ATHES UNIVERSITY OF ECONOMICS AND BUISNESS

Department of International and European Economic Studies

MSc International Economics and Finance

Investment Strategies on French's 49 Industry Portfolios

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Abstract

The writing of the present thesis was conducted as part of completion of the graduate program "International Economics and Finance" at Athens University of Economics and Business. The objective of the thesis is to examine the effectiveness of certain investment strategies on past stock returns categorized in 49 industries obtained from Kenneth R. French's data library. The strategies are based on effects and factors observed in various asset markets. Specifically the strategies are: Momentum, Time-Series Momentum, Size, Book-to-Market and Industry Concentration. The rest of this thesis is organized as follows: Introduction: A brief petition on the main subject, Chapter 1: Detailed presentation of theory elements, Chapter 2: Presentation of the empirical analysis, Chapter 3: Conclusions

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Introduction

The famous efficient market hypothesis has been constantly questioned the recent years by famous scientists and investors. They have been searching for behavior patterns which outperform the market without assuming additional risk. In this thesis we pose the same question to the efficient market hypothesis using a very interesting type of market. Our universe of assets can be found at K. French data library and consists of NYSE, AMEX, and NASDAQ stock. Each stock is assigned to an industry portfolio at the end of June of year t based on its four-digit SIC code at that time. Compustat SIC codes are used for the fiscal year ending in calendar year t-1. Whenever Compustat SIC codes are not available, CRSP SIC codes are used instead for June of year t. Then returns from July of t to June of t+1 are constructed. Thus we result having returns for 49 industry portfolios for the time period 1926-2015. Although our data extends very long in the past when market conditions were very different and sometime very unstable to examine, we try to ascertain if our market experiences some of the most common phenomena such as Momentum. Momentum appears to be present on our universe and it pays greater returns when the strategy rebalances monthly and skips the last month while uses the previous 12 months as formation period. Momentum is also present for short-term periods giving positive returns, which means that short-term Reversal is absent as an effect. Subsequently we examine Time-Series Momentum. We include all the assets (industries) in our portfolio and we weight our position proportionally to the volatility of each asset. The strategy returns are generally stable and they have average close to 1%. Next we examine if the negative relation between size and returns and the positive relation between book-to-market and returns exists in our data. The strategy is formed on July and the position is held for 12 months. The results of the previous is a very low average return. This means that the size and the book-to-market effect are not captured by our strategy or are not present in our data. Finally we examine if there is a connection between Industry Concentration and returns. The Industry Concentration is measured using the Herfindahl index on market shares. The strategy constructed uses data for book equity, total assets and sales as means of calculating market share. The position kept is long for low concentrated industries and short for highly concentrated industries. For once more the results are poor. The average returns are positive but very close to zero. The connection between Industry Concentration and returns isn't captured.

CHAPTER 1 – TRADING STRATEGIES

In this chapter we present the theoretical elements which were applied on our data. In other words, we present the investment strategies followed. The results of the empirical analysis are discussed in the following chapter.

1.1) Momentum

Although it is essentially a phenomenon, momentum can reasonably be considered an investment strategy. It has been observed as a phenomenon over the 20th century in various markets and assets and has been widely used as a strategy by investors or as recommendation by financial analyst. It controverts the well-known "Random Walk" hypothesis. Though financial theory hasn't definitely explained why momentum exist the most likely explanation of the effect is a under-reaction of the market to firm-specific information. The time needed for information to be fully reflected in stock prices allows for an exploitable window in price changes.

The essence of the strategy can be summarized into a simple and short sentence: "Buy past winners and sell past losers.". In other words, an investor buys the stocks whose price increased and sells the stocks whose price felt in the short past. Aside from that, the rules necessary to form a portfolio which will perform according to momentum are easily explained and implemented. This simplistic nature has proven momentum investing to be quite robust across different countries and asset classes. In spite of being formerly observed, Narasimhan Jegadeesh and Sheridan Titman (1993) were the first to look at the performance of stocks who did well in the past. They concentrated their view in periods of time varying from 3 to 12 months. By looking at the past 3,6,9 and 12 month performance (formation period-J) they applied the strategy holding the position for the same time (holding period-K) creating thus 16 different portfolios which are reported as J-month/K-month.

More specifically, at the beginning of each month t the securities are ranked in ascending order on the basis of their returns in the past J months. Based on these rankings, ten decile portfolios are formed that equally weight the stocks contained in the top decile, the second decile, and so on. The top decile portfolio is called the "losers" decile and the bottom decile is called the "winners" decile. In each month t, the strategy buys the winner portfolio and sells the loser portfolio, holding this position for K months. In addition, the strategy closes the position initiated in month t-K. Aside from the above formation and holding periods Jegadeesh and Titman suggested a formation period of 12 months without taking into consideration the last month. The most recent month (skip month) is excluded in order to account for short term reversal effects. In this case, the portfolio is rebalanced monthly making the investment more adaptive to the incoming information but, on the other hand, a monthly rebalance implies continuous trading which burdens the investment with higher transaction costs. In this dissertation due to its limitations we will examine 6 and 12 month periods with a "buy and hold" strategy and a monthly balanced 12 month formation period in which the last month is not taken into consideration.

1.2) Reversal

Reversal is the corresponding phenomenon related to the over-reaction of the market to information. In this case, an uptrend on the stock prices quickly transforms into a downtrend and vice versa. It can be considered as a phenomenon converse to momentum but it there is a significant element which differentiates these two. Reversal is manifested in a short period of time, 1 month or less, in contrast with momentum which occurs approximately in 12 months. Although the procedure of constructing a strategy is much alike the monthly rebalanced 12 momentum case, with the only difference being at the position held: a long position on the worst performing assets and a short position in the best performing assets, the very essence of the reversal strategy stands off from the typical momentum strategy mainly due to the relative short time of occurrence. Again, due to the monthly rebalance needed, profits are impacted from trading costs.[1]

1.3) Time Series Momentum

Time series momentum is a different version of the common momentum strategy presented previously. The occurring phenomenon it's the same but it is exploited in a different way. Such as the classical momentum, time series momentum challenges the "Random Walk" hypothesis and it is characterized by a consistency across different assets classes and markets. The strategy does not focus on the cross-sectional performance of each asset but regards the asset's past return as a predictor of its future course.

According to T.J.Moskowitz, Y. Hua Ooi and L. H. Pedersen time series momentum that partially reverses over the long term may be consistent with initial under-reaction and delayed over-reaction of the markets. Their findings indicate strong correlation structure between time series momentum and cross-sectional momentum. The returns of the strategy tend to be largest when the stock market returns are most extreme, performing best when the market experiences large up and down moves. This means that time series momentum may be a hedge for extreme events, making its large return premium even more puzzling from a risk-based perspective.

The strategy is constructed as follows:

We use all asset included in the universe and for each of them we consider whether the excess return over the past k months is positive or negative. If positive we keep a long position and if negative we keep a short position on the asset. In order to compensate

[1] More recent studies argue that the impact of trading costs in reversal profits can largely be attributed excessively trading in small cap stocks which tend to be the most expensive to trade. According to these studies a limitation of the stock universe to large cap stocks significantly reduces trading costs.

for the different values of each asset's volatility, we set the position size for each of the assets to be inversely proportional to the ex-ante volatility.

In order to accomplish that, we weigh each asset every month using the following formula:

$$w_{t,i} = \frac{\sigma_{t,i}^{-1}}{\sum_i \sigma_{t,i}^{-1}} \quad (1.1)$$

$w_{t,i}$ is the weight of the asset i at month t.

Following the above steps we result having a time series of monthly returns for each asset. Then by summing for all assets we get the portfolio's monthly return. The strategy can be realized using various formation and holding periods. In this dissertation we will examine only the case of 12 month formation period and 1 month holding period.

1.4) Size and Book-to-Market

E. F. Fama and K. R. French documented in 1992 that there is a positive relation between book-to-market and returns and a negative relation between size and returns. A possible explanation to the above findings was that firms which the market judged to have poor prospects were signaled by low stock prices and high ratios of book-to-market and have higher expected stock returns than firms with strong perspectives. Also, small sized firms are considered more vulnerable to market downfalls and therefore more risky to invest in. So, small-sized firms are characterized by greater returns in relation to big-sized.

To ensure that the accounting variables are known before the returns they are used to explain, a minimum gap of six months is kept. A firm's market equity is used at the end of December of year t-1 in order to compute the book-to-market, and at June of year t to measure the size. The above measurements are matched with the returns from July of year t to June of year t+1.

1.5) Industry Concentration

"Industrial concentration" refers to a structural characteristic of the business sector. It is the degree to which production in an industry—or in the economy as a whole—is dominated by a few large firms. The link between industry concentration and average stock returns explore K. Hou and D. T. Robinson, offering the empirical evidence of the asset pricing implications if industry market structure. The reasons why the structures of product markets may affect stock returns may be many. Firms take operating decisions that may affect the riskiness of their cash flows. These operating decisions arise from an equilibrium in the product market that potentially reflects strategic interaction among market participants. Therefore, the structure of product markets may affect the risk of a firm's cash flows, and hence a firm's equilibrium rate of return.

As an example, we can use innovation, which, according to Schumpeter (1912), is a form of creative destruction that is more likely to occur in small firms of competitive industries or on the fringes of established industries. These small firms challenge and ultimately overturn the existing status quo, leading in a new technological paradigm. If we accept that innovation is risky, which risk can be priced, and creative destruction describes the relation between market structure and risky innovative activities, then more concentrated industries should experience lower average returns, because firms in more concentrated industries engage in less innovation. Hence, innovation is one channel through which the structure of product markets has implications for stock returns.

Or distress. If barriers to entry in product markets insulate some firms from aggregate demand shocks, while exposing others, then distress risk would be expected to vary with market structure. This predicts that industries with high barriers to entry are associated with lower equilibrium stocks return. Thus, distress is another way that market structure can impact stock returns. The Structure/Conduct/Performance (S/C/P) paradigm, which considers the nature of the production technology in an industry to be exogenous, suggests that barriers to entry affect expected returns whenever differences in the number of competitors in an industry, or in the pricing practices they observe, change the risk characteristics of the firms in question. For example, barriers to entry may affect how firms optimally respond to aggregate demand shocks. Firms in high barriers-to-entry industries can respond to positive demand shocks by increasing prices or raising output without fearing competitive entry. All else equal, this raises their expected future profitability, giving them deeper pockets that help them weather downturns without facing industry exit. Thus, if exit in response to aggregate demand shocks is associated with priced distress risk, we would expect these firms to face less distress risk. Thinking the previous it is safe to assume that firms in highly concentrated industries earn lower returns because, all else equal, they are better insulated from undiversifiable, aggregate demand shocks. On the contrary, firms in industries which have low concentration namely are more competitive are expected to have greater returns.

Industry concentration can be measured using the Herfindahl index.:

$$Herfindahl_j = \sum_{i=1}^{l} s_{ij}^2 \quad (1.2)$$

Where s_{ij} is the market share of firm i in industry j.

The above calculation is done each year for each industry, and then average the values over the past 3 years. This ensures that potential data errors do not have undue influence on the Herfindahl measure. The position is held from July of year t to June of year t+1 while the formation period is the fiscal year ending in t-1

The Herfindahl measure uses the entire distribution of industry market share information to obtain a complete picture of industry concentration. Small values of Herfindahl index imply that the market is shared by many competing firms, while large values imply that market share is concentrated in the hands of a few large firms.

Herfindahl index can be measured in many ways. Net sales can be used producing the variable H(sales), total assets which gives H(assets), or book equity which gives H(equity).

1.6) Sharpe Ratio

In finance, the Sharpe ratio is a way to examine the performance of an investment by adjusting for its risk and it is defined as follows: Let R_F represent the return on fund F in the forthcoming period and R_B the return on a benchmark portfolio or security. The difference R_F-R_B is called the excess return d. The quotient of average d over the standard deviation of d is called the Sharpe Ratio. In other words:

$$Sharpe\ Ratio = \frac{\overline{d}}{\sigma_d}$$

The ratio measures the excess return (or risk premium) per unit of deviation in an investment asset or a trading strategy, typically referred to as risk. The Sharpe ratio characterizes how well the return of an asset compensates the investor for the risk taken. When comparing two assets versus a common benchmark, the one with a higher Sharpe ratio provides better return for the same risk

CHAPTER 2 – EMPIRICAL ANALYSIS

In this chapter we apply the strategies described previously using real data. Our data come from Kenneth R. French library, and consists of NYSE, AMEX and NASDAQ stocks each assigned to an industry portfolio based on their four digit SIC code at the end of June of each year. In total there are 49 industries and the data consists of: average equal weighted returns (monthly), average value weighted returns (monthly and annual), number of firms in each portfolio (monthly), average firm size (monthly), BE/ME (monthly). Apart from that, for the Industry Concentration strategy we use data obtained from Datastream which will be described in the corresponding section. For each case we present the returns and the value at each month of $1 invested at the beginning. Also we present the Sharpe Ratio in order to examine the performance of the investment by adjusting for risk.[2]

Our portfolio consists of 10 out of 49 industries. We have long position in 5 and short position in the other 5 industries.

2.1) Momentum – A first look

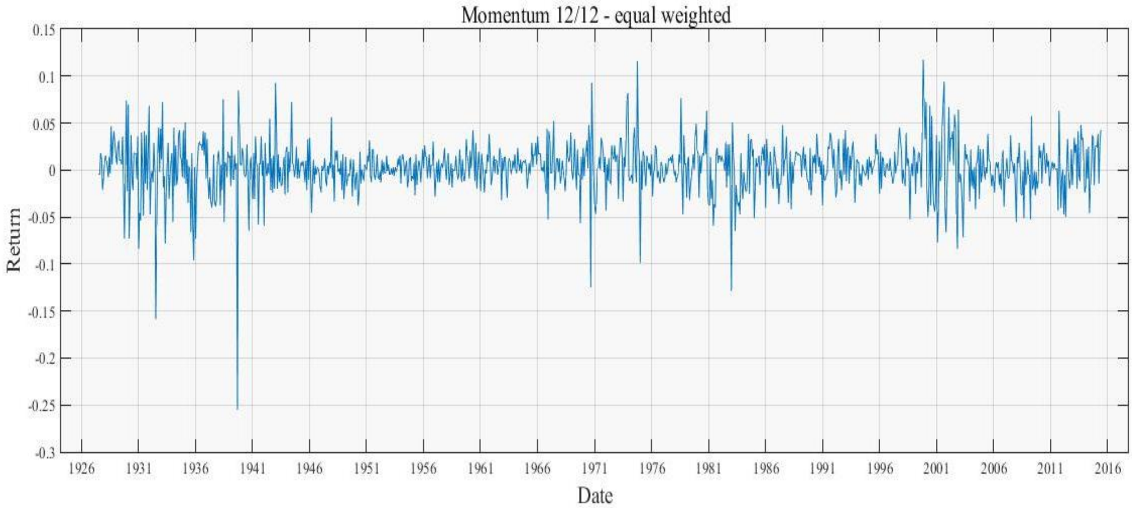
In this section we apply on our data the momentum strategy in its simplest forms. The skip period essential to account for short-term reversal effects is ignored and the formation and holding periods are 6 and 12 months. The previous are rather unsuited for the strategy to be optimal but, on the other hand, make our strategy very simplistic and helps to capture the essence of the phenomenon.

[2] We consider the 3-month US Government Treasury bills secondary market rate as a risk-free return. The data used are obtained from the "Board of Governors of the Federal Reserve System" website.

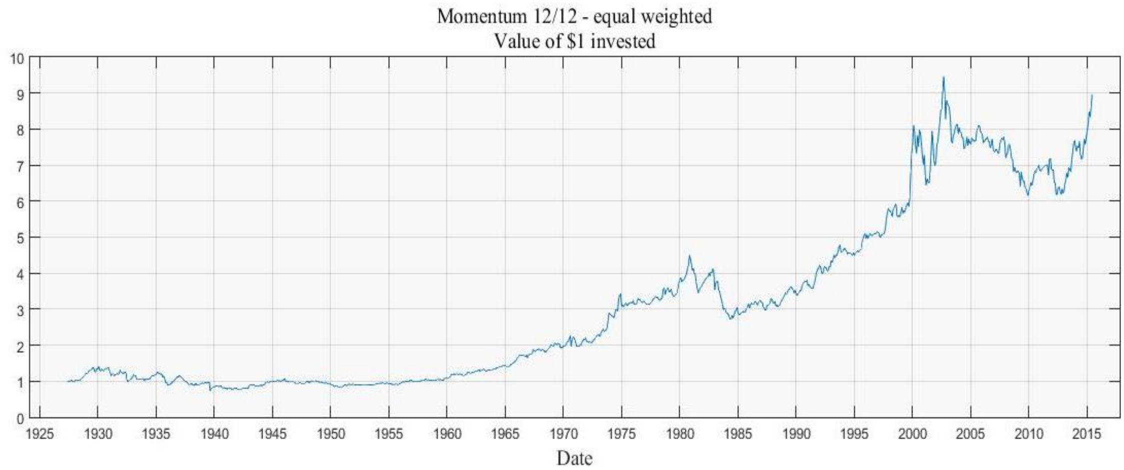
1. Formation Period = 12 months
   Holding Period = 12 months

- Equal Weighted Returns

Sharpe Ratio = -0,014 aver. Return = 0.25%



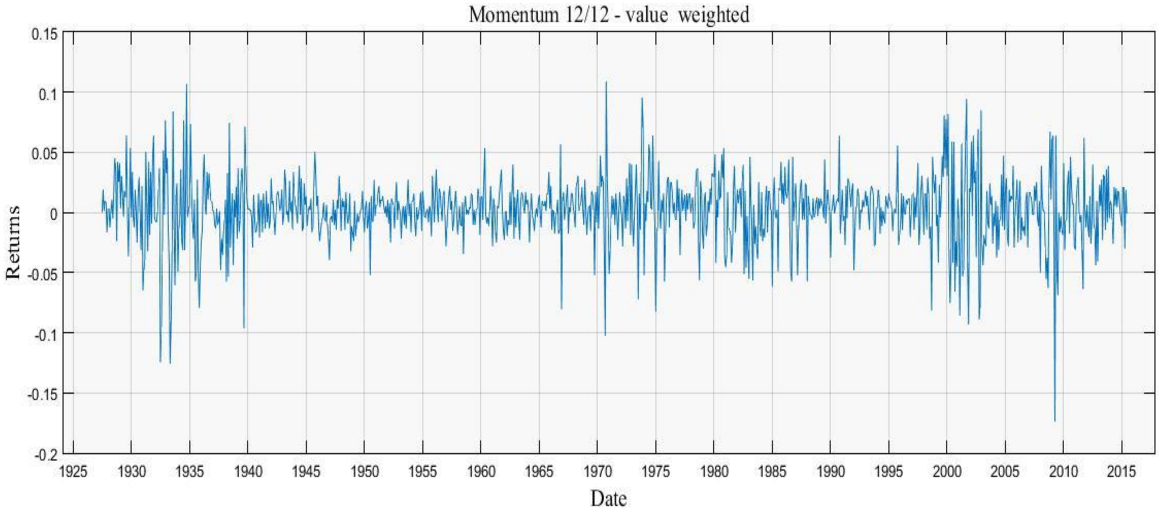
Picture 1



Picture 2

- Value Weighted Returns

Sharpe Ratio = -0,026 aver. Return = 0,22%



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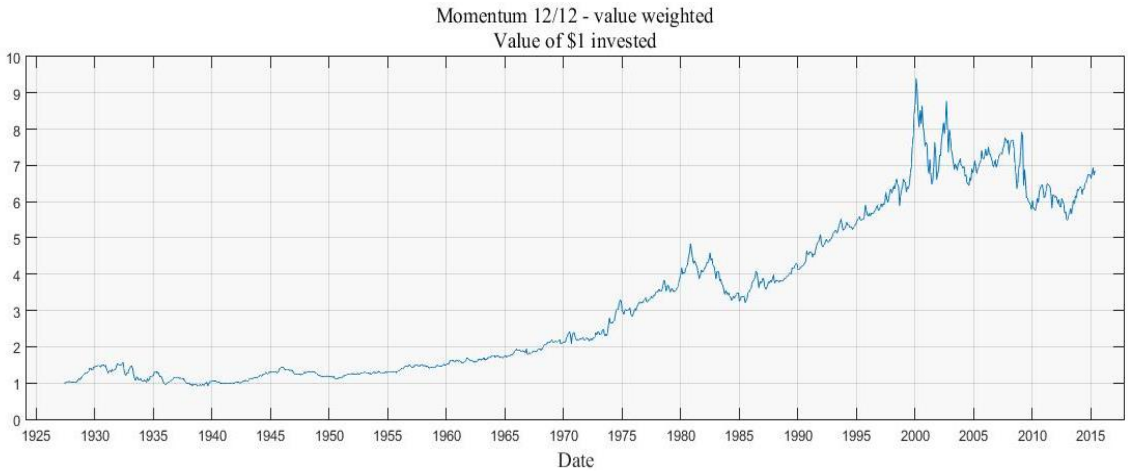
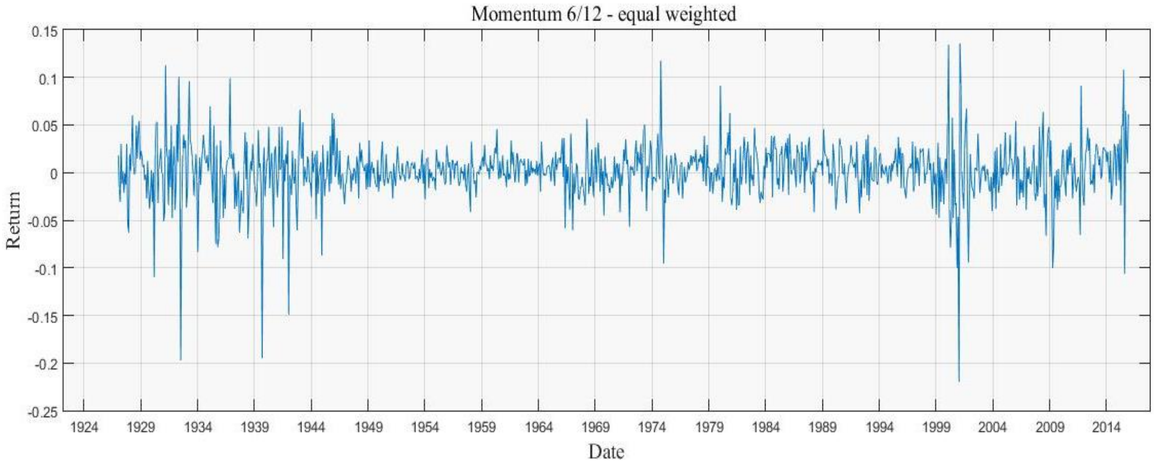


Picture 4

2. Formation Period = 6 months
   Holding Period = 12 months

- Equal Weighted Returns

Sharpe Ratio = -0,04 aver. Return = 0,19%



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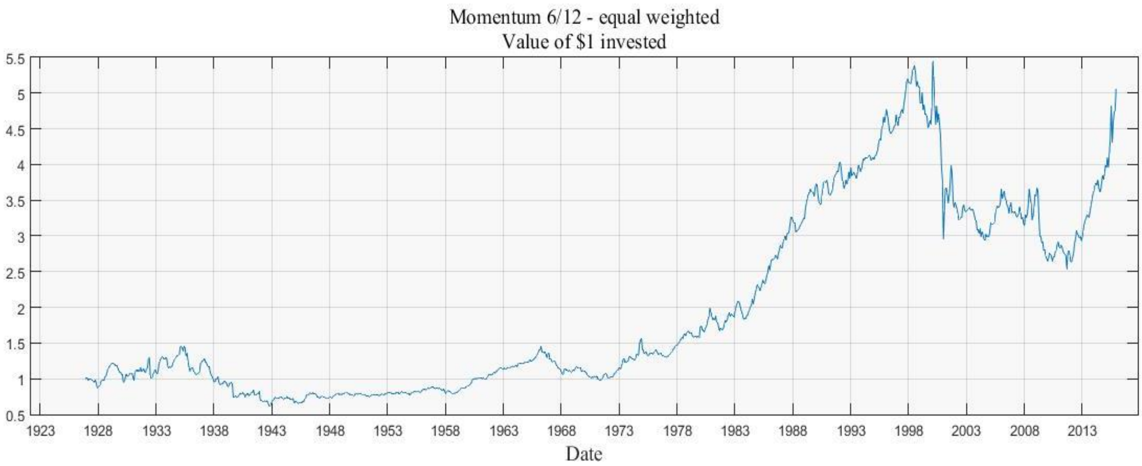

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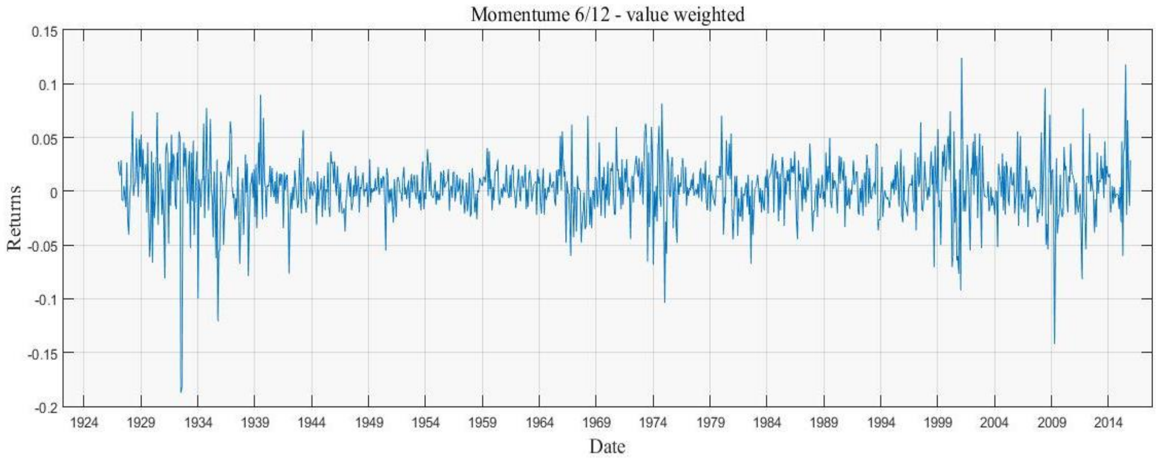
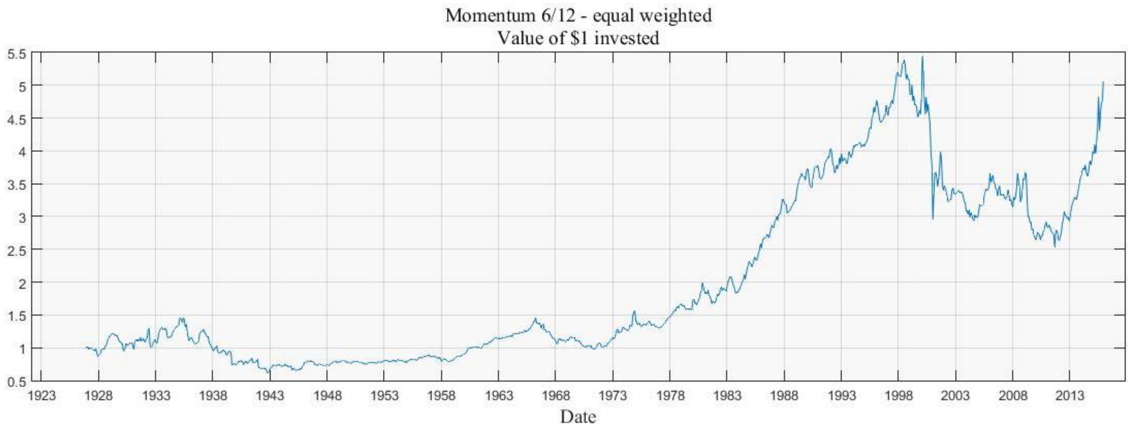
- Value Weighted Returns

Sharpe Ratio = -0,018 aver. Return = 0,26%



Picture 7

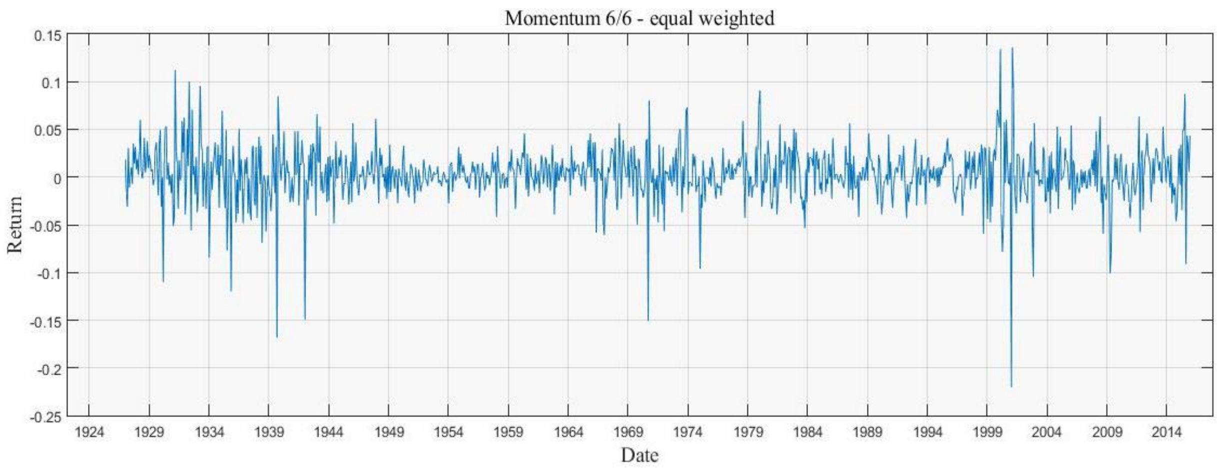


Picture 8

3. Formation Period = 6 months
   Holding Period = 6 months

- Equal Weighted Returns

Sharpe Ratio = -0,003 aver. Returns = 0,35%



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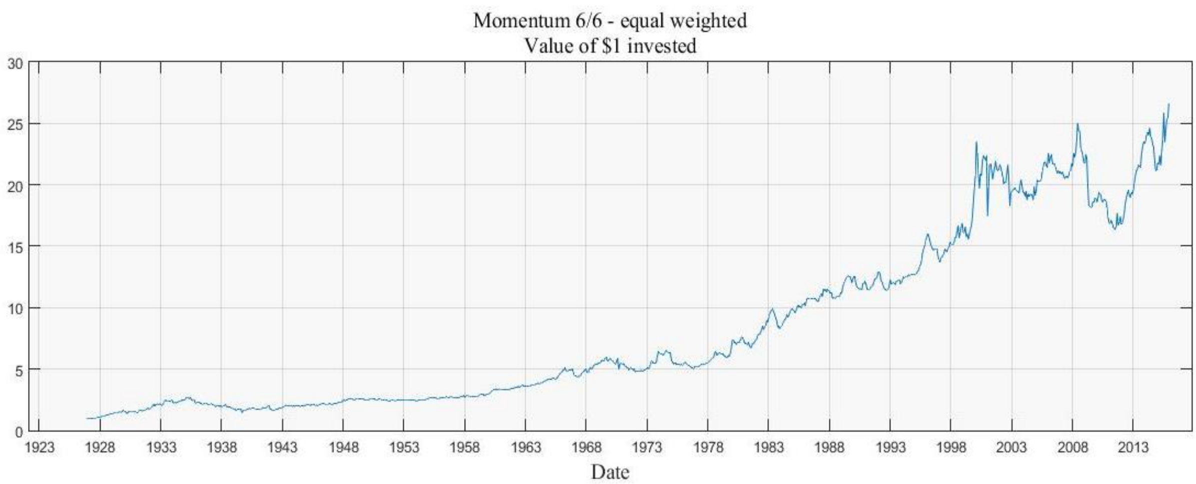
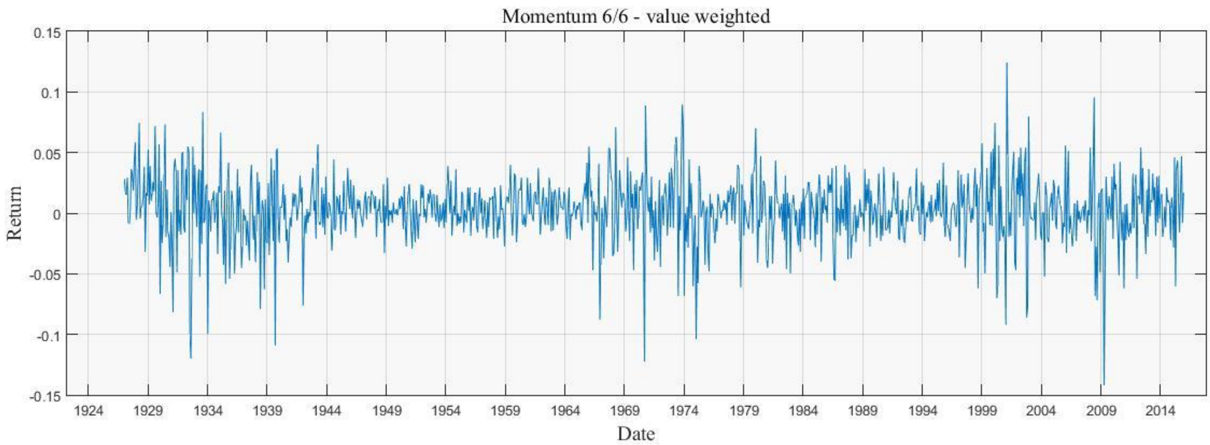


Picture 10

- Value Weighted Returns

Sharpe Ratio = -0,02 aver. Return = 0,30%



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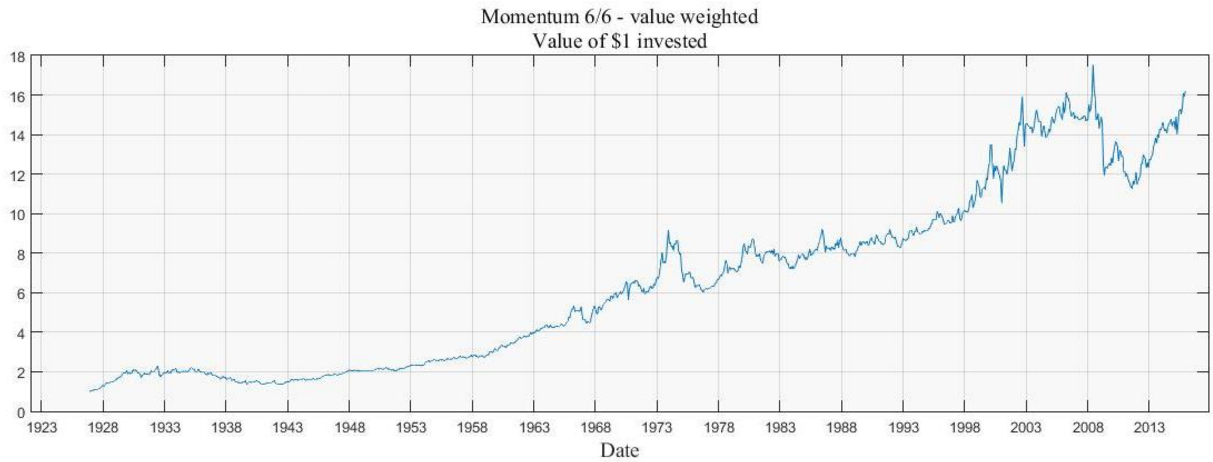


Picture 12

By looking the above, we can clearly understand the existence of the effect. Momentum does exist in our data but, even so, although the returns are positive on average they are not satisfactory. Actually, they are way lower than 1%, which is the average monthly return that Jegadeesh and Titman found on momentum portfolios. In all cases our initial investment of $1 never exceeds $10, except the last one where it reaches $16. For a 88-year investment this kind of return is considered very poor. Apart from that, judging by the long-term investment, the value of the portfolio has an upward trend from about 1970 and on, which means that returns after 1970 are higher than the returns before 1970.

A likely cause of this behavior is the greater volatility at the first half of 20th century. Many of the losing firms were close to bankruptcy and thus had very high betas over the holding periods. Jegadeesh and Titman provide a second cause which is related to the market's mean reversion in that time period. Their research indicates negative serial correlation in the market. Large market movements reduce the profits from relative strength strategies which tend to select high (low) beta stocks following a market increase (decrease) and hence tends to perform poorly during market reversals.

If we look at all the cases presented previously over the 1960-2015 time period returns tend to be somewhat better (about 0.05% - 0.10% higher) especially when the holding period is 12 months.

The Sharpe Ratio is negative as well, which is to be expected because our investment has a very small return in the long run. Also in the returns we see several unstable periods of the U.S. economical history. These periods match to recessions such as the Great Depression, the oil crisis in the mid-70's, the early 2000's recession etc.

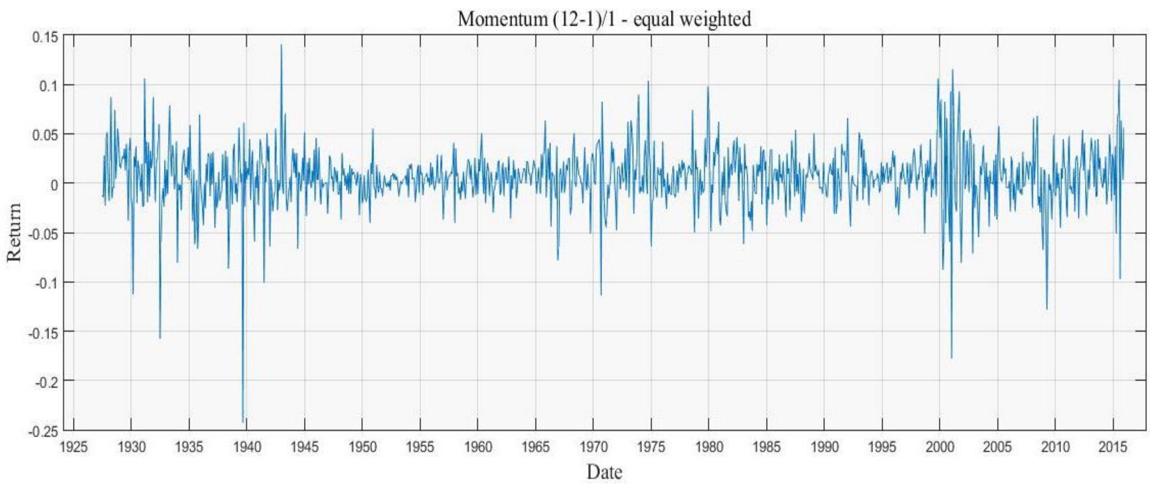
2.2) Long-term and Short-term Momentum

In this section we try a more sophisticated and flexible momentum strategy. We have a 12 month formation period, we skip the last month and we keep the position for 1 month. We also control for short-term momentum using a momentum strategy with 1 month formation and holding period.

1. Long-Term Momentum

- Equal Weighted Returns

Sharpe Ratio = 0,095 aver. Return = 0,62%



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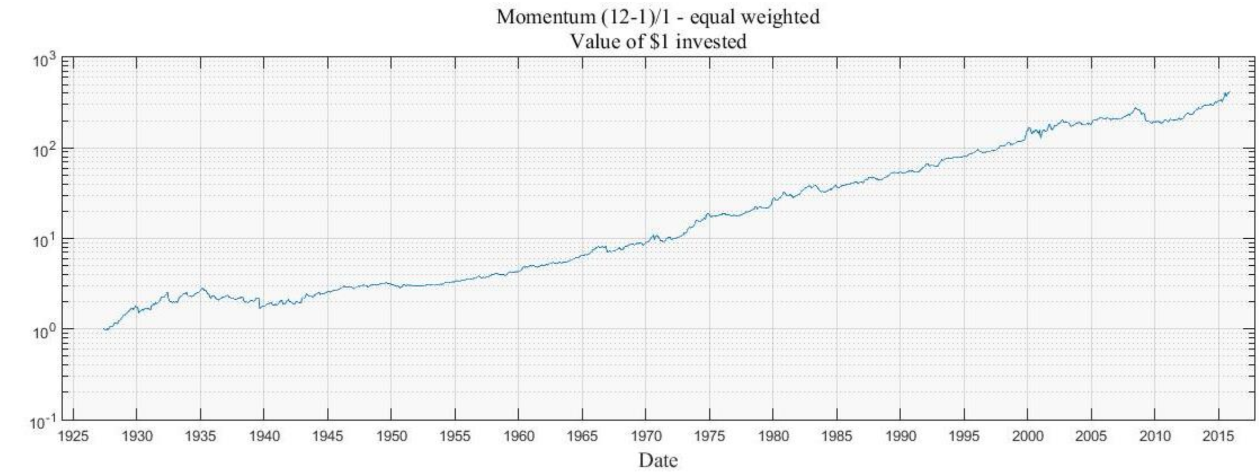

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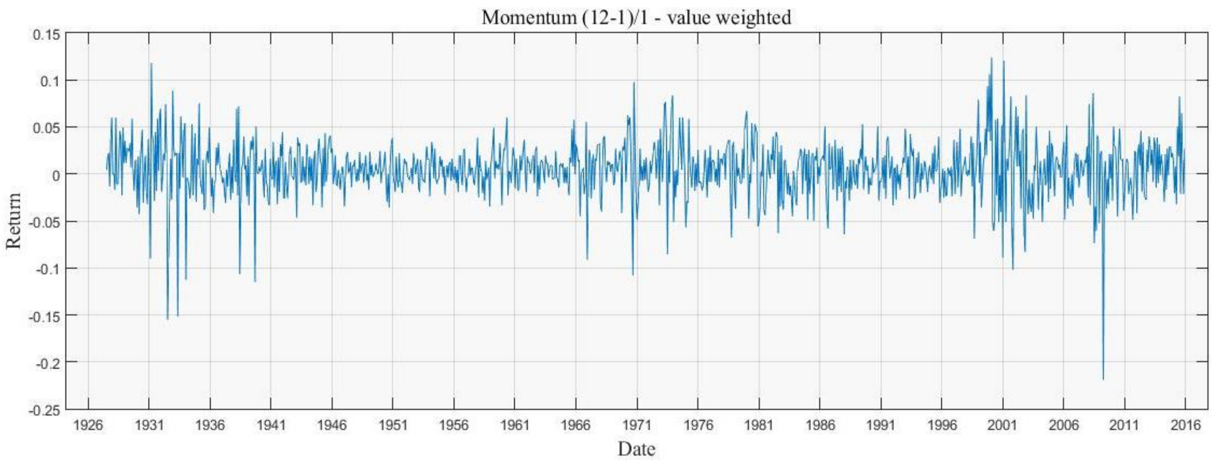
- Value Weighted Returns

Sharpe Ratio = 0,055   aver. Return = 0,50%



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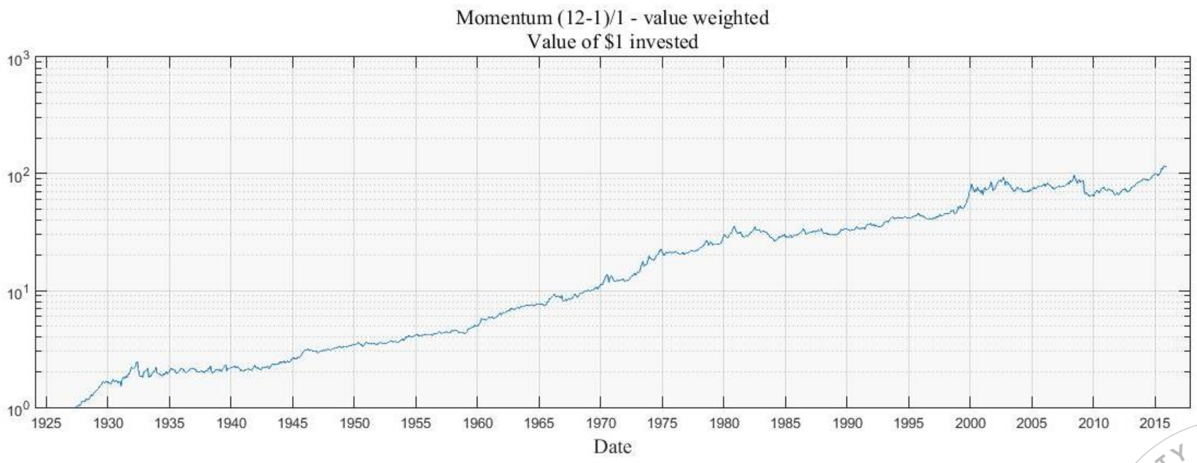
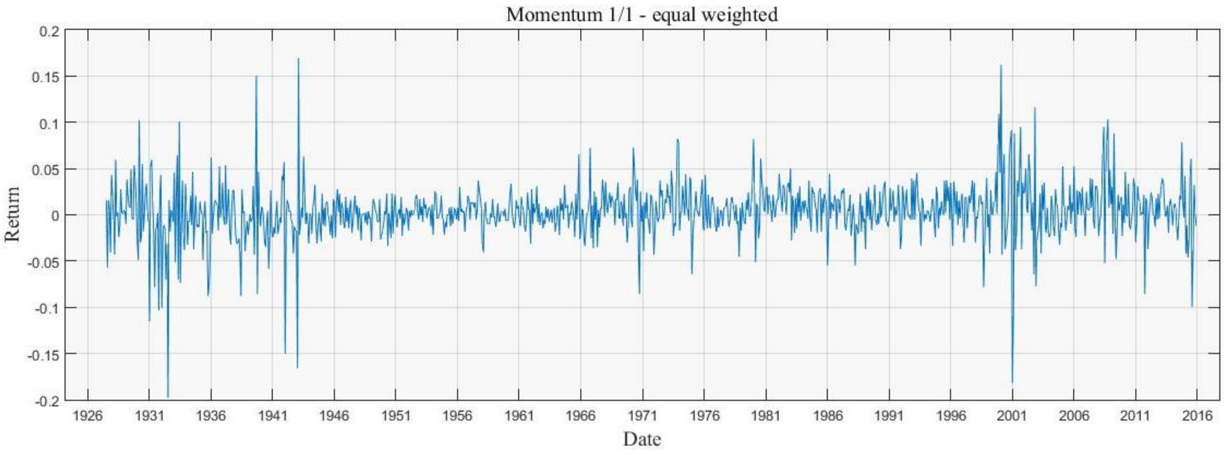


Picture 16

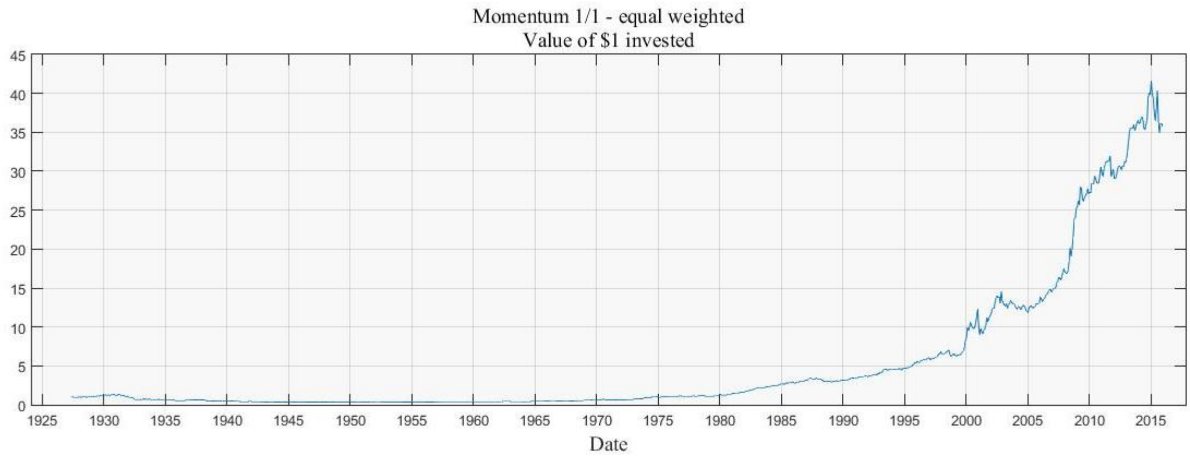
2. Short-Term Momentum

- Equal Weighted Returns

Sharpe Ratio = 0,054 aver. Return = -0,38%



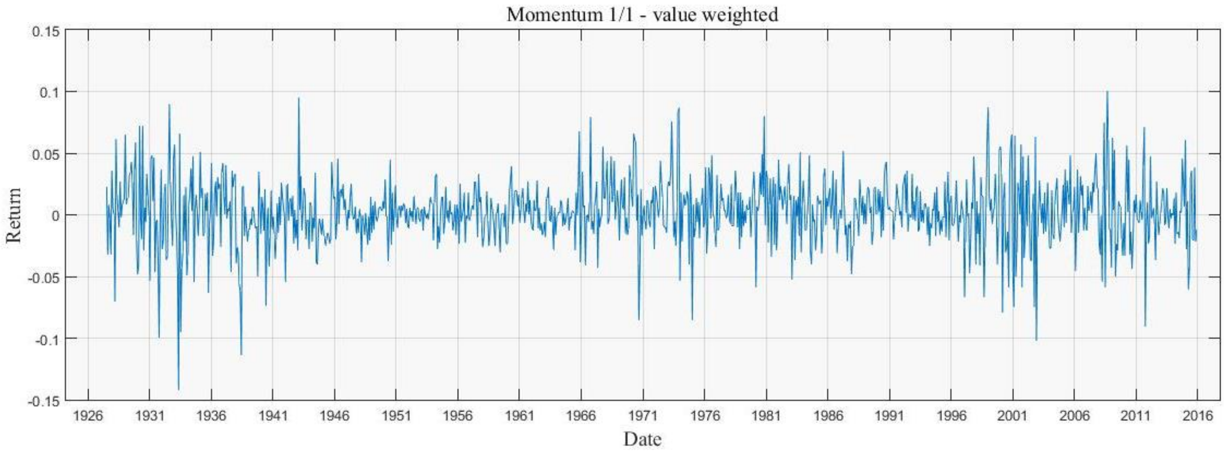
Picture 17



Picture 18

- Value weighted Returns

Sharpe Ratio = -0,014 aver. Return = -0,26%



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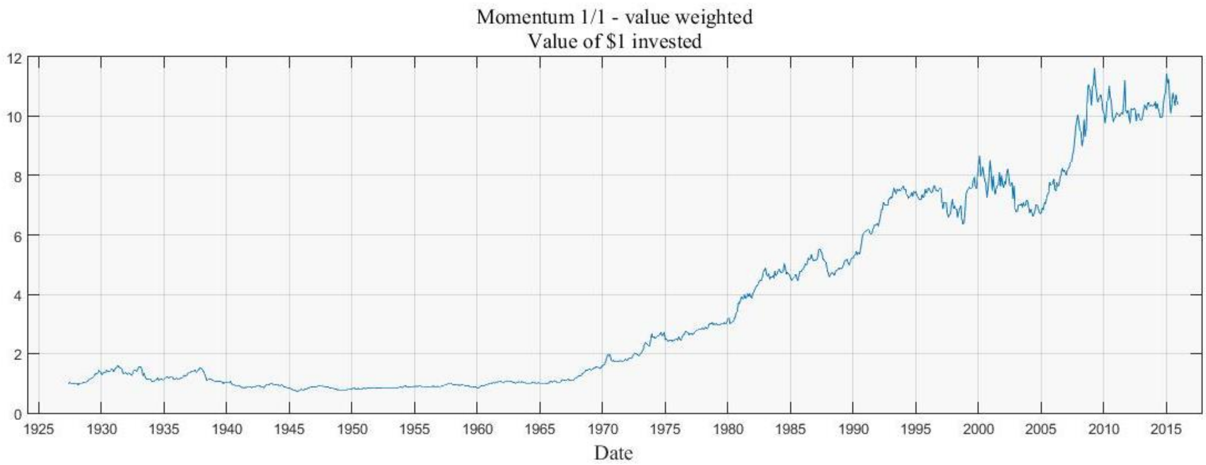


Picture 20

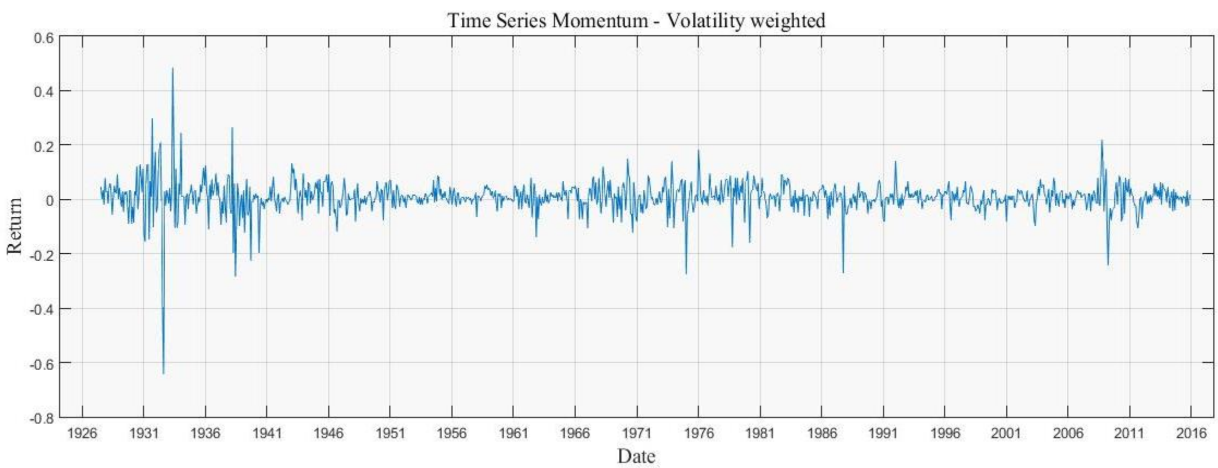
Now the existence of long momentum becomes more intense and returns are much greater. In the long-term investment we can see that the return rises to greater class sizes which means that the strategy's results come closer to the desired level, especially when the returns are equally weighted. In overall the strategy is much more profitable. The positive returns are dominant during the whole time period we examine, in contrast with the previous subchapter. A possible explanation is the monthly rebalance of the portfolio. The strategy is more agile and can adapt more easily to market changes. The skipped last month may also have a contribution which means that the overreaction, which usually creates reversals is avoided (although reversal is not observed in our case). Sharpe ratio is still negative but closer to zero.

The positive return of the short-term momentum means that the short-term overreaction leads in momentum effects and not in reversal effects. Momentum is present even in the very short rung in our data in contrast to other markets where prices tend to reverse on the short run.

2.3) Time Series Momentum

In this strategy we keep the formation and holding periods of the long-term momentum and we set the positon size for each of the assets to be inversely proportional to the ex-ante volatility according to formula 1.1 . Only equal weighted returns are used.

Sharpe Ratio = 0,10 aver. Return = 0,83%



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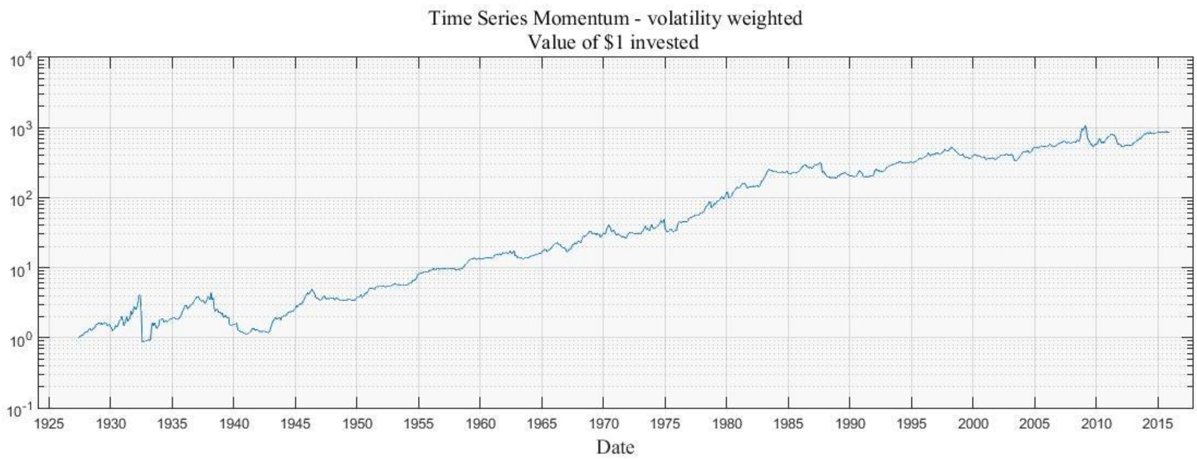


Picture 22

The first thing that we notice for the Time-Series Momentum results is the great resemblance with the cross-sectional Momentum. Moskowitz, Ooi and Pedersen report a relation between the two in their results. This relation can be noticed in our results as well. In addition, Time-Series Momentum profits are greater that the cross-sectional, which is also documented in the literature. It is reasonable to presume that the improved performance of this strategy has attributes to the fact that volatility, which is related with risk, is taken into consideration. We notice, as well, the high instability of returns in the time period 1930-1945 which strengthens the explanation posed on subchapter 2.1 concerning the volatility of that time.

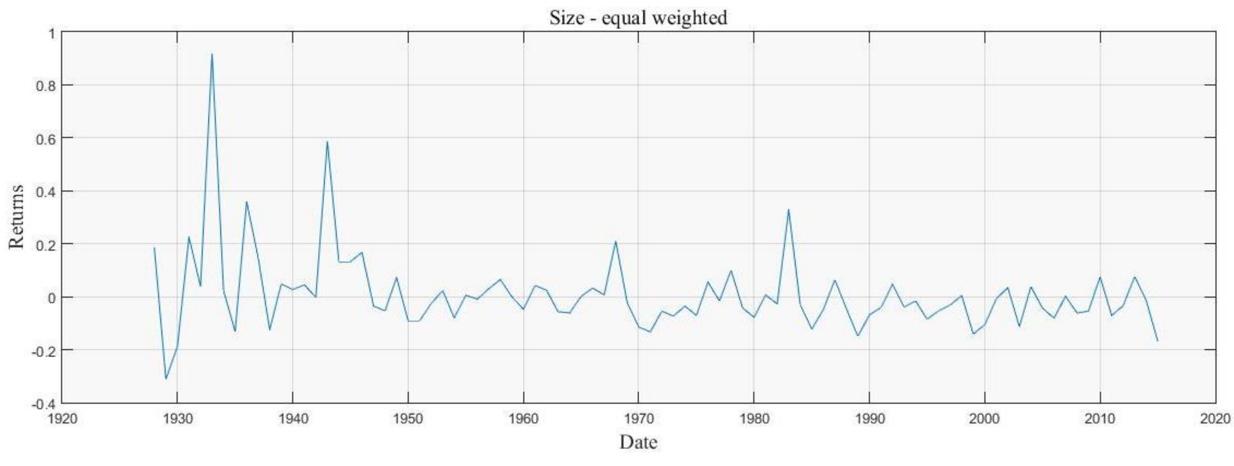
2.4) Size and Book-to-Market

In order to exploit the negative relation between size and returns and the positive relation between book-to-market and returns we construct two strategies. In the first strategy we keep a long position on small size industries and a short position on small size industries. In the second strategy we keep a long position in industries which have big values of book-to-market and a short position in industries which have low values of book-to-market. In both cases investment is made on July of each year and the position is held for 12 months based on the size at the moment and the book-to-market at December of the previous calendar year.

1) Size investment

- Equal weighted Returns

Sharpe Ratio = -0,31 aver. Return = 0,87%



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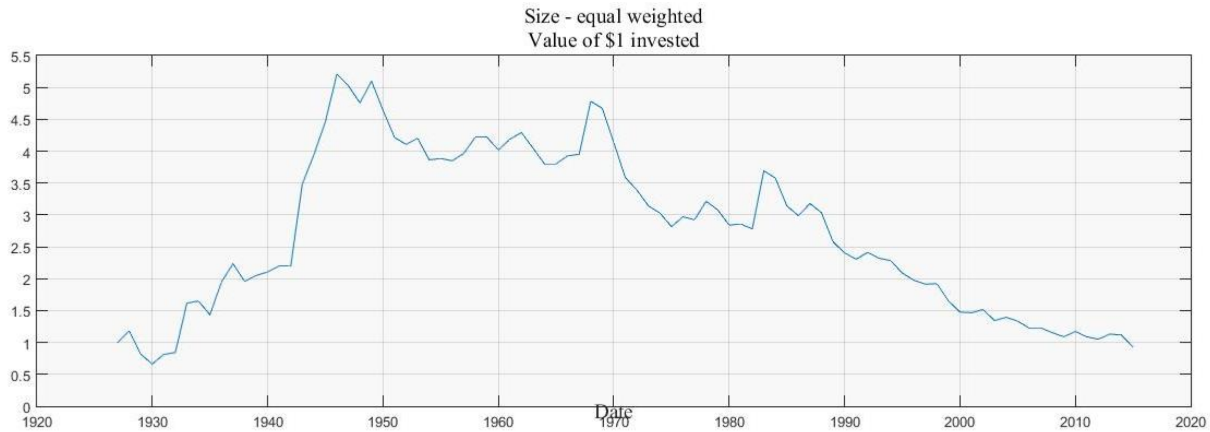
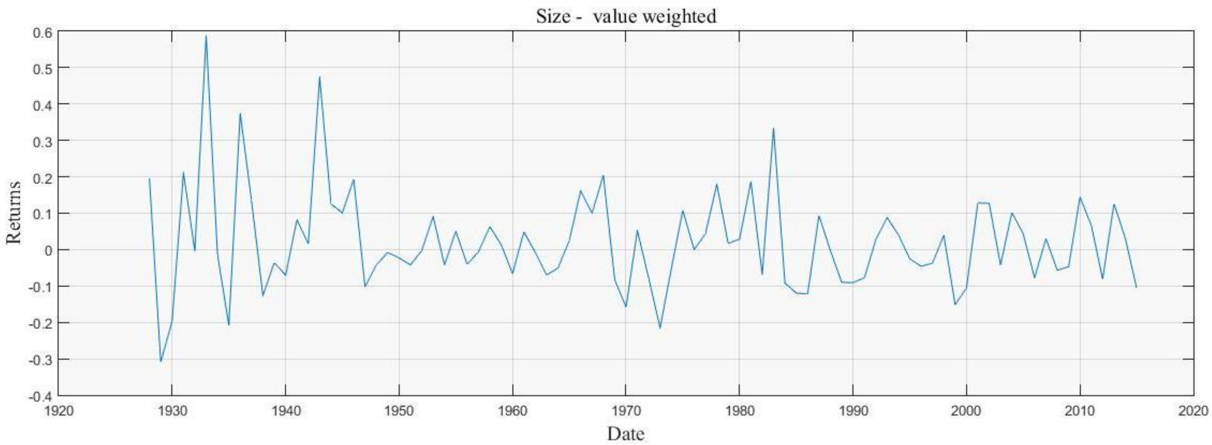


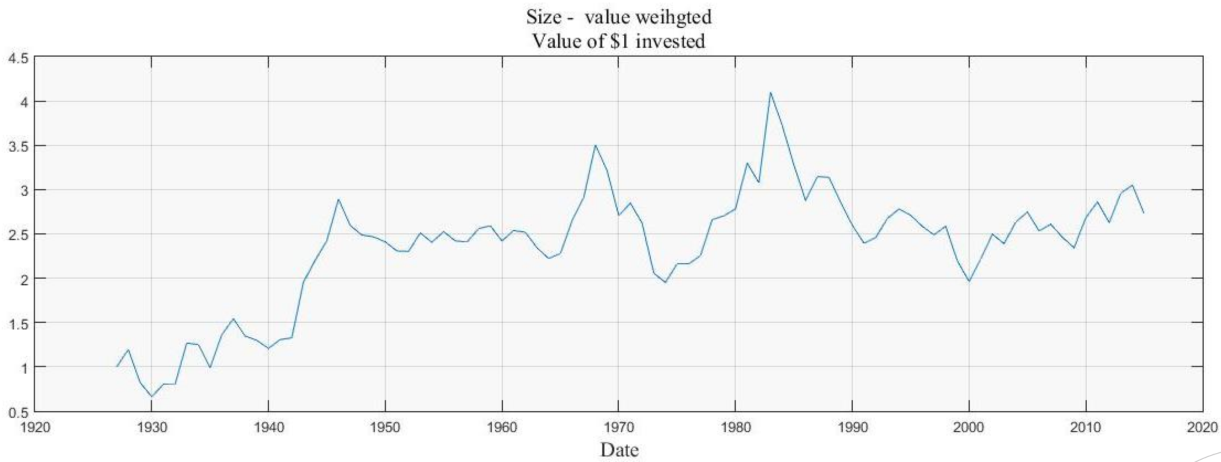
Picture 24

- Value weighted Returns

Sharpe Ratio = 0,025 aver. Return = 2,02%



Picture 25

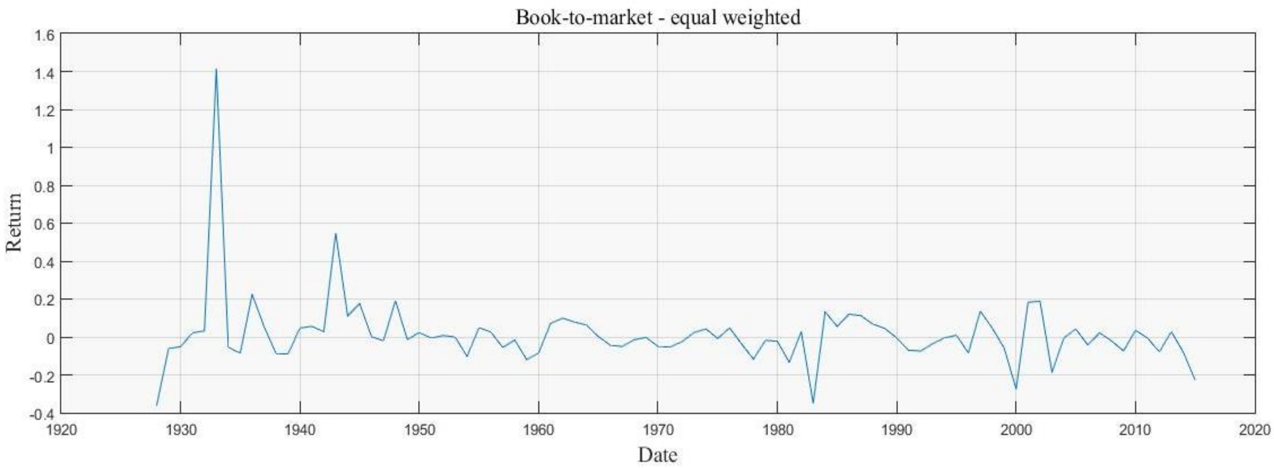


Picture 26

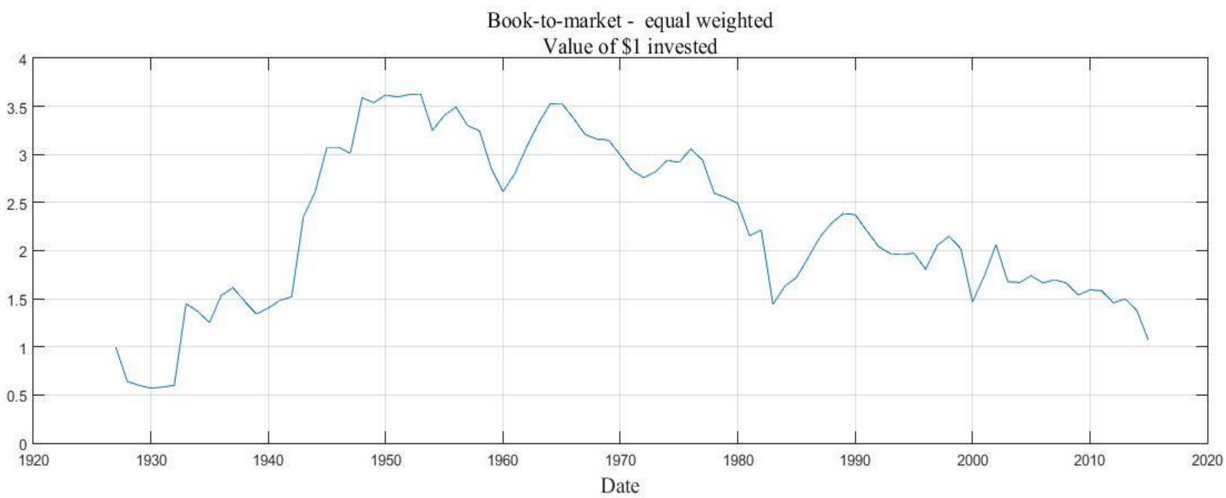
2) Book-to-Market investment

- Equal weighted Returns

Sharpe Ratio = -0,187 aver. Return = 1,36%



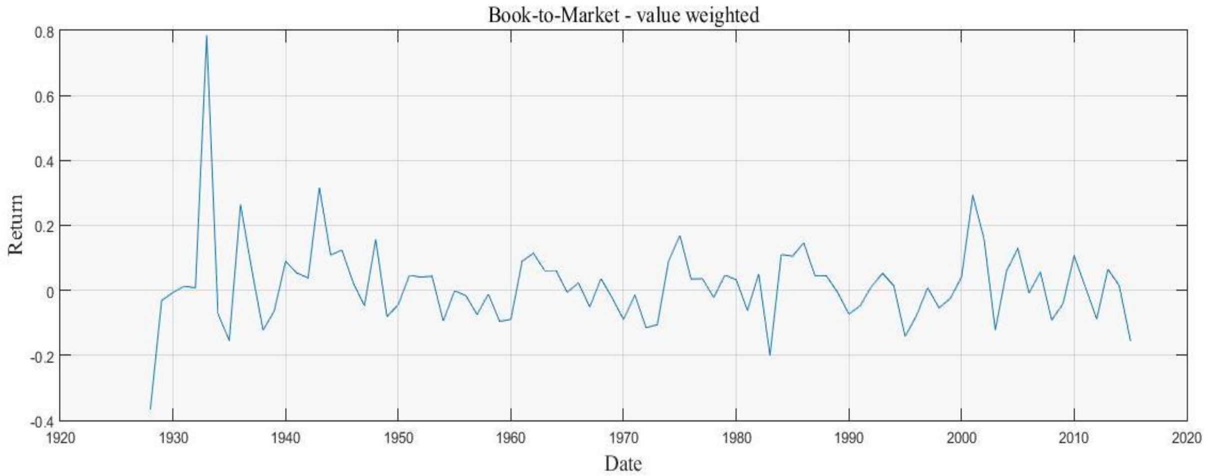
Picture 27



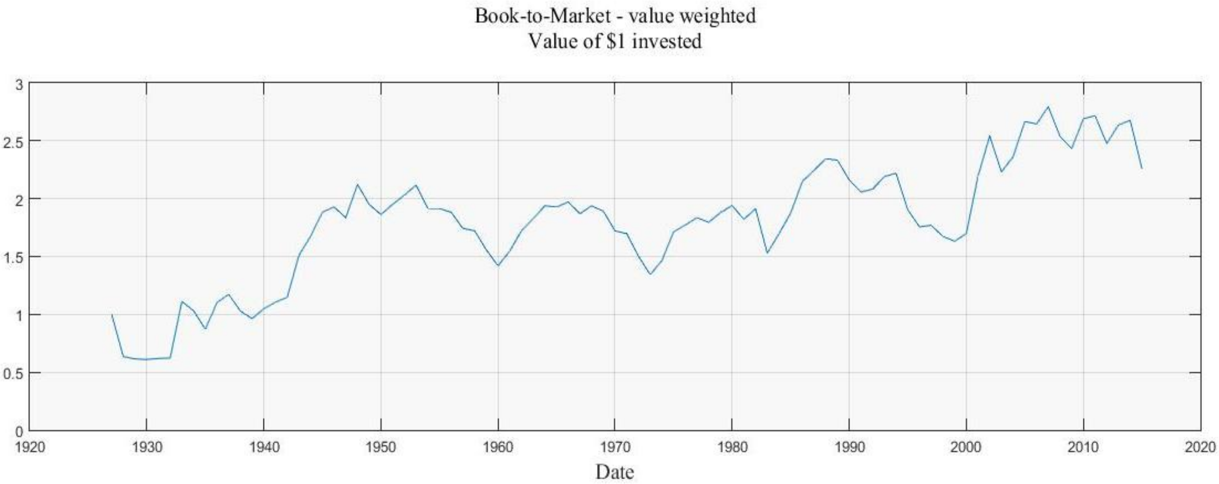
Picture 28

- Value weighted Returns

Sharpe Ratio = 0,014 aver. Return = 1,69%



Picture 29



Picture 30

The hypothesis related to Size and Book-to-Market does not apply in our data. The returns don’t seem to be responding to either effect, but instead they seem to change randomly. A feature that is strongly distinguishing in the returns of both of the strategies is the very high returns in the years that followed the Great Depression and the World War II. These outstanding performances are more or less expected because these periods of U.S. economical history were quite unstable.

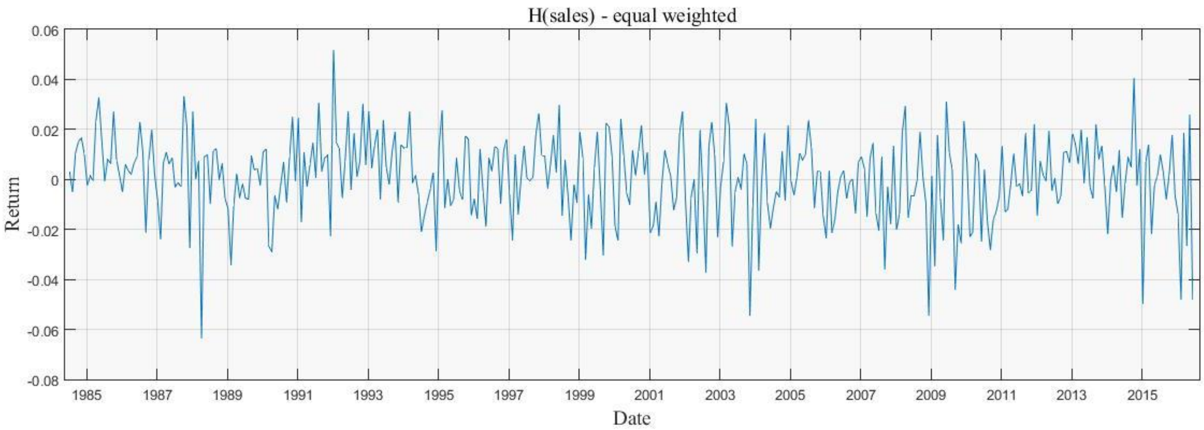
The fact that the returns are positive in these periods probably indicates that our strategies related to size and book-to-markets are more effective when applied to industry portfolios after financial crises. But in order to verify such a conclusion a more focalized and elaborate research is necessary. Probably a three factor model as described by E. Fama and K. French would be more appropriate to interpret the effects related to size and book-to-market and to produce a better strategy using our data. Unfortunately, the limits of this thesis don't allow for avocation with either of the above matters.

2.5) Industry Concentration

In this strategy it is essential to calculate the concentration of each industry. We use as an industry concentration measure the Herfindahl Index of the market shares for each firm in the specific industry. We use Datastream to obtain data for Sales which are defined as net Sales or Revenues represent gross sales and other operating revenue less discounts, returns and allowances. Next we use four-digit SIC codes[3] to classify these assets into 49 industries according to their definitions which can be found in the description of the 49 Industry Portfolios at K. French's data library. The position is kept for 12 months starting in July of year t. The data presented are monthly.

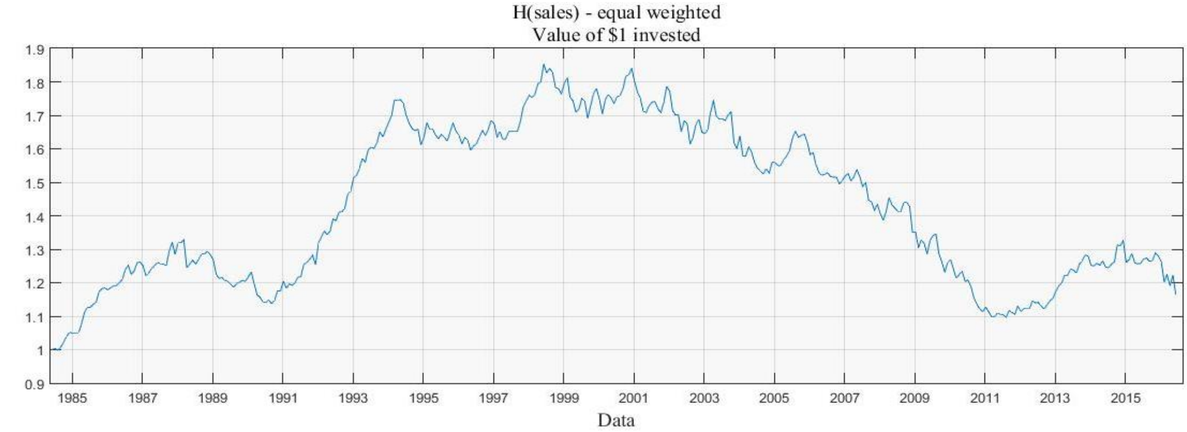
- Equal weighted Returns

Sharpe Ratio = -0,136 aver. Return = 0,05%



Picture 31

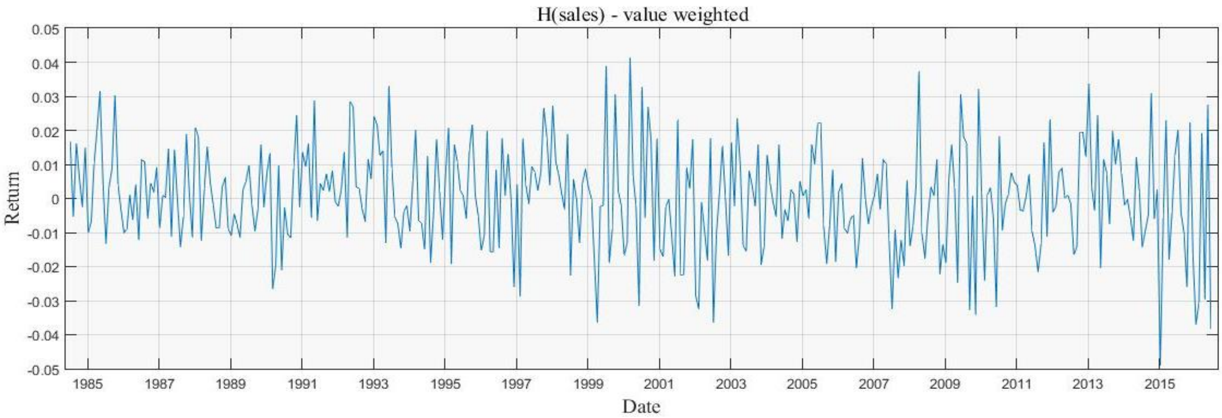
[3] SIC CODES were developed by the U.S. government to provide a standard industry classification that covers all the economic activities of the United States. They are derived from the 1987 edition of the Standard Industrial Classification Manual compiled by the Executive Office of the President of the United States, Office of Management and Budget. These SIC codes are assigned to both U.S. and non-U.S. companies according to the type of business in which they are engaged.



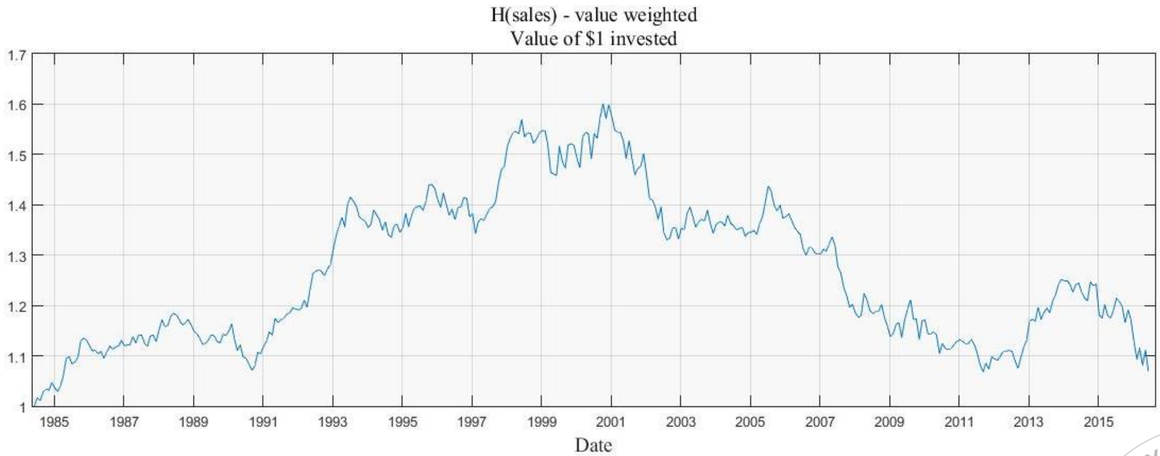
Picture 32

- Value weighted returns

Sharpe Ratio = -0,166 aver. Return = 0,03%



Picture 33



Picture 34

Industry Concentration strategies are characterized as well by a very poor performance. The link between market structure and average stock returns probably doesn't exist in our case. Even if it exist, the strategy as it was constructed fails to capture it. The long-term investment has a zero payoff. This behavior was also manifested in the Size and Book-to-Market strategies using the equal weighted returns. The above causes questions about the information that our strategies do not take into consideration. This is quite strange owing to the fact that the industry concentration strategies were the only strategies to use information relevant with each firm included in each industry.

CHAPTER 3 – CONCLUSIONS

In this chapter we try to exact the main conclusions for the strategies and for the universe of industries that were used. Also we try to interpret the results and find the possible reasons of the performance of each strategy.

First of all, it is important to emphasize the purpose of this thesis which is the study of a certain dataset. This dataset although originates from stocks it is categorized into industry portfolios instead. In other words, the strategies could only invest in industries. Industrial sectors, when considered as an asset class and not a total of individual stocks with a common lineament, differ from the broader market sectors and are subject to other factors. This constitutes a possible cause for the discrepancy between the results we had and the result someone would expect from the strategies implemented.

The result of the empirical analysis are summarized in the below table:

STRATEGY	weight	AVER. RETURN	SHARPE RATIO	alpha	OBSERVATIONS
Momentum (12/12)	equal	0,25%	-0,014	0,0035	1056
	value	0,22%	-0,026	0,0033	1056
Momentum (6/12)	equal	0,19%	-0,04	0,0029	1068
	value	0,26%	-0,018	0,0039	1068
Momentum (6/6)	equal	0,35%	-0,003	0,0038	1068
	value	0,30%	-0,02	0,004	1068
Momentum(12-1/1)	equal	0,62%	0,095	0,007	1062
	value	0,50%	0,055	0,0063	1062
Momentum (1/1)	equal	0,38%	0,05	0,00446	1062
	value	0,26%	-0,014	0,0032	1062
Time series Momentum	equal	0,83%	0,1	0,0094	1062
Size	equal	0,87% (annual)	-0,31	-0,019	1056
	value	2,02% (annual)	0,025	-0,002	1056
Book-to-Market	equal	1,36% (annual)	-0,187	-0,017	1056
	value	1,69% (annual)	0,014	-0,0001	1056
Industry concentration - H(sales)	equal	0,05%	-0,136	0,0002	384
	value	0,03%	-0,166	-0,0006	384

Picture 35

Our results are indeed very different from what we expected, especially in the period after the Second World War. The pre-war period was, by an economical perspective, totally different from the post-war period. The economy was unstable, the rate of growth was very low and negative in many cases. The low income in combination with the high unemployment were making the situation even worse. The industrial sectors were exposed to dangers incommensurate to their capabilities. This leaded a growing debt for many firms which eventually could not be repaid resulting in bankruptcy. So in the pre-war period the results were not expected to be good. But, in the post-war period the U.S. economy switched in normal an operated much better. That means that we can trust the results and lead to conclusions.

The best performing strategy was Time-Series Momentum. Cross-sectional Momentum performs better when the portfolio is rebalanced monthly and the last month is skipped. But even so, the resulting month average return of 0.62% and 0.5% is much lower form the 1% that Jegadeesh and Titman experience in their analysis for the stock market. The other versions of Momentum didn't performed well. Jegadeesh and Titman implemented the same strategies and experience much greater average returns. We can compare their results in the following table:

	49 Industry Portfolios	Jegadeesh - Titman
12 month/12 month	0,24%	0,68%
6month/12month	0,23%	0,86%
6month/6month	0,33%	0,95%

Picture 36

The divergence between the two analyses increases while the holding and the formation period decrease. The positive return of the short-term momentum means that the short-term reversal effects are not present in our data. This is of great surprise because short-term reversal is a well-established phenomenon which exists in stock markets and is not just absent in our industry market, but it inverses creating short-term momentum effects. A more detailed and targeted research, which is out of the limits of this thesis, would give an explanation to the absence of reversal effects.

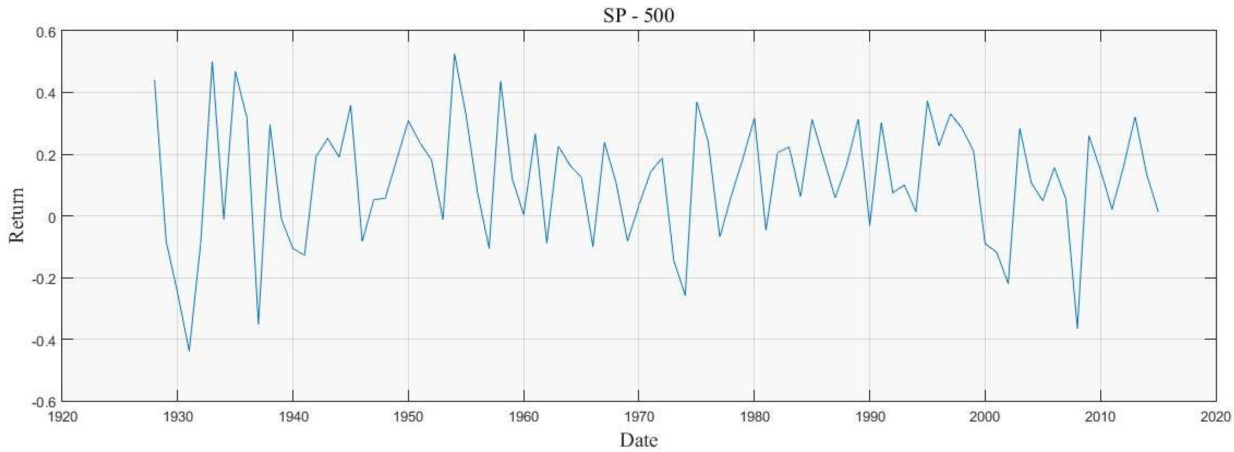
Next, size and book-to-market strategies failed as well. Apart from the unusually high returns in the pre-war period which is common in most of our results, what causes consideration is the strategy itself. The size strategy choses industries to invest in based on the size of each industry. So the only element that is taken into consideration is the size of an industry which means that our strategy cannot distinguish if for example a large industry consists of large or small firms, same for a small industry. Obviously, a large industry which consist of large firms has not the same behavior with a large industry which consists of small firms, but these two industries may have the same size. The previous show that an important parameter in this case is the number of firms in each industry. The previous can be said as well for the book-to-market case. The conclusion here is that the size and book-to-market strategy enriched with components on the firms in industries would give more information and better answers about the said effects in our data. An interesting study would be forming a strategy which except for size and book-to-market would take into account industry concentration effects.

The final strategy examined was related to concentration. In this case, in order to compute the concentration for each industry, as defined by K. Hou and D. Robinson, we downloaded from Datastream data regarding sales for NYSE, AMEX and NASDAQ stocks. Then, in order to calculate the market shares and consequently the concentration, these data were sorted in 49 industries using a SIC code categorization as defined by K. French. Although the concentration strategies implement firm-specific information their performance is the worst in our analysis. And to make matters even worst the data we used in order to calculate industry concentration are pretty much the same data that Hou and Robinson used in their analysis, where they take into account book-to-market and size. They produce positive returns in their strategy which average to 1.5% monthly. So why our results diverge so much? The fact is that Hou and Robinson develop a far more sophisticated strategy. They control for market betas, portfolio betas, size and many other factors which we don't take into consideration. Even in this case, we expected our results to be more similar to the results of Hou and Robinson. We expected the link between the market structure and returns to be captured even in a minimum level. Another factor which may have been determinant for our results is the categorization of firms in industries. Hou and Robinson use three-digit SIC classification to define industry membership, without clarifying the total number of industries which results. Our assets were categorized into 49 industries based on a four-digit SIC code. The number of industries was chosen arbitrarily. Similarly we could categorize the assets into 39 or 59 industries, and for each case the results would be different.

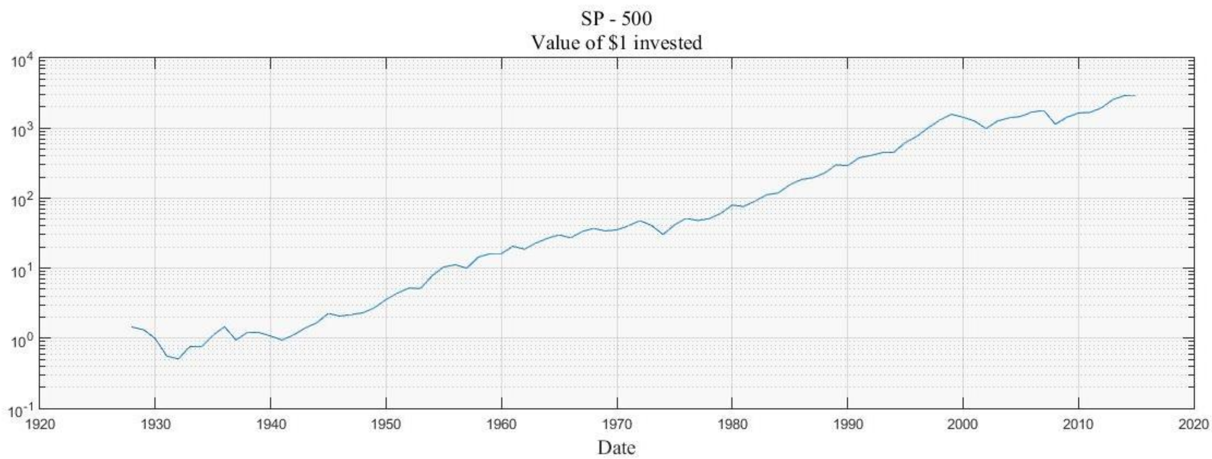
Conclusively, Time-Series Momentum was the best responding strategy providing the best average return and the best long-term investment. The average return is very close to the 1% which we see as the most usual return found for this strategy in other papers. The momentum effect is reflected intensively in our data and especially when risk is taken into account a momentum strategy performs even better. This discloses a very obvious but important characteristic of investing: in any case and under any circumstances risk must be considered.

Another question which arises when looking at our results is why industry portfolios have such a different behavior compared to stocks and the broader market? The industrial sector is subject to very different factors compared to other markets. The most industries consist of companies that produce goods. Companies in the industrial sector have large capital investments in the business and need regular access to credit markets to smooth out fluctuations in cash flow. Further, there is constant need to maintain plants and equipment and make upgrades to support the production and keep up with competitors. Therefore, industrial stocks tend to carry heavy debt loads. Also the industrial sector is a cyclical industry. Its products tend to be low-margin with intense competition and constant downward pressure on pricing. There is clearly sector risk due to the leverage of the industrial sector to the economy's growth rate. Due to competition, there is also company risk, as competition can lead to rapid losses of market share. Additionally, debt burdens can lead to steep declines in equity prices. Due to technological innovations, prices tend to decline over time with quality improving. While this is good for customers, it increases risk for investors in the sector while limiting upside. The previous suggest that investing in the industrial should be done with great caution.

Eventually, having in mind the previous what should we advise an unexperienced investor interested in investing in the 49 Industry Portfolios? The first and most important advice is that he anyhow must take into account risk factors in his investing strategy. CAPM and three-factors model are some tools which are easy to use and can help to assess the risk. Momentum effect seems to be strongly present in our data but the returns of the momentum strategy are not satisfactory. This means that the investor is able to take advantage of the effect but momentum as a stand-alone strategy will perform poorly. If, for example, we look at the SP500 returns we have the following pictures:



Picture 37



Picture 38

As we can see an investment on the SP500 index, which doesn't require any sort of strategy would be much more profitable compared to our returns. The above leads to the conclusion that a momentum strategy should be combined with other strategies in order to have a better performance. Also it is recommended that this combination if strategies take into account factors related to expectations, risk, competition, interest rates, seasonality and the broader macroeconomical and microeconomical conditions in the U.S. and other countries economically related to U.S. . A final advice we could give to this investors relates to the portfolio diversification. In the majority of the publications we read as a theoretical basis for this thesis the portfolios which were constructed consisted of several assets classes. A portfolio apart from industries can be as well consisted of stocks, bonds, options, currency, futures etc. A portfolio consisted of different asset classes is well-diversified and protected from steep fluctuations.

Our analysis concludes that the industrial sector is a very complicated market which is related to a lot of factors many of which are different from the stock market factors. More detailed and targeted studies will help describing and understanding better these factors and the behavior of the Industrial Markets.

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