 3 percent in a following third investment period, while the benchmark returns 1 percent, then a performance fee will be paid out (i.e. 20 percent on the difference between 3 percent, and 1 percent). Because active-extension funds use relative benchmarks, the concept of the high-water mark changes somewhat, since it is measured as a relative high-water mark. Some active-extension managers, for this reason, call it threshold value instead of high-water mark to distinguish the differences between an absolute high-water mark. The implication from a relative high-water mark is that even if the active-extension fund is down 3 percent, while the index is down 5 percent, the performance would be called a success, and a performance fee is paid out.

Agarwal, Daniel and Naik (2007) study the role of managerial incentives and discretion in hedge fund performance. They find that funds with greater managerial incentives and high-water mark provisions are associated with superior performance. Massa and Patgiri (2007) find similar results studying US mutual funds. They find that high-incentive funds deliver higher returns and increased risk-adjusted performance. Moreover, they find that the performance of the high-incentive funds is highly persistent. On the other hand, high-watermark provisions and performance fees could in another perspective encourage excessive risk taking. This is because a fund that has severely underperformed the benchmark (believing that the can not get back to the high-water mark) can close the fund and start a new one with a clean high-water mark. Kouwenberg and Ziemba (2004) investigate how performance fees affect risk taking by fund managers in a behavioral framework. They found that performance fees do encourage funds managers to take excessive risk. However, the empirical results indicate that returns of hedge funds with incentive fees are not significantly more risky than the returns of funds without such a compensation contract.

3.3.5 SHORTAGE OF SHORT SUPPLY

A more long-term argument against active-extension funds is the question about the capacity of active-extension strategies with regard to the supply of stocks available to borrow for the short leg. The idea is that hedge funds are currently the primary segment of investment funds that use short selling today. If a large proportion of capital is allocated to active-extension funds, the borrowing of stock for short selling could be overcrowded. Also, some argue that active-extension managers are more likely to short small cap stocks since they can effectively express a negative view on a large cap stocks by simply weighting it at 0 percent. Since small caps are not as available to borrow as large caps this might pose a problem of supply as active-extension strategies grow, which in turn would increase shorting-costs and diminish the benefits of the strategy. This is illustrated by the fact that the average borrowing cost for a Russell 1000 stock was only slightly higher than a baseline easy-to-borrow stock, while the average Russell 2000 stock recently peaked at around 3x that figure, up from only 2x in February 2007 (Allaboutalpha, 2007a).

Alford (2006) warns that as active-extension strategies gather assets, they could face higher fees for shorting stocks and at some point these higher fees could have a material impact on performance. On the other hand, they conclude that for the near future, the supply of shortable stock is large. Since 1998 only about 10 percent of all lendable stock has been on loan, suggesting the aggregate supply of lendable stock greatly exceeds demand (Alford, 2006).

3.4 OPTIMAL LEVEL OF ACTIVE-EXTENSION

Since an active-extension portfolio is a leveraged structure and as such it follows the properties shared by any leveraged portfolio, specifically that it can experience losses that exceed capital. This derives from the fact that more than 100 percent of the portfolio net asset value is invested. However, there is a difference between a leveraged long-only portfolio and a leveraged long-short portfolio. Both the gross and net exposure for a 130 percent leveraged long-only portfolio is 130 percent. In case of a

130/30 portfolio, the gross exposure is 160 percent and the net exposure is 100 percent as mentioned above. From a portfolio perspective there are two features of an active-extension portfolio that changes with leverage, namely the gross exposure and the ratio short positions size to long-positions.

Grinold and Kahn (2000) concluded that a fully leveraged 200/100 portfolio yields the highest information ratio and efficiency gain above a long-only portfolio. In this context, more leverage is better. Clarke, de Silva, & Saphra (2004) found the marginal benefit of relaxing short sales to be diminishing, meaning that the benefit of going from long-only to 120/20 is larger than that of going from 120/20 to 140/40. Already with a 130/30 portfolio 90 percent of the improvement in transfer coefficient relative a 200/100 portfolio is achieved.

3.4.1 LEGISLATION AS A KEY FACTOR

It is important to note that while there is some scientific underpinning of the 130/30 weighting it is widely believed to be arbitrarily chosen to satisfying practical considerations such as marketing and regulatory constraints. From a legal perspective, active-extension funds do not want to be categorized together with hedge funds as alternative investments. One of the reasons for this is that the total assets under management of hedge funds globally is only 3.9 percent compared to that of the mutual fund industry. Also, many managers are not allowed to allocate capital or only allocate a very small proportions to funds that are not regulated as public funds.

In the US this means that funds must comply with regulation T, which is a Federal Reserve Board regulation that governs customer cash accounts and the amount of credit that brokerage firms and dealers may extend to customers for the purchase of securities. It limits gross exposure to no more than twice the investment capital. Also, mutual funds and other companies regulated under the Investment Company Act of 1940 cannot relinquish custody of their long positions to a broker. As a result, they may not be able to use stock loan accounts. Although a mutual fund can pledge its long positions as margin for the short positions. Doing so requires a margin account, which is subject to Regulation T limits on leverage. Regulation T requires 50 percent initial margin for long positions and 150 percent initial margin for short positions, so when securities are used as margin for the short positions, they are generally valued at 50 percent of their market price. Initial capital of $100 can support no more than $50 in short positions (and $50 in additional long positions). Thus, the most leveraged active-extension portfolio permitted under the Investment Company Act, would hold long positions of 150 percent of capital and short positions of 50 percent of capital (a 150/50 portfolio).

The European Union directive aimed at regulating public funds is UCITS III. The EU Commission published UCITS III as new proposal in July 1998, which was subsequently adopted in December 2001 (Ernst, & Young, 2003). Under the regulations, an investment manager can be long up to

100 percent in directly held equity securities. Additionally he can be short up to 100 percent using stock specific derivatives such as total returns swaps, or stock specific futures. The new rules permit a fund to be leveraged up to 100 percent of NAV through the use of derivatives. Permitted cover in respect of a derivative instrument can often be any liquid asset including any listed equity security that meets certain liquidity criteria (Donohoe, 2006). Active–extension funds obtain their short exposure synthetically through the use of derivatives. This restricts gross exposure to 200 percent, maximally allowing for a 150/50 fund.

Since UCITS III do not allow funds to use short selling, active-extension funds must instead replicate the short leg with derivatives instruments. This is most commonly done with total return swaps, which are also called CFDs. The exact definition of a CFD is that it is a total return equity swap that replicates the economic performance and cash flows of a conventional investment. Total return swaps allow the party receiving the total return to gain exposure and benefits of a reference asset without actually having to own it. In the case of active-extension, they receive the exposure of shorting individual stocks without outright short positions.

Conclusively, both Regulation T and UCITS III gives an upper bound of 150/50 for how much leverage a fund can have before turning into a lesser regulated investment vehicle (i.e. a hedge fund), which is usually prohibited from marketing itself to the public. Many mutual fund, pension and endowment managers are not allowed to invest, or invest very little, in lightly regulated alternative investment vehicles, such as hedge funds. The lower bound is a long-only portfolio, which leaves the market with an interval between 100/0 and 150/50 to choose from. Within that range, some research suggests that more leverage is to prefer. Other researchers stress that above 130/30, the gains of leverage are diminishing. Also, the optimal level of shorting depends on the targeted level of tracking error. Géhin (2007) argued that given the fact that active-extension funds is a product aimed at traditional long-only investors it is reasonable to assume that the level of active-extension is set to what can be construed as a moderate level. Since 130/30 has been established as the market convention and a label itself, it is also reasonable to believe that new funds that are started up are biased toward this weighting.

3.5 FUNDAMENTAL VERSUS QUANTITATIVE

The main issue related to the fundamental investment approach is if a manager with great skills picking winning stocks can use the same skills to pick losers. One can claim that there are some substantial differences in going long and going short. For example, a long position has a limited down side, mainly the value of the stock, whereas a short position has an unlimited downside, mainly the stock going up. This requires risk management techniques not always present in long only funds. Moreover, the underlying trend of the stock market is usually positive. This means that a long only manager is swimming downstream, meaning that he will move forward even with poor swimming skills, whereas shorting entails swimming upstream, requiring a lot more skill to be successful. However, many of these facts also apply equally to quantitative managers.

Short selling a stock also requires a prime brokerage relationship, as traditional custodians used by long-only managers cannot hold short positions. Different from a long-only manager, a manager of a short extension fund therefore needs to nurture a prime brokerage relationship, find a broker who can provide access to the desired stocks and manage shorting costs (Géhin, 2007). The conclusion with respect to fundamental managers is that manager selection is even more important when selecting a fund with short-extension. Joseph (2007) underlines that managerial experience in short selling is actually used by active-extension fund promoters in their marketing.

In the context of active-extension strategies, the quantitative approach has the advantage that it does not require any modification of the proprietary model used by a long-only manager. Stock that have a poor ranking in a model are simply ignored by long-only managers, but shorted by active-extension fund managers. Therefore, quantitative long-only managers can rather easily and quickly set up a 130/30 product. In this perspective their initial method is scalable into the active-extension world. During the first half of 2007, the total assets under management of the active-extension industry grew with 78.5 percent. The fact that quantitative strategies are over-represented could be a result from the fact that they are more scalable. The process for a fundamental manager takes much longer time and requires more commitment, having to dedicate or hire fund managers to manage the fund.

Johnson, et al. (2007) indicate that between 60 percent and 80 percent of the active-extension strategies currently in the marketplace are quantitatively run. Further, they argue that this is largely because such strategies are particularly well suited to quantitative management. Others predict that the quantitative/fundamental split will move from the current figure of around 85/15 to 60/40 in the years to come (Allaboutalpha, 2007b). It is important to emphasize that quantitative and fundamental managers have different views on this topic. In terms of generating of alpha, which is the ultimate goal of active investment management, it seems like active-extension is equally suited for both quantitative and fundamental managers.

3.6 THE TRADE-OFF: ACTIVE-EXTENSION VS. OTHER INVESTMENT VEHICLES

The trade-off between long-only, active-extension and market neutral long-short funds depends on two factors: 1) If one has a neutral or negative market view and does not want any beta exposure, then one should invest into a market neutral long-short hedge fund. However, if one has a positive market view and wants beta exposure, then one should invest into either a long-only or active-extension strategy. 2) If one believes that the fund manager can generate alpha from the short leg than it is better to invest into an active-extension strategy rather than a long-only strategy. However, if one believes, that the manager cannot generate alpha from short selling or that the higher gross exposure of an active-extension fund is unbearable, then one should invest into a long-only strategy.

3.6.1 MARKET NEUTRAL LONG-SHORT STRATEGIES

The greater part of hedge funds describe themselves as market neutral long-short equity strategies. The purpose of all market neutral long-short funds is to run an absolute-return strategy. Consequently, the aim of the investment strategy is to produce profits regardless of market direction. Many hedge funds and market neutral long-short funds were started following the last bear market from 2000-2002, endorsed by a prolonged bear market that sparked interest in absolute returns and the separation of alpha and beta management (Rajan, et al. 2005). The worldwide growth in hedge funds was driven by three factors: the equity bear market; investor interest in absolute returns due to heavy losses and the flow of top talent into those hedge funds notching up absolute returns.

Typically, market neutral long-short funds will have a beta exposure between 30 percent net long to 10 percent net short. Since market neutral long-short returns often move in a different direction from the overall market, it can help investors to diversify their portfolios. In a neutral or bear market scenarios, the advantages of market neutral long-short are prevailing. In bull markets, market neutral long-short strategies tend not to be able to generate better returns than other investment strategies. In comparison, it would be advantageous to invest into an active-extension fund in a strong bull market.

The main obvious similarity between these strategies and active-extension is that both strategies have both long and short positions. Market neutral hedge funds typically charge a performance fee, inline with most active-extension funds. On the other hand they are not managed to an index, but instead use the risk-free interest rate as their benchmark.

The holy grail of alpha hunting and absolute returns is a zero sum game, producing winners and losers. A fact that often seems to be unobserved is that performance fee besides aligning the interest of fund managers with investors, also attain top talent. Since alpha is difficult to extract, the single most important factor of active management is the talent of the fund manager. According to a hedge fund survey in 2005, the three key risks for the fund segment is overcrowding, poor returns and mis-pricing. In effect, the argument is that due to overcrowding the alpha available for capture by hedge funds has to spread over more funds, resulting in lower returns. Furthermore, the study concluded that two in three pension funds believe that worldwide overcapacity will drive down the returns (Rajan, et al. 2005). One should underline that these risks are also noteworthy for active-extension strategies. As an asset class hedge funds have recorded an annual return of 10.7 percent since 1994, according to CSFB/Tremont, which tracks about 400 hedge funds. That is marginally ahead of Standard & Poor's 500 annual gains over the period of 10.4 percent (Zuckerman, 2004). In this perspective, beta seems to offer rather attractive risk-adjusted returns over time. Conclusively, one could argue that it might be desirable to invest in a strategy that can offer both beta and the potential upsides of long-short strategies in terms of alpha generation. Nevertheless, active-extension is first and foremost not competing with market neutral long-short funds as an investment vehicle. Instead, they should be viewed as an alternative to long-only funds, where managers can use short selling as a possible additional source of alpha.

3.6.2 OTHER VEHICLES

Many existing investment strategies look to be similar to active-extension strategies but they differ in several aspects. A market-neutral long-short strategy with an index overlay resembles an active-extension 200/100 strategy. The strategy is designed to have a beta exposure of zero and offers returns related to individual securities. The manager can than add an equity market overlay with a beta of one, for example adding an exchange traded fund (ETF) to the portfolio thereby getting equity market exposure while retaining the active return benefits of a market-neutral long-short strategy (Jacobs, & Levy, 1999).

Such a portfolio may appear to be similar to an active-extension 200/100 portfolio, but there are some significant differences. Foremost, the equity overlay part of the portfolio is passive but for an active-extension portfolio all positions are active. The active-extension portfolio establishes market exposure by the 100 percent active net long investment, not passive overlay. The cost of the active-extension 200/100 structure is about the same as the cost of equitizing a market-neutral portfolio with an overlay.

An active-extension portfolio might also be mistaken for a leveraged beta-one portfolio because of the leveraged long leg. For example an investor can borrow funds equal to 30 percent of the initial capital and fully invest in a passive index-portfolio, such as an ETF. The strategy would result in a market exposure of beta 1.3 whilst the active-extension 130/30 strategy targets a beta-one exposure and creates alpha through active management. Also, a leveraged passive portfolio would not yield a higher risk adjusted performance. The leveraged passive strategy does not take advantage of any of the benefits from being able to underweight stocks.

3.6.3 PASSIVE STRATEGIES

Looking at the mutual fund industry as a whole, one could argue that alpha is a zero-sum game. In a world with only two investors, if investor a is outperforming the benchmark by X percent, then investor b must be underperforming the benchmark by the same figure. The net sum of alpha in this example would be $\alpha_a - \alpha_b = 0$. If those two investors were two funds, the expected average alpha would be zero. The expected performance would be equal to beta, and the return net of management fees would be worse than beta. In this case all investors would rather prefer holding the benchmark, or a passive fund only generating beta. This is because beta can be offered to a much lower management fee. Looking at the real world a predominant part of capital is invested into active rather than passive funds. Further, a predominant part of active funds are long-only funds. A rational investor must be anticipating that the manager of the fund he is investing in is more skillful than the average, and can actually generate positive alpha over time. The conclusion is different if alpha is not considered to be a zero-sum game. It is also important to underline that there could be a net flow of alpha between different classes of investment vehicles (i.e. hedge funds or active-extension funds could be generating positive alpha on the expense of long-only funds).

The basic underlying assumption is that the investor expects the manager of the fund to generate positive alpha and have superior investing skills, enabling the fund to outperform the benchmark. On the other hand, if an investor's underlying assumption is that he expects that the manager cannot generate alpha and will underperform the benchmark over time, then the only rationale option is to invest in a passive fund that delivers only beta. The assumption is that the manager has a alpha model that generates positive alpha over time. Also, if the investor thinks the manager cannot generate alpha, investing into a beta-neutral hedge fund product is not alternative either.

3.7 ACTIVE-EXTENSION INDEXING

Although active-extension funds just recently started to gain in popularity there has been attempts to develop indexes with the aim of benchmarking their performance. The usefulness of these benchmarks has been questioned as it aims to evaluate an active-strategy with beta-one. In theory there is no common risk factor underlying these funds that can serve as a benchmark other than systematic market risk.

Nonetheless, both S&P and Credit Suisse have developed 130/30 indexes. S&P calls its index S&P 500 130/30 Strategy Index and it is composed by a core 100 percent long position in the S&P 500, 1% under-weight positions in 30 S&P 500 constituents stocks and 1 percent over-weight positions in 30 S&P 500 constituents stocks. The stocks to over- and underweight are chosen by a quantitative model S&P calls STARS which ranks stocks according to a multitude of variables (Standard & Poor's, 2007).

Credit Suisse has also announced that it will launch an entire family of 130/30 Indexes which will feature both an investable index and a look-ahead index, and will cover a full range of investment styles, market capitalization and geographies (Credit Suisse, 2007).

To sum up, we have presented the two main measures we will use to evaluate the performance of active-extension portfolios; the information ratio which is well suited to evaluate portfolios with different leverage and Jensen's alpha which is the best measure of risk-adjusted performance and also offers the opportunity to statistically test the results obtained.

4 HYPOTHESES

We derive our hypotheses from our theoretical framework. Previous research has tested how long-only managers' performance are limited by the fact that the are constrained to no short selling. They have performed back testing, comparing active-extension portfolios against long-only portfolios. We will first test if active-extension portfolios outperform long-only portfolios, derived from the same alpha-model, based on the Fama-French portfolios formed on size and book-to-market. This relates to our main presentation of a problem: are long-only portfolios limited in their ability to generate performance by the fact that they are constrained to no short selling. Our first hypothesis will thus illustrate the performance, benefits and risks of active-extension strategies, in comparison to long-only funds.

Hypothesis I: Long-only managers can create more efficient portfolios and enhance returns with active-extension strategies.

Some studies have suggested that the marginal benefit of relaxing short sales to be diminishing, meaning that the benefit of going from long-only to 120/20 is larger than that of going from 120/20 to 140/40. Still, the relaxing of the short sale constraint should continuously increase the transfer coefficient and the set of optimal portfolios and in consequence the risk-adjusted returns of the portfolio. The incremental increase in returns should therefore outpace the increase in risk. Thus, our second hypothesis is derived based on our belief that although the marginal benefits of increase leverage are diminishing, they are still positive at the maximum level allowed by legislation[1]:

Hypothesis II: An active-extension portfolio that is 150 long and 50 short, within the range from 100/0 to 150/50, provide the highest efficiency gains over a long-only portfolio.

Active-extension portfolios are expected to have higher transaction costs relative long-only due to part financing costs and part increased management costs. Sorensen, et al. (2007) find, using conservative estimates of transaction costs, that the benefits from active-extension are still positive. In view of that, we derive our third hypothesis about the effects of transaction costs:

Hypothesis III: Active-extension strategies outperform long-only, even after imposing transaction costs and costs of short selling.

[1] This as previously been tested by Grinold and Kahn (2000), Clarke, de Silva and Saphra (2004), Clarke, de Silva and Sapra (2007) and Sorensen, et al. (2007) among other authors mentioned in the theoretical framework.

5 METHODOLOGY AND DATA

We have performed an empirical back testing analysis of the performance of active-extension strategies. This is done through a bootstrap statistical technique, which sets up active-extension portfolios, using equity portfolios, based on the 25 Fama-French portfolios formed on size and book-to-market, during the 1929 to 2007 period. The purpose of the back testing is to examine how a pool of active-extension portfolios perform in comparison to the equivalent pool of long-only portfolios that are using the same multi-factor alpha model. This will give us an illustration on how active-extension strategies perform over a longer time-period, from 1927 to 2007. The historical back test will hopefully give us a deeper understanding of the performance of active-extension strategies and the characteristics of the vehicle over long time periods.

5.1 BACK TESTING FAMA-FRENCH EQUITY PORTFOLIOS

We decided to use a strategy based on a multi-factor model, using size and book-to-market factors, for our back testing. The purpose is to show the performance of 130/30 portfolios compared to long-only portfolios, when the same alpha model is used. To maximize transparency for the alpha model, we wanted to have factors that are widely know and used among quantitative driven funds. For this reason we chose the size and book-to-market factors. Further, size and book-to-market are amongst the most widely used factors to predict long-term stock performance and have a high explanatory power on long term stock returns. Fama and French (1993) introduced size and value in addition to market risk in a CAPM framework to create a three-factor model to explain stock valuation. The model is based on earlier findings from Banz (1981) who found a strong negative relation between average return and firm size and Basu (1983) who finds a positive relation between average return and E/P. When adding size and value as factors to CAPM in order to explain the performance of portfolios via linear regression the result is a better fit to the data points than you get with a one factor CAPM, with an r-squared in the mid-ninety percent range instead of the mid eighties. It is important to underline that we do not use the Fama-French three-factor model to evaluate the performance of the portfolios. We only use the Fama-French portfolios, which divide the market into 25 portfolios formed on size and book-to-market to set up our 130/30 and long-only portfolios. We could have set up to portfolios ourselves, using the same sorts, but Fama-French provided an extensive and accessible dataset. Other factors, such as P/E and momentum, have been used successfully in other models. However, we wanted to test a very simple model, with few factors, to be able to increase the transparency, and trace the drivers behind the performance.

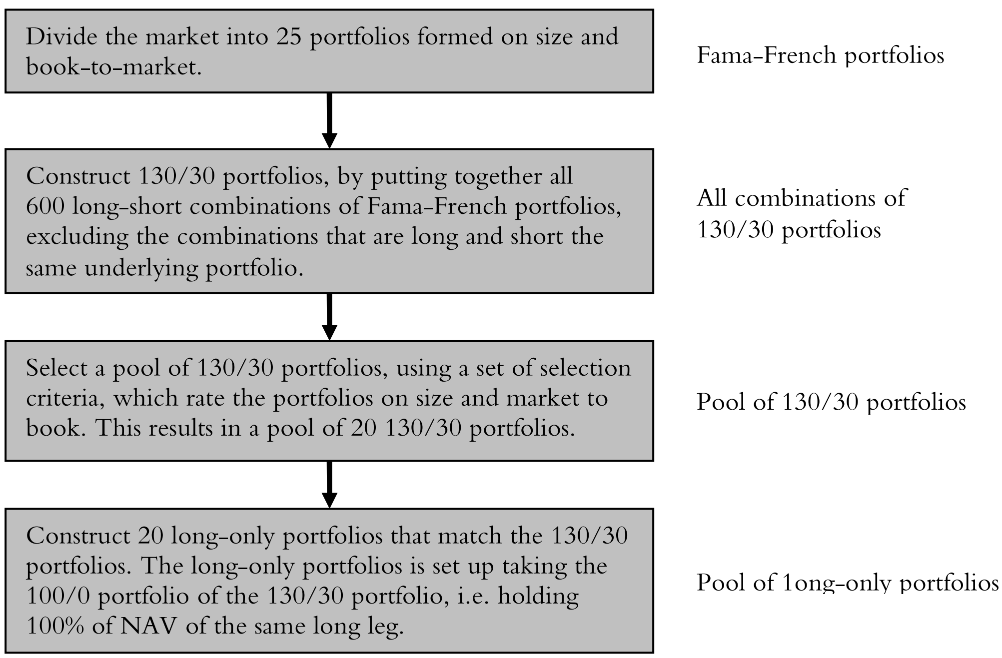
The Fama-French portfolios include all NYSE, AMEX and NASDAQ companies and are rebalanced quarterly using two independent sorts, in size (market equity) and book-to-market (the ratio of book equity to market equity). There are intersections of 5 portfolios formed on each size and book-to-market, which adds up to a total of 25 portfolios. The size breakpoints are the NYSE market equity quintiles. The book-to-market breakpoints are NYSE book-to market quintiles. The portfolios are volume weighted, do not include holding ranges and do not incur transaction costs. The Fama/French benchmark factor we used (R_m) is the value-weighted return on all NYSE, AMEX, and NASDAQ stocks from the CRSP database. All calculations are on monthly data. We also performed some tests, including transaction costs and costs of short selling; assuming a 1 percent spread between long financing and short rebate and transaction cost of 1 percent for 100 percent turnover. This is similar to the cost assumptions of previous tests done by Sorensen et al. (2007).

The dataset covers the period from January 1927 to July 2007 (24000 data points). We use the ten and a half year period January 1997 to June 2007 as our baseline period for all of our tests. We also perform most of our tests on the full dataset period from 1927 to 2007. Since 130/30 is the most widely used portfolio weighting for active-extension funds, we use this as our baseline weighting for the tests. The main performance evaluations models used are Jensen's alpha and information ratio. The significance of the Jensen's alphas are tested with a Wald test and a Gibbons-Ross and Shanken test (Gibbons, Ross, & Shanken, 1989). The Wald test and Gibbons-Ross and Shanken test are further explained below. To expand on the effect of the leverage of active-extension weighting, we also test the range of active-extensions portfolios between 100/0 to 200/100 (i.e. leverage from long-only to 200 percent long and 100 percent short). This is to see if there is any optimal level of leverage with active-extension strategies. We have chosen to use both Jensen's alpha and information ratio for two reasons 1) Jensen's alpha is a common performance metric, and is suitable to use since the significance can be tested with the Wald Test and the Gibbons-Ross and Shanken test (GRS). 2) Information ratio is superior to Jensen's alpha as a performance metric when comparing equal portfolios with different leverage.

All active-extension portfolios hold one of the 25 Fama-French portfolios in the long leg, and short one other out of the 25 Fama-French portfolios in the short leg. This results in a total of 600 active-extension portfolios that can be formed, excluding the combinations that are long and short the same underlying Fama-French portfolio. Hence, each active-extension portfolio holds a basket of stocks in the long leg and short sells another basket of stocks in the short leg. Instead of forming one active-extension portfolio like most previous empirical tests, ranking stocks on an individual level, we instead select a pool of these active-extension portfolios from a set of criteria. Each of those portfolios, as mention above, then hold a basket of stocks in the long leg and short leg, represented by the Fama-French portfolios. We then compare the performance of that pool of active-extension portfolios against the matching pool of long-only portfolios. The matching pool of long-only funds is calculated by taking the active-extension portfolios, and changing the leverage of the leg to 100/0 (100 percent long, and 0 percent short). With the selection criteria stated below a pool 20 active-extension are selected. These are then compared to a pool of 20 matching long-only portfolios.

Finally we also look at the aggregate performance of all possible combinations of 130/30 portfolios (600 of them) versus the performance of all long-only funds. The purpose of this is to simulate what happens if this was a closed system representing all funds available (i.e. under the assumption that alpha is a zero-sum game and the portfolios constitute the whole market).

Figure 5.1: Constructing The Portfolios



5.1.1 PORTFOLIO SELECTION CRITERIA

All Fame-French portfolios have a size rating from 1-5 (low is good high is bad), and also a book-to-market rating from 1-5 (low is bad and high is good). The strategy of the alpha model is to hold portfolios of stocks with a low size rating and high book-to-market, and sell short portfolios of stocks with a larger size rating and a low book-to-market ratio. In detail, the pool of active-extension portfolios are selected using the following set of criteria: I) Long portfolios size rating is either 1 or 2, II) Long portfolio book-to-market rating is not 1, III) Short portfolio book-to-market is 1, IV) Short portfolio size is not above 3. V) The size rating of the long portfolio is not higher than the short portfolio. There are 20 active-extension portfolios that comply with the rules stated above. The leverage is set to 130/30, i.e.

holding 130 percent of net asset value in the long leg, and 30 percent of net asset value in the short leg. The performance is compare with a pool of 20 long-only portfolios, which hold 100 percent of net asset value of the same underlying Fama-French portfolios as the 130/30 portfolios in the long leg. The benchmark of the pool of active-extension portfolios and the pool of long-only portfolios is the same Fama-French benchmark, being volume-weighted and including all firms on NYSE, AMEX and NASDAQ.

5.1.2 THE WALD TEST AND GIBBONS-ROSS AND SHANKEN TEST

The purpose with the Wald test and Gibbons-Ross and Shanken (GRS) test is to see if the Jensen's alphas obtained are statistically jointly significant, for various periods. The tests will be performed for the full sample period and intervals of ten-year periods. Shorter periods are difficult examine (Gibbons, Ross, & Shanken, 1989). This can also be used to test Hypotesis I, by looking at a zero sum portfolio strategy that is defined to show the relative differential return between the active-extension portfolios and the long-only portfolio. The tests will then examine if differential portfolio returns between the active-extension portfolios and the long-only portfolios are statistically significant (i.e. telling us if the 130/30 portfolios are better than the long-only portfolios). The differential portfolio returns are calculated as $R_{130/30} - R_{long\text{-}only}$. This can also be interpreted as the zero investment portfolio, or the return on R_P in excess of the return on R_J. This can be illustrated by a variation of the equation (1) of CAPM, described by Engström (2004). Let R_p be the returns of the active-extension portfolios and R_J the return of the long-only portfolio:

(10) $$R_P - R_J = \alpha_P + \beta_P (R_B - R_f) + \varepsilon_P$$

The Wald-statistic is an asymptotic test assuming infinite amount of data. We estimate the test statistic J_0 to test the alphas according to the following hypothesis (GRS looks at the same hypothesis) :

(11) $$\begin{aligned} &H_0 : \alpha_1 = \alpha_2 = \ldots \alpha_{20} = 0 \\ &H_A : \alpha_1 \text{ jointly } \alpha_2 \ldots \alpha_{20} \neq 0 \end{aligned}$$

The Wald test statistic is:

(12) $$J_0 = \hat{\alpha}' \left[Var\left[\hat{\alpha} \right] \right]^{-1} \hat{\alpha} = T \left[1 + \frac{\hat{\mu}_m^2}{\hat{\sigma}_m^2} \right]^{-1} \hat{\alpha}' \, \Sigma^{-1} \hat{\alpha}$$

Under the null hypothesis J_0 will have a chi-square distribution with N degrees of freedom ($J_0 \sim \chi^2_{(N)}$). In our case N=20 and we perform the test at the 5 percent level of significance. The next step would be to look at the chi-square critical value for J_0. If $\chi^2_{crit} < J_0$ the null hypothesis is reject, i.e. the alphas are not simultaneously zero, hence there are significant abnormal returns. Our critical value given $\chi^2_{(20)}$ is 31.4104 for all periods tested.

The Wald test is an asymptotic test and it assumes infinite amount of data. Since we know the finite sample distribution we can also use the Gibbons-Ross and Shanken (1989) test. Performing both tests will yield a more through test results by taking them both into account. The GRS test statistic is defined as:

(13) $$J_1 = \frac{(T-N-1)}{N}\left[1+\frac{\hat{\mu}_m^2}{\hat{\sigma}_m^2}\right]^{-1} \hat{\alpha}' \hat{\Sigma}^{-1} \hat{\alpha} = \frac{(T-N-1)}{N} * \frac{J_0}{T}$$

Under the null hypothesis, J_1 is unconditionally distributed central F with N degrees of freedom in the numerator and (T-N-1) degrees of freedom in the denominator. If $F_{v1,v2,\alpha} < J_1$, we must reject the null hypothesis that the alphas are not simultaneously zero, hence there are significant abnormal returns. The critical value for J_1 is F distributed with F (N, T-N-1), i.e. F (20, 945) for the full sample period. The reason to use J_1 is that the exact finite-sample distribution is known under both the null and alternative hypothesis.

We will evaluate our Jensen's alpha both using the Wald-test and GRS test. The GSR finite sample tests can differ from the asymptotic Wald-tests and it could be that large sample tests reject the null "too often" in the case where we know the true (small) sample distribution. Stated differently, it opens up the possibility that the size of the test will be incorrect if the sample size is not large enough for the asymptotic results to provide a good approximation. In our case however, we have a rather large sample and it could be that the asymptotic test results provides a good approximation. The tests will be performed over the full sample period of 80.5 years, and also on 10 year intervals. It would also be interesting to see if the alphas are jointly significant on a yearly basis, however this is not possible, given the restrictions of tests (i.e. the number of portfolios must be less than the number of months tested).

To review, we will evaluate our hypotheses using a back testing model. We create a set of 130/30 portfolios using size and market-to-book, and test their performance against matching long-only portfolios using the Wald test and Gibbons-Ross and Shanken test to see if the Jensen's alphas obtained are statistically jointly significant. We perform test for both the full sample period and ten-year periods. Finally we will look at the performance of all possible combinations of 130/30 portfolios versus the performance of all long-only funds.

6 RESULTS AND ANALYSIS OF RESULTS

6.1 PERFORMANCE

6.1.1 PERFORMANCE 1927-2007

The 130/30 portfolios outperform both the long-only portfolios and the benchmark over the longer 80-year period from 1927-2007, with a CAGR of 16.40 percent. The average CAGR of the long-only portfolios is 14.60 percent and 10.20 percent for the benchmark for that period. The CAGR of three time periods is illustrated below. The same pattern is observed for the two longer time periods:

Table 6.1.1a: The Compounded Average Annual Returns

	1927-2007	1997-2007	July 2006-June 2007
130/30	16.4%	20.0%	19.6%
Long-only	14.6%	16.8%	21.0%
Benchmark	10.2%	9.4%	23.1%

The average yearly excess return of the 130/30 portfolios is 7.65 percent compared to the long-only portfolios of 5.77 percent. Risk adjusted, the information ratio of the 130/30 portfolios is higher than the long-only portfolios at 0.344 against 0.306. The ratio between the two information ratio figures is 1.12x; this is because the excess return increases relatively more than the tracking error. The information ratio shows that the 130/30 portfolios are outperforming, but does not give any guidance on the statistical significance of these figures. Instead, the key takeaway is that the table below illustrates the difference in risk, in terms of tracking error, when comparing 130/30 against long-only. The difference in tracking error is 18 percent, for the 1927-2007 time period, which should be interpreted as moderate:

Table 6.1.1b: Average Performance Summary: 1927-2007

	Information Ratio	Excess Return	Tracking Error
130/30	0.344	7.65	22.25
Long-only	0.306	5.77	18.87
Ratio	*1.12x*	*1.33x*	*1.18x*

To test if the difference in performance is jointly statistically significant, we have used Jensen's alpha and performed Wald tests and GRS tests. Testing the Jensen's alphas of the 130/30 portfolios, shows if the alphas are jointly significant (i.e. if the 130/30 portfolios outperform the benchmark).

The average annual Jensen's alpha for the full period is 4.54 for the 130/30, 1.53x higher versus the long-only of 2.96; this figure is statistically jointly significant with both the Wald and GRS test. This shows that the 130/30 portfolios outperform the benchmark over the full period. Looking at shorter ten-year periods, the Jensen's alpha of the 130/30 portfolios are jointly significant for the latter half of the full time period using the GRS test (i.e. 1967-1976, 1977-1986, 1987-1996 and 1997-2007). The same pattern is observed with the Wald test, which. in addition, also shows significance for 1937-1946, and 1947-1956. Imposing transactions costs and cost of short selling have a quite substantial impact on alphas. The average annual alpha for the full period decreases with 0.2 for the long-only portfolios, and with 0.6 for the 130/30 portfolios. The added 40 basis points in costs for the 130/30 portfolios is regarded as moderate, and we view this as a good proxy. It is difficult to interpret how this would deviate from the actual difference in costs that real 130/30 funds would experience. The added cost largely depends on the assumptions regarding the turnover of the fund, and also if the fund only shorts stocks that the it can short to a reasonable cost of short selling. The actual added cost could be lower, around 30 basis points, for a fund with low turnover and selective shorting. The average annual alpha for the whole period and alphas for ten-year intervals, can be observed in the table below:

Table 6.1.1c: Average Ten-year Interval Performance, Portfolio Returns and Jensen's Alpha: 1927-2007

	1927-1936	1937-1946	1947-1956	1957-1966	1967-1976	1977-1986	1987-1996	1997-2007	Avg
Returns									
130/30	13.4	12.2	14.3	13.8	11.4	25.7	16.2	20.0	**15.9**
Long-only	11.7	11.2	13.0	12.7	9.2	23.7	14.6	16.8	**14.1**
Benchmark	6.1	4.9	16.2	9.4	5.5	14.8	14.5	9.4	**10.1**
Jensen's alpha									
130/30	4.2	5.6	-1.9	2.9	2.9*	10.5*	3.2*	8.5*	**4.5***
Long-only	2.6	4.7	-2.6	2.0	2.2	8.0	0.7	5.7	**2.9**

**Indicates that the Jensen's alpha of the 130/30 portfolios are statistically jointly significant on a 5 percent level, using a Gibbons-Ross and Shanken test (1989).*

Imposing transaction costs and cost of short selling:

	1927-1936	1937-1946	1947-1956	1957-1966	1967-1976	1977-1986	1987-1996	1997-2007	Avg
Jensen's alpha									
130/30	3.6	4.9	-2.5	2.2	2.3	9.9	2.6	7.9	**3.9**
Long-only	2.4	4.5	-2.9	1.8	2.0	7.8	0.4	5.4	**2.7**

To test if the 130/30 portfolios outperform the long-only portfolios, we can not just simply look at the Jensen's alphas of both, which only shows the performance against the benchmark. Instead, to test if the difference in performance is positive and statistically jointly significant, we must perform Wald and GRS tests on the Jensen's alphas of differential portfolios, which hold the 130/30 portfolios long and sell short the long-only portfolios. These tests have been performed before and after imposing transaction costs and cost of short selling. The 130/30 portfolios outperform the long-only portfolios over the full sample period, and also in all ten-year intervals observed. The results are statistically jointly significant for the full period, both before and after imposing transaction costs and cost of short selling. For the ten-year periods, the results are predominantly significant. The Wald test shows a significance for all periods, except 1937-1946, while the GRS test shows significant results for the latter half of the ten-year periods. The results are similar after imposing costs, and both tests show significance in five out of eight periods. The results are illustrated below (a full declaration of the Wald and GRS tests are presented in table A.4, A.5, A.6 and A.7):

Table 6.1.1d: Differential Portfolios Wald Test and Gibbons-Ross and Shanken Test (GRS) For Ten-year Interval Performance: 1927-2007

	1927-1936	1937-1946	1947-1956	1957-1966	1967-1976	1977-1986	1987-1996	1997-2007	Full period
Wald Test	Rej. H_0	Cannot	Rej. H_0	Rej. H_0	Rej. H_0	Rej. H_0	Rej. H_0	Rej. H_0	**Rej. H_0**
GRS Test	Cannot	Cannot	Cannot	Cannot	Rej. H_0	Rej. H_0	Rej. H_0	Rej. H_0	**Rej. H_0**
				Imposing transaction costs and cost of short selling:					
Wald Test	Cannot	Cannot	Rej. H_0	Rej. H_0	Rej. H_0	Cannot	Rej. H_0	Re. H_0	**Rej. H_0**
GRS Test	Cannot	Cannot	Rej. H_0	Rej. H_0	Rej. H_0	Cannot	Rej. H_0	Rej. H_0	**Rej. H_0**

The conclusion is that 130/30 portfolios outperform long-only portfolios over the full sample period, and also over shorter ten-year periods. The results are statistically predominantly signficant, and especially robust for the latter half of the observed period.

6.1.2 PERFORMANCE 1997-2007

Over the shorter ten-year period from 1997-2007; the 130/30 portfolios outperform both the long-only portfolios and the benchmark. The 130/30 portfolios have an average CAGR of 20.00 percent versus the long-only of CAGR 16.8 percent and the benchmark CAGR of 9.4 percent: this is illustrated in table 6.1.1a above. Over the same time period the average yearly excess returns of the 130/30 portfolios is 10.59 percent and the equivalent figure for the long-only portfolios is 7.69 percent. The information ratio for the 130/30 portfolios is 0.644, 1.22x higher compared to the long-only portfolios of 0.529. The tracking error is 13 percent higher, which is a lower increase in risk compared to the full sample period. Also, the average tracking error is nominally lower at 16.43 for the 130/30 portfolios, compared to the full period of 22.25:

Table 6.1.2a: Average Performance Summary: 1997-2007

	Information Ratio	Excess Return	Tracking Error
130/30	0.644	10.59	16.43
Long-only	0.529	7.69	14.55
Ratio	*1.22x*	*1.38x*	*1.13x*

The 130/30 average annual Jensen's alpha for the period is 8.5; 1.49x higher compared to the long-only of 5.70. The alphas for both the 130/30 portfolios and the differential portfolios are significant, over the period from 1997 to 2007, using both the Wald test and the GRS test. The 130/30 portfolios outperformance against the long-only portfolios, from 1997-2007, is hence jointly significant. Looking at average yearly returns and Jensen's alpha, the 130/30 outperform long-only in all years, except 1998, 1999 and 2007. The worst relative performance is in 2007. No formal test of robustness has been performed since there are some implications to test the joint significance on yearly alphas (these are presented in 5.1.2). The table below illustrates the average yearly alphas for the ten-year period:

Table 6.1.2b: Average Yearly Performance, Portfolio Returns and Jensen's Alpha: 1997-2007

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Avg
Returns												
130/30	37.5	-11.5	8.9	17.9	22.7	-6.4	55.1	14.7	9.4	18.9	12.3	**16.3**
Long-only	29.7	-8.8	15.0	4.2	14.6	-11.4	53.6	13.1	8.2	15.3	14.8	**13.5**
Benchmark	28.1	15.0	15.6	-12.8	-12.8	-16.4	27.3	9.2	6.9	15.0	21.0	**8.7**
Jensen's alpha												
130/30	16.9	-26.1	-0.6	33.2	36.4	14.9	16.8	2.35	1.0	2.0	-3.3	**8.5**
Long-only	7.8	-25.5	2.5	24.1	34.1	9.4	14.9	0.1	-1.1	-2.4	-1.1	**5.7**
						Imposing transaction costs and cost of short selling:						
Jensen's alpha												
130/30	16.2	-26.7	-1.3	32.6	35.8	14.3	16.2	1.7	0.4	1.5	-3.9	**7.9**
Long-only	7.5	-25.8	2.3	23.9	33.8	9.1	14.6	-0.2	-1.3	-2.6	-1.4	**5.4**

6.1.3 PERFORMANCE IN SHORTER PERIODS

Will the 130/30 and long-only portfolios always consistently outperform the benchmark? The answer is no. Looking at shorter periods, for example in 1998 the 130/30 portfolio showed a negative return of 11.5 percent, while the benchmark was up 15.6 percent. For the twelve-month period from July 2006 to June 2007, the average return of the 130/30 portfolios is 19.6 percent, underperforming both the long-only portfolios 21.0 percent, and the benchmark 23.1 percent (see table 6.1.1a). Because both the pool of 130/30 and pool of long-only underperform the benchmark, in the latter period, they have an annualized negative excess returns of -4.78 percent for the 130/30 and -4.41 percent for the long-only. The information ratio is -0.792 for the 130/30 portfolios, and -0.810 for the long-only portfolios. The Jensen's alpha for the 130/30 is -3.3, versus the long-only of -1.1. As mentioned above, it is difficult to test the robustness for shorter periods. The performance summary is presented in the table below:

Table 6.1.3: Average Performance Summary: July 2006 – June 2007

	Information Ratio	Excess Return	Tracking Error
130/30	–0.792	–4.78	6.04
Long-only	–0.810	–4.41	5.44
Ratio	*0.98x*	*1.08x*	*1.11x*

So why is it that both the 130/30s and the long-only portfolios clearly underperform the benchmark portfolio in 2007? The reason is that small caps have underperformed large caps and high book-to-market firms have underperformed low book-to-market firms in 2007. The alpha model on which the 130/30 portfolios and the long-only portfolios are based on is underperforming the benchmark. It is important to underline that the alpha model is based on a factor-model that that have outperformed the benchmark historically over time. In the short term this is not always true. During shorter periods, when the alpha model generates negative alpha, the results are different. Obviously this is a dilemma with all back testing on historical data. In this case of the twelve-month period from 2006 to 2007, the active-extension 130/30 strategy is performing even worse than the long-only portfolios. As mentioned above in 6.1.1, the 130/30 portfolio underperforms the long-only in 1998, 1999 and 2007. In all of these years growth stocks have performed particularly well. The 130/30 portfolio on average hold growth stocks in the short leg, while the long-only portfolio does not short any stocks. In terms of transfer coefficient, the 130/30 portfolio gives higher exposure to the ideas of the manager. In 1998, 1999 and 2007 the managers is wrong in picking underperformers and the 130/30 portfolio is exposed to this. The transfer coefficient cannot be measured in individual years. Even if it could be measured in individual years, there would be little interest to do so, since it per definition is assumed to be constant over time. Instead, the conclusion that can be made, is that the 130/30 portfolios have a higher transfer coefficient compared to the long-only portfolios, and hence have higher exposure to the investment ideas of the manager.

6.2 OPTIMAL LEVERAGE OF ACTIVE-EXTENSION

When looking at the relationship between the weighting of an active-extension strategy and the efficiency (i.e. information ratio), we have done a number of observations. First of all, it is difficult to give an optimal weighting that applies to all portfolios. The relationship depends on the dynamics of each individual fund and what time horizon you are looking at. What happens when you increase the leverage of an active-extension portfolio? The dynamics are twofold: 1) the gross exposure increases with more leverage, 2) the ratio of short positions size to long positions size increases. For example, depending on whether a manager is more talented at generating alpha from holding stocks long or shorting stocks can have impact on the relationship. The general conclusion is that for an active-extension strategy generating positive alpha, the information ratio will increase with higher weightings for the interval 100/0 to 200/100. The ratio of short positions size to long positions is illustrated in the table below:

Table 6.2a: Size of short positions in relation to long positions

Leverage	Short positions' size relative to the long positions
110/10	9%
130/30	23%
150/50	33%
170/70	42%
200/100	50%

Applying our Fama-French alpha model, the excess return increases with higher weightings in a linear fashion for all observed periods. In contrast, the tracking error increases with an increasing rate of return. Hence, the information ratio increases with a diminishing rate of return, ultimately flattening out at around 200/100. A graphic presentation can be seen in Figure A.2.

The tracking error is higher for the 130/30 portfolios relative to the long-only portfolio for both periods. For the period 1927-2007 the tracking error is 1.18 times higher, at 22.25 compared to 18.87. For 1997-2007 the tracking error is 1.13x higher for the 130/30 portfolios, at 16.43 compared to 14.55. This seems to be an effect from the fact that a 130/30 strategy has a higher gross exposure. The reason why the 130/30 portfolios have higher information ratios, even though the tracking error is larger compared to the long-only portfolios, is because the average annual excess returns are proportionally higher compared to the tracking error over the respective period. The increase in risk seems moderately to low in comparison to the increasing in returns.

For both the 1927-2007 and 1997-2007 periods, the 200/100 yields the highest information ratio. This is inline with the findings of Grinold and Kahn (2000). Within a range from 100/0 to 150/50, a portfolio with a leverage of 150/50 will on average have the highest improvement in performance. This is illustrated in table below:

Table 6.2b: Active-extension Portfolios Leverage from 100/0 to 200/100

	100 0	110 10	120 20	130 30	140 40	150 50	160 60	170 70	180 80	190 90	200 100
1927-2007											
Information Ratio	0.322	0.339	0.353	0.364	0.372	0.377	0.382	0.385	0.387	0.388	0.389
Ratio versus 100/0		1.05x	1.10x	1.13x	1.16x	1.17x	1.19x	1.20x	1.20x	1.21x	1.21x
Tracking Error	18.87	19.88	21.01	22.25	23.58	24.99	26.45	27.97	29.53	31.13	32.76
Ratio versus 100/0		1.05x	1.11x	1.18x	1.25x	1.32x	1.40x	1.48x	1.57x	1.65x	1.74x
1997-2007											
Information Ratio	0.540	0.587	0.625	0.654	0.675	0.691	0.701	0.708	0.713	0.715	0.717
Ratio versus 100/0		1.09x	1.16x	1.21x	1.25x	1.28x	1.30x	1.31x	1.32x	1.33x	1.33x
Tracking Error	14.55	15.02	15.66	16.43	17.32	18.31	19.38	20.52	21.73	22.98	24.28
Ratio versus 100/0		1.03x	1.08x	1.13x	1.19x	1.26x	1.33x	1.41x	1.49x	1.58x	1.67x

Solely looking at the information ratio our findings indicate that funds should actually have higher weightings than the widespread 130/30 weighting. However this is not the only important variable. First of all, active-extension funds primarily want to compete in the universe of long-only funds, rather than falling into the category of alternative investments, in which hedge funds belong. For this reason active-extension funds must comply with the UCITS III in Europe, alternatively Regulation T in US. In both Europe and US, this means that the maximum allowed weightings for such fund is 150/50.

Further, the tracking error increases with an increasing rate of return. If investors are interested in funds that have a target tracking error in the range implied by a 130/30 strategy, then that could be a reason for such a market convention. Last but not least, it is important to underline that the results presented above are generated by one individual alpha model. It is reasonable that other research and researchers using other alpha models can generate more robust and a greater number of historical back testing portfolios indicating otherwise. Authors studying the transfer coefficient conclude that 90 percent of the improvement in transfer coefficient can be achieved with a 130/30 portfolio, relative a 200/100 fully leverage portfolio.

6.3 TESTING ON ALL COMBINATIONS

If the twenty-five Fame-French long-only portfolios represented the global mutual fund industry in its entirety, how would they perform against the aggregate of all 130/30 variations on those? Since the above example is a closed system, no new alpha can be generated running all combinations of 130/30 portfolios. For every 130/30 portfolio with a positive alpha there will also be another 130/30 portfolio with an equal negative alpha. Hence, the average excess return for the 600 individual 130/30 fund combinations is the same as the average excess returns for the twenty-five long-only portfolios. Over the period from 1997-2007, the average excess return for both the pool of long-only and the 130/30 portfolios is 3.82. Looking at the tracking error, the long-only portfolios will have a gross exposure of 100 percent and the 130/30 funds will have a gross exposure of 160 percent. For this reason the average tracking error on the pool of 130/30 portfolios will always be relatively higher. On average, the tracking error of all 130/30 portfolios is 26 percent higher than the tracking error or Fama-French portfolios. Conclusively, the pool of all combinations of 130/30 portfolios will, on average, always yield lower information ratios, and hence be less efficient, as illustrate in the table below. For the 1997-2007 period, the long-only has an information ratio of 0.308 compared to the 130/30 portfolios of 0.256. This illustrates why active-extension cannot be tested versus long-only portfolios in a passive manner, including all variations of long-short combinations. The results of testing all combinations also indicate that the increase in tracking error with leverage, previously tested, seems fairly robust. Table 5.2.2 shows that the tracking error of 130/30 is 23 percent higher compared to long-only. The table below suggests that the tracking error is 26 percent higher for all combinations, which is in the same range:

Table 6.3: Performance Summary For All Combinations of 130/30 Portfolios Versus All Long-only Portfolios: 1997-2007

	Information Ratio	Excess Return	Tracking Error
All 130/30 combinations*	0.235	3.83	16.31
All long-only portfolios	0.295	3.83	12.99
Ratio	*0.80x*	*1.00x*	*1.26x*

**The 25 Long-only portfolios can be combined into 600 130/30 portfolios, excluding the portfolios that are long and short the same underlying portfolios.*

Conclusively, if a manager can generate alpha from short-selling, a 130/30 portfolios is to prefer to a long-only portfolio, assuming that the increase return is higher than the increase in risk. An active-extension strategy outperforms a long-only strategy even net drag on returns and friction, in terms of transaction costs and cost of short-selling. The 130/30 portfolios have a higher risk compared to long-only, due to the higher gross exposure, however the difference is moderate. If the alpha model generates negative alpha in a specific period, both the long-only and 130/30 portfolios will underperform the benchmark. The relative performance between the 130/30 portfolio and the long-only portfolios, in those years, depends on the alpha contribution of the short leg. In a period when the alpha contribution of the short leg is either zero or negative, the 130/30 portfolios will relatively underperform the long-only portfolios. Also, it is important to underline that the short leg only needs to relatively underperform the benchmark, in order to yield a positive alpha contribution.

7 DISCUSSION

7.1 RELIABILITY AND VALIDITY

It is important to underline that back testing uses historical data and circumstances to set up portfolios and measure the performance. This can sometimes be a strong indication of how an investment strategy is likely to perform in the future, but in many occasions it is not. We use a set of criteria in the portfolio selection of our Fama-French back testing alpha-model, which might be considered subjective, but are based on the ideas of Fama and French. Those criteria might not be valid for evaluating a specific active-extension fund. Nevertheless, the purpose is to set up a robust proxy for the performance and behavior of active-extension strategies in order to evaluate the characteristics, over a long time period.

Also, we believe that among real funds it is common to include size and book-to-market factors, which we have used. However, quantitative funds typically use up to 50 factors, and construct models that are far more advanced than ours. The key benefit of using a simple back testing model is the increased transparency. Further, our model estimates transaction costs and cost of short selling. These variables could have impact on the relative performance between long-only funds and active-extension funds. Turnover is higher for active-extension, and cost of short selling can vary a lot depending on what market the stock is trading and the market cap.

It is important to underline that the alpha-model that we apply generates positive alpha over time. For this reason, it is valuable to look at periods when both active-extension and long-only are underperforming the benchmark. This is somewhat illustrated by the test results for the twelve-month period from July 2006, to June 2007. In this period, the active-extension portfolios underperform the long-only portfolios; the negative alpha in the long leg is exaggerated by leverage, and also the short leg generates negative alpha. The higher gross exposure, of active-extension funds, could amplify negative relative performance of untalented managers. One might think that the market timing ability of the fund manager is key when generating alpha from the short leg. This is not true, since an active-extension portfolio always has a beta of one; hence the fund manager can not use market timing to generate returns. Instead, the short leg of the portfolio only needs to relatively underperform the long leg, for the strategy to generate more alpha, in comparison to a replicating long-only portfolio.

Previous back testing models for active-extension strategies have typically constructed a 130/30 portfolio using an alpha-model with a greater number of factors, and also ranked stocks on an individual level. Our approach instead looks at a pool of active-extension portfolios that hold long, and sell short baskets of stocks, versus a pool of long-only portfolios. Some might argue that it is more accurate to select stocks on an individual level, instead of using baskets. We think that it is a two-sided coin. A real active-extension fund would rank stocks on an individual level; this will result in a number of stocks that are held long and shorted. To simulate the long leg and short leg, basket of stocks should represent the same underlying. The concluding results of back-testing only one single 130/30 portfolio, could to some extent only viable to that individual portfolio. In this perspective, one could theorize that the average results of a pool of active-extension portfolios, which we have tested, would be easier to interpret as a general proxy for these funds. The broad set of portfolios could mitigate the risk of our results being spurious and only valid for a specific portfolio composition. It is important to underline that we think the two approaches complement each other, in terms of analyzing active-extension performance.

We present the performance of a small sample of 14 funds, with six months performance data, and 30 funds, with three months performance data. This should be considered as an observation rather then a formal test, and this data can only give investors an idea of how a sample active-extension funds have performed, over this short time period. In addition, the empirical data covers a time period with severe market turmoil, and might not be indicative of performance in more normal market conditions. We do not claim that our results are indicative of future performance.

The error terms are assumed to be jointly, normally distributed when testing the significance of Hypothesis I, and error terms are assumed to be normally distributed in all Jensen's alpha intercepts presented. We have tested for normality with varying results. Generally, the normality assumption should been viewed as providing a "good working approximation" to the distribution of monthly stock returns (Fama, & French, 1992). Gibbons et al. (1989) argue that there is some evidence that the true distributions are slightly leptokurtic relative to the normal distribution. Simulation evidence from MacKinlay (1987) suggests that the F-tests, which we have performed, are fairly robust to such misspecifications.

7.2 IMPLICATIONS

For investors, there are two main implications of our study. First, if you expect your manager to have an investment process generating alpha, an active-extension structure can be expected to consistently outperform a long-only constrained investment structure, in terms of abnormal returns. Second, unique risks and costs related to relaxing the long-only constraint are outweighed by the benefits, given that the ex-ante expected abnormal returns are positive for the long-only manager; also the short leg must relatively underperform the index, over time.

The above assumptions of abnormal returns for a manager are manifested in the choice by an investor to invest into an active long-only fund, instead of a risk-free, or passive vehicle. As such, given industry average management fees, the extreme implication is that active-extension funds should always be preferred to long-only funds. Although, such conclusion should be handled with caution.

8 CONCLUSION

We have investigated the performance of active-extension strategies and how they compare to other investment vehicles. Our study shows that a pool of active-extension 130/30 portfolios outperform a pool of long-only portfolios over the full sample period from 1927-2007. Looking at shorter ten-year periods, the active-extension portfolios predominantly outperform the long-only portfolios; the results are especially robust for the second half of the 1927-2007 period. This includes very robust results for our main observation period, running from 1997 to 2007. Looking at average yearly alphas from 1997 to 2007, the active-extension portfolios outperform the long-only portfolios in all years, except 1997, 1998 and 2007. In all of these years growth stocks have performed well. Our alpha model, on average, sells growth stocks short, which is the probable explanation for the underperformance of the active-extension portfolios in those years. Active-extension will never generate alpha out of nowhere, but this illustrates that it is an effective investment strategy for talented managers, who generate positive alpha over time.

Secondly, we show that within the range from 100/0 to 150/50 a portfolio with a leverage of 150/50 will on average have the highest improvement in performance. Mutual funds, pension and endowment managers either invest relatively little, or are not allowed to invest in lightly regulated alternative investment vehicles, such as hedge funds. The upper bound of the range is therefore limited to 150/50, primarily since the active-extension targets traditional long-only investors, and does not want the risk in term of tracking error to increase more than moderately; also, legislation is an important factor. Over the period from 1997 to 2007, the tracking error on average is 26 percent higher for a 150/50 portfolio, compared to a long-only portfolio. For a 130/30 portfolio, the tracking error is on average 13 percent higher relative to a long-only portfolio. 13 percent might be considered a more moderate increase in risk, and could very well be a driving factor why 130/30 is the most common level of leverage among active-extension firms.

Active-extension strategies are foremost not competing with hedge funds, running absolute returns strategies. Their appeal depends simply on the investor's appetite for risk, and fundamentally the view on the market since it is a beta-one strategy. In a strong bull market it would on average be better to be invested into an active-extension fund. In an neutral or bear market the advantages of market neutral long-short strategies are more prevailing.

Conclusively, why consider an active-extension strategy? It offers multiple sources of alpha and is an approach, based on both a long and short side of the portfolio, enabling managers to pursue stocks that they believe may increase in value and also stock that they believe may decline in value. This can enable managers to achieve higher performance, through having greater scope to express their views. In our view, active-extension is not a holy grail in the world of investment, it does not generate alpha by itself. If the managers is fundamentally wrong in either selecting stocks to long or short over time, it does not provide any upside in returns. Likewise, if the managers have greater scope to express their views, and those views are underperforming, then an active-extension portfolio could enhance a negative performance. There are also benefits. This applies to both the both the long leg by the fact that it is leveraged, and the added short leg. In terms of generating superior returns actitve-extension offers no free lunch. Even so, we find that it is a strategy that allows talented fund managers, either with a fundamental or quantitative approach, to form more efficient portfolios, through a vehicle that offers both alpha and beta to investors.

8.1 SUGGESTIONS FOR FURTHER STUDIES

In this thesis we have created an alpha-model for evaluating active-extension funds. We see two areas of interest for further study. First, it would be of great interest to evaluate the performance of actual active-extension funds, once there are longer periods of time-series data available. It would especially be interesting to look at the effects of management and performance fees. Secondly, it would be interesting to compare the performance of fundamental and quantitative funds, and expand in the positives and negatives of both investment approaches.

9 REFERENCES

ARTICLES AND BOOKS

Banz, R. (1981). The Relationship Between Returns and Market Value of Common Stocks. *The Journal of Financial Economics, Vol. 9*(1), pp. 3-18.

Clarke, R., de Silva, H., & Thorley, S. (2002). Portfolio Constraints and the Fundamental Law of Active Management. *Financial Analysts Journal, Vol. 50*(5).

Clarke, R., de Silva, H., & Sapra, S. (2004). Towards more information efficient portfolios – a series of geared portfolios against a long-only strategy. *Journal of Portfolio Management, Vol. 31*(1).

Clarke, R., de Silva, H., & Thorely, S. (2006). The Law of Active Portfolio Management. *Journal of Investment Management, Vol. 4*(3).

Clarke, R., de Silva, H., & Thorely, S. (2007). Long/Short Extensions: How Much is Enough? Working paper September 2007.

Engström, S. (2004). Does Active Portfolio Management Create Value? An Evaluation of Fund Manager's Decisions. *SSE/EFI Working Paper Series In Economics and Finance*, No. 554, pp. 1-32.

Fama, F., & French, K. (1992). The Cross-Section of Expected Stock Returns. *The Journal of Finance, Vol. 47*(2), pp. 427-465.

Fama, F., & French, K. (1993). Common Risk Factors in the Returns on Stocks and Bonds. *The Journal of Financial Economics, Vol. 33*(1), pp. 3-56.

Gibbons, M., Ross, S., & Shanken, J. (1989). A Test of Efficiency of a Given Portfolio. *Econometrica, Vol. 57*(5), pp. 1121-1152.

Grinold, R. (1989). The Fundamental Law of Active Management. *Journal of Portfolio Management, Vol. 15*(1), 29-34.

Grinold, R., & Kahn, R. (2000). Efficiency Gains of Long-Short Investing. *Financial Analysts Journal, Vol. 56*(6).

Hill, J. (2006). Alpha as a Net Zero-sum Game. *Journal of Portfolio Management, Vol. 32*(4), pp. 24-32.

Jacobs, B., Levy, K.,& Starer, D. [1998], On the Optimality of Long-Short Strategies. *Financial Analysts Journal, vol. 54*(2), pp.40–51.

Jacobs, B., Levy, K., & Starer, D. (1999). Long-Short Portfolio Management: An Integrated Approach. *The Journal of Portfolio Management, Vol. 25*(2).

Jacobs, B., & Levy, K. (2006). Enhanced active equity strategies. *Journal of Portfolio Management, vol. 32*(3). pp. 45-55.

Jacobs, B., & Levy, K. (2007). 20 Myths about Enhanced Active 120-20 Strategies. *Financial Analysts Journal, Vol. 63*(4), pp. 19-26.

Johnson, G., Ericson, S., & Srimurthy, V. (2007). An Empirical Analysis of 130/30 Strategies: Domestic and International 130/30 Strategies Add Value Over Long-Only Strategies. *The Journal of Alternative Investments¸ Vol. 10*(2).

Jensen, M. (1968). The Performance of Mutual Funds in the period 1945-1964. *The Journal of Finance, Vol. 23*(2), pp. 389-416.

Levy, M., & Ritov, Y. (2001). Portfolio Optimization with Many Assets: The Importance of Short-Selling. *University of California at Los Angeles, Anderson Graduate School of Management,* No.1006.

MacKinlay, A. (1987). On Multivariate Tests on the CAPM. *Journal of Financial Economcis, Vol. 18*, pp. 341-372.

Markowitz, H. (1952). Portfolio Selection. *The Journal of Finance, Vol.* 7(1), pp. 77-91.

Sharpe, W. (1963). A Simplified Model of Portfolio Analysis. *Management Science, Vol. 9*(2), pp. 277-293.

Sharpe, W. (1966) Mutual Fund Performance. *The Journal of Business, Vol. 39*(1), Part 2: pp. 119-138.

Sharpe, W. (1994), The Sharpe Ratio [Electronic Version]. *The Journal of Portfolio Management, Vol. 21*(1).

Sorensen, H., Hua, R., & Qian, E. (2007). Aspects of Constrained Long-Short Equity Portfolios. *The Journal of Portfolio Management, Vol. 33*(2), pp. 12-20.

Stewart, F. (2007). Pension Fund Investment in Hedge Funds. *OECD Working Paper on Insurance and Private Pensions*, No. 13.

Treynor, J. (1965). How to Rate Management of Investment Funds. *Harvard Business Review 43*, pp. 63-75.

OTHER PRINT SOURCES & ELECTRONIC SOURCES

Agarwal, V., Daniel, N., & Naik, N. (2007). Role of Managerial Incentives and Discretion in Hedge Fund Performance [Electronic Version]. Working Paper, March 1, 2007. Retrieved December 3, 2007, from http://ssrn.com/abstract=889008.

Alford, A. (2006). *Demystifying the newest equity long-short strategies: making the unconventional conventional.* Perspectives, Goldman Sachs Asset Management. Retrieved on October 25, 2007, from http://www2.goldmansachs.com/client_services/asset_management/institutional/pdf/PS_equity_long-short.pdf.

Allaboutalpha. (2007a) Fahrenheit 130/30. Retrieved November 4, from http://allaboutalpha.com/blog/2007/03/09/fahrenheit-13030/.

Allaboutalpha. (2007b). A shortage of shorts? Retrieved November 23, 2007, from http://allaboutalpha.com/blog/2007/11/08/a-shortage-of-shorts/.

Collins, A. (2007). 130/30 Funds – A New Middle Ground. *Alternative Investment Management Association Journal,* Summer 2007. Retrieved December 2, 2007, from www.aima.org/uploads/FortisPFSCollins75.pdf.

Credit Suisse. (2007, October 1). Credit Suisse and AlphaSimplex Launch the Industry's First 130/30 Index. Press Release, New York. Retrieved October 15, 2007, from http://www.credit-suisse.com/news/en/media_release.jsp?ns=40513.

Donohoe, J. (2006). New Strategies for Hedge Funds under UCITS III. *Alternative Investment Management Association Journal,* Winter 2006. Retrieved December 12, 2007, from www.aima.org/uploads/CarneUCITS73.pdf

Ernst & Young. (2003). UCITS III - a practical guide [Electronic Version]. Retrieved November 5, 2007, from http://www.ey.com/Global/Assets.nsf/Luxembourg_E/UCITS_III_-_a_practical_guide/$file/ucits%20III.pdf.

Géhin, W. (2007). 130/30 funds: what is behind the commercial offensive? Retrieved November 11, 2007, from http://www.edhec-risk.com/latest_news/featured_analysis/RISKArticle.2007-10-03.0934?newsletter=yes.

Hedge Fund Intelligence. (2007, October 1). Global hedge fund assets surge 19% to $2.48 trillion. Press Release. Retrieved December 1, 2007, from http://www.hedgefundintelligence.com/Content.aspx?PageID=2176.

Hennessee Hedge Fund Advisory Group. (2005). *11th Annual Hedge Fund Manager Survey*. New York: Author.

Joseph, J. (2007). Traditional meets alternative in the form of 130/30 funds. *Investment Advisor Magazine,* May 2007.

Kouwenberg, R., & Ziemba, W. (2004). Incentives and Risk Taking in Hedge Funds. Sauder School of Business Working Paper June 21, 2004. Retrieved November 24, 2007, from http://ssrn.com/abstract=574186

Martielli, J. (2005). *Quantifying the Benefits of Relaxing the Long-Only Constraints* [Electronic Version]. Oaks, Pennsylvania: SEI Investments Developments.

Massa, M., & Patgiri, R. (2007). Incentives and Mutual Fund Performance: Higher Performance or Just Higher Risk Taking. EFA 2007 Ljubljana Meetings. Retrieved November 15, 2007: from: http://ssrn.com/abstract=891442.

Merrill Lynch.(2007). *Building the Organization to Support the 130/30 Opportunity* [Electronic Version]. Retrieved December 1, 2007, from www.investmentnews.com/assets/docs/CI27844918.PDF.

Patterson, S. (2006, October 13). A Strategy Aiming to Pump Returns Gains Clout but May Be "No Free Lunch". *The Wall Street Journal.*

Pension & Investments. (2007a). P&I/Watson Wyatt world 500: the world's largest managers. Retrieved November 19, 2007, from: http://www.pionline.com/apps/pbcs.dll/article?AID=/20071001/CHART/70927004/-1/DataPresentationStore.

Pension & Investments. (2007b). Active-extension managers. Retrieved November 6, 2007, from: http://www.pionline.com/apps/pbcs.dll/article?AID=/20071029/CHART/71026051/1039/'.

Rajan, A., Martin B., Brown T., & Johnson, M. (2005). *Hedge Funds: a catalyst reshaping global investment.* London: KPMG International.

Standard & Poor's. (2007). S&P 500 130/30 Strategy Index, Index Methodology. Retrieved November 23, 2007, from: http://www2.standardandpoors.com/spf/pdf/index/SP_500_130-30_Strategy_Index_Methodology_Web.pdf

Zuckerman, G. (2004, October 8). Hedge Funds Grab More in Fees As Their Popularity Increases. *The Wall Street Journal.*

APPENDIX

Table A.1
Passive Underweighting

This table shows the number of stocks that a manager can fully underweighted in the S&P 500* given certain levels of active weight limits and short-sale restriction. The table is constructed taking index weight and comparing it with an active weight limit. For example, there are only 7 stocks included in the S&P 500 that have an index weight of 1.5% and above. This illustrates the problem of passive underweighting.

Number of Stocks that can be fully underweighted in S&P 500*

Active Weight Limit (%)	**# of stocks that can be fully underweighted**	**% of stocks that can be fully underweighted**
0.25	96	19.2%
0.50	38	7.6%
1.00	20	4.0%
1.50	7	1.4%
2.00	3	0.6%

**As of November 2007*

Table A.2
Descriptive Statistics Monthly Returns

The descriptive statistics of the monthly returns, for the period from 1997-2007, illustrate some characteristics of the two investment strategies. First and foremost, the 130/30 portfolios have a much higher mean, compared to the long-only portfolios. Further, the standard deviation is lower for the 130/30 portfolios, indicating a lower risk. The minimum and maximum observation for both are in the same range, but 130/30 both show more deviating extremes. The skewness of the 130/30 is more positive, indicating that the strategy could be more favorable. Finally, the 130/30 have a higher kurtosis, which could indicate that the strategy is less riskier, compared to the long-only. On the other hand, in a crash-test simulation one could have a contradictory conclusion, given the wider minimum and maximum interval of the 130/30 portfolios.

Descriptive Statistics: 1997-2007

	Obs	**Mean**	**Std. Dev.**	**Min**	**Max**	**Skewness**	**Kurtosis**
130/30	2520	1.727	5.805	-24.8	42.77	0.115	7.72
Long-only	2520	1.486	5.960	-22.3	38.63	0.047	6.57

Table A.3
Imposing Transaction Costs and Cost of Short Selling:
Information Ratio, Excess Return and Tracking Error

The following tables show the performance and risk of the pool of 20 130/30 portfolios, imposing transactions costs and cost of short selling. When comparing the results before and after costs , the tracking error is constant. However, the excess return decreases more for the 130/30 portfolios, given the higher relative cost structure. Consequently, the ratio between the information ratios decrease, between the two.

Average Performance Summary: 1927-2007

	Information Ratio	**Excess Return**	**Tracking Error**
130/30	0.316	7.03	22.25
Long-only	0.292	5.52	18.87
Ratio	*1.08x*	*1.27x*	*1.18x*

Average Performance Summary: 1997-2007

	Information Ratio	**Excess Return**	**Tracking Error**
130/30	0.606	9.96	16.43
Long-only	0.512	7.44	14.55
Ratio	*1.18x*	*1.33x*	*1.13x*

Average Performance Summary 12 Months: July 2006 - June 2007

	Information Ratio	**Excess Return**	**Tracking Error**
130/30	-0.895	-5.41	6.04
Long-only	-0.856	-4.66	5.44
Ratio	*1.05x*	*1.16x*	*1.11x*

Table A.4

The Wald Test and Gibbons-Ross and Shanken Test (GRS) for 1927-2007

J_0 is the Wald test statistics, J_1 is the GRS test statistic.

Under the null hypothesis J_0 will have a chi-square distribution with N degrees of freedom. In our case N=20 and we perform the test at the 5 percent level of significance. We test against a chi-square critical value. The J_1 statistic is unconditionally distributed central F with N degrees of freedom in the numerator and (T-N-1) degrees of freedom in the denominator. The critical value for J_1 is F distributed with F (N, T-N-1), i.e. F (20, 945) for our sample period. The results in the table below, show that the Jensen's alpha for the 130/30 portfolios, is statistically jointly significant on a 5 percent level, over the full sample period. This means that the 130/30 portfolios outperform the benchmark.

130/30 Portfolios J_0 and J_1 Test Statistic for the period 1927-2007

N=20, T=966	**Test Statistic**	**Critical value at 5%**	**Distribution**	**Decision**
J_0, full sample	57.426	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0
J_1, full sample	2.809	1. 5816	$J_1 \sim F(20, 945)$	Reject H_0

The results in the table below, show that the Jensen's alpha for the differential portfolios, is statistically jointly significant on a 5 percent level, over the full sample period. The differential portfolios are zero investment portfolios, that hold long the 130/30 portfolios, and sell short the long-only portfolios. The results conclude that the 130/30 portfolios outperform the long-only portfolios, over the full sample period.

Differential Portfolios* J_0 and J_1 Test Statistic for the period 1927-2007

N=20, T=966	**Test Statistic**	**Critical value at 5%**	**Distribution**	**Decision**
J_0, full sample	42.699	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0
J_1, full sample	2.089	1.5816	$J_1 \sim F(20, 945)$	Reject H_0

**R_p of differential portfolios is defined as: ($Return_{130/30}$ – $Return_{long\text{-}only}$)*

Table A.5
The Wald Test and Gibbons-Ross and Shanken Test (GRS) for Ten-year Intervals
J_0 is the Wald test statistics, J_1 is the GRS test statistic.

These tables show the same information, as table A.4, but over different time periods. In the periods when H_0 is rejected, one can conclude that that it is statistically jointly significant that the 130/30 portfolios outperform the benchmark. The former table of the two, shows the Wald test, whereas the latter table of the two, shows the GRS test.

130/30 Portfolios J_0 Test Statistic for Ten-Year Interval Performance: 1927-2007

N=20, T=120	Test Statistic	Critical value at 5%	Distribution	Decision
1927-1936	23.152	31.4104	$J_0 \sim \chi^2_{(20)}$	Cannot R. H_0
1937-1946	34.114	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0
1947-1956	32.347	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0
1957-1966	22.908	31.4104	$J_0 \sim \chi^2_{(20)}$	Cannot R. H_0
1967-1976	44.984	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0
1977-1986	62.083	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0
1987-1996	82.850	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0
1997-2007**	46.570	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0

***T=126*

The Wald-statistic is an asymptotic test assuming infinite amount of data. The GSR finite sample tests can differ from the asymptotic Wald-tests and it could be that large sample tests reject the null "too often" in the case where we know the true (small) sample distribution. Stated differently, it opens up the possibility that the size of the test will be incorrect if the sample size is not large enough for the asymptotic results to provide a good approximation.

130/30 Portfolios J_1 Test Statistic for Ten-Year Interval Performance: 1927-2007

N=20, T=120	Test Statistic	Critical value at 5%	Distribution	Decision
1927-1936	0,955	1.6775	$J_1 \sim F(20, 99)$	Cannot R. H_0
1937-1946	1,407	1.6775	$J_1 \sim F(20, 99)$	Cannot R. H_0
1947-1956	1,334	1.6775	$J_1 \sim F(20, 99)$	Cannot R. H_0
1957-1966	0,945	1.6775	$J_1 \sim F(20, 99)$	Cannot R. H_0
1967-1976	1,856	1.6775	$J_1 \sim F(20, 99)$	Reject H_0
1977-1986	2,561	1.6775	$J_1 \sim F(20, 99)$	Reject H_0
1987-1996	3,418	1.6775	$J_1 \sim F(20, 99)$	Reject H_0
1997-2007**	1,941	1.6714	$J_1 \sim F(20,105)$	Reject H_0

***T=126*

Table A.6
The Wald Test and Gibbons-Ross and Shanken Test (GRS) for Ten-year Intervals
J_0 is the Wald test statistics, J_1 is the GRS test statistic.

As mentioned above, the differential portfolios are zero investment portfolios, that hold long the 130/30 portfolios, and sell short the long-only portfolios. The results below, show when H_0 can be rejected, looking at ten-year intervals. It is important to underline that the 130/30 portfolios outperform the long-only portfolios in all periods, in economics terms. The tests are performed to show if this outperformance is statistically significant.

Differential Portfolios* J_0 Test Statistic for Ten-Year Interval Performance: 1927-2007

N=20, T=120	Test Statistic	Critical value at 5%	Distribution	Decision
1927-1936	36.270	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0
1937-1946	-56.120	31.4104	$J_0 \sim \chi^2_{(20)}$	Cannot R. H_0
1947-1956	36.350	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0
1957-1966	32.083	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0
1967-1976	147.536	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0
1977-1986	594.77	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0
1987-1996	154.229	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0
1997-2007**	123.195	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0

*R_p *of differential portfolios is defined as: (*$Return_{130/30} - Return_{long\text{-}only}$*)*
***T=126*

Differential Portfolios* J_1 Test Statistic for Ten-Year Interval Performance: 1927-2007

N=20, T=120	Test Statistic	Critical value at 5%	Distribution	Decision
1927-1936	1.496***	1.6775	$J_1 \sim F(20, 99)$	Cannot R. H_0
1937-1946	-2. 315	1.6775	$J_1 \sim F(20, 99)$	Cannot R. H_0
1947-1956	1.499***	1.6775	$J_1 \sim F(20, 99)$	Cannot R. H_0
1957-1966	1.323	1.6775	$J_1 \sim F(20, 99)$	Cannot R. H_0
1967-1976	6.086	1.6775	$J_1 \sim F(20, 99)$	Reject H_0
1977-1986	24.534	1.6775	$J_1 \sim F(20, 99)$	Reject H_0
1987-1996	6.362	1.6775	$J_1 \sim F(20, 99)$	Reject H_0
1997-2007**	5.133	1.6714	$J_1 \sim F(20,105)$	Reject H_0

*R_p *of differential portfolios is defined as: (*$Return_{130/30} - Return_{long\text{-}only}$*)*
***T=126*
****Significant at a 10 percent level*

Table A.7
Imposing Transaction Costs and Cost of Short Selling:
The Wald Test and Gibbons-Ross and Shanken Test (GRS) for Ten-year Intervals
J_0 is the Wald test statistics, J_1 is the GRS test statistic.

The tables below, illustrate the same information, as table A.6 above, but after imposing transaction costs and cost of short selling. The results are largely the same as without including any costs, however one should underline that H_0 cannot be rejected for the ten-year interval, from 1977-1986.

Differential Portfolios* J_0 Test Statistic for Ten-Year Interval Performance: 1927-2007

N=20, T=120	Test Statistic	Critical value at 5%	Distribution	Decision
1927-1936	13.892	31.4104	$J_0 \sim \chi^2_{(20)}$	Cannot R. H_0
1937-1946	6.442	31.4104	$J_0 \sim \chi^2_{(20)}$	Cannot R. H_0
1947-1956	101.411	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0
1957-1966	131.326	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0
1967-1976	126.250	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0
1977-1986	-219.604	31.4104	$J_0 \sim \chi^2_{(20)}$	Cannot R. H_0
1987-1996	63.442	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0
1997-2007**	52.176	31.4104	$J_0 \sim \chi^2_{(20)}$	Reject H_0

*R_p *of differential portfolios is defined as: (*$Return_{130/30} - Return_{long\text{-}only}$*)*
***T=126*

Differential Portfolios* J_1 Test Statistic for Ten-Year Interval Performance: 1927-2007

N=20, T=120	Test Statistic	Critical value at 5%	Distribution	Decision
1927-1936	.573077	1.6775	$J_1 \sim F(20, 99)$	Cannot R. H_0
1937-1946	.26576	1.6775	$J_1 \sim F(20, 99)$	Cannot R. H_0
1947-1956	4.183	1.6775	$J_1 \sim F(20, 99)$	Reject H_0
1957-1966	5.417	1.6775	$J_1 \sim F(20, 99)$	Reject H_0
1967-1976	5.207	1.6775	$J_1 \sim F(20, 99)$	Reject H_0
1977-1986	-9.058	1.6775	$J_1 \sim F(20, 99)$	Cannot R. H_0
1987-1996	2.616	1.6775	$J_1 \sim F(20, 99)$	Reject H_0
1997-2007**	2.174	1.6714	$J_1 \sim F(20,105)$	Reject H_0

*R_p *of differential portfolios is defined as: (*$Return_{130/30} - Return_{long\text{-}only}$*)*
***T=126*

Table A.8
CAPM Regressions: 1927-2007

The CAPM regressions for the pool of 130/30 portfolios and the pool of long-only portfolios show that the beta for both is 1.34. Also, the alpha constant of the 130/30 portfolios is significant on a 5 percent level. The significance of the alpha should, however, be interpreted with caution, since the distribution of the error terms cannot be assumed to be normally distributed. We have tested for normality with vary results. Previous authors have argued that there is some evidence that true distributions, of returns, are slightly leptokurtic relative to the normal distribution. Our results indicate the same, especially for the 130/30 portfolios.

CAPM Regression, 130/30 portfolios for the period 1927-2007

Source	SS	df	MS			
				Number of obs	=	966
				F(1, 124)	=	2010.19
Model	51455.1271	1	51455.1271	Prob > F	=	0.0000
Residual	24675.6746	964	25.5971728	R-squared	=	0.6759
Total	76130.8016	965	78.8920224	Adj R-squared	=	0.6755
				Root MSE	=	5.0594

	Coef.	Std. Err	t	P>|t|	[95% Conf.	Interval]
benchmark	1.343097	.0299564	44.84	0.000	1.28431	1.401884
_cons	.415088	.1639383	2.53	0.011	.093371	.736805

CAPM Regression, Long-only portfolios for the period 1927-2007

Source	SS	df	MS			
				Number of obs	=	966
				F(1, 124)	=	2630.98
Model	51470.085	1	51470.085	Prob > F	=	0.0000
Residual	18858.8209	964	19.5630923	R-squared	=	0.7318
Total	70328.9059	965	72.8796953	Adj R-squared	=	0.7316
				Root MSE	=	4.423

	Coef.	Std. Err	t	P>|t|	[95% Conf.	Interval]
benchmark	1.343292	.0261886	51.29	0.000	1.291899	1.394685
_cons	.2581498	.1433188	1.80	0.072	-.023103	.5394026

Table A.9
CAPM Regressions: 1997-2007

These tables show the same as table A.9 above, but for the time period running from 1997 to 2007. Here the beta for the 130/30 portfolios is 0.77, while the beta for the long-only portfolios is higher, at 0.93. The alpha constant is significant for both the 130/30 and long-only, and higher for the 130/30. Again, the significance can be questioned, given the issue presented above.

CAPM Regression, 130/30 portfolios for the period 1997-2007

Source	SS	df	MS			
				Number of obs	=	126
				F(1, 124)	=	104.69
Model	1495.45036	1	1495.45036	Prob > F	=	0.0000
Residual	1771.27255	124	14.284456	R-squared	=	0.4578
Total	3266.7229	125	26.1337832	Adj R-squared	=	0.4534
				Root MSE	=	3.7795

	Coef.	Std. Err	t	P>|t|	[95% Conf. Interval]	
benchmark	.765524	.0748178	10.23	0.000	.6174387	.9136093
_cons	1.00992	.339147	2.98	0.003	.3386527	1.681187

CAPM Regression, Long-only portfolios for the period 1997-2007

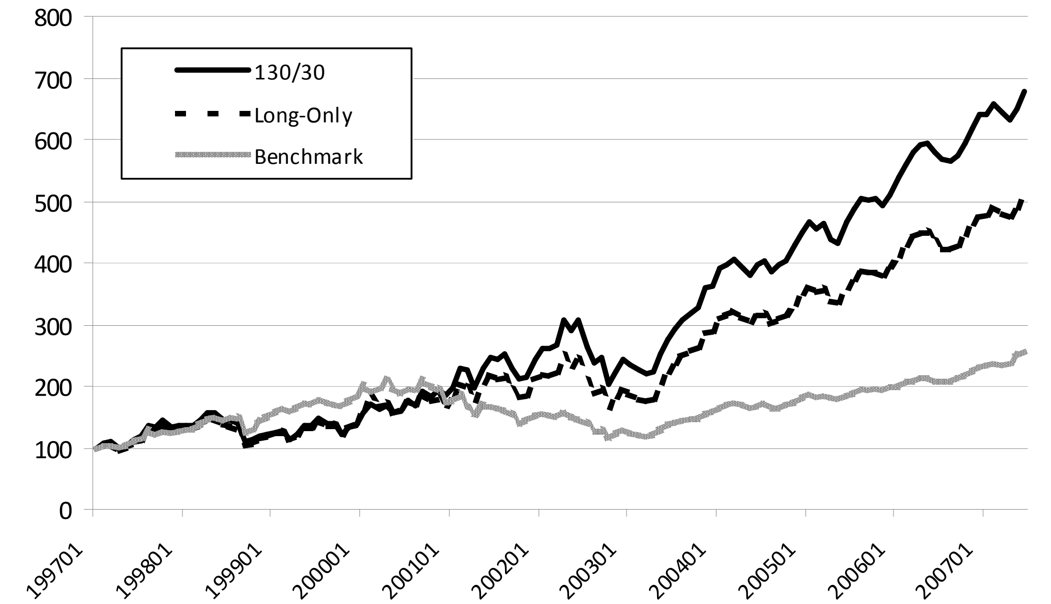
Source	SS	df	MS			
				Number of obs	=	126
				F(1, 124)	=	162.31
Model	2202.61583	1	2202.61583	Prob > F	=	0.0000
Residual	1682.73062	124	13.5704083	R-squared	=	0.5669
Total	3885.34645	125	31.0827716	Adj R-squared	=	0.5634
				Root MSE	=	3.6838

	Coef.	Std. Err	t	P>|t|	[95% Conf. Interval]	
benchmark	.9290567	.0729238	12.74	0.000	.7847201	1.073393
_cons	.6798101	.3305618	2.06	0.042	.0255357	1.334084

Figure A.1
Cumulative Returns

The figures below show cumulative returns for the pool of 130/30 portfolios, versus the pool of long-only portfolios and the benchmark portfolio for given time periods. For the ten year period the 130/30 portfolios outperform, but over the shorter 12 month period they underperform.

Performance Summary 1997-2007



Performance Summary 12 Months: July 2006 - June 2007

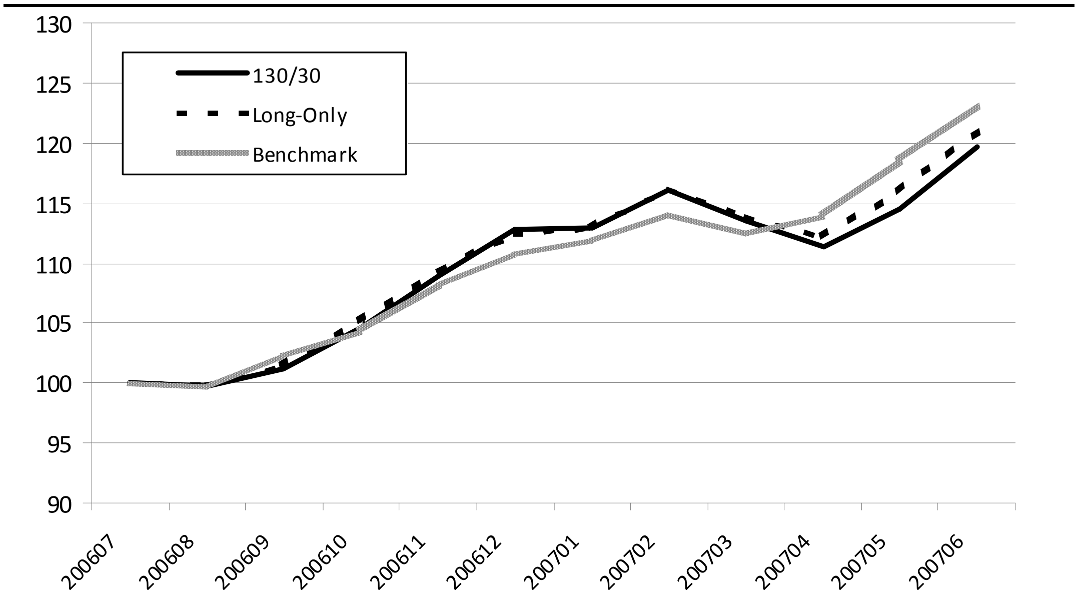
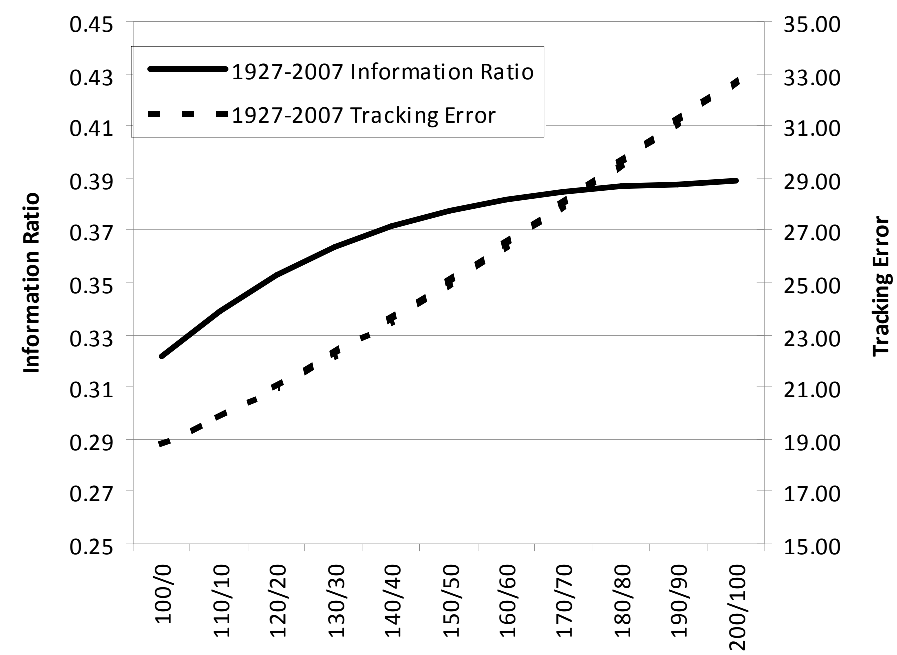


Figure A.2
The Effect of Leverage on Information Ratio and Tracking Error

The graphs show a continuous, but diminishing improvement in information ratio for higher levels of leverage. Naturally, the tracking error increases with a exponential fashion, giving the information ratio a asymptotically diminishing curve. From this, one could argue that 130/30 is a preferred level of leverage.

Active-extension Portfolios Leverage 100/0 to 200/100 1927-2007



Active-Extension Portfolios Leverage 100/0 to 200/100 1997-2007

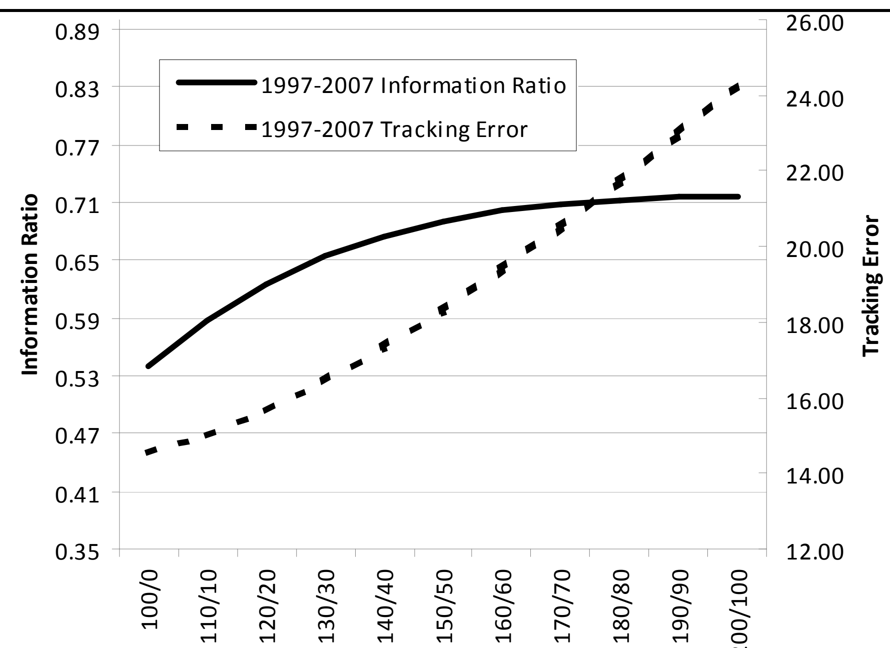
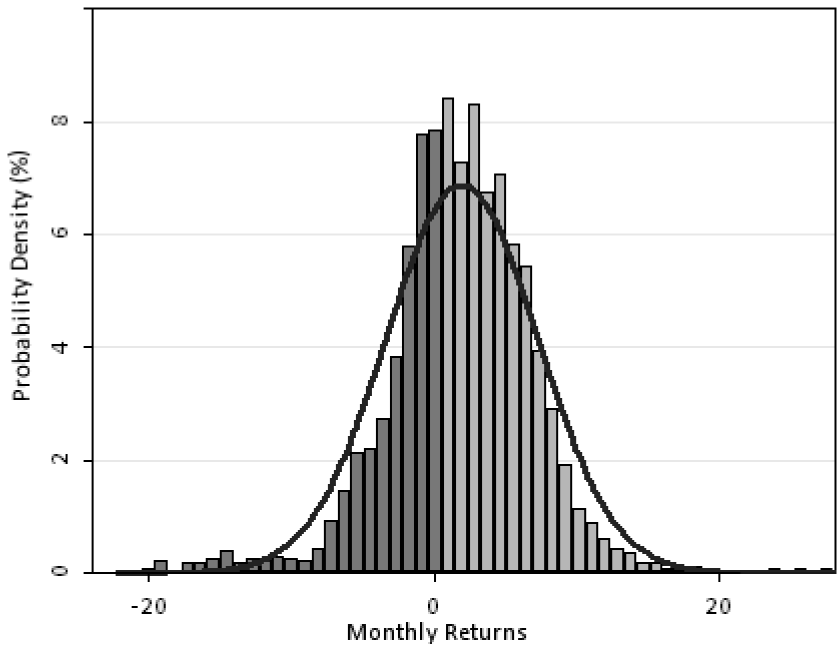


Figure A.3
Probability Density Distributions of Monthly Returns: 1997-2007.

This again shows that the returns are slightly leptokurtic, to the normal distribution. The 130/30 portfolios, show a higher kurtosis, and also a lower standard deviation.

130/30 Portfolios 1997-2007



Long-only Portfolios 1997-2007