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A Statistical Analysis of the Small Firm Effect in the 21st Century -Does Size Matter?

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1. Executive Summary

This paper investigates the existence of a small firm effect so far in the 21st century. Furthermore, it seeks out possible small firm effect sources based on a discussion note written by Norwegian Bank Investment Management, and tries to validate which sources are applicable on this particular data set. Finally, the paper very briefly discusses how one could benefit from the small firm effect by using a long-short strategy.

The problem formulation this paper tries to answer is as follows: "Is there evidence for a small firm effect in the 21st century, and, if so, how can this market anomaly be explained?"

To discover any possible small firm effect, 16 years, 10 months and 22 days' worth of data on the big capitalization company index S&P 500 and small capitalization company index S&P SmallCap 600 were collected. Statistical tests on differences in average return were conducted and the test results implies that there has indeed been an apparent small firm effect so far in the 21st century.

In trying to determine the sources of this observed small firm effect, this paper discusses the January effect and differences in volatility and liquidity between the two indices, and connects behavioural finance and news coverage to the small firm effect.

This paper finds there has been no statistically significant difference in return between the two indices over the past 17 January months, and raises questions over whether there has been any January effect in this time period at all. Furthermore, differences in both volatility and liquidity were found and these factors could therefore be contributors to the observed small firm effect. The rational flaws all investors are subject to could also contribute to creating a small firm effect. Finally, by utilizing a long-short strategy to isolate the small firm effect, one could obtain substantial profit and at the same time reduce risk through hedging.

Regardless of how unequivocal these findings appear in this summary, most if not all are ambiguous. This paper is subject to several weaknesses, and further research may be required to obtain more reliable results and conclusions.

2. Introduction

Does size matter? This paper investigates whether there is a small firm effect in American traded companies in the 21st century, i.e. from January 1, 2000 to November 23, 2016. In other words, it investigates if small capitalization firms in the US market have outperformed greater capitalization firms over these years. The market anomaly is proven and known in the financial world, and is discussed in a paper written by Norwegian Bank Investment Management (NBIM) (2012). Small firm effect was originally a term coined by Rolf W. Banz in an empirical study where he examined the relationship between the return and total market value of NYSE common stocks (Banz, 1981). The effect was later included as one of three factors in Fama and French's extended asset pricing model to account for any outperformance tendencies linked to size, thus making the model better suited for evaluating a portfolio managers' performance (Fama & French, 1992). NBIM's paper is largely based upon Fama and French's research paper, thereby making it the main source of inspiration for this paper. Based on this description, the problem formulation for the paper emerges:

Is there evidence for a small firm effect in the 21st century, and, if so, how can this market anomaly be explained?

The paper is divided into two main sections, statistical analysis and discussions of results. The sections are further divided into sub-sections, to outline a clear structure and enhance readability.

In the first main section, the paper presents and describes novel statistical analysis on two selected stock indicators, the S&P 500 Index and the S&P SmallCap 600 Index. The statistical analysis revolves around testing for any significant differences between the indices, and whether the tests returns valid data.

Thereafter, in the second main section, different explanations for the results are discussed, drawing on explanations from NBIM's paper. The discussion section attempts to connect the small firm effect to factors such as the January effect, difference in liquidity and volatility, and behavioral finance. A conclusion will then follow to tie the discussion together and summarize any findings. Conclusively, the final subsection will direct awareness to potential weaknesses of, and limitations to, the paper and any results.

3. Data Analysis

3.1. Introduction of statistics and data material

Data on the two indices S&P 500 and S&P SmallCap 600 from 1st of January 2000 until 22nd of November 2016 were gathered to analyze the existence of a small firm effect. These indices were selected because they represent a big part of the US stock market landscape, specifically large and small capitalization firms respectively. Every available day of the year is included in the dataset for both indices, which means that for every observation on S&P 500, there is a matching observation on S&P 600.

3.2. The S&P 500 index

The S&P 500 is an index consisting of 500 large-cap, influential companies listed on either the NYSE or Nasdaq Composite. The index measures the average market value of the included companies and is intended to provide quick insight to the stock market and economy (S&P, 2016). The index is calculated based on the average weighted market cap of the companies, meaning the larger companies, say Apple, has a bigger influence on the index than smaller companies with smaller market cap, e.g. Diamond Offshore Drilling. The formula from which the index fund is calculated is quite straight-forward, with the only factor, "Divisor", needing further explanation.

$$Index\ Level = \frac{\sum(P_i \cdot Q_i)}{Divisor}$$

P and Q indicates respectively the price per share and the volume of shares, and the product yields the market capitalization (The McGraw-Hill Companies, 2013). The divisor, on the other hand, is more complicated. It is a factor which is produced by Standard and Poor to prevent non-economic factors to affect the index, i.e. stock splits, special dividends or spinoffs. It follows that the divisor must increase when a large cap stock replaces a small cap stock to prevent an unnatural increase in the index value, while it can remain unchanged when stock splits, as the latter does not change total capital values (Harris, 2003). The divisor's time series is, in effect, a chronological summary of all changes affecting the base capital of the index (The McGraw-Hill Companies, 2012, p. 8). A slightly outdated number of the divisor is about $8.9 billion, which was present in 2013 (Langager, 2013).

3.3. The S&P SmallCap 600 index

The S&P SmallCap 600, hereafter just referred to as "S&P 600", is an index consisting of 600 small cap firms registered in the US stock market. The firms market cap size range from $400 million to $1,8

billion and are all covered by the standard "small cap firm"-definition (The McGraw-Hill Companies, 2015). Firms included in the index are selected by S&P to ensure that all the constituents are liquid and financially viable. The index is based on the total float-adjusted market capitalization, and calculated in the same way as the S&P 500, meaning the index-calculating formula includes a divisor with the previously mentioned properties. (The McGraw-Hill Companies, 2012).

3.4. Analysis of the small firm effect

In this section, the data material will be analyzed and investigated for a small-firm effect, i.e. if the small capitalization firms give excess returns compared to the big capitalization firms. The dataset contains the market capitalization movements from January 1st, 2000 to November 22nd, 2016, which will be the timeframe for the analysis.

Firstly, the respective indices are graphically displayed to show the movements of S&P 500's large capitalization firms and S&P 600's small capitalization firms.

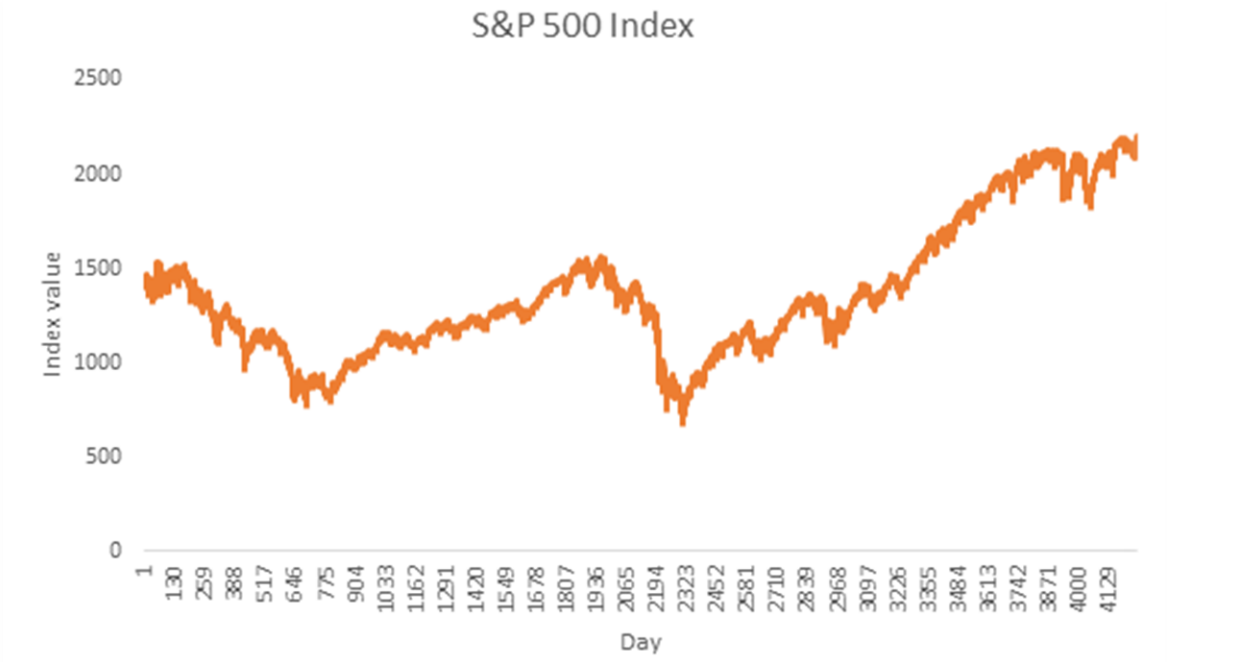


Figure 1: S&P 500 Index' movement from 2000 until 11/22/2016



Figure 2: S&P 600 Index' movement from 2000 until 11/22/2016

The S&P 500 index opening value is 1469,25 January 1st, 2000 and its closing value November 22nd, 2016 is 2204,71. In other words, over the approximate period of 16 years and 11 months, the index rose 804.72, which is an increase of 50,06 %. In comparison, the S&P 600 index started January 1st, 2000 on 197,79 and closed November 22nd, 2016 on 816,82, which is an increase of 618,85 or 313,12 %. These relative movements are computed in figure 3. If our estimate of the S&P 500 and the S&P 600 indices as an indicator of small and great US firms is valid, small US firms give excess returns compared to greater ones. At first glance, the small firms give 263,03 % excess returns over the period of 16 years, 10 months and 22 days. However, we need to investigate if this is statistically significant or just normal variation.

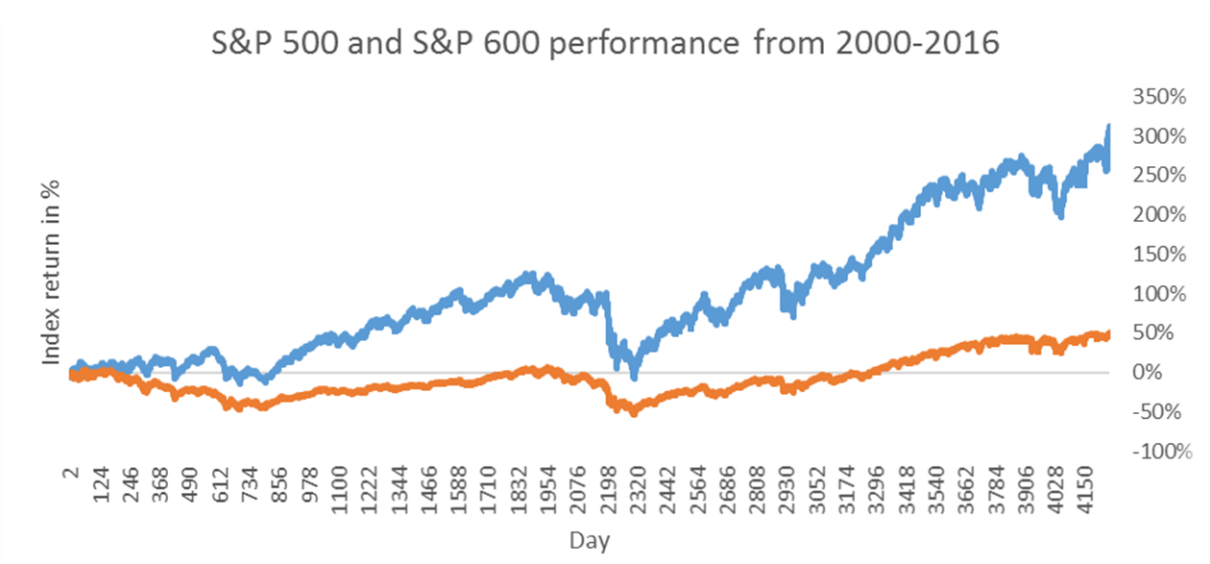


Figure 3: Comparison of the indices S&P 500 and S&P 600, measured relatively to starting point of January 1, 2000. The orange line displays S&P 500's performance, while the blue line shows the performance of S&P 600.

3.5. Formally testing the small firm effect

In this section, it is formally tested whether there is a small firm effect in the US firms in the 21st century. To do this it is investigated if the 16 year 11-odd months' return on S&P 600 (313.12 %) is significantly greater than S&P 500 index (50.06%).

Recall that each of the observations from the two sets of data can be paired according to date. Hence, to formally test the existence of the small firm effect, a matched pairs experiment is the appropriate statistical test. However, the differences between the two data variables which are being tested must be normally distributed for the matched pair experiment to be valid. The differences' distributions are pictured in Figure 4 and Figure 5 on the next page.

Both the differences in daily and monthly return between the S&P 600 and S&P 500 indices appear to be normally distributed. The monthly differences deviate more from the normal distribution than does the daily differences (most likely due to a lower number of observations), but there is a clear bell-shapes form to both. Therefore, an assumption of normal distribution applied to both differences seems valid.

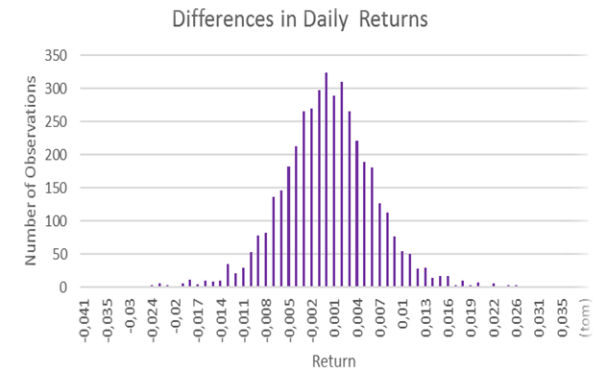


Figure 4: Distribution of the differences in daily return between the S&P 600 and S&P 500 indices

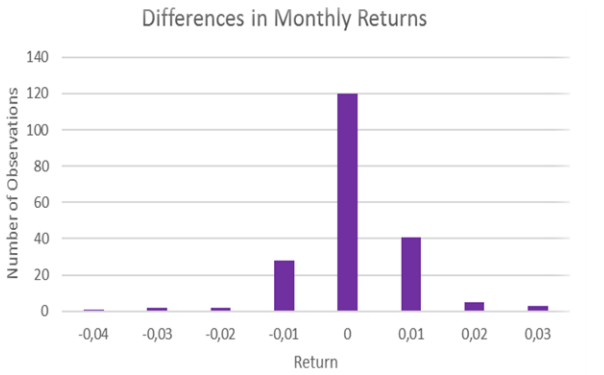


Figure 5: Distribution of the differences in monthly return between the S&P 600 and S&P 500 indices.

In all the matched pairs experiments, the null hypothesis is zero difference in expected return between the two indices; that is H_0: $\mu_D = 0$. Because the small firm effect theory argues that small cap companies provide higher returns than does big cap companies, the alternative hypothesis will be that the expected difference in returns is greater than 0, or H_A: $\mu_D > 0$. Consequently, this paper will focus on the one-tailed p-values the tests return and uses a five percent significance level, $\alpha = 0{,}05$.

Table 1: Results from matched pairs experiment on differences in daily return between S&P 600 and S&P 500.

Indexes	S&P 600	S&P 500
Average	0,000442	0,000178
Variance	0,000198	0,000145
Observations	4251	4251
P-Value (One-Tailed)	0,004611	

The matched pairs experiment on differences in daily return are shown in Table 1. There appears to be a clear difference between the two indices, where the small cap index provides more than twice the average return than does the big cap index. The one-tailed P-value indicates that this difference is well within the five percent significance level. In other words, there is no more than a 0,46 % chance of seeing the values presented in Table 1 given that there are no differences in daily return between the two indices. Therefore, the null hypothesis is discarded, and one can with overbearing statistical certainty conclude that there are differences in daily return between the S&P 600 and S&P 500 indices. It appears that the small cap index has provided a bigger daily return on average than the big cap index.

Table 2: Results from matched pairs experiment on differences in monthly return between S&P 600 and S&P 500.

Indexes	S&P 600	S&P 500
Average	0,001069	-0,000007
Variance	0,000163	0,000102
Observations	203	203
P-Value (One-Tailed)	0,030038	

This conclusion holds true when testing for differences in monthly return as well, whose test results are shown in Table 2. There appears to be an obvious difference between the average returns from the two indices, where the S&P 600 provides

bigger returns on average than does the S&P 500 index. Note that the P-value is considerably greater than when testing the daily data. This could be because the number of observed months are much lower than the number of observed days, which will increase uncertainty in any statistical test. However, the P-value indicates that there is but a 3 % chance to observe these values given a true null hypothesis, and H_0 is therefore discarded. There is sufficient statistical evidence to conclude that there are differences in expected monthly return between the two indices, and it appears to be because the small cap index has provided bigger monthly returns on average the past 16 years and eleven-odd months.

Both tests indicate that there have been differences in expected returns between S&P 600 and S&P 500 the past 16 years and 11-odd months. The S&P 600, the small cap company index, appear to provide bigger daily and monthly returns than the S&P 500, the big cap company index, on average. This implies that the small firm effect has existed so far in the 21st century.

4. Discussion of the Results

In this section, the results from the analysis will be discussed. Based on the data material, there appears to be a small firm effect, i.e. the small capitalization firms constituting the S&P 600 index gave superior returns over the 16 years and 11 months, compared to the big capitalization firms in the S&P 500 index. In the following, different explanations are discussed. The explanations were originally discussed by Norwegian Bank Investment Management in their discussion note about the small firm effect (Norwegian Bank Investment Management, 2012). This section will try to validate which sources are applicable on this particular data set.

4.1. The January effect

One of several much-debated explanations on the small firm effect is the so-called January effect (Norwegian Bank Investment Management, 2012). This phenomenon is recognised as a larger than normal increase in the stock exchange's value during the first month of the year. It is thought that investors are more willing to invest in stock in January because many of them clear their inventory at the end of the year. This is called tax-loss selling (Jones, Pearce, & Wilson, 1987). The hypothesis is that the January effect is bigger for the small cap companies than the big cap companies, and that the January effect is a considerable small firm effect source.

As discussed earlier, there is clear statistical evidence in favour of the existence of the small firm effect. It is therefore highly relevant to test whether there are differences in returns between S&P 600 and S&P 500 in January. The data can, as before, be matched in pairs according to date. Furthermore, the normality condition holds for the daily data, but cannot be made about the monthly data in January as there are very few observations (17). Consequently, the daily data will be tested using the matched pair experiment as before, while the monthly data will be analysed using the nonparametric test called Wilcoxon signed rank sum test.

Table 3 presents the results from the matched pairs experiment on daily return. Perhaps surprisingly, the return is on average negative for both indices, contradicting the existence of a January effect on stock in the US market. There appears to be a positive difference in favour of the small cap index. This difference, however, is not big enough to prompt a conclusion of a statistically significant difference in daily return between the two indices. The one-tailed P-value

Table 3: Results from matched pairs experiment on differences in daily return in January from year 2000-2016.

Average	-0,000153	-0,000510
Variance	0,000185	0,000137
Observations	344	344
P-Value (One-Tailed)	0,166963	

indicates that there is an almost 17 % chance of making a type 1 mistake by discarding the null hypothesis of equal average daily return.

Table 4: Results from matched pairs experiment on differences in monthly return in January from year 2000-2016.

Signed Rank Sum	T+/T(upper)	T-/T(lower)
Value	110	43
Critical Limit	> 112	< 41

The test results of the Wilcoxon signed rank sum test on the monthly differences in return in January is presented in Table 4. Note that the respective signed rank sums are quite far apart in value. Furthermore, the upper sum is very close to exceeding the critical limit, and the lower sum is equally close to being lower than its critical limit. This indicate that, although there is not enough statistical evidence on the five percent level to discard the null hypothesis, the chances of observing these values given a true null hypothesis are quite low. As it is, almost is never enough. It is important to stress that these test results' validity should be considered as low because of few observations.

Both test statistics argue against the hypothesis of a bigger January effect on small cap firms, as no statistical evidence of a bigger effect on small firms was found when analysing data from the past 17-odd years. The first test (Table 3) raises questions about whether the January effect has existed at all in the 21st century, as both indices had a negative average daily returns as opposed to a positive average when including all months (Table 1). Therefore, the statistically proven small firm effect must have its source from somewhere else.

4.2. Liquidity

One explanation for the small firm effect may be that there on average is less liquidity in the smaller firm trading markets. This means that there is less trading or less standing limit orders in the order books of the smaller publicly traded firms. The stocks of the greater firms in the S&P 500 index are traded more frequently, hence there are more standing limit orders and liquid markets. For instance, Apple and Facebook are big capitalization firms and these stocks are traded frequently, and therefore the stocks are more liquid. Less liquidity is a source of risk because traders with standing limit orders may not trade. The result is that there is more risk in holding and trading small firm shares, thus they should give superior returns compared to bigger firms. Hence excess returns in small cap firms may constitute an illiquidity premium. Norwegian Bank Investment Management's paper (2012) about the small firm effect before the 21st century, highlights this perspective and supports the theory that the small firm effect may be partly due to less liquidity in smaller firms leading to more risk. Their evidence is a journal from Amihud, Y. and Mendelson, H. (1986).

If smaller firms on average are less liquid than greater ones like Facebook and Apple, there should be less trading in these markets. Less liquid trading markets have greater bid-ask spreads (Harris, 2003), and greater bid-ask spreads give higher expected returns (Yakov Amihud, 1986). A reason is that traders with standing limit orders face the risk of not trading when there is lack of liquidity, and more risk should give greater return. This means execution risk that traders face may be one of the factors giving greater returns to smaller firms.

4.2.1. Measuring liquidity

One way to calculate liquidity in a stock is to measure its bid/ask spread relative to its market price (Slabinski, 2015). To analyze the liquidity in the indices their bid/ask spreads are divided by their values. The value of this quotient says something about the size of the bid/ask spread relative to its value. A high value quotient implies low market liquidity and vice versa. Averaged over 30 days from 12th November to 12th December, 2016, the bid/ask spread of the S&P 500 was 0.01 % of its index value, or 0.02 $. In comparison, the equivalent number for the S&P 600 index was 0.08 % or 0.09 $ (Vanguard, 2016). In other words, the relative bid/ask spread was eight times higher in the smaller firms, and therefore these stocks were considerably less liquid in this period from the end of November to end of December, 2016. To conclude, a reason for the small firm effect in this analysis may be liquidity differences.

However, the differences in liquidity are not necessarily big enough to justify excess returns from the smaller firms compared to the greater ones. The firms with the greatest market capitalization in the S&P 600 are worth up to 1.8 billion dollars. Despite being labeled as small cap firms, they are perhaps too big to be subject to illiquidity in the market. One can therefore question whether the liquidity differences are big enough to warrant a type of illiquidity premium. Accordingly, the significant difference in stock returns in the S&P 600 and S&P 500 indices is probably not due to liquidity differences alone.

4.2.2. Transaction costs

Furthermore, the bid-ask spread is based on different components, one of which is the transaction cost component (Harris, 2003). The transaction cost component compensates traders for the normal costs of doing business. These costs include costs of finding a buyer or a seller, which are greater when there is less liquidity in the market. Moreover, if the trader is professional, he or she will be compensated for time spent on trading and searching for traders. A higher transaction cost component for smaller firms gives greater spreads and hence returns of the stock. The fact that the S&P 600's

bid/ask spread relative to its index value is eight times higher than S&P 500's bid/ask spread, can indicate that S&P 600's transaction cost component is greater than S&P 500's. Another aspect of this is that there is less publicly available information about smaller firms than greater ones. Two extreme examples are Apple and Facebook, of which there is a significant amount of public information regarding their performance. When there are higher costs of research for stock trading, the transaction cost component should be greater, hence higher spread and returns for smaller firms than greater ones.

4.3. Volatility

Volatility is the tendency for prices to change unexpectedly. It is a statistical measure of the dispersion of returns for a given market index or security. In other words, volatility refers to the amount of risk or uncertainty about the size of the changes in a security's value. Volatility itself changes over time. Prices can sometimes be very volatile and at other times prices are very stable and hardly change at all. (Harris 2003). Low volatility means that the security's value does not fluctuate so dramatically, but changes in a stable pace over a period of time. High volatility means that the price of the security can change dramatically over a short period of time in either direction.

It is interesting to discuss the concept of volatility when investigating the small firm effect. Because there is, on average, less liquidity in the smaller firm trading markets, there is less frequent trading. Small-cap firms are also traded in lower quantities than the stocks of large-cap firms. These are factors that tend to make small-cap stocks more volatile than large-cap stocks. A purchase of 10 000 shares in a large-cap firm would probably have little effect on its price, but it could have more of an impact on a small-cap firm with similar price.

The standard when measuring volatility is to either use variance or standard deviation between returns. The more volatile the index or security is, the riskier it is. The graph in Figure 6 is added to display volatility in the S&P 600 and S&P 500 index. As the graph shows, volatility seems to be greater in the S&P 600 index, compared to S&P 500. It appears that the small-cap index fluctuates more than the large-cap index. There is more risk in holding and trading small firm shares, thus they should give relatively better returns than the larger firms.

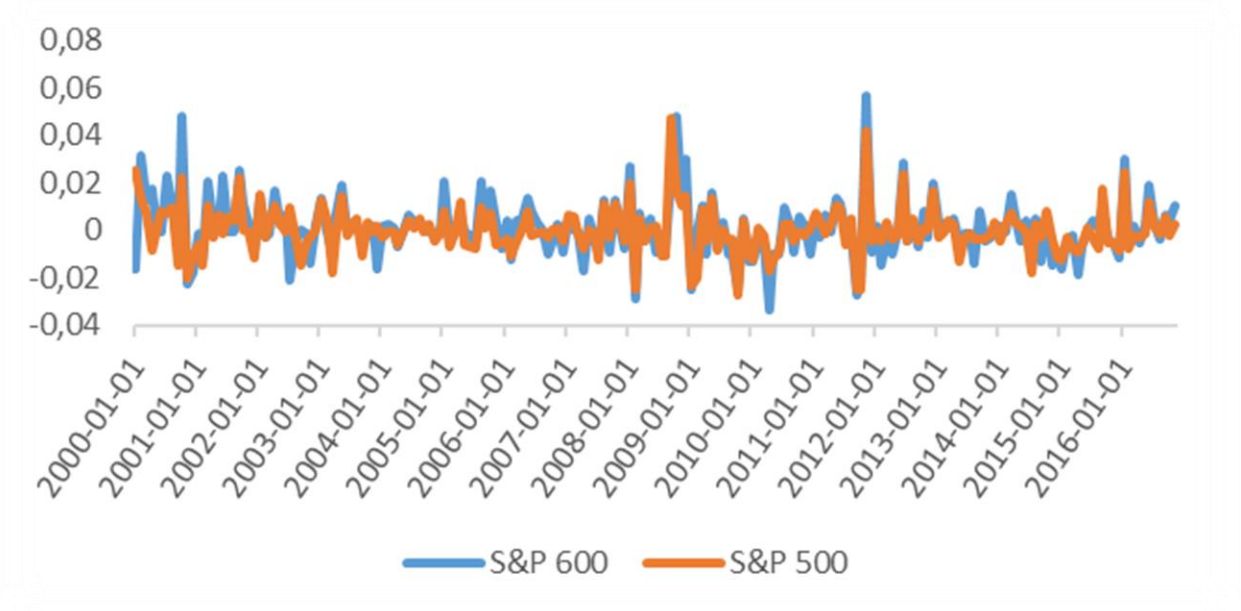


Figure 6: The volatility of the S&P 600 and S&P 500 indices.

When using standard deviation as a statistical measure of how volatile the indices are, it is important to analyze whether the S&P 600 differ significantly from S&P 500. This can be done by conducting an F-test. The criteria for this test is that the data is normally distributed, which was confirmed earlier in the paper. With a test statistic of approximately 1,6 (critical limit 1,26), the null hypothesis of zero difference in standard deviation is rejected, and it appears that the S&P 600 is significantly more risky (higher standard deviation). In other words, the small-cap index contains more risk than the large cap-index, implying that differences in volatility could be an explanation for the observed small firm effect.

Even though risk and return seem to be greater for small-cap firms, it would be interesting to see whether the small-cap index is more profitable given the index' risk. The industry standard for such calculations is the Sharpe ratio. The Sharpe ratio can be understood as a stock's excess return relative to the risk-free return, per unit of total risk (standard deviation). This paper uses an adjusted version of the Sharpe ratio by not subtracting risk-free rate from the average return. Analyzing the Sharpe ratios, it becomes clear that the S&P 600, with a Sharpe ratio of 0,083, performs better relative to the S&P 500, with ratio of -0,00067. This means that the small-cap index appears to have a higher risk-adjusted return than the large-cap index, which implies that differences in volatility cannot be the sole small firm effect source.

The negative Sharpe ratio for S&P 500 is due to a negative monthly average return for the index (Table 2). The ratios only give information about how well one index does relative to another, because it is a relative measure of return. Thus, if you isolate the ratios, it does not say a lot about performance.

4.4. Behavioral finance

NBIM's paper on the small firm effect states that several authors have rivaled Fama and French's (1993) theory that the small firm effect can be explained solely by systematic risk evaluation (Norwegian Bank Investment Management, 2012). Among other things, they present an explanation based on behavioral finance theory and studies of individual investors estimation of value and future market movement. The most prominent argument for the proponents of this line of thought is that individual investors tend to act irrationally and thus break with the efficient market hypothesis' underlying assumption of rational behavior. This irrationality then leads to the absence of an efficient market and market anomalies such as the small firm effect.

In 1985, De Bondt and Thaler presented a theory called "the overreaction effect" (De Bondt & Thaler, 1985). In short, the theory states that people tend to overreact when confronted with unexpected earning news, i.e. buy more than expected when earning news are positive, and vice versa. The effect is then reversed when news changes, and stock prices which have been artificially inflated by overreacting investors will now drop significantly and be outperformed by prior "losing" stocks. Naturally, small cap stocks tend to be prior losers more often than large cap stocks and will in turn, per the reverse overreaction effect, outperform large cap stocks. Hence, the small firm effect can be understood as a natural market correction to the market anomaly caused by the overreaction effect.

Moreover, Lemmon and Portniaguina described in 2006 a negative correlation between investors opinion and excess return from small market capitalization firms, based on a study over 29 years. The study reveals that bullish investors tend to overestimate small capitalization stocks, while bearish investors underestimate their value. (Lemmon & Portniaguina, 2006). Smaller capitalization firms usually have a larger share of individual investors than large capitalization firms, which have a disproportionately large number of institutional investors, and considering individuals tend to have more emotional impact on their decisions compared to institutions, smaller cap firms experience a relatively bigger effect from investors sentiment. This train of thought combined with the fact that in general there is a notion that markets, in long term, will grow, leads to a relatively bigger overvaluation of small cap firms compared to large cap firms. In other words, the overestimation outweighs the underestimation, favoring smaller cap firms due to investor composition and general investor

sentiment. The result of Lemmon and Portnigauinas (2006) research aligns with the one described by De Bondt and Thaler (1985), revealing possible explanations for the small firm effect anchored in behavioral finance.

4.5. News

There is a substantial difference in news coverage between the biggest and the smallest market cap firms. A quick google-search reveals that there are several dozen news articles commenting on Apples growth, stock or sales performance in just the last few days (Google News, 2016). Apple is a large cap firm and the news coverage reflects the amount of updated information available to potential investors. A company on the other side of the spectrum is Alliance One International, a firm with a market cap of $133 million, which is covered less frequently in the news (Google News, 2016). Access to information for laypeople or individual investors can mean a lot for the trading price of a share, especially regarding the market price' reflection of the fundamental value. Institutional investors have in general better access to thorough analyses and updated news about markets and companies, and are therefore better suited to trade efficiently and move the market so that the market price reflects the fundamental value. Individual investors on the other hand are more reliant on popular news to get an idea about the true fundamental value of a company. This difference can in turn cause the two types of investors to consistently act differently, thereupon creating a small firm effect.

According to Harris (2003) efficient markets produce prices that are very informative. Informative in this manner means in which degree prices equal fundamental value. Informed traders are incentivized to trade until the price is equal to the fundamental value of the stock. Uninformed traders, on the other hand, trade exclusively on their beliefs about the future movement of the stock, thus opening for the possibility of increasing/decreasing market price regardless of fundamental value. Ergo, the market mechanism causing market price to reflect the fundamental value does not occur when most of the traders of a stock are uninformed.

Smaller firms are inclined to be relatively more traded by individual investors compared to large cap firms, and consequently, to a greater degree, suffer from uninformed traders moving the prices irrationally. As relatively more institutional investors, with great access to updated news, trade larger cap firms, the market price of large cap firms' shares usually reflect the fundamental value of the firm to a greater degree than for small cap firms. This leads to small cap firms' market price being artificially driven up in line with uninformed individuals optimistic view on future growth, more so than for the large cap firms' market price. If the condition holds true, that is that more people are optimistic rather

than pessimistic about the future, the result of the previous line of thought is that small cap firms on average will experience a higher growth than large cap firms, i.e. a small firm effect.

4.6. Long-short strategy

Isolating the small firm effect with a long-short strategy gives an indicator on how lucrative it could be to exploit the small firm effect. The long-short strategy is based on the theory of hedging against risk by going long in the better performing stock, in our case the S&P 600 Index, while also short selling another stock, the S&P 500 Index. By having both a long and short position in the market, it is possible to make money on a variety of market movements between the two stocks. Different alterations to the market position can be made to ensure an optimal exposure to expected movements and risk, such as higher or lower long/short ratio or picking stocks which are close to completely negatively correlated. To investigate and highlight the small firm effect, the returns from a 50/50 exposure in long/short between the two positively correlated indices over the relevant time period will be further examined.

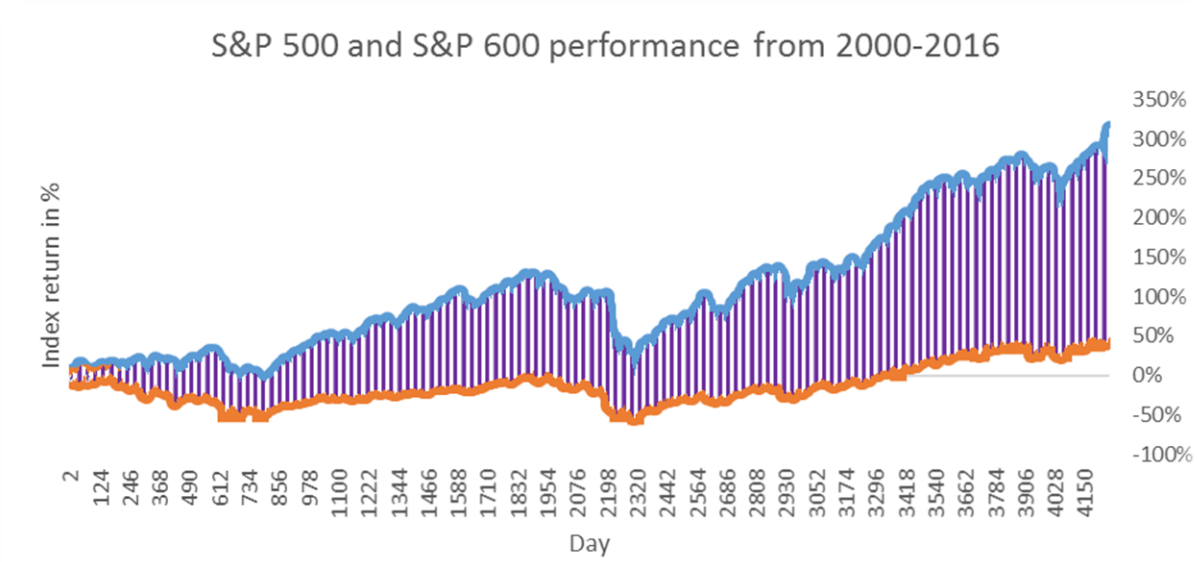


Figure 7: Comparison of the returns from S&P 500 and S&P 600.

The graph (Figure 7) displays the returns for the two indices and the purple area highlights the difference in returns. The money-making scheme behind the long-short strategy is based around this difference, as a correct applied strategy on two perfect negatively correlated stocks will yield returns twice the difference-area. S&P 500 and S&P 600 are not negatively correlated at all, conversely, the graphs prove to be correlated. The correlation reduces the effect of the strategy to some extent, but does not remove all benefits from hedging from risk. (Thaler, 1987).

A 50/50 long-short strategy applied respectively on the S&P 600 and S&P 500 indices would mean that the long position in S&P 600 would yield a return of 50 % of the 16-year growth of 313,12 %, while the short position in S&P 500 would return a loss represented by the increase of 50,06 %. Hence, the total return would be the difference between the relative returns,

$$Total\ Return = \frac{long\ position}{long+short} \times return\ of\ S\&P\ 600 - \frac{short\ position}{long+short} \times \text{return of S\&P 500}$$

$$Total\ Return = 0{,}5 \times 313{,}12\ \% - 0{,}5 \times 50{,}06\ \% = 131{,}53\ \%$$

The 50/50 long-short strategy applied on the S&P 600 and S&P 500 would yield a return of 131, 53 %. This is drastically lower than what a pure long position in S&P 600 would yield, yet more than twice as much as what a long position in S&P 500 would yield, while also hedging against risk. Given that the difference between S&P 600 and S&P 500 could be attributed to the small firm effect, the presented long-short strategy exemplifies how a trading strategy could be applied to benefit from the effect.

5. Conclusions

The statistical analysis has revealed that size does indeed matter. Small cap firms have outperformed large cap firms so far in the 21st century. The difference in returns between the two researched indices are substantial and proven to be statistically significant. It appears that the S&P 600 has provided bigger daily and monthly returns than the S&P 500 on average. This implies that the small firm effect has existed so far.

One of several explanations for the small firm effect that this paper has discussed is the so-called January effect. Both test statistics in our paper argue against the theory of bigger January effect on small cap firms. Therefore, the small firm effect must have its source from somewhere else. One of the sources could be that there on average is less liquidity in the smaller firm trading markets. Less liquidity indicates greater risk, and should thus yield superior returns compared to the larger firms. The same reasoning applies when it comes to volatility. It appears that the S&P 600 fluctuate more compared to the S&P 500. The test statistics for volatility conclude that the S&P 600 is significantly riskier. In other words, there is more risk holding and trading small firm shares. By looking at the Sharpe ratio for the two indices, it seems that the S&P 600 performs better relative to the S&P 500 with a higher risk-adjusted return.

The small firm effect could also be explained based on behavioral finance and studies of individual investors' estimation of value and future market movement. Individual investors tend to act irrationally and thus break with the efficient market hypothesis' underlying assumption of rational behavior. This irrationality then leads to inefficient markets and market anomalies such as the small firm effect.

To summarize, there is evidence for a small firm effect in the 21st century. The small cap index provided bigger daily and monthly returns compared to the large cap index on average. The differences in both volatility and liquidity and the rational flaws all investors are subject to could contribute to creating a small firm effect. Finally, by utilizing a long-short strategy to isolate the small firm effect, one could obtain substantial profit and at the same time reduce risk through hedging.

6. Weaknesses of the analysis

The excess returns on the small cap stocks relative to the big cap stocks, does not necessarily mean that there in fact exists a small firm effect. There are issues or weaknesses surrounding external and internal validity.

6.1. Internal validity

The small firm effect is characterized as a long-term phenomenon of smaller firms outperforming greater ones (Norwegian Bank Investment Management, 2012). The analysis of this paper is conducted on a period of approximately 16 years and 11 months. Norwegian Bank's paper presents the phenomenon from 1927 to 2011, which questions if the significant excessive returns of the smaller firms in this paper in fact is a small firm effect or a just a temporary phenomenon. It is quite possible that the observed trend could be reversed or disappear in the following decades, as it did over a period of 20 years after it was documented in 1981 (Norwegian Bank Investment Management, 2012). The small firm effect has historically been sensitive to the time frame considered.

Furthermore, the analysis is based on firms in the US stock market. It is unknown whether a small firm effect exists globally in the 21st century, albeit its previously global existence. One could hardly draw inferences and conclude that there is a global effect on the basis of the American market. Norwegian Bank's paper supports this, highlighting that the effect existed in some countries, while it was reversed with big cap firms outperforming small cap firms in other countries, e.g. Norway. In addition, the S&P 500 and the S&P 600 make up only a sample of the total number of American firms, indeed they make up even less of all small cap and big cap firms in the world. Therefore, this paper's analysis is limited to the scope of the two American indices and is thus not evidence for a universal small firm effect.

6.2. External validity

It is uncertain whether the time period considered in this paper is representative, i.e. if a small firm effect is generalizable and will exist over a longer period and in the future. There is statistical evidence to discard the null hypothesis of no small firm effect. Nevertheless, it remains to see if this effect will persist, for instance over the next 50 years. Given the fact that the small firm effect vanished for two decades after 1981, the effect in this paper does not mean that the small firm effect can be considered a financial law in the 21st century.

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