CAN ONE OUTPERFORM THE MARKET BY INVESTING IN SMALL AND MID CAPS?

An investigation of the size effect in the context of a passive strategy

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ABSTRACT

This study deals with one of the efficient market hypothesis’ anomaly. The research aims at proving the existence of a size anomaly by answering the question: can you outperform the market by investing in small and mid caps? It is in fact a questioning of the well-know efficient market hypothesis (EMH). We investigate the size effect in the situation of a passive strategy with different indices (Russell Indices and S&P Indices) from 1995 to 2005.

The introduction gives to the reader the background he needs to understand the methodology and the approach of the issue by the authors. Key concepts are defined such as EMH, passive strategy.

The second part exposes the methodology the authors choose and the methodology of exploited indices. The research consist on measuring the risk adjusting excess returns by comparing the market index return (S&P 500 or Russell 3000) and the Small and Mid Caps indices (S&P Small Cap 600, S&P Mid Cap 400, Russell Mid Cap and Russell 2000) over the period. Indeed the methodology of indices is exposing in details to understand in which extent the study can be influence by the construction of indices.

Then in part 3 the authors describe theories that are possible explanations for the size effect. Then it is understandable that the size anomaly is the result of a set of factors that generate abnormal returns. These theories help the authors to come up with a model that gives an overview of the research.

After having explained their research method and reveal their empirical findings. The authors demonstrate that excess returns can be earned by investing in small and mid caps indices even after controlling for risk. The risk adjusting excess returns their findings can potentially be explained by the other factors depicted in the theoretical part. E/P ratios, Trading Costs, January effect, Overreaction are possible reasons to explain the size anomaly. They also find an instability and/or reversal of the size effect consistent with one of the theories. However the authors find data with non statistic significance, so I accept the null hypothesis that the excess returns of small and mid caps indices are equal to zero.

The paper ends with a discussion about the limitations of the study and possible further researches. The authors conclude that even if the existence of a size effect is obvious for some years and horizons of investment, the passive strategy appears to be an unsuited method to take advantage of the small effect since the results reject the null hypothesis. The authors clarify the fact that before investing in small and mid caps, one has to be aware of all the factors that can influence his investment (beside risk) because the size effect is a set of factors.

Key words: Efficient Market Hypothesis, Abnormal returns, Size effect (anomaly), Passive strategy, Market Index, S&P indices, Russell indices
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1. INTRODUCTION

In the first chapter the reader is given an introduction of the topic this research is dealing with, also some background information in order to be familiarized with the subject in discussion. Furthermore the problem statement, research question and objectives, study limitations and demarcations and the thesis disposition are presented.

1.1 Problem Background

Investing in stock markets has become very popular among common individuals during the last decades. This trend associated with the development of several technologies and devices originated a new situation in which became common for people to invest in any stock market around the world.

Nevertheless one that plans to invest in these markets should be aware of one of the most important rules in financial markets: the risk and return relationship. This concept states that the higher return an investor intends to achieve, more risk he/she has to bear. But besides obtaining financial returns by bearing the risk related to an investment, investors seek a further objective: outperform the market.

However one of the most common theories within finance literature is related to the market efficiency. Regarding this topic, the most known is the Efficient Market Hypothesis, in which Eugene Fama states that prices fully reflect all available information on a market, so nobody is enabled to foretell returns originated by a stock as information related to it is not available in the market.¹

This is a very controversial theory because it has been proved that the financial markets experience anomalies such as size effects, small firms seem to offer higher stock returns than large ones; and calendar effects, like the 'January effect’ which states that higher returns can be earned in the first month compared to the others. Also the ‘weekend effect’ or ‘blue Monday on Wall Street’ - which suggests that you should not buy stocks on Friday afternoon or Monday morning since they tend to be selling at slightly higher prices. Not to mention the supposed indicators of undervalued stocks used by value investors, such as low price-to-earnings ratios and high dividend yields.²

1.2 Background Information

1.2.1 Versions of the Efficient Market Hypothesis

For our study we have to distinguish the three versions of the EMH³: the weak-form where the stock prices have already absorbed all information regarding market trading data (i.e. past prices), the semi strong-form states that all the public information related to prospects of a company are reflected at its stock price (i.e. earnings forecasts) and the strong-form implies that all information including the data available to company insiders are included at the stock price.

² LeBaron, The Ultimate Investor, 1999
³ Bodie Z., Kane A. & Marcus A. J., Investments, 2005
1.2.3 Stock Size Definitions

For the best comprehension of our research we have to come up with definitions of stock size. These definitions and agreed limits of capitalization has changed over the time, for instance during the 1980’s so-called big cap would be a small one nowadays. The current approximate definitions are as follows:

<table>
<thead>
<tr>
<th>Stock Size</th>
<th>Company’s capitalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big Cap</td>
<td>of $10 billion and greater</td>
</tr>
<tr>
<td>Mid Cap</td>
<td>from $2 billion to $10 billion</td>
</tr>
<tr>
<td>Small Cap</td>
<td>from $300 million to $2 billion</td>
</tr>
<tr>
<td>Micro Cap</td>
<td>from $50 million to $300 million</td>
</tr>
<tr>
<td>Nano Cap</td>
<td>Under $50 million</td>
</tr>
</tbody>
</table>

Table 1: Definition of stock size through market capitalization

Small and Medium caps are known as being good investments due to their low valuations and potential to grow into big-cap stocks. In several stock exchanges they are listed in special compartments and indexes, for example in United States the Nasdaq 100 or in France the CAC Mid & Small 190 are well-known Small & Medium caps indexes. To summarize we can say the definition is quite subjective, relative and change over time.4

1.2.4 U.S. Stock Market

Besides the stock size definitions described in the previous section, another important feature for the reader to be aware is where a company can issue its stocks in the U.S. market. This market is mainly composed by three actors which are briefly described next:

- **American Stock Exchange (AMEX)** - third-largest stock exchange by trading volume in the United States (comprises about 10% of all securities traded). In 1998, AMEX merged with Nasdaq. Currently, almost all trading on the AMEX consists in small-cap stocks, exchange-traded funds and derivatives. It was known as the "curb exchange" until 1921.5 Curb exchange (trading) occurs outside of general market regulations by using computers or telephones after the official exchanges have closed. In the past, stocks considered unfit to be traded on the NYSE were negotiated on the street curb. This led to the creation American Stock Exchange.6

- **NASDAQ** - the term “Nasdaq” was used to be acronym of National Association of Securities Dealers Automated Quotation (nowadays Nasdaq is used as a proper noun). Created in 1971, NASDAQ is the world's first electronic stock market. Nasdaq is recognized by being home to many high-tech stocks.7

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4 Wayman R., *What is a small cap?,* 2002 ([www.investopedia.com](http://www.investopedia.com))
New York Stock Exchange (NYSE) - the largest equities marketplace in the world and is home to 3,025 companies worth more than $16 trillion in global market capitalization.\(^8\) NYSE uses floor traders to make the transactions while Nasdaq and many other exchanges are computer driven.\(^9\)

However AMEX and NASDAQ merged they operate as separate markets under the management of The Nasdaq-Amex Market Group, a newly-created subsidiary of NASD (National Association of Security Dealers).

### 1.2.5 Indices History

This section provides a brief historical review of the indices used in this study for the readers being able to situate in which historical context we are performing this research.

**Standard & Poor’s Indices\(^{10}\)**

- 1923 - Standard Statistics Company developed its first stock market indicators which covered 233 companies based in the United States
- 1926 - Standard Statistics Company created the U.S.-focused 90 Stock Composite Price Index
- 1941 - Standard Statistics and Poor’s Publishing merged to form Standard & Poor’s.
- 1941 - 233 Composite increased to 416 companies
- 1957 - 416 Composite became the 500 Composite Stock Price Index. This new index is linked to the 90 Stock Composite Price Index. The original 233 and 90 stock indices evolved into the modern S&P 500
- 1991 - Creation of S&P MidCap 400
- 1994 - Creation of S&P SmallCap 600

**1.2.5.1 Russell’s Indices\(^{11}\)**

- 1984 - Creation of Russell 2000
- 1993 - Multi-factor style indices are launched by Russell Company
- 1999 – First Exchange Traded Fund (ETF) based on Russell Index is introduced
- 2003: Multi factor banded style methodology becomes global industry standard
- 2005: Russell Micro Cap index is created

### 1.3 Problem Statement

From the anomalies described at the section 1.1 our research focus on testing EMH regarding small and medium caps. Through the results we intend to analyze the performance of these kinds of stocks by comparing with the market index and therefore see if whether or not a passive strategy is relevant to take advantage of the size anomaly.

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8. [http://securities.stanford.edu/sites.html](http://securities.stanford.edu/sites.html)
11. [http://www.russell.com/indexes/about/index_leadership.asp](http://www.russell.com/indexes/about/index_leadership.asp)
1.4 Research Question

The proposed study objectives to answer the question: *In which extent is it possible to beat the market indexes by investing in small and medium stocks?*

1.5 Research Objectives

Our objectives are to first conduct an empirical research to see if the small and medium caps really outperform market indexes on different time horizons. Through the results obtained from this study we intend to see the relevancy of these kinds of stocks just considering the size effect, regardless economic sectors and other possible variants.

1.6 Study Limitations and Demarcations

It is imperative to restrict and define the limitations of our study to follow the same path throughout the thesis. So we have to specify the markets we want to analyze and the period of time we are considering. There are hundreds of stocks so it would be almost impossible to compare the returns of each small and mid caps to the market index that is why our study will focus on small and mid caps indices as a relevant benchmark.

We will narrow our study to United States financial markets more specifically to U.S financial market indexes. The United States financial markets are among the biggest ones in the world and can be consider as very representative. We select two key indices that serve as market indices (S&P 500 and Russell 3000) and several indices that represent the small and mid caps (S&P Small Cap 600, S&P Mid Cap 400, Russell 2000 and Russell Midcap).

Concerning the studying period we divide our analysis in different periods of time. We believe we cannot study just one horizon of investment and that we have to take into account different strategies. Furthermore we have natural limitations due to the fact that some indexes we use have been recently created, so the historical data have limited horizon.

The data series is divided in four different periods:

- *Very short term:* 1-year investment
- *Short term:* 2-year investment
- *Middle term:* 5-year investment
- *Long term:* 10-year investment

In this way it was possible to differentiate several patterns of the indices and analyze the differences between them. Investments up to 10-years were not studied as some of the indices have been created in 1995 so it was not possible to obtain the data necessary to do analysis beyond their creation date.

Also, it is important to emphasize that his study intended just to compare the behavior of small and medium stocks indices with their respective market proxy. We did not take into consideration external facts such as the U.S. economic indicators that might influenced the indices in the period under analysis.
Trying to explain the impact of these indicators in the indices would demand a deep study of the U.S. economy behavior that is not feasible due to the time constraint to do this research.

Regarding the theories, as there are several literatures about investment strategy and behavioral finance from which we had to select the most relevant ones that guided to analyze and explain our research. We pick up theories that help the reader to understand the main concepts of our study.

1.7 Thesis Disposition

1. Introduction: We introduce the reader to the study, explain the research question. We also define some key concepts. The chapter aims at raising interest about the size anomaly.

2. Methodology: In this part we give the reader an insight of our methodology. We describe our approach of the subject by giving information about our scientific approach, view of knowledge. We also explain our choice of subject, indices and theories.

3. Indices Methodology: In this chapter we provide an explanation of the main procedures of the construction of indices regarding the methodology and other important features of those indices.

4. Theories: In this chapter, the key theories that are directly related to our study are exposed in details. The reader is invited to look at Figure 1 which summarize the theories and draw a model for our study.

5. Data Analysis: This part is showing with several tables our results. First raw returns are presented, then cumulated volatility and finally adjusted returns. After analyzing these results, we try to connect them with the different theories seen in Chapter 4.

6. Conclusion: This chapter summarizes the analysis and discussions of our study. We give an answer to our research question and come up with different suggestions for further researches. We also measure the contribution of our thesis.

7. Credibility criteria: The aim of this part is to conduct a discussion concerning the credibility of the research under main features as reliability, validity and replication.
2. METHODOLOGY

In this part we explain our choice of subject, market and indices. We also present our view of knowledge and how it may affect our study. The scientific approach of our research is also discussed in this chapter.

2.1 Choice of Subject

Our subject deals with financial markets and investment decisions. Such a subject attracts us because we both are interested in financial markets and investment strategy discussions. Actually the module “Investments” has been our preferred during the masters program. Moreover this module emphasised the fact that investment is always a matter of trade off between risk and return. One topic got our attention, that later became our topic for this thesis: the link between passive strategy (this strategy does not require any direct or indirect stock analysis \(^\text{12}\) and is based on the performance replication of an index with a portfolio of securities) and of investing in a market index portfolio and small and mid capitalizations concerning the risk-return relation mentioned previously.

Furthermore small and mid caps issues have not been deeply approached during the lectures, so we wanted to know more about that type of securities, about their characteristics. In fact they are not very famous for financial market actors especially for individual investors, so through our study we objective to enhance our knowledge and describe their behaviour at the U.S. market as this is one of the most important in the financial world.

Finally, both of us intend to be familiarized with financial markets as, in the near future; we intend to work at them. So we naturally come up with a topic related to them.

2.2 Choice of Market and Indices

Our study focuses on the United States Stock Market in general, regardless where companies that compose the used indices issue their stocks (either AMEX, NASDAQ or NYSE). There are several reasons for that choice. First, United States are among the biggest stock markets in terms of transactions volume. It is very representative at the financial world. Secondly there is a large panel of different indices available which perfectly fit with the purpose of our study. In fact, there is a wide range of indices which are built on special criteria and which follow a strict methodology. Furthermore it would be too complicated to take into account other stock exchanges like London or Paris, due to the time constraint to conduct our study. Consequently, we have to narrow our study to the most relevant market and its indices we consider them to be.

Our financial data providers for this study are Standard and Poor’s and Russell. The first is known as being source of credit ratings, indices, investment research, risk evaluation and data \(^\text{13}\). The second is


\(^\text{13}\) [http://www2.standardandpoors.com/portal/site/sp/en/us/page.topic/aboutsp_overview/4,1,1,0,0,0,0,0,0,0,0,0,0.html](http://www2.standardandpoors.com/portal/site/sp/en/us/page.topic/aboutsp_overview/4,1,1,0,0,0,0,0,0,0,0,0,0.html)
also acknowledged by being a financial services provider\textsuperscript{14}, including some of the indices used in our research.

Concerning the choice of indices, firstly a market proxy is needed which has to supply us with an overall view of stock market of United States in order to be compared with the small and mid caps indices. Instead of one we chose two market proxies: S&P500 and Russell. This choice provided us a wider analysis than using only one market proxy as these two indices have different ranges considering the number of constituent companies.

The S&P 500 and Russell 3000 were chosen because they use, mainly, market capitalization\textsuperscript{15} to select the companies that will be part of this index and by the fact that both are value weighted (each company has its representation at the indices equivalent to theirs at the U.S. economy). Yet these indices utilize different features to classify the companies concerning their market values as will be explained in Chapter 3.

To make our research feasible we selected the small and medium stocks indices from the same providers of S&P500 and Russell 3000. We utilized S&P SmallCap 600 and S&P MidCap 400 to be compared with the first and Russell 2000 and Russell Mid Cap to establish a comparison with the second. By doing this we analyze indices that utilize the same methodology thus did not require adjustments to be compared, fact that is explicated in Chapter 3.

- **Indices definitions**

The indices capitalizations are as follows:

- **S&P 500**
  
  Index which represents the 500 most capitalized companies in the U.S. stock market according to their industry classification.

- **S&P Mid Cap 400**
  
  Denotes mid-sized companies with market capitalization from US$ 1 billion to US$ 4.5 billion (represents over 7% of the U.S. equities market)\textsuperscript{16}

- **S&P Small Cap 600**
  
  Illustrates small-sized companies with market capitalization from US$ 300 million to US$ 1.5 billion for the S&P SmallCap 600 (covers 3%-4% of the U.S. equities market)\textsuperscript{17}

- **Russell 3000**
  
  Analyzes the performance of the 3000 largest U.S. companies considering their total market capitalization (represents approximately 98% of the investable U.S. equity market)\textsuperscript{18}

\textsuperscript{14} http://www.russell.com/ww/about_russell/default.asp
\textsuperscript{15} Market capitalization is the number of shares outstanding by a company times the current price of this share
\textsuperscript{16} http://www2.standardandpoors.com/portal/site/sp/en/us/page.topic/indices_400/2,3,2,2,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0.html
\textsuperscript{17} http://www2.standardandpoors.com/portal/site/sp/en/us/page.topic/indices_600/2,3,2,2,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0.html
\textsuperscript{18} http://www.russell.com/indexes/default.asp
Russell 2000

Performance of the 2000 smallest companies in Russell 3000 is analyzed through this index (represents approximately 8% of the total market capitalization of Russell 3000).

Russell Mid Cap Index

Assess the performance of the 800 smallest companies in Russell 1000 (represents approximately 26% of the total market capitalization of Russell 1000).

By reading the descriptions above one can notice that the S&P Mid Cap 400 and S&P Small Cap 600 have a common range in both (from US$ 1 billion to US$ 1.5 billion). It can be explained by the classification that Standard and Poor uses to rank the companies, the Global Industry Classification Standard (GICS) as is explained in detailed in Chapter 3.

2.3 View of Knowledge

To conduct our study we need to clarify our knowledge in order to foresee how they can influence us during the writing of the thesis. The authors both have a background specialized in Business and Economics and more specifically in Finance.

Mathieu has a Master in Business Administration obtained in the Business School of Burgundy in France. Gustavo has not finish his Graduation studies, but he has attended to several Finance courses during his studies at Economics, Business Administration and Accounting Faculty in São Paulo, Brazil. Both have followed the same classes in the Master’s Program of Accounting and Finance, but the last module. In fact Mathieu took the module “Analysis of Financial Data” and Gustavo the module “Methodology and Research”.

Concerning the professional background of the authors, Mathieu have done an internship for one year in an investment bank in Paris, he was a middle/back office agent in the securities lending service. Gustavo has done an internship during one year as well, but in retail bank in São Paulo dealing with quality of services provided to its customers.

We have accumulated a lot of knowledge in the field of Finance during our education which helped us to understand the concepts we met through this research. Our familiarity with the topic was quiet low, we had dealt with the size effect superficially during the module “Investments” and at the beginning of our research we did not have a solid understanding about this issue.

Finally none of us have had a personal experience in investing in small and mid caps so that we did not have preconceptions about the performance and behaviour of such stocks.

We believe our level of objectivity is high and we will not be influenced by our knowledge, we rather think that our education will help us to better understand the concepts and issues we will have to deal with. This topic can be approached in a realistic way by looking at the past data of the chosen indexes.

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20 Russell 1000 measures the performance of the 1000 largest companies of Russell 3000
and link them we theories, our education background and general pre-understanding will not bias the results of our study.

2.4 Scientific Approach

Regarding the research approach, this thesis is based on deductive methods as the EMH provided us a hypothesis to be tested through the analyses of return volatility of small and medium caps compared to market indices.

These analyses will be made by comparing S&P 400 mid cap and S&P 600 small cap separately to S&P500 and by comparing Russell mid cap and Russell small cap to Russell 3000 also individually. According Bryman and Bell’s process of deduction\textsuperscript{22}, with these findings we will be able to confirm or reject the hypothesis we raised previously and review the theory we initially used to build this study.

Concerning the epistemology our thesis will have positivism orientation as our study will try to explain one the EMH anomalies (our hypothesis) as described in prior and some secondary theories will be used to justify our results.

About quantitative methods since we will establish a measure to analyze the possibility to outperform the market index by using the stocks mentioned previously. By establishing this measure our theoretical framework is supported by a comparative design which “embodies the logic of comparison in that it implies that we can understand social phenomena better when they are compared in relation to two or more meaningfully contrasting cases or situations” \textsuperscript{23}. In other words, two market indices will be used (S&P500 and Russell 3000) to be compared to their respective small and medium cap indices in order to see if they have different behavior patterns than the firsts.

Regarding ontological orientation our research will use the objectivism as a basis. Using past events our research is supported on a definitive reality that is not possible to do constant revision considering the time period under analysis. Obviously other studies can be done using the same period but with different analysis approach or considering other factors not studied at this thesis.

2.5 Choice of Theories

2.5.1 Sources

The researchers have to carefully select their theories. They have to be of course linked to the topic, relevant and accepted among the scientific world.

Many authors have dealt with the size effect; it let us with a huge choice of different studies and theories. The size effect anomaly has been studied for many years. Nevertheless we have not find articles or theories that analyse the size effect through a passive or indexes strategy. That is why we have to pick up the most appropriate theories and studies that will help in accomplish our research. Our research subject has specific characteristics. Thus the theories we use must match these characteristics and be close to the purpose of the study.

\begin{footnote}
22 Bryman, A. & Bell, E., Business research methods, 2003, p.11
23 Ibid, p.56
\end{footnote}
2.5.1.1 Choice of main sources

There are a massive panel of financial publications and books that are available. Most of our articles come from two different journals. “The Journal of Financial Economics” and “The Journal of Financial Markets”. They are two well known publications that deal with financial issues, who provide case studies and articles. Many researchers have published their studies on those journals, providing tools and means to illustrate or challenge accepted theories. The scientific articles provided us relevant materials for our study as they are related to our subject and written by authors acknowledged in the financial academic field. These theories have been chosen because they give us realistic explanations and interpretations of our results.

2.5.1.2 Choice of secondary sources

In order to define the basic concepts we use the manual of the “Investments” module and websites providing information about general finance concepts as Investopedia24 being the main one.

Regarding the data collection, the main tool was the companies’ websites (www.standardandpoors.com and www.russell.com) in order to collect information about their indices methodology, whereas for the data analysis our providers were the Russell’s website and Yahoo Finance25.

2.5.2 Theories

We have to recall that our objectives are to prove if you can outperform the market by investing in small and mid caps in the context of a passive strategy. So our theories should help us supporting and explaining our results. We found several studies focusing on the size effect and trying to explain its causes. That is why we organize our theories according to which factors they link the size effect with.

* Risk omitted

Marc R. Reinganum26 is in paper proves that the CAPM is mispecified for small stocks because he finds a large and persistent size effect that leads to abnormal returns. According to this author the CAPM is an inadequate model to predict returns for portfolios based on firm E/P ratio or size because the model forget to take into account some risks. Even after taking risk into account the author still finds abnormal returns that the CAPM is not able to catch. Rolf W. Banz also proves that “common stock of small firms had on average higher risk adjusted returns than the common stock of large firms.”27

* Earnings’ yield and market value

Marc R. Reinganum is his paper discover a E/P effect, meaning that high E/P firms earns risk adjusted abnormal returns compare to low E/P firms then he investigates the relationship between E/P effect and value effect (size effect) and then finds that the low market value firms tend to be classified in the group of firms with the high E/P ratios, then he concludes that E/P anomaly and value anomaly proxy for the

24 http://www.investopedia.com/
25 http://finance.yahoo.com/
same set of factors, he shows that the value effect subsumes the E/P effect. Basu\(^28\) is in paper comes up with the same conclusions that Reinganum., he demonstrates that high E/P firms seem to have earned on average higher risk adjusted returns than the common stock of low E/P firms and that small stocks of NYSE have earned higher returns than large stocks of the NYSE. Then he establishes that the strength of the E/P effect seems to vary inversely with the firm size. But he concludes that both variables are proxies for other factors that can explain the misspecification of the expected returns model.

- **Liquidity, Infrequent Trading and trading costs**

Several authors argue that the size effect may be due to infrequent trading that leads to a liquidity premium itself due to higher trading costs.

Vinay T. Datar, Narayan Y. Naik, Robert Radcliffe\(^29\) prove in their study that liquidity plays a significant role in explaining the stock returns. They find that stock returns are strongly negatively related to their respective illiquidity level. This effect remains even after controlling for size, but they fund a negative and statistically significant relationship between liquidity and size. Elroy Dimson\(^30\) confirms that trading infrequency biases beta estimates and predicts a downward bias for infrequently traded shares. Hans R. Stoll and Robert E. Whaley\(^31\) find that after adjustment for transaction costs and risk small firms earn lower returns than large stocks if bought and held for two months or less. However Paul Schultz\(^32\) conducts another study that leads to different results, in fact by using another sample if finds that the small firm effect still exists. But he points out that the size effect cannot be explained totally by the transactions costs.

- **The size effect, the return seasonality, and overreaction**

Donal B. KEIM\(^33\) is his research demonstrates that 50% of the yearly abnormal returns for small firms are due to the January effect. So it appears that the size effect can be divided into two factors: the January effect and a risk factor. The January effect seems to have several origins like tax loss selling and financial and informational events. Navin Chopra, Josef Lakonishok and Jay R\(^34\) show that overreaction effect is much stronger among small firms and then argue that there is an economically-significant effect above and beyond any size effect.

- **Relativity of the size effect**

Philip Brown, Allan W. Kleidon, Terry A. March\(^35\) agree on the fact that there is an evidence for a “size effect” but they suggest in their research that this effect is unstable through time. According to them

\(^{30}\) Dimson E., *Risk Measurement when shares are subject to infrequent trading*, Journal of Financial Economics, 1979, pages 197-226
\(^{34}\) Chopra N., Lakonishok J. and Jay R, *Do stocks overreact?*, Journal of financial economics, 1991
different methodologies can lead to different conclusions about the size effects. This theory helps us to relativize the theories of other authors.

2.6 Criticism of Sources

2.6.1 Literature

The authors have to be aware that their sources may have some negative points which can decrease the quality of the study and bias the results in some extent. We are going to expose the drawbacks of our sources in terms of theories, figures and methodology.

Since there is a vast literature about or linked with our topic we were not able to find and read every article or book that could have been relevant for our study. Therefore we could have missed some articles that would have helped us dealing with this subject. Moreover some articles are relatively old, as the majority of them had been written in the 1970’s or 1980’s, one can say that the relevancy of these articles could be discussed since the behaviour of a financial market changes considerably over time. Even such critics have a logical basis in some aspects; we considered that these theories give consistency to our results, so considered them as interesting references and should be used despite they are old references.

2.6.2 Methodology and Figures

First our study is a quantitative method which consists on comparing the market indices (S&P 500 and Russell 3000) with the different small and mid caps indices. We are aware that we used two proxies that could lead to very different results than using a different proxy like Dow Jones or NASDAQ composite. Our study depends on the methodology used by Standard & Poor’s and Russell to build their indices, the criteria taken into account by them could limit the perspective of the study. We chose the S&P 500 and Russell because it would take too much time to compare with all the market proxies and because we believe S&P 500 and Russell 3000 are the most relevant index for our study.
3. INDICES METHODOLOGY AND PRACTICAL METHOD

For a better comprehension of our study it is crucial to understand how the market indices selected for our research are constructed. In this chapter we provide an explanation of the main procedures of the construction of them regarding the methodology and other important features of those indices. Furthermore we also explain how the data collection was performed with an explanation of the formulas used to obtain the results presented along this thesis.

3.1 Standard and Poor’s indices

3.1.1 Standard and Poor’s indices features

- **S&P 500** - the most popular value-weighted index of U.S. stocks (Bodie et al, page 210). Composed by the 500 most capitalized companies in their respective industries, the constituents of this index have a minimum market capitalization of US$ 4 billion covering approximately 75% of the U.S. equities market. 

- **S&P MidCap 400** - gauges mid-sized U.S. companies with market capitalization from US$ 1 billion to US$ 4.5 billion. It represents approximately 7% of the U.S. equities market.

- **S&P SmallCap 600** - covers 3%-4% of the U.S. equities market. It denotes small-sized companies that possess a market capitalization from US$ 300 million to US$ 1.5 billion. Besides the particular features of each index, all indices described above are capitalization-weighted (each constituent company has its representation at the indices equivalent to their value at the U.S. economy), reconstituted on a have an as needed basis and have public float of at least 50%. Moreover, all the companies that compose the S&P indices are classified according to the Global Industry Classification Standard (GICS).

3.1.2 Eligibility Criteria

To be added to the S&P 500, S&P MidCap 400 and S&P SmallCap 600, companies have to fulfill the following requirements:

- **Liquidity** - ratio of annual dollar value traded to market capitalization should be 0.3 or greater
- **Domicile** - Companies must have their domiciles in United States
- **Sector Classification** - contribution to sector balance maintenance (assessed by comparing each GICS sector’s weight in an index with its weight in the market, considering the relevant market capitalization range)

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36 http://www2.standardandpoors.com/portal/site/sp/en/us/page.topic/indices_500/2,3,2,2,0,0,0,0,0,0,0,0,0,0,0,0.html
37 http://www2.standardandpoors.com/portal/site/sp/en/us/page.topic/indices_400/2,3,2,2,0,0,0,0,0,0,0,0,0,0,0,0.html
38 http://www2.standardandpoors.com/portal/site/sp/en/us/page.topic/indices_400/2,3,2,2,0,0,0,0,0,0,0,0,0,0,0,0.html
39 Float represents the total number of shares publicly owned and available for trading. Obtained through the subtraction of restricted shares from outstanding shares (http://www.investopedia.com/terms/f/float.asp)
Financial Viability - measured as four consecutive quarters of positive as-reported earnings (Generally Accepted Accounting Principles (GAAP) net income excluding discontinued operations and extraordinary items). For REIT’s, financial viability is based on both as-reported earnings and Funds from Operations (FFO). Financial viability is analyzed in the context of the company’s balance sheet leverage, which operational justification should lie on the context of both its industry peers and its business model.

IPO’s - should be seasoned for 6 to 12 months before being analyzed addition into an index.

Eligible Companies - Operating company and not a closed-end fund, holding company, tracking stock, partnership, investment vehicle or royalty trust and REIT’s

Companies will be deleted from the indices under the following situations:

- Involvement in mergers, acquisitions, or significant reconfiguration that no longer meet inclusion criteria.
- Violation of one or more of the addition criteria.

However, when a company may appear to temporarily violate one or more of the addition criteria to its respective index it will not be deleted unless ongoing conditions warrant an index change; as the criteria described above are for addition to an index not for continued membership.

3.1.3 Global Industry Classification Standard (GICS)

The Global Industry Classification Standard (GICS) currently consists of 10 sectors, 24 industry groups, 67 industries and 147 sub-industries. The GICS sectors are: consumer discretionary, consumer staples, energy, financials, health care, industrials, information technology, materials, telecommunication services and utilities.

This classification was established in accordance to companies’ main business activity by using their revenues as a key measure. However, earnings and market perception are also utilized as important and relevant information for GICS establishment and are considered into the review process.

Concerning the classification methodology, GICS uses mainly a company’s primary business model determined by its financial performance. This system organizes over 34,500 active, publicly traded companies into GICS sub industries, according to the definition of their principal business activity. If a company’s subsidiary files separate financials to its reporting government agency, that subsidiary is

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41 Real Estate Investment Trust (REIT) sells like a stock on the major exchanges and invests in real estate directly, either through properties (Equity REIT), mortgages (Mortgage REIT) or both (hybrid REIT) (http://www.investopedia.com/terms/r/reit.asp)

42 FFO is used by REIT’s to obtain the cash flow from their operations and is calculated by adding depreciation and amortization expenses to earnings (http://www.investopedia.com/terms/f/fundsfromoperation.asp)

43 Closed-end fund is a publicly traded investment company that raises who raises capital through an initial public offering (IPO) (http://www.investopedia.com/terms/c/closed-endinvestment.asp)

44 Tracking stock is a common stock issued by a parent company that pursues the performance of a specific parent’s division without having claim on the assets of this division or its parent company. (http://www.investopedia.com/terms/t/trackingstocks.asp)

classified independently as a separate entity. Equity securities or issues directly linked to a company have the same classification as their issuer. Also, at least, annual reviews are realized to assess if a company has not redefined its line of business through a series of smaller events.  

3.1.4 Floating Adjustment Methodology

The floating adjustments objective to distinguish strategic shareholders (mainly board members, founders and owners of large blocks of stock); regarding theirs holdings control maintenance rather than the economic aspects of the company (from those holders whose investments depend on the stock’s price and their evaluation of the company’s future prospects).

Frequently one corporation holds stocks of another corporation due to control interest instead of investment purposes. Moreover, government holdings are not investments made because a stock is expected to appreciate or the government entity is managing its excess funds through equity investments. Thus float adjustments excludes shares that are held by control groups, other publicly traded companies or government agencies.

On the other hand, investors who hold these shares, analyses changes in the stock’s price, earnings or the company’s operations considering their appreciation/depreciation at its price in order to buy or sell this stock. This category comprehends mutual funds, pension plans, investment advisory firms, pension funds or foundations not associated with the company and investment funds in insurance companies. This kind of institutional investor can hold a block of shares for several years but it does not mean that these shares are being held for control, rather than investment reasons. Thus they are part of the float.

The floating adjustment classifies shareholders whose the holdings are assumed to be for control into three groups. Holdings in a group which exceed 10% of the outstanding shares of a company are excluded from the float-adjusted count of shares to be used in index calculations.

The three groups are composed by:

1. “Holdings by other publicly traded corporations, venture capital firms, private equity firms or strategic partners or leveraged buy-out groups.
2. Holdings by government entities, including all levels of government in the United States or other countries.
3. Holdings by current or former officers and directors of the company, founders of the company, or family trusts of officers, directors or founders. Second, holdings of trusts, foundations, pension funds, employee stock ownership plans or other investment vehicles associated with and controlled by the company” (S&P’s Float Adjustment, page 3).

- Calculation of Investable Weight Factors

46 S&P Global Industry Classification Standard, page 9
47 S&P Float Adjustment Methodology
(http://www2.standardandpoors.com/spf/pdf/index/Float_Adjustment_Methodology_Web.pdf?vregion=us&vlang=en)
48 S&P Float Adjustment Methodology, page 6
(http://www2.standardandpoors.com/spf/pdf/index/Float_Adjustment_Methodology_Web.pdf?vregion=us&vlang=en)
Investable Weight Factor (IWF) is calculated for every stock under analysis:

\[
IWF = \frac{\text{available float shares}}{\text{total shares outstanding}}
\]

Where:

- Available float shares is calculated as total shares outstanding less shares held in one or more of the three groups listed above whose holdings exceed 10% of the outstanding shares.
- Reviewed annually, except when changes in IWF’s resulting from corporate actions which exceed 10% of shares outstanding occur. In these cases the changes are implemented as soon as possible.

In S&P indices used in this research, multiple classes stocks are combined into one class with an adjusted share count. In this situation, the stock price is based on one class (usually the one who presents higher liquidity) and the share count is summarized by the total shares outstanding.

The float for companies with multiple classes of stock is obtained by the calculation of the weighted average IWF for the stock using the proportion of total company market capitalization of each share class as the weights.

3.1.5 Mathematics Methodology

3.1.5.1 Index Divisor

The scale normally showed at Standard and Poor’s indices is obtained by dividing the portfolio market value by a factor (the divisor). Indices differ completely from portfolios in several cases like a stock addition to or deletion for both cases.

The index level should fluctuate, whereas a portfolio’s value would normally change in case of inclusion or exclusion of stocks in these two situations. To avoid the index’s value fluctuation, when stocks are added or deleted, the divisor adjustment occur to offset the change in market value of the index. This adjustment is utilized also when some corporate actions that induce variations in the market value of the stocks in an index should not be reflected in the index level.

These corporate actions are following listed and briefly described how they can influence in a market index value change:

- **Company added/deleted** - divisor adjustment caused by net change in market value

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49 S&P Float Adjustment Methodology, page 6
(http://www2.standardandpoors.com/spf/pdf/index/Float_Adjustment_Methodology_Web.pdf?vregion=us&vlang=en)

50 S&P Index Mathematics
(http://www2.standardandpoors.com/spf/pdf/index/Index_Mathematics_Methodology_Web.pdf?vregion=us&vlang=en)

51 Ibid, page 2
(http://www2.standardandpoors.com/spf/pdf/index/Index_Mathematics_Methodology_Web.pdf?vregion=us&vlang=en)
- Change in shares outstanding - review of share counts due to possible combination of secondary issuance, share repurchase or buy back
- Spin-off 52 - divisor adjustment shows the decline in index market value when a spun-off company is not added to the index. Also the divisor is adjusted when a spun-off company is added to the index and, at the same time, another company removed to keep number of names fixed
- Change in IWF due to a corporate action or a purchase or sale by an inside holder – divisor changes when total market index value is increased/decreased as a consequence of increasing/decreasing of the IWF
- Special Dividend - divisor adjustment shows the drop in index market value related to the price fall of share occurred due to the payment of a special dividend
- Rights offering - divisor is recalculated in order to reflect the increase in market capitalization occurred by the issuing of rights to buy a proportional number of additional shares at a set price to each shareholder. It is assumed that the offering is fully subscribed.

Concerning corporate actions related to distribution of cash or other corporate assets to shareholders, the price of the stock will decrease on the ex-dividend day (first day that a new shareholder is not eligible to receive the distribution.) The divisor adjustment avoids any effect of this stock price drop in the index related in a possible correspondent decrease in the index value.

3.1.5.2 Capitalization Weighted Indices53

Standard and Poor’s provides two kind of indices, the equal weighted54 and the capitalization weighted (also called as value-weighted or market cap weighted. In this research only the second type will be used as they represent each industry’s leading companies according to their respective value in the U.S. economy.

The formula to calculate the capitalization weighted indices is:55

\[
\text{IndexLevel} = \frac{\sum P_i \times Q_i}{\text{Divisor}}
\]

- \(P_i\) is the price of each stock
- \(Q_i\) is the number of stocks

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52 Spin-off is an independent company created through the sale or distribution of new shares of an existing business/division of a parent company (http://www.investopedia.com/terms/s/spinoff.asp)
54 In an equal weighted index every stock has equal weight in the index and a portfolio that tracks the index will invest an equal dollar amount in each security.
3.1.5.3 Adjustments to Share Counts

S&P’s market cap-weighted indices are float adjusted (only shares publicly owned and available for trading are taken into consideration in this situation). For each stock, an Investable Weight Factor (percentage of total shares outstanding included in the index calculation) is calculated. By using Index Level equation, the variable $Q_i$ is substituted by the product of outstanding shares and the IWF:

$$Q_i = IWF_i \times TotalShares_i$$

In order to balance the weight of a stock in an index some adjustments are required, which are expressed as IWF in the equation above. Following FA is the fraction of shares eliminated due to float adjustment IS represent the fraction of total shares to be excluded based on the combination of FA:

$$IS = 1 - FA$$

Then equation $Q_i$ can be expressed like:

$$Q_i = IS_i \times TotalShares_i$$

3.1.5.4 Divisor Adjustments

Divisor adjustments are related to changes of stocks in the index that influences the value of the market index. This section explains how the divisor adjustment is made given the change in total market value. The Index Level equation is explored to illustrate stock $r$ being removed from the stocks that remain in the index:

$$IndexLevel_{t-1} = \frac{\left( \sum P_i \times Q_i \right)}{Divisor_{t-1}} + P_r Q_r$$

Index level and the divisor are labeled for the time period $t-1$. In this formula, IWF and adjustments to share counts are not considered. After stock $r$ is replaced with stock $s$, the equation is presented in the following form:

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56 Ibid
57 S&P Index Mathematics, page 5
58 Ibid
59 Ibid
60 Ibid
61 Ibid
62 S&P Index Mathematics, page 6
In the two equations above, \( t-1 \) represents moment prior to deletion of company \( r \) from and to addition of company \( s \) to the index; \( t \) is the moment right after the event. By design Index Level \((t-1)\) is equal to Index Level \((t)\). Using and re-arranging the two formulas, the adjustment to the Divisor can be obtained from the index market value before and after the change: \(^63\)

\[
\text{Index Level}_t = \frac{\left( \sum_i P_i \times Q_i \right) + P_r Q_r}{\text{Divisor}_t}
\]

From now the numerator of the left hand fraction is placed by MV\((t-1)\), for the index market value at \((t-1)\), and the numerator of the right hand fraction is substituted by MV\((t)\), for the index market value at time \( t \). By the determination of MV\((t-1)\), MV\((t)\) and Divisor\((t-1)\) it is possible to obtain the new divisor that keeps the index level constant when stock \( r \) is replaced by stock \( s \): \(^64\)

\[
\text{Divisor}_t = (\text{Divisor}_{t-1}) \times \frac{\text{MV}_t}{\text{MV}_{t-1}}
\]

### 3.2 Russell’s indices

#### 3.2.1 Russell’s indices features

All Russell indices which use market capitalization are a subset of Russell 3000E. This index comprises 4000 companies by covering approximately 99% of the U.S. equity market \(^65\). For our study we used the indices described below:

- **Russell 3000** - composed by the 3000 largest U.S. companies, representing approximately 98% of the investable U.S. equity market. In the last reconstitution, its average market capitalization was approximately US$5.1 billion and had a total market capitalization range of approximately $368.5 billion to $218.4 million \(^66\).

- **Russell Midcap** - constituted by the 800 smallest companies of Russell 1000 \(^67\) (represents approximately 30% of the total market capitalization of this index). In the last reconstitution, its average market capitalization was approximately US$5.2 billion and its largest company had an approximate market capitalization of US$14.8 billion \(^68\).

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\(^63\) S&P Index Mathematics, page 6  

\(^64\) Ibid

\(^65\) http://www.russell.com/indexes/about/russell_us_equity_indexes_definitions.asp

\(^66\) Ibid

\(^67\) Ibid

\(^68\) Ibid
Russell 2000 – comprehends the 2000 smallest companies of Russell 3000 (represents approximately 8% of the total market capitalization of this index). In the latest reconstitution, its average market capitalization was approximately US$762.8 million and its largest company had an approximate market capitalization of US$1.9 billion and a smallest of US$218.4 million.

3.2.2 Inclusion criteria

Russell U.S. Indexes are constituted by U.S. incorporated companies. However, not only U.S. companies compose these indices, they also include companies incorporated in the following countries: Bahamas, Belize, Bermuda, British Virgin Islands, Cayman Islands, Channel Islands, Cook Islands, Gibraltar, Isle of Man, Liberia, Marshall Islands, Netherlands Antilles, & Panama.

Companies incorporated in these countries are classified as Benefits Driven Incorporations (BDIs) as they typically incorporate in these regions for operations, tax, political or other financial market benefits. To be eligible for any U.S. index, companies incorporated in these mentioned countries have to fulfil one of the following criteria:

- Its headquarters has to be located in the U.S.
- Or its headquarters is in the BDI designated region, and its primary exchange for local shares is in the U.S.

To evaluate the addition of a company in any of the U.S. indices, the primary exchange is determined by the average daily dollar trading volume (ADDTV). ADDTV is the accumulated dollar trading volume divided by the actual trading days of the past year. Indices constituents companies remain assigned to their existing primary U.S. exchange.

Primary exchange is only an index insertion factor if both incorporation and headquarters are situated in a BDI designated region or if multiple headquarters are registered in the SEC filings.

3.2.3 Maintenance criteria

In order to remain of being part of Russell’s U.S. indices a company has to fulfil the following requirements:

- **Trading Requirements** - securities eligible for inclusion have to be traded on a major U.S. Exchange Market
- **Minimum Trading Price** - stocks trading value must have a minimum price of US$1.00 on their primary exchange during annual reconstitution or IPO eligibility. A stock is not excluded from its respective index if its price falls below US$1.00 between two reconstitution periods and its price recovers by being traded above US$1.00.

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69 [http://www.russell.com/indexes/about/russell_us_equity_indexes_definitions.asp](http://www.russell.com/indexes/about/russell_us_equity_indexes_definitions.asp)


71 U.S. Securities and Exchange Commission
- **Company Structure** - the following companies are included in Russell Indices: royalty trusts, limited liability companies, closed-end investment companies (Business Development Companies are eligible), and limited partnerships.

- **Shares Excluded** - the following share types are not eligible for inclusion: Preferred and convertible preferred stock, redeemable shares, participating preferred stock, warrants and rights, and trust receipts.

IPO’s must have to obey all Russell U.S. Index eligibility requirements. Besides, there are additional criteria on the final trading day of the month prior to quarter-end that IPO’s must fulfil:

- price/trade higher regarding market capitalization compared to the market-adjusted smallest company in the Russell 3000E as of the latest reconstitution
- higher ranking in total market capitalization than the market-adjusted smallest company in the Russell 3000E as of the latest reconstitution

### 3.2.4 Russell Methodology

Russell’s indices are reviewed annually in a process called annual reconstitution in which they are completely rebuilt. This process classifies all the eligible securities according to their total market capitalization.

Regarding IPO’s, they are added quarterly to Russell’s indices to assure that these new additions to the investing opportunity set are presented in its respective index, due to their importance regarding their impact in the addition into an index. IPO’s addition occurs quarterly because, frequently, they are not available at the reconstitution period.

#### 3.2.4.1 Market capitalization

Market capitalization of a company is calculated by only using common stock. In case of existence of multiple share classes of common stock, they are combined. In situations where the common stock share classes act independently of each other, each class is added separately.

Annual reconstitution uses companies’ last traded price on May 31 from the primary exchange to calculate their market capitalizations. In case of existence of multiple share classes, the calculation uses a primary trading vehicle and the price of the primary trading vehicle (normally the stock presenting the highest liquidity).

Primary trading vehicles are calculated by an objective equal-weighted matrix of relative trading volume, price and float-adjusted shares outstanding. A primary trading vehicle is determined by the common share class with the highest trading volume, price and float-adjusted shares outstanding or highest combination of these three indicators.

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73 Ibid, page 8
In situations where the original equal-weighted matrix presents a change at reconstitution of a current member of Russell 3000E with multiple common share classes, they are assessed through a secondary matrix.

This secondary matrix eliminates the possibility of influence in membership and share turnover due to small differences in the three indicators of the primarily matrix. Variables are removed from the secondary matrix if the difference between the current and alternate class is the following indicators range:

- difference is greater than 20% in float-adjusted shares outstanding
- price difference is greater than 10%
- 100-Day Average Trading Volume difference is greater than 20%

Percentage differences are calculated through the following formula: (current member price-other class price)/current member price. The same formula is applied for all indicators.

In a potential tie at this secondary matrix results, the class of a stock who presents a combination of both higher trading volume and float-adjusted shares outstanding is used instead of the others. Otherwise, when the matrix results in a tie, preference is given to the current member.

The companies’ classification is based on market capitalization breakpoints that determine the ranges of the indices where Russell 3000 comprises the first 3,000 of Russell 3000E, Russell Midcap is constituted by the 201st to the 1000th ranked companies at Russell 3000E and Russell 2000 has its components as 1001st to the 3000th ranked firms at Russell 3000E. Added members are classified according to the breakpoints explained above while current members are reviewed in order to identify possible falls within a cumulative 5% market cap range around these market capitalization breakpoints. This market cap range is calculated by subtracting and adding 2.5% of a company’s market capitalization.

3.2.4.2 Float

Float adjustment objectives to identify all the available stocks for trading. To accomplish this, stocks are weighted in the Russell U.S. indexes by their available (float-adjusted) market capitalization. This market capitalization is obtained by multiplying the primary closing price by the available shares. These available shares exclude from market calculations the capitalization that is not available for public trading.

Float adjustment excludes the following types of shares from the available market capitalization:

- Cross ownership by another Russell 3000E index member - stocks held by another member of a Russell index are adjusted regardless of percentage held.
- Large corporate and private holdings - shares held by another listed company (non-member) or private individuals are adjusted when the number of shares held is higher than 10%. Following

74 Russell U.S. Equity Indexes, page 11 (http://www.russell.com/indexes/PDF/Methodology.pdf)
75 Ibid, page 12
institutional holdings are not included: investment companies, partnerships, insurance companies, mutual funds, banks, or venture capital firms.

- **ESOP**\(^{76}\) or **LESOP**\(^{77}\) shares – adjusted when they comprehend 10% or more of the shares outstanding
- **Unlisted share classes:** classes of common stock not traded at a U.S. Exchange Market
- **IPO lock-ups:** shares locked up during an IPO are not available to the public thus is excluded from the market value at the time the IPO is added at its respective index.

### 3.3 Data collection

The data collection was conducted by using public access websites. For our research we used Yahoo Finance\(^{78}\) as the data provider to obtain the weekly and monthly indices values of S&P 500, S&P Mid Cap 400 and S&P Small Cap 600. Also through the same source we acquired the monthly indices values for Russell 3000, Russell Midcap and Russell 2000. Through the Russell’s website\(^{79}\) we obtained the daily returns of the three indices that were utilized for our analysis (Russell 3000, Russell Midcap and Russell 2000).

Regarding their reliability, we obtained the data from public access websites that are widely used in the industry so it is expected that they are not biased as they represent past information that will not be modified as a consequence of new facts or changes in the indices methodology.

Furthermore, regarding the data selection, we chose to use the closing index value with dividends to take into account the whole performance of the indices. They were an initial tool that we used to obtain the figures we are interested in: the indices return. Return was our main focus since the purpose of this study was to analyze whether or not one can outperform the market by investing in small and mid caps stocks, so we considered above all in terms of excess return. Also the literature used in this studied was mainly based on returns, so we utilized them in order to compare our findings with the literature conclusions. Moreover we need to think in terms of return because later we are going to discuss about theories that use CAPM (see definition 1.2.2).

### 3.4 Return and volatility calculation

All the formulas presented in this section were provided through the Financial Data Analysis, but the Adjusted Return formula, which is originated from the methodology used by Basu\(^{80}\) in his article utilized in this research.

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\(^{76}\) Employee Stock Ownership Plan is employee benefit plan created to invest in the stock of the sponsoring employer ([http://www.investopedia.com/terms/e/esop.asp](http://www.investopedia.com/terms/e/esop.asp))

\(^{77}\) Leveraged Employee Stock Ownership Plan is system where the company leverages its credit to borrow money, which it then uses to fund the plan. Shares are used for the purposes of the stock ownership plan, and the company pays back the original loan with annual contributions ([http://www.investopedia.com/terms/l/LESOP.asp](http://www.investopedia.com/terms/l/LESOP.asp))


\(^{79}\) [http://www.russell.com/](http://www.russell.com/)

The daily weekly and monthly indices value adjusted with dividends were used when they were present. The index value with dividends was chosen to take into account the whole performance of this class of securities that constitute them. Through the index value, the return is calculated by using the following formula:

\[ \text{Return} = \ln(indexvalue_t) - \ln(indexvalue_{t-1}) \]

Using the returns obtained with the formula above, we could determine the average of return for 1, 2, 5 and 10 years by dividing the cumulative sum of the returns by the period studied. Also the excess returns were calculated using these returns by subtracting the small or medium cap index return by the market index return.

To volatility of returns were calculated through the use of the standard deviation of each of the returns through the following formula:

\[ \sigma = \sqrt{\frac{\sum (indexreturn - averageofindexreturn)^2}{n}} \]

Where:
- \( \sigma \) = standard deviation of the return under analysis
- \( n \) = number of periods analyzed
- \( indexreturn \) = the index value of one single period (daily, weekly or monthly, depending on which index is being used)
- \( averageofindexreturn \) = the average of returns of the index studied

The combination of these two formulas provides the adjusted return by which we could measure the return taking the risk (volatility) of each index into consideration as this measure indicates the respective unit of return from each return of risk through the following formula:

\[ Adjusted \ Return = \frac{averageof \ Return}{\sigma} \]

The average of adjusted return for 1, 2, 5 and 10 years is obtained by dividing the cumulative sum of the adjusted returns by the period studied. Also the abnormal adjusted returns were calculated using these returns by subtracting the small or medium cap index adjusted return by the market index adjusted return.

- **Cumulated volatility**

The cumulated volatility has been calculated as well in order to observe the evolution of volatility for each index throughout time. The different steps to calculate the cumulated volatility are described in the following table:
### Variables for each n observations

<table>
<thead>
<tr>
<th>Variables</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return</td>
<td>Difference of closing price logarithm ( R_t - R_{t-1} )</td>
</tr>
<tr>
<td>Cumulative return (n observations)</td>
<td>( C_{rt} = \sum r_i )</td>
</tr>
<tr>
<td>Average Return</td>
<td>( C_{rt} / n )</td>
</tr>
<tr>
<td>Variance of return (cumulated volatility for n observations)</td>
<td>( S^2 = \frac{1}{n} \sum (\text{return } r_i - \text{average return } r_{n})^2 )</td>
</tr>
</tbody>
</table>

### 3.5 Period studied

The indices were divided in four different time periods in order to have different perspectives of the returns behavior of the indices as it is described next:

<table>
<thead>
<tr>
<th>Very short term: 1 year investment</th>
<th>Short term: 2 year investment</th>
<th>Middle term: 5 year investment</th>
<th>Long term: 10 year investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>from January 1997 to December 1997</td>
<td></td>
<td>from January 1998 to December 1998</td>
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<tr>
<td>from January 1998 to December 1998</td>
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<td>from January 1999 to December 1999</td>
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<td>from January 1999 to December 1999</td>
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<td>from January 2000 to December 2000</td>
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<tr>
<td>from January 2000 to December 2000</td>
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<td>from January 2001 to December 2001</td>
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<tr>
<td>from January 2001 to December 2001</td>
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<td>from January 2002 to December 2002</td>
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<tr>
<td>from January 2002 to December 2002</td>
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<td>from January 2003 to December 2003</td>
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<tr>
<td>from January 2003 to December 2003</td>
<td></td>
<td>from January 2004 to December 2004</td>
<td></td>
</tr>
<tr>
<td>from January 2004 to December 2004</td>
<td></td>
<td>from January 2005 to December 2005</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Periods studied

The S&P indices were studied in the 1 year period by the returns obtained from the average of weekly return while the other periods (2, 5, and 10 years) the data was acquired from the average of monthly returns.
Whereas Russell indices returns are originated from the daily returns average for the 1 year investment period while for the 2, 5 and 10 years investment periods the data was collected through the calculation of the average of monthly returns.

### 3.6 Hypothesis

#### 3.6.1 Hypothesis formulation

Our first step is to show rather or not the small and mid caps indexes can outperform the market indexes. By saying “outperform”, we understand that it is possible to experience negative or positive abnormal returns by investing in small and mid caps. Because we assume the possibility for an investor to buy or sell a portfolio composed by these kinds of stocks.

Through the formulas described previously we are provide with data from different indexes which represent the returns of both categories.

For Market Indexes, we chose S&P 500 and for the small and mid caps indexes, we want to use S&P Small caps 600 and S&P Mid Caps. On the other hand we selected Russell 3000 as the market index to be compared with the Russell Mid Cap index and Russell 2000 (medium and small cap indices respectively).

The sampling period will be 10 years with both weekly and monthly data. By using SPSS we will transform this data in terms of weekly and monthly returns. The next step is to test the following hypothesis. The test will be

The hypothesis basically consists in if the excess return (in the context of a market index investment strategy) of small and medium caps indices equal or different from 0 (each index is analyzed separately). In statistical terms it means:

\[
H_0 : \iff \bar{R}_i - R_j = 0 \\
H_1 : \iff R_i - R_j \neq 0
\]

Where \( R_i \) represents either a small or a medium cap index depending which one is studied (raw returns of 1, 2, 5 and 10 years for each indices and adjusted returns for 1, 2, 5 and 10 years for each indices) and \( R_j \) represents the market index (again for each different periods and for raw returns and adjusted returns).

If the excess return of small and mid caps indexes is equal to 0 then the null hypothesis can be accepted, on the opposite if it higher or lower we can accept the hypothesis \( H_1 \).

We want to test this hypothesis on several periods of time in order to distinguish short, middle and long terms (one, two, five and ten years) as described in the previous section.
Then we will perform through SPSS (by entering the data of excess returns for each periods) a one sample T-Test in order to check for the significance of the sample tested.

3.6.2 Hypothesis Testing

We have to detail the process to reject or accept a hypothesis. This process is done through the software SPSS a statistical software.

During the module “Financial Data Analysis”, we have learned the four different steps to test the validity of a hypothesis:

- Formulating two opposing hypothesis (see 3.6.1): $H_0$ stands for the null hypothesis; it is a statement that appears to be true unless you have statistical evidence to disprove it. $H_1$ stands for the alternative hypothesis, it is the opposite of the null hypothesis, it takes into account all the statements that are not covered by $H_0$.

- Selecting a test statistic: then the results of the study have to be tested in order to check for the significance of the results. A t-value (in our case 0) has to be determined and compared with the results to see whether the results are significantly different from the T-Value. We are going to use a One sample T test in our study.

- Deriving a decision rule: it consists on taking into account parameters like the number of observations, the standard deviation and the confidence interval when accepting or rejecting the null hypothesis. Then we state an $\alpha$, which is the probability to reject the null hypothesis when it is true, usually the researchers use an $\alpha$ of 0,05. So if the significance figure is below 0,05 the result are not significant and the $H_0$ cannot be rejected. Moreover the confidence interval of the difference must not contain 0 otherwise it means also that the results are not significant.

- Taking a sample, computing the test statistic and confronting it with the decision rule: a sample has to be chosen and the results have to be confronted to the decisions rules.
4. THEORIES

In this part, we introduce theories that we will need to discuss our results and conclude the study. Basically the structure of this part is organized according to which factor the theory is explaining. At the end we put a model for our study that sums up the theoretical framework.

Reminder:

For a better comprehension of the following theories we need to define the CAPM, capital asset pricing model:

One of the most important theories for our research is the Capital Asset Pricing Model (CAPM) that according to Body is a set of predictions about equilibrium expected returns on risky assets.

Basically the CAPM consists on a combination of investments between a risk free asset and the market portfolio. By this we have the so-called capital allocation line (CAL) that tangencies the efficient frontier, obtaining the optimal risky portfolio. The line from the risk free rate and the optimal risky portfolio is called capital market line (CML).

To use this model developed by Sharpe\textsuperscript{81}, Lintner\textsuperscript{82} and Mossin\textsuperscript{83} there are some assumptions that are needed to be used in order to make this model realistic and comprehensive (i.e. investments are restricted to publicly traded assets).

The CAPM can be summarizing with the following formula:\textsuperscript{84}

\[ E(R_i) = R_f + \beta_i [E(R_m) - R_f] \]

Where

\begin{itemize}
  \item \( E(R_i) \) is the expected return of an asset \( i \)
  \item \( R_f \) is the risk-free rate of returns (usually the return of Treasury bond)
  \item \( \beta_i \) is the sensitivity of the asset returns to market returns, or also:
    \[ \beta_m = \frac{Cov(R_i, R_m)}{\text{Var}(R_m)} \]
  \item \( E(R_m) \) is the expected return of the market
\end{itemize}

\textsuperscript{83} Mossin J., Equilibrium in a Capital Asset Market, Econometrica, 1966
\textsuperscript{84} http://en.wikipedia.org/wiki/Capital_asset_pricing_model
4.1 Efficient Market Hypothesis Anomaly: evidence for a “size effect”

The Efficient Market Hypothesis states an investor cannot beat the market because all available information about securities is already reflects in their prices. Nevertheless Marc R. Reinganum\(^{85}\) published studies showing that the returns of small stocks were higher than returns of large stocks. In his research he uses a sample of 566 firms listed on the New York Stock Exchange (NYSE) and American Stock Exchange (AMEX) and analyse the data from June 1967 through December 1975. In order to calculate the excess returns generated by small firms he subtracts the small firms’ returns to the return of the market index. He uses an equal-weighted NYSE-AMEX market index as the market proxy for his study. Then he calculates the mean market value of his sample and classified in deciles the firms according to the market value average of the sample. In order to check the risk adjusted return he uses beta which are estimate from the market index used. Finally he subtracts the mean daily returns of each decile to the mean daily return of the index.

He then finds that positive anomalous return is detected for the two lowest deciles. Even after one year and even after two years the first decile (the smallest firms of the sample) is earning abnormal returns. His study is a perfect demonstration that a size effect exists. The strength and persistence of abnormal returns demonstrate that the CAPM of Sharpe (1964) and Lintner (1965) and Black (1972) is mispecified or that the EMH does not hold or both. His work is the basement of studies about the market value effect.

Rolf W. Bank\(^{86}\) in one of his research finds similar results; the data he uses are wider than the one use by Reinganum. The sample includes all common stocks quoted on the NYSE for at least five years between 1926 and 1975, monthly price and return data are use. Three market indices are use: the CRSP (centre for Research in Security Prices) equally and value weighted indices and a value weighted combination of the CRSP value weighted index and return data on corporate and government bonds from Ibboston and Sinquefield. The securities are classified in five equally weighted portfolios according to their size and then each portfolio is divided the securities in five groups according to their beta (level of risk). Five years of Data are used to estimate the betas and the next five years for the reestimation of the betas. Then all the data are computed according to the CAPM taking the three different market indices. The results lead to a misspecification of the CAPM since share of firms with large market values have had smaller returns than small firms. But he raises the question whether or not this “size effect” is a proxy for one or more factors correlated with size. We are going to see that other theories have been performed to distinguish other possible explanations for the “market value effect”.

These theories allow use to say that one can earn abnormal returns by investing in small stocks because some omitted factors are not taken into account in the different pricing models.

4.2 The link between earnings’ yield and market value

Marc R. Reinganum points out another variable that seems to play an important role in explaining the size effect. In fact he proves that even the E/P ratio (see definition) is essential to understand the abnormal returns (Reinganum, Journal of financial economics 1981). By using the same sample (see 3.1) he classifies the securities on the basis of the quarterly E/P ratios of firms. The portfolios are constructed in a way to have an estimated beta equal to one it allows the researcher to control for risk and then be able to catch the abnormal return due to E/P ratio effect. To calculate the returns of each portfolios the author takes the closing price of each stock prior to the pre-announcement of earnings and the closing price of the post announcement day. Then he subtracts the returns of the high E/P ratio firms to the returns of low E/P ratios firms, the difference in mean daily returns is positive and this premium can be interpreted as abnormal return since the portfolios have the same beta. It is another evidence that the CAPM is misspecified but this study is consistent with the EMH since he observes that the returns persists at least 6 months, so prices reflect information.

The very interesting point of this study is the link the author finds between E/P ratio and Market Value. He test this inter-dependence of E/P ratio and size, he ranks the stocks according to the both the market value and E/P ratios. The first evidence is that high E/P ratios tend to be classified in the low market value deciles. Then in order to check if E/P ratios can generate abnormal returns above and beyond the size effect (already detected) he subdivides the market value portfolios into sub-portfolios based on E/P ratios. He observes that for a given E/P ratios quintile the smallest firms always outperform the biggest firm. So he concludes that an E/P ratio and a size effect exist separately, but the size effect is more a proxy for the other one.

Sanjoy Basu bases his work on the studies of Reinganum (1981) and the one of Banz (1981). He approaches the relationship between Market value and E/P ratios in the same way as Marc R. Reinganum. He takes into account all the common stocks of NYSE between December 1962 and 1978. He gets the data from the monthly stock return file of the CRSP file and the accounting earnings per share from the Compustat Prices –Dividends-Earnings (PDE) tape. It leads him with a sample of about nine hundred firms. He ranks the securities in two ways. He first forms five basic portfolios based on E/P ratios (EP1,EP2,…, EP5) and five portfolios based on common value(MV1,MV2…., MV5). Then he constructs portfolios by crossing the two basic portfolios, for instance the lowest earnings’ yield groups relating to the five market value classes were combined to form a randomized portfolio EP1*. He calculates the mean monthly return for each portfolio and the monthly standard deviation throughout the period, and then divides the average monthly return by the monthly standard deviation. This method is used to adjust returns to risk. This method allows to both catching the systematic and unsystematic risk. His results show that the strength of the earnings’ yield effect seems to vary inversely with firm size. The smallest firms experience the highest E/P effect. So the small firm benefit from a combination of both size and E/P effect.

Nevertheless it seems that both variables are just proxies for other factors that generate abnormal returns.

4.3 The effect of infrequent trading on stock’ returns

As we have seen previously the size effect seems to be link to size and E/P ratios, however the authors were not able to prove if these variables are influenced by other factor. In other words it might be other features which are indirectly link with the size effect.

4.3.1 Definitions

Transactions Costs are divided into two categories, direct and indirect, the direct costs are brokers’ commissions, income taxes, transfer taxes, custodial fees, and outlays for research information. Indirect Cost is composed by the Bid and Ask spread.\(^{88}\) The bid-ask spread is “The amount by which the ask price exceeds the bid. This is essentially the difference in price between the highest price that a buyer is willing to pay for an asset and the lowest price for which a seller is willing to sell it.”\(^{89}\)

Liquidity is defined as “The degree to which an asset or security can be bought or sold in the market without affecting the asset's price. Liquidity is characterized by a high level of trading activity.”\(^{90}\) It is well accepted that investors involve in illiquid assets will ask for a liquidity premium to raise the required rate of return.

4.3.2 Infrequent Trading and Liquidity

The problem of infrequent trading has been raised by Elroy Dimson\(^{91}\), according to this author, infrequent trading is an additional risk which is not taken into account by market model like the CAPM. Infrequent trading has an effect on the beta of a share, therefore the beta of infrequently traded securities is bias downwards and the beta of frequently traded securities is bias upwards. His study is based on 421 UK companies’ stock prices throughout the 1955-74 period.

The study of Vinay T. Datar, Narayan Y. Naik and Robert Radcliffe agree with the results of Dimson. “Liquidity plays a significant role in explaining the cross sectional variation in stock returns.”\(^{92}\) They demonstrate that investors expect higher returns for buying stocks that are illiquid. In fact the observed asset returns must be an increasing and concave function of the transactions costs (Amihud and Mendelson, 1986). Vinay T. Datar, Narayan Y. Naik and Robert Radcliffe use the turnover rate of an asset as a proxy for its liquidity, it is the number of shares traded divided by the number of shares outstanding in that stock. To conduct their study, they use the data of all non-financial firms on the NYSE from July 31 1962 through December 1991. They collect the monthly returns over the period for each stock from the Centre for Research in Security Prices and the book value is extracted from the COMPUSTAT tapes. The first observation is that the turnover rate is significantly negatively related to stock returns. Then they check if the liquidity effect persists after checking for book-to-market value.

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\(^{89}\) http://www.investopedia.com/terms/b/bid-askspread.asp
\(^{90}\) http://www.investopedia.com/terms/l/liquidity.asp
\(^{91}\) Dimson E., *Risk Measurement when shares are subject to infrequent trading*, Journal of Financial Economics, 1979, pages 197-226
size and beta. By performing a univariate regression, they find a slope coefficient on size negative and significant. So we see that there is a liquidity premium compensate by higher returns. But the bi-variate regressions with size and turnover rate show that the higher returns is more due to the liquidity than size. So the size does not matter, what matter is the liquidity and frequency of trading in explaining the abnormal returns of small stocks. In general they find that a drop of 1% in the turnover rate is associated with a higher return of about 4.5 basis points per month.

4.3.3 The transactions costs and the “size effect”

Several researchers have investigated stock returns of small firms to check the returns net of transactions. Hans R. Stoll and Robert E. Whaley ask if an investor can earn abnormal returns net of all transactions costs by trading on the basis of the market value of the stock. They discover that the answer of their question depends on the investment horizon. They collect the monthly returns of all common stocks traded on the NYSE between January 1955 and December 1979 and use the CRSP equal-weighted and value-weighted market indices as market proxies. They rank the stock into ten groups according to their market value. Bid and Ask prices were collected for each NYSE stock for the last day of each year. The proportional spread is calculated as following:

\[
\frac{(askprice - bidprice)}{(askprice + bidprice)}
\]

They use the average dollar transaction size for each year to calculate the average commission rate. Then they are able to calculate the mean trading costs by using the mean percentage spread and the mean percentage commission rate on stocks within each portfolio in each year. After that, they show that the relative spread and commission rate is inversely proportional to the market value of stocks. In other words it is more costly to buy and sell small stocks than large stocks. The next step consists on using the two-parameter CAPM to apply to after transaction cost returns.

\[
R_{ac} = (1 + R_{bc})\times\frac{(1 - F)}{(1 + F)} - 1
\]

- \(R_{ac}\) = Return after trading costs
- \(R_{bc}\) = Return before trading costs
- \(F\) = proportional transaction

This equation is performed for each stock and each month of the period. They find that after incorporating trading costs, the largest stocks outperform small firms each year during the period 1960 through 1979. For the three first portfolios composed by the smallest stocks of the sample, the abnormal returns become negative, so it appears that after adjusting returns for trading costs the “size effect” still exists but in the opposite way since these stocks have abnormal negative returns. But they go further in their study by considering several investment horizons, 1 month, 2 month, 3 month, 4 month, 6 month and 12 month. They find negative after transactions costs returns for 1, 2 and 3 month investment period

but positive abnormal after transactions costs returns for 4, 6, and 12 month. They conclude that taking the transactions into account the CAPM is consistent for short term investment. Since the returns are not significantly different from zero (quiet positive abnormal returns for 4, 6 and 12 month investment period) the authors conclude that even for longer period investment the CAPM still hold if one adjusts returns for transactions costs.

However Paul Schlutz⁹⁴ is his study critics the results of Hans R. Stoll and Robert E. Whaley. In fact he argues that even after controlling for risk and transactions costs the size effect cannot be explained. By using a different methodology and sample he comes up with different results than Hans R. Stoll and Robert E. Whaley. Concerning the sample, in addition to the NYSE common stocks he uses the stocks listed on the American Stock Exchange. So the sample is bigger and more representative. The studied period is 1962 through 1978. He classifies the stocks in nine groups according to their average equity value. Regarding the transactions cost he uses the following formula:

$$\text{Cost} = \frac{(\text{commissiontobuy} + \text{commissiontosell} + \text{spread})}{(\text{askprice} + \text{commissiontobuy})}$$

By using the same two parameters CAPM as R. Stoll and Robert E. Whaley used, Schlutz finds contradictive results. The small firm portfolio is found to earn excess returns after transactions costs even for period as short as one month.

So Schlutz concludes that the “size effect cannot be totally explain by the transactions costs effect and therefore some other determinants might explain the size effect.

4.4 The seasonality of the size effect

According to other researcher the size effect is rather a temporary effect that appears mostly in January. In fact Donald B.KEIM in his study shows that “nearly fifty percent of the average magnitude of the risk adjusted premium of small firms relative to larger firms over this period is due to anomalous January abnormal returns.”⁹⁵ The sample use is all firms quoted on NYSE and AMEX for the period from 1963 to 1979, the daily returns are employed. The firms are ranked according to their market value for each year. The author adjusts the returns of each portfolio by risk and infrequent trading (we have seen in previous articles that infrequent trading can bias upward or downward the beta of a firm) and then investigate the month to month stability of the size anomaly. The evidence indicates clearly that the size effect is more prominent in January than in the other months. Closer examination of the effect within the month of January reveals that a large amount of the abnormal returns experienced in January takes place in the first five days of the year. The difference between the smallest stocks and largest stocks is about 3.2%; this abnormal positive return is constant for each year throughout the period. Moreover 10.5% of the annual size effect happens in the first day of trading each year and 26, 3% can be attributed to the first five trading days.

Several hypotheses regarding the January Effect have been raised. Reinganum’s research reveals that the January Effect may be due to tax loss selling. “The argument is that the prices of firms which have previously declined in price will decline further in the latter months of the year as owners sell off the shares to realize capital losses. Then, after the New Year, prices bounce up in the absence of selling pressure.” However the international evidence also suggests that while taxes seem relevant to the January effect, they are not the entire explanation. Other possible explanations could be related to the information effect. In fact Rozeff and Kinney (1976) note that “January marks the beginning and ending of several potentially important financial and informational events... January is the start of the tax year for investors, and the beginning of the tax and accounting years for most firms, and preliminary announcements of the previous calendar year’s accounting earnings and made”. So January is key period for firms and financial markets, it is a period of anticipation and uncertainty due to the publication of important information. This set of factors can lead investors to under reaction or overreaction.

4.5 Small stocks are prone to overreaction

Navin Chopra, Josef Lakonishok and Jay R investigate the issue to know whether or not stocks overreact. They use the data all common stock listed on the NYSE between 1926 and 1986. They rank the firms the firm each year according to their five years buy and hold returns and then assign them to one of twenty portfolios. Thus, the portfolio 20 is composed by extreme losers and portfolio1 by big winners. Portfolio 1 has an average annual return of 23, 7% over the period and Portfolio 20 has 13, 3%.They use an equally-weighted portfolio of NYSE stocks to calculate abnormal returns. They find abnormal returns even after controlling risk. Using annual data, the extreme winner portfolio underperforms the extreme loser portfolio with the same beta. But Zarowin (1990) show that in average losers tend to have smaller capitalizations than winners. The authors find the same correlation between size and loser. So they adjust each portfolio by size and find that there is an economically-significant overreaction effect above and beyond any size effect. Moreover by looking closer at the data they find that this overreaction effect is concentrated in January. Besides this fact, they find that the overreaction effect is stronger for smaller firms since the extreme loser portfolio is mostly composed by small firms. The authors suggest that since small firms stocks are hold by individuals and large firm stocks by institutional, “it seems that overreaction by individuals is more prevalent than overreaction by institutions.”

4.6 The stability of the size effect

We have seen previously that there is evidence that one can earn abnormal returns by investing in small firm stocks. But we have to ask if this effect is stable through time.

Philip Brown, Allan W. Kleidon and Terry A. Marsh investigate in their article the stability of excess returns obtained by ranking firms according to their market value of equity.

Their study is based on a sample of 566 firms the one that Reinganum used. The studied period is from June 1967 to December 1975. The firms are ranking according to their market value and the daily returns are adjusted by risk (beta estimated). Then they distinguish periods when the size effect is positive and periods when it is negative. For instance they find that for the period January 1967 to December 1975 shows both negative and positive size effect, the effect appears negative for the period 1967-1969. Thus for the period January 1976 to June 1979 the effect is also negative and significant. From January 1969 to December 1973 small firms experienced negative returns of about 25% per year and on the other side, from January 1974 to June 1979 they earned 25% excess returns in average.

So they conclude that even if there is expressions of a size effect it cannot be consider stable through time. The authors come up with the argument that different methodologies can lead to different results about the size anomaly.

It as to be noticed that Donald B.KEIM was aware of the study of Allan W.Kleidon and Terry A.Marsh, but it showed that the January Effect is stable even for the periods that experienced negative returns according to Allan W.Kleidon and Terry A.Marsh. But he agrees that for the rest of the year one can observe instability in the excess returns of small stocks.

4.7 Theories Summary

We have exposed in this part several theories that have investigated the size effect. First it appear that the CAPM or/and the Efficient Market Hypothesis are bias. The size effect is a reality; one can earn abnormal returns by investing in small and mid caps even after adjusting for risks. Several factors come into sight to explain this phenomenon. We sum up them as follows:

- **Risk omitted**: the size effect can be explained by a bias in beta, some risks related with this kind of stock are omitted and that leads to excess returns.

- **E/P ratio**: the size effect is link with the E/P ratio effect, meaning that the returns of small stock is influenced by the E/P ratio (itself an anomaly)

- **Trading Costs and Infrequent Trading**: small stocks are among the infrequent traded stocks. It causes the investors to require higher rate of returns to cover these fees. The infrequent trading creates higher ask-bid spread and so small stocks are costlier than large stocks to trade.

- **Overreaction**: since the small stocks are hold by individuals, they are more subject to overreaction when new information is released. Then certain euphoria is created around this kind of stocks.

However we have seen theories that minimize the size effect in some extent.

- **The January effect**: the size anomaly seems to be concentrated during the month of January. 50% of the yearly excess returns of the size effect can be explained by the January excess returns. So the size effect may be a seasonal effect.
The instability of the size effect: The anomaly is not stable through time; there are periods when the excess return of small stocks are positive and some periods when the effect is negative.

To conclude, the size effect depends on several factors which have to be taken into account when investigating the size anomaly. Every factor appears to be related to each other because none of those is able to totally explain the size effect. In our thesis we could not explore all the variables that seem to play a role in explaining the size effect. They are several reasons for such a breach. We have a limited amount of time to conduct the study which forces us to focus on few variables. Moreover we miss a lot of data for some variables (for instance the trading costs). Nevertheless the purpose of the study is to first show if we can demonstrate the existence of the size over the studied period. The second step will be to see if the theories can still illustrate our theories and if they are realistic hypothesis.
5. DATA ANALYSIS

This chapter consists one presenting our results, we go gradually from the raw returns to the volatility and then to the adjusted return, we also make the link between results and theories. Finally we present the results of the one sample T-test for each periods and indexes.

5.1 Empirical Findings

Comments about the figures in the following tables: for a better comprehension and reading of the figures below, we have to precise that the results have to be multiplied by 100 to obtain percentage. For instance for the S&P 500 in 1996 the figure “0,16465” means that the S&P 500 has experienced a return of 16,465% in 1996 (0, 16465*100).

Thus the excess returns are calculated in the following way for each period (1 year, 2 years, 5 years, 10 years) and for each kind of returns ( raw and adjusted returns) by subtracting the return of the small or mid cap indices to the return of the market index. In mathematics terms it means:

- S&P small cap 600 – S&P 500 = excess return S&P small cap 600
- S&P mid cap 400 – S&P 500 = excess return mid cap 400
- Russell 3000 – Russell Mid Cap = excess return Russell Mid Cap

Therefore, for example in 1996 the excess return 0,03479 means that the S&P small cap 600 has outperformed the S&P 500 (the market) by 3,479% (0,03479*100).

- 1-Year Return

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<td>-0,05313</td>
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<td>0,08219</td>
<td>0,05654</td>
<td>0,08581</td>
</tr>
<tr>
<td>Excess return S&amp;P Small Cap 600</td>
<td>0,03479</td>
<td>-0,00868</td>
<td>-0,25497</td>
<td>-0,01833</td>
<td>0,19940</td>
<td>0,17391</td>
<td>0,06143</td>
<td>0,12571</td>
<td>0,11110</td>
<td>0,03532</td>
</tr>
</tbody>
</table>

Table 3: 1 year raw returns for S&P indices

- Comments: the size effect seems to be unstable the first 3 years, switching between negative and positive abnormal returns. But then the S&P Mid Cap 400 shows 8 excess positive returns in a raw.

Moreover we can notice that the returns are very different from on year to another for example in 2000 the excess return is 24,99% and then falls to 12,24% in 2001. These differences are probably due to economic reasons that we will not discuss in this study because it is not the purpose of the study.

Comments: again the results are unstable and very different the first 4 years then between 2000 and 2005 the excess returns are always positive but show some gaps. For example in 2004 the S&P small cap 600 experienced an excess return of 11, 11% and in 2005 the excess return is just 3,532%, it gives a difference of 7, 5%.

Negative excess returns for Russell Mid Cap: 1998/1999

Comments: we can observe the same path as with the S&P indices, the first 4 years show unstable returns (1996:4,185%;1997:0,0529%;1998:-13%;1999:-3,183%) but then from 2000 to 2005 the results are positive and stable. Again, we can remark that there are huge differences when comparing the returns, this is probably due to economic conditions that influence the behavior of financial markets.


Comments: The 1 year raw returns fro Russell 2000 show some stability, they can be divided into two periods 1996-1998 they are negative and from 1999 to 2005 they are positive. We can still observe pronounced differences from one year to another, for instance 17, 51% in 2003 and only 4, 25% in 2004.

2-Year Return


- **Comments:** We can observe a reversal of the returns, in fact between 1996 and 1999 the 2 year returns are negative but then the three next periods of 2 years excess returns are positive. Moreover the difference are quiet high, indeed the period 1996-1997 show a return of -1.568% and in 1998-1999 the excess return is far more negative (-13.77%). Thus if we look at the period 2000-2001 and 2002-2003 we can notice that the returns have been divided by two, going from 35.39% to 15.61%.

- **Comments:** We can notice that the size effect is even more pronounced for the Small Cap 600, in fact the first two periods the excess returns are even more negative than Mid Cap 400 (-1.56% compare to – 3.3% in 1996-1997 and -13.77% compare to -38.47%). Moreover we can see that the periods 2000-2001/2002-2003/2004-2005 are also positive as the Mid Cap 400 but there are not significantly higher. (35.39% compare to 38.86% in 2000-2001 and 15.61% compare to 17.13% in 2002-2003).

- **Negative excess returns for Russell Mid Cap:** 1998-1999
- **Comments:** Russell Mid Cap shows only one negative excess return period of -18% in 1998-1999, the period 1996-1997 has experienced a small positive excess return of about 2% and the three other periods 2000-2001/2002-2003/2004-2005 have high positive excess returns. So once again we observe instability with the excess returns.


<table>
<thead>
<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Russell 3000</td>
<td>0.50196</td>
<td>0.45489</td>
<td>-0.16747</td>
<td>0.00724</td>
<td>0.12558</td>
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<tr>
<td>Russell Mid Cap</td>
<td>0.52268</td>
<td>0.27472</td>
<td>0.01827</td>
<td>0.15751</td>
<td>0.32789</td>
</tr>
<tr>
<td>Russell 2000</td>
<td>0.38569</td>
<td>0.17370</td>
<td>-0.01558</td>
<td>0.15278</td>
<td>0.15921</td>
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<tr>
<td>Excess return</td>
<td>0.02072</td>
<td>-0.18018</td>
<td>0.18575</td>
<td>0.15027</td>
<td>0.20231</td>
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<tr>
<td>Excess return</td>
<td>-0.11627</td>
<td>-0.28119</td>
<td>0.15190</td>
<td>0.14554</td>
<td>0.03362</td>
</tr>
</tbody>
</table>

Table 6: 2 years raw returns for Russell Indices
• 5-Year Return

<table>
<thead>
<tr>
<th>Index</th>
<th>Time Period Range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1996-2000</td>
</tr>
<tr>
<td>S&amp;P 500</td>
<td>1.07585</td>
</tr>
<tr>
<td>S&amp;P Mid Cap 400</td>
<td>1.34073</td>
</tr>
<tr>
<td>S&amp;P Small Cap 600</td>
<td>0.81045</td>
</tr>
<tr>
<td>Excess return</td>
<td></td>
</tr>
<tr>
<td>S&amp;P Mid Cap 400</td>
<td>0.26489</td>
</tr>
<tr>
<td>Excess return</td>
<td></td>
</tr>
<tr>
<td>S&amp;P Small Cap 600</td>
<td>-0.26539</td>
</tr>
</tbody>
</table>

Table 7: 5 years raw returns for S&P indices

- **Positive excess returns for S&P Mid cap 400:** 1996-2000/2001-2005
- **Negative excess returns for S&P Mid cap 400:** none
- **Comments:** The 5 year excess returns of the S&P Mid Cap 400 are both positive and very high, about 26% and 48%. Still we can notice a difference of about 22% between the two periods. We have to specify that it is not the purpose of this study to explain and analyze these differences from period to the other.

- **Positive excess returns for S&P Small Cap 600:** 2001-2005
- **Negative excess returns for S&P Small Cap 600:** 1996-2000
- **Comments:** The behavior of the Small Cap 600 differs from the one of S&P Mid Cap 400; indeed it shows a high negative excess return for the period 1996-2000 of about -26% and then the excess return for the period 2001-2005 is 61, 82% so even higher than the excess return of the S&P Mid Cap 400 for the same period. This is another evidence for the instability of the size effect.

<table>
<thead>
<tr>
<th>Index</th>
<th>Time Range Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1996-2000</td>
</tr>
<tr>
<td>Russell 3000</td>
<td>1.00727</td>
</tr>
<tr>
<td>Russell Mid Cap</td>
<td>1.13533</td>
</tr>
<tr>
<td>Russell 2000</td>
<td>0.53317</td>
</tr>
<tr>
<td>Excess return</td>
<td></td>
</tr>
<tr>
<td>Russell Mid Cap</td>
<td>0.12806</td>
</tr>
<tr>
<td>Excess return</td>
<td></td>
</tr>
<tr>
<td>Russell 2000</td>
<td>-0.47411</td>
</tr>
</tbody>
</table>

Table 8: 5 years raw returns for Russell Indices

- **Positive excess returns for Russell Mid Cap:** 1996-2000/2001-2005
- **Negative excess returns for Russell Mid Cap:** none
- **Comments:** The two periods of five years indicate positive excess returns for the Russell Mid Cap but they are very different, in fact the index earns 12,80% for the period 1996-2000 and 56,87% for 2001-2005, so about 4,5 times more.

- **Positive excess returns for Russell 2000:** 2001-2005
- **Negative excess returns for Russell 2000:** 1996-2000
- **Comments:** The Russell 2000 shows negative excess return for 1996-2000 of -47%, it is a huge difference. The Russell 3000 has a raw return of about 100% and in the mean time the Russell
2000 has a return of only 53%. The period 2001-2005 show a positive excess return of about 36% so the out performance is quiet pronounced.

General comments about the 5 year raw excess return: We can notice that it seems there is an obvious parallelism in terms of performance between the two classes of indices. In fact the Mid Caps indices have experienced positive excess return for both periods and the Small Caps had first a negative excess return and then a positive excess return. So it is of interest to remark the similarity between the two kind of indices despite the fact they have different methodologies.

- **10-Year Return**

<table>
<thead>
<tr>
<th>Index</th>
<th>Time Period Range</th>
<th>Excess return</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;P 500</td>
<td>1996-2005</td>
<td>0.9266</td>
</tr>
<tr>
<td>S&amp;P Mid Cap 400</td>
<td></td>
<td>2.3422</td>
</tr>
<tr>
<td>S&amp;P Small Cap 600</td>
<td></td>
<td>1.8911</td>
</tr>
<tr>
<td>Excess return</td>
<td></td>
<td>1.3805</td>
</tr>
<tr>
<td>S&amp;P Mid Cap 400</td>
<td></td>
<td>0.92851</td>
</tr>
<tr>
<td>Excess return</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9: 10 years raw returns for S&P indices

- Positive excess returns for S&P Mid cap 400: 1996-2005
- Negative excess returns for S&P Mid cap 400: none
- Comments: The 10 years excess return is 138% which is very high and can be consider as a very score. The S&P Mid Cap 400 capitalization has been multiplied by more than two during this period.

- Positive excess returns for S&P Small Cap 600: 1996-2005
- Negative excess returns for S&P Small Cap 600: none
- Comments: Over this period the index experience a positive excess return of 92.85%, this excess return is enormous but lower than the excess return of the S&P Mid Cap 400 for the same period.

<table>
<thead>
<tr>
<th>Index</th>
<th>Time Range Period</th>
<th>Excess return</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russell 3000</td>
<td>1996-2005</td>
<td>1.00053</td>
</tr>
<tr>
<td>Russell Mid Cap</td>
<td></td>
<td>2.30624</td>
</tr>
<tr>
<td>Russell 2000</td>
<td></td>
<td>1.13463</td>
</tr>
<tr>
<td>Excess return</td>
<td></td>
<td>1.30571</td>
</tr>
<tr>
<td>Russell Mid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excess return</td>
<td></td>
<td>0.13411</td>
</tr>
</tbody>
</table>

Table 10: 10 years raw returns for Russell Indices

- Positive excess returns for Russell Mid Cap: 1996-2005
- Negative excess returns for Russell Mid Cap: none
Comments: The Russell Mid Cap shows a excess return of 130%, like S&P Mid Cap 400 this excess return is very high and we can also notice that these two returns are almost similar (S&P Mid Cap 400: 138% The Russell Mid Cap 130%)

Negative excess returns for Russell 2000: none
Comments: The excess return of the Russell 2000 for the period differ considerably from the other indices, in fact the excess return is positive but very small (13,41%), this huge difference is probably due to the methodology used to build the index.

5.2 Cumulated volatility

These graphs illustrate the cumulated volatility (see calculation 3.4) of all indices throughout the studied period.

S&P indices: we can observe that from 1996/09 until the end of the period the cumulated volatility of the S&P Small Cap 600 is higher than the one of S&P 500 and S&P Mid Cap 400. Thus from 1998/09 until the end of the period the S&P Mid Cap 400 has a higher volatility than the S&P 500. After 1998/09 the graph shows us that the level of volatility is ranked according to the size of company indices represent. In fact it seems that the smaller the companies in the index the higher is the volatility so the risk.

Russell Indices: The same remarks can be done looking at Graph 2, the Russell 2000 has always a volatility higher than the cumulated volatility of Russell 3000 and Russell Mid Cap. Thus from 1998/09 until the end of the period the Russell Mid Cap has a higher cumulated volatility than the Russell 3000. Once again, the risk (the volatility) seems to be related with the size of companies.

These observations give us reasons to take volatility into account when calculating returns because small stocks appear to be far more risky than other kind of securities. That is why later in this chapter, we present the risk adjusted risk in order to take into consideration the risk of stocks measured by the standard deviation.
Volatility of Return (Monthly)

Graph 1: cumulated volatility for S&P indices

Graph 2: cumulated volatility for Russell Indices
5.3 Adjusted Return

In section 1.1 it is observable that during the majority of periods the returns of small and medium indices of S&P and Russell were positive. However these returns do not take into account the risk factor (systematic and unsystematic risks). Thus it partially accomplishes the aim of this study. To achieve the entire objective the risk factor is considered in this section as the volatility of indices are calculated and they are used to adjust all indices by creating a measure of return regarding the risk involved (return divided by volatility). This provides the respective unit of return from each return of risk.

We attempt to distinguish differences between the results of raw returns and risk adjusted returns, we want to see how risk affects the returns of the indices.

- **1-Year Return**

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;P 500</td>
<td>0.22518</td>
<td>0.23495</td>
<td>0.17418</td>
<td>0.13346</td>
<td>-0.06477</td>
<td>-0.07320</td>
<td>-0.17232</td>
<td>0.18619</td>
<td>0.11646</td>
<td>0.04205</td>
</tr>
<tr>
<td>S&amp;P Mid Cap 400</td>
<td>0.20713</td>
<td>0.26520</td>
<td>0.10038</td>
<td>0.11415</td>
<td>0.07490</td>
<td>0.00137</td>
<td>-0.11794</td>
<td>0.24787</td>
<td>0.14322</td>
<td>0.11364</td>
</tr>
<tr>
<td>S&amp;P Small Cap 600</td>
<td>0.21979</td>
<td>0.23106</td>
<td>-0.01121</td>
<td>0.10395</td>
<td>0.05156</td>
<td>0.04087</td>
<td>-0.11668</td>
<td>0.24163</td>
<td>0.16737</td>
<td>0.05760</td>
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<tr>
<td>Excess return S&amp;P Mid Cap 400</td>
<td>-0.01805</td>
<td>0.03025</td>
<td>-0.07360</td>
<td>-0.01931</td>
<td>0.13957</td>
<td>0.07457</td>
<td>0.05438</td>
<td>0.06168</td>
<td>0.02676</td>
<td>0.07159</td>
</tr>
<tr>
<td>Excess return S&amp;P Small Cap 600</td>
<td>-0.00538</td>
<td>-0.00389</td>
<td>-0.18539</td>
<td>-0.02951</td>
<td>0.11633</td>
<td>0.11407</td>
<td>0.05563</td>
<td>0.05545</td>
<td>0.05091</td>
<td>0.01555</td>
</tr>
</tbody>
</table>

Table 11: 1 year adjusted returns for S&P indices

- **Negative adjusted excess returns for S&P Mid cap 400:** 1996/1998
- **Comments:** There is no difference in terms of returns’ sign with the raw returns (see Table 1), the returns are positive for the same years even when we take risk into account. We will note repeat the comments about the reversal trend and the instability of the effect that we have made in previously.

- **Comments:** When taking risk into consideration we can observe that the year 2004 and 2005 have excess negative returns. So we can state that in 2004 and 2005 the raw return of the S&P Small Cap 600 were not enough high to compensate for the risk, the trade off between risk/return was unbalanced. The reward for holding this index in a portfolio during 2004 and 2005 did not reflect the level of risk that an investor took.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Russell 3000</td>
<td>0.10938</td>
<td>0.10452</td>
<td>0.06886</td>
<td>0.06956</td>
<td>-0.02103</td>
<td>-0.03517</td>
<td>-0.05998</td>
<td>0.10152</td>
<td>0.06176</td>
<td>0.03498</td>
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<tr>
<td>Russell Mid Cap</td>
<td>0.09981</td>
<td>0.11280</td>
<td>0.03246</td>
<td>0.07116</td>
<td>0.01884</td>
<td>-0.01759</td>
<td>-0.04624</td>
<td>0.12948</td>
<td>0.09396</td>
<td>0.06392</td>
</tr>
<tr>
<td>Russell 2000</td>
<td>0.08790</td>
<td>0.10232</td>
<td>-0.00765</td>
<td>0.08620</td>
<td>-0.00342</td>
<td>0.01916</td>
<td>-0.05688</td>
<td>0.12211</td>
<td>0.05671</td>
<td>0.02427</td>
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<tr>
<td>Excess return Russell Mid</td>
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<td>-0.03639</td>
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<td>0.01758</td>
<td>0.03174</td>
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<td>0.02894</td>
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<tr>
<td>Excess return Russell 2000</td>
<td>-0.02148</td>
<td>-0.00220</td>
<td>-0.07651</td>
<td>0.01663</td>
<td>0.01761</td>
<td>0.05433</td>
<td>0.00310</td>
<td>0.02059</td>
<td>-0.00505</td>
<td>-0.01071</td>
</tr>
</tbody>
</table>

Table 12: 1 year adjusted returns for Russell Indices
Comments: excess returns of 2004 and 2005 become negative when taking risk into account, again it shows the importance of considering the factor risk when calculating returns.

Comments: 2004 shows a negative adjusted excess return for the Russell 2000 even tough it was positive in Table 2. It decreased from 4.25% (see Table 2) to -0.05%.

Comments about 1 year adjusted return: we have seen that some years switch from positive excess return to negative excess return when taking risk into account, moreover 2004 is a “dark” year since S&P Small Cap 600, Russell Mid Cap and Russell 2000 have positive raw excess return (see tables 1 and 2) and then have negative adjusted excess return.

- 2-Year Return

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;P 500</td>
<td></td>
<td>0.20766</td>
<td>0.15449</td>
<td>-0.06928</td>
<td>-0.02153</td>
<td>0.08110</td>
</tr>
<tr>
<td>S&amp;P Mid Cap 400</td>
<td></td>
<td>0.22409</td>
<td>0.10422</td>
<td>0.03971</td>
<td>0.04179</td>
<td>0.12936</td>
</tr>
<tr>
<td>S&amp;P Small Cap 600</td>
<td></td>
<td>0.21323</td>
<td>0.03007</td>
<td>0.04658</td>
<td>0.04784</td>
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<tr>
<td>Excess return</td>
<td>S&amp;P Mid Cap 400</td>
<td>0.01643</td>
<td>-0.05027</td>
<td>0.10900</td>
<td>0.06332</td>
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<tr>
<td>Excess return</td>
<td>S&amp;P Small Cap 600</td>
<td>0.00557</td>
<td>-0.12441</td>
<td>0.11586</td>
<td>0.06937</td>
<td>0.03271</td>
</tr>
</tbody>
</table>

Table 13: 2 years adjusted returns for S&P indices

Negative adjusted excess returns for S&P Mid cap 400: 1998-1999
Comments: In this case we can observe a new phenomena, in fact the 2 years adjusted excess return for the period 1996-1997 is positive (1,643%) even though is was negative in Table 3. This is due to the fact that when taking risk into account the S&P 500 has a lower adjusted return than the S&P Mid Cap 400, it means that the market has a too low raw return compare to its level of volatility or that the Mid Cap 400 a too low volatility compare to its raw return.

Comments: We can observe the same behavior with the S&P Small Cap 600, in fact in Table 3 we observe a negative raw excess return and when taking risk into account this excess return becomes positive ( 0.05%) but however it is close to zero.
Table 14: 2 years adjusted returns for Russell Indices

- Negative adjusted excess returns for Russell Mid Cap: 1998-1999
- Comments: There is no reversal with the Russell Mid Cap, if we compare these results with the results of Table 4 we can observe that the sign of the returns remains the same with only the period 1998-1999 which has a negative adjusted excess return. However we can notice that this negative adjusted excess return is lower than the raw excess return (-8% compare to -18%, see table 4).

- Comments: This is the same situation for Russell 2000 as Russell Mid Cap, there is no reversal of the size effect even after taking risk into account but we can notice the negative excess return differ from Table 4. Indeed the period 1996-1997 has a raw excess return of -11.62% (Table 4) while the adjusted excess return is -18% so the risk intensifies the effect. On the opposite, in 1998-1999 the raw excess return is -28% (see Table 4) even though the adjusted excess return is -20% so this time the risk minimizes the effect.

5-Year Return

Table 15: 5 years adjusted returns for S&P indices

- Positive adjusted excess returns for S&P Mid cap 400: 2001-2005
- Negative adjusted excess returns for S&P Mid cap 400: 1996-2000
- Comments: We can remark that the excess return of the period 1996-2000 becomes negative when taking risk into account. It goes from 26% (see Table 5) to -0.09% so the return is almost totally canceled by the risk.

- Positive adjusted excess returns for S&P Small Cap 600: 2001-2005

Comments: Here there is no reversal, nevertheless we can notice that for the period 2001-2005 the risk minimizes. Indeed, the raw excess return is 61.82% (see table 5) and the adjusted excess return is only 17%, so the risk affects the performance and therefore the size effect.

<table>
<thead>
<tr>
<th>Index</th>
<th>Time Period Range</th>
<th>1996-2000</th>
<th>2001-2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russell 3000</td>
<td></td>
<td>0.25688</td>
<td>-0.00127</td>
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<tr>
<td>Russell Mid Cap</td>
<td></td>
<td>0.32943</td>
<td>0.17733</td>
</tr>
<tr>
<td>Russell 2000</td>
<td></td>
<td>0.11434</td>
<td>0.09886</td>
</tr>
<tr>
<td>Excess return</td>
<td></td>
<td>0.07255</td>
<td>0.17861</td>
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<tr>
<td>Excess return</td>
<td></td>
<td>-0.14254</td>
<td>0.10013</td>
</tr>
</tbody>
</table>

Table 16: 5 years adjusted returns for Russell Indices

Positive adjusted excess returns for Russell Mid Cap: none

Comments: The Russell Mid Cap experience no reversal of the size effect (see table 6), however we can notice that the risk minimizes again the raw return in fact both periods see their excess returns decrease when taking risk into account, the raw excess return is 12.80% in 1996-2000 (see table 6) and the adjusted excess return is only 7.255% so it makes a difference of 5.5%. Thus the excess return goes from 56.8% (see table 6) to 17% for the period 2001-2005, the excess return is divided by more than 3.

Positive adjusted excess returns for Russell 2000: 2001-2005


Comments: Russell 2000 experiences no reversal for the 5 years adjusted excess return however we can observe huge differences when comparing the adjusted excess return with the raw excess return (see table 6), in fact, for instance the adjusted excess return for the period 2001-2005 is 3.6 times lower than the raw excess return (10% compare to 36%; see Table 6).

• 10-Year Return

<table>
<thead>
<tr>
<th>Index</th>
<th>Time Period Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;P 500</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.12973</td>
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<tr>
<td>S&amp;P Mid Cap 400</td>
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<td></td>
<td>0.19967</td>
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<td>S&amp;P Small Cap 600</td>
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<td></td>
<td>0.16172</td>
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<td>Excess return</td>
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</tr>
<tr>
<td></td>
<td>0.06994</td>
</tr>
<tr>
<td>Excess return</td>
<td></td>
</tr>
<tr>
<td>S&amp;P Small Cap 600</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.03199</td>
</tr>
</tbody>
</table>

Table 17: 10 years adjusted returns for S&P indices

Positive adjusted excess returns for S&P Mid cap 400: 1996-2005

Negative adjusted excess returns for S&P Mid cap 400: none

Comments: The 10 year adjusted excess return is still positive even when taking risk into account, but the size effect is far less pronounced since the adjusted excess return is equal to
6.99% (see table 7) even tough the raw excess return is equal to 138%. This is an enormous difference; we see once again the importance of taking risk into consideration.

- **Positive adjusted excess returns for S&P Small Cap 600: 1996-2005**
- **Negative adjusted excess returns for S&P Small Cap 600: none**
- **Comments:** Same situation for the S&P Small Cap 600, the risk makes the excess return go from 92.85% (see table 7) to only 3.19%. The risk really minimizes the size effect even tough the excess return remains positive and respectable.

<table>
<thead>
<tr>
<th>Index</th>
<th>Time Period Range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1996-2005</td>
</tr>
<tr>
<td>Russell 3000</td>
<td>0.13135</td>
</tr>
<tr>
<td>Russell Mid Cap</td>
<td>0.14735</td>
</tr>
<tr>
<td>Russell 2000</td>
<td>0.10730</td>
</tr>
<tr>
<td>Excess return</td>
<td>0.01600</td>
</tr>
<tr>
<td>Russell Mid</td>
<td></td>
</tr>
<tr>
<td>Excess return</td>
<td>-0.02405</td>
</tr>
<tr>
<td>Russell 2000</td>
<td></td>
</tr>
</tbody>
</table>

Table 18: 10 years adjusted returns for Russell Indices

- **Positive adjusted excess returns for Russell Mid Cap: 1996-2005**
- **Negative adjusted excess returns for Russell Mid Cap: none**
- **Comments:** The 10 years adjusted excess return of the Russell Mid Cap is still positive but far more smaller than the raw excess return (130% see table 8), so again the risk tend to cancel the size effect.

- **Positive adjusted excess returns for Russell 2000: none**
- **Negative adjusted excess returns for Russell 2000: 1996-2005**
- **Comments:** For the Russell 2000, the risk makes the excess return even negative, (it goes from a raw excess return of 13% (see table 8) from a risk adjusted excess return of -2.4%. So the risk cancels the positive size effect.

### 5.4 General comments about the adjusted excess returns

First we can notice that when taking into consideration the risk implied by small and mid caps stocks, the size effect is minimize but still obvious. These results are consistent with the study of Marc R. Reinganum (see theoretical framework 4.1), we also find positive excess returns for small and mid caps even after considering risk into account. So even if the studied period and methodology differ from the ones use by Marc R. Reinganum, our findings are consistent with his research results.

Moreover since we find abnormal excess returns for most of the intervals, we can point out that other factors seem to generate abnormal returns. We can raise the same question as Rolf W.Bank (see theoretical framework) to know weather or not the size is a proxy for other variables that influence the returns of this class of securities. Because we see that even the risk is not able to explain the positive or negative excess return alone.

An other key point is the stability of the size effect, indeed as pointed out by Philip Brown, Allan W.Kleidon and Terry A.Marsh (see theoretical framework 4.6) the size effect seem to be instable
through time. Our results are consistent with this theory. There are periods when the size effect is positive and stable, for instance the Small Cap 600 earned positive adjusted excess returns each year from 2000 to 2005 or both Mid Cap 400 index and Small Cap 600 index show positive two-year abnormal returns for 2000-2002, 2002-2004 and 2004-2006 in a raw. Thus we have to pay attention to some results with are not very different from zero.

- One sample T-test

To perform this One sample T-test we took the excess returns shown in the Data Analysis part and put them in a SPSS spreadsheet. Then we conducted a T-test with a $\alpha$ equal to 5%.

We can observe that none of the results are significantly different from zero (at the 5% confidence level) except the 1 year raw excess return for S&P Mid Cap 400 (0.03). In the next part we will discuss these results. We have also test the results at the 10% confidence level but they are still not significant (the results of the 10% level confidence are not shown here). It is useless to test results up to 10% of confidence level.

<table>
<thead>
<tr>
<th>Tested Value</th>
<th>Number of observations</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Significance (2-tailed)</th>
<th>95% Confidence Interval of the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw excess returns Mid Cap 400</td>
<td>10</td>
<td>0.0665</td>
<td>0.08178</td>
<td>0.03</td>
<td>Lower: 0.0080 Upper: 0.1250</td>
</tr>
<tr>
<td>Raw excess returns Small Cap 600</td>
<td>10</td>
<td>0.046</td>
<td>0.12863</td>
<td>0.287</td>
<td>Lower: -0.0460 Upper: 0.1379</td>
</tr>
<tr>
<td>Raw excess returns Russell Mid Cap</td>
<td>10</td>
<td>0.0363</td>
<td>0.07579</td>
<td>0.164</td>
<td>Lower: -0.0179 Upper: 0.0906</td>
</tr>
<tr>
<td>Raw excess returns Russell 2000</td>
<td>10</td>
<td>0.0106</td>
<td>0.10765</td>
<td>0.764</td>
<td>Lower: -0.0665 Upper: 0.0876</td>
</tr>
<tr>
<td>Adjusted excess returns Mid Cap 400</td>
<td>10</td>
<td>0.0348</td>
<td>0.0602</td>
<td>0.101</td>
<td>Lower: -0.0083 Upper: 0.0787</td>
</tr>
<tr>
<td>Adjusted excess returns Small Cap 600</td>
<td>10</td>
<td>0.0184</td>
<td>0.08657</td>
<td>0.519</td>
<td>Lower: 0.00066 Upper: 0.0803</td>
</tr>
<tr>
<td>Adjusted excess returns Russell Mid Cap</td>
<td>10</td>
<td>0.0124</td>
<td>0.02282</td>
<td>0.119</td>
<td>Lower: 0.0039 Upper: 0.0287</td>
</tr>
<tr>
<td>Adjusted excess returns Russell 2000</td>
<td>10</td>
<td>-0.0004</td>
<td>0.03404</td>
<td>0.974</td>
<td>Lower: -0.0247 Upper: 0.0240</td>
</tr>
</tbody>
</table>

Table 19: One sample T-test for the 1 year raw and adjusted excess returns

<table>
<thead>
<tr>
<th>Tested Value</th>
<th>Number of observations</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Significance (2-tailed)</th>
<th>95% Confidence Interval of the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw excess returns Mid Cap 400</td>
<td>5</td>
<td>0.1016</td>
<td>0.18718</td>
<td>0.292</td>
<td>Lower: 0.1308 Upper: 0.3340</td>
</tr>
<tr>
<td>Raw excess returns Small Cap 600</td>
<td>5</td>
<td>0.0601</td>
<td>0.28991</td>
<td>0.667</td>
<td>Lower: 0.2899 Upper: 0.4201</td>
</tr>
<tr>
<td>Raw excess returns Russell Mid Cap</td>
<td>5</td>
<td>0.0758</td>
<td>0.15984</td>
<td>0.349</td>
<td>Lower: 0.1227 Upper: 0.2742</td>
</tr>
<tr>
<td>Raw excess returns Russell 2000</td>
<td>5</td>
<td>0.0133</td>
<td>0.18513</td>
<td>0.88</td>
<td>Lower: 0.2431 Upper: 0.2166</td>
</tr>
<tr>
<td>Adjusted excess returns Mid Cap 400</td>
<td>5</td>
<td>0.0373</td>
<td>0.05925</td>
<td>0.231</td>
<td>Lower: 0.0362 Upper: 0.1109</td>
</tr>
<tr>
<td>Adjusted excess returns Small Cap 600</td>
<td>5</td>
<td>0.0198</td>
<td>0.09062</td>
<td>0.65</td>
<td>Lower: -0.0927 Upper: 0.1323</td>
</tr>
<tr>
<td>Adjusted excess returns Russell Mid Cap</td>
<td>5</td>
<td>0.0758</td>
<td>0.15984</td>
<td>0.349</td>
<td>Lower: 0.1227 Upper: 0.2742</td>
</tr>
<tr>
<td>Adjusted excess returns Russell 2000</td>
<td>5</td>
<td>-0.0133</td>
<td>0.18513</td>
<td>0.88</td>
<td>Lower: -0.2431 Upper: 0.2166</td>
</tr>
</tbody>
</table>

Table 20: One sample T-test for the 2 year raw and adjusted excess returns

<table>
<thead>
<tr>
<th>Tested Value</th>
<th>Number of observations</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Significance (2-tailed)</th>
<th>95% Confidence Interval of the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw excess returns Mid Cap 400</td>
<td>2</td>
<td>0.3746</td>
<td>0.15512</td>
<td>0.181</td>
<td>Lower: 0.1-0.192 Upper: 1.7683</td>
</tr>
<tr>
<td>Raw excess returns Small Cap 600</td>
<td>2</td>
<td>0.1764</td>
<td>0.62481</td>
<td>0.758</td>
<td>Lower: 0.5-0.4373 Upper: 5.7901</td>
</tr>
<tr>
<td>Raw excess returns Russell Mid Cap</td>
<td>2</td>
<td>0.3464</td>
<td>0.31164</td>
<td>0.359</td>
<td>Lower: 2.4516 Upper: 3.1484</td>
</tr>
<tr>
<td>Raw excess returns Russell 2000</td>
<td>2</td>
<td>0.0571</td>
<td>0.56874</td>
<td>0.913</td>
<td>Lower: -0.5-0.3557 Upper: 5.2415</td>
</tr>
<tr>
<td>Adjusted excess returns Mid Cap 400</td>
<td>2</td>
<td>0.0692</td>
<td>0.11186</td>
<td>0.542</td>
<td>Lower: -0.9-0.9358 Upper: 1.0742</td>
</tr>
<tr>
<td>Adjusted excess returns Small Cap 600</td>
<td>2</td>
<td>0.0353</td>
<td>0.19679</td>
<td>0.842</td>
<td>Lower: -1.7328 Upper: 1.8034</td>
</tr>
<tr>
<td>Adjusted excess returns Russell Mid Cap</td>
<td>2</td>
<td>0.1256</td>
<td>0.07499</td>
<td>0.254</td>
<td>Lower: 0.5-0.462 Upper: 0.7994</td>
</tr>
<tr>
<td>Adjusted excess returns Russell 2000</td>
<td>2</td>
<td>-0.0212</td>
<td>0.1716</td>
<td>0.89</td>
<td>Lower: -1.5-1.5629 Upper: 1.5205</td>
</tr>
</tbody>
</table>

Table 21: One sample T-test for the 5 year raw and adjusted excess returns
We can notice that for each variable tested the 95% confidence interval of the difference contains 0, in fact the upper difference of the interval is always negative except for the 1 year raw excess return for S&P Mid Cap 400, so it means again that we cannot reject $H_0$.

In the tables above we can detect a high standard deviation, most of the variables show an enormous standard deviation, for instance the 1 year raw excess return for Russell 2000: 0.764 or the 2 year adjusted excess return for S&P Small Cap 600, we are not going to mention them all. But this high standard deviation could be one of the reasons why the results are not significant.

Concerning the means, we can see that most of them are close to zero, it could be another explanation for the results to be not significant. But we can pointed out the fact that even if most of the mean excess returns are close to zero most of them are between 1% and 3%, it can be consider as a good score but this is a personal opinion that has no statistical validity. Another fact that can be underlined is that few mean returns are negative among the different variables.

Finally it has to be said that an one sample T-test is impossible to perform for the 10 years period because just one figure is available, SPSS needs at least two observations to run such a test.

- **Hypothesis review**

The null hypothesis ($H_0 : \rightarrow R_i - R_j = 0$)$^{100}$ cannot be rejected in our study according to the One Sample T-Test, the results show too many different situations, in fact sometimes the small and mid caps outperform the market, sometimes they outperform the market or they have a null excess return. Therefore we see that the mean of excess return are very close to zero and that the standard deviations are very high, so these variables could be the reasons why we find insignificant results. Moreover the number of observations may be too low (10, 5 and 2) to perform such test.

Our results are never significant (at the 5% level of confidence) except for the 1 year raw excess return for S&P Mid Cap 400 (0.03). Therefore the results are not consistent with the theories we have seen, it seems that this not possible to take advantage of the size effect in the context of a passive strategy (see definition). Our approach is original compare to the ones of the authors we have studied and it leads us with different evidence.

Thus we can state it is not possible to outperform the market by investing in small and medium caps in the context of a passive strategy. In fact even if positive or negative abnormal returns can be earned (by buying or selling a small or medium caps portfolio) in average the excess returns are close to zero and not significantly different from zero for each investment horizons and each indices (see one sample T test). So if an investor earns excess return it would be more due to luck than evidence of a size effect. Taking advantage of the size effect would be a gambling strategy in the context of a passive strategy.

The theories we have seen previously are realistic hypothesis to explain our results. Unfortunately due to the time constraint to do this research and data availability, we were not able to test the well known factors like trading costs, E/P ratio effect, or January effect.

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$^{100} R_i =$ small or a medium cap index depending which one is studied and $R_j =$ market index.
• Different Indices Methodologies

The indices methodologies can be considered the main reason of the different results presented in this chapter when the small and medium cap indices are compared to their respective market proxies. The S&P 500 uses an industry classification while Russell 3000 uses only market capitalization. Moreover S&P 500 covers 75% of U.S. equity market while Russell 3000 uses 98% of the same market, not to mention the different classification regarding market capitalization of small and medium stocks used by the indices creator’s as one can see at Chapter 3, sections 3.1.1 and 3.2.1. We want to remind to the readers that the purpose of this study is not to explain the differences between the many different results we have found. It will imply further researches to link the different excess returns with economic factors. The main purpose of the study is to see whether you can outperform the market by investing in small and mid caps.
6. CONCLUSION AND FURTHER RESEARCH

In this part, we summarize the results of the study and draw the conclusions. We answer the research questions and explain the contribution of the research. Then we suggest some possible further researches that could complete this work.

Before concluding, we have to first remain our research question:

In which extent is it possible to beat the market indexes by investing in small and medium stocks?

We can state we have been able to show the existence of a size effect in the context of a passive strategy. However the T-test reveals that the results are not significantly different from zero. In fact our approach was original since we have not used a specific sample or all listed common stocks on the NYSE to perform the study. Our methodology differs from the one used by the authors we quote. For several possible reasons (limited number of observations, high standard deviation, means close to zero) our results are not consistent with the prior researches about the size anomaly. We have demonstrated that even after adjusting returns for risk an investor does not have the opportunity to earn abnormal returns by investing in small and mid caps. Our studied period was basically from 1995 to 2005, during this period it was possible for some periods to earn excess return (see data analysis part 5) and outperform the markets, however if we consider the mean of the excess return for each period they are too close from zero and not significantly different from zero. So we can conclude that in the context of a passive strategy outperforming the market is a matter of luck, one has to gamble on the probability that the small and mid caps indices outperform the market indices. In fact since Small and Mid Caps indices show negative or positive excess returns, one could have earned abnormal returns by selling or buying (according to the period) a portfolio of stock representing one of the index.

Moreover we have also pointed out the instability of the size effect, Philip Brown, Allan W.Kleidon and Terry A.Marsh (4.6) have observed periods with either insignificant abnormal returns or reversal of the size effect (negative abnormal returns), between 1995-2005 the size effect still had these characteristics.

We have found adjusted abnormal returns for some periods for each index, it means that risk associated with small mid and mid cap is not the single determinant to explain the size anomaly. In the theoretical part, we have seen several factors that contribute besides risk to clarify the size anomaly. Nevertheless, because of a lack of time and data, we have not taken these determinants into account.

Trading Costs, the earning-price ratio, the overreaction, the influence of the January effect are other factors that one has to take into consideration when pretending to explain the size anomaly. In fact, each factor could be a possible explanation of the remaining abnormal returns with have found. The size effect is very complex, and it appears that there is a possible independence between these factors.

So we can conclude that that outperforming the market by investing in small and mid caps indices is not possible in average. But this conclusion is drawn from our results, in fact one could find different with a different methodology or more observations. We were not able to study more than 10 year data because most of the studied indices in this research have been created recently (see 1.2.5).
Further research could consist on adjusting the abnormal returns for each factor and find out any correlation between them. A multi-regression test could explain the size effect as a set of factors or reveal that size is just a proxy for the other factors.

Our study is limited to the U.S markets, the same analysis could be performed with indices of other markets (Asian, European, South American stock exchanges). It would be of interest to see if markets follow the same path. The methodology is a limit of our study. As we have seen for trading costs, (see 3.3) different methodologies or sample can lead to different results. Moreover the research may be biased by the methodology used to build the indices.

The contribution of our study is to demonstrate that in the context of a passive strategy (replicate the performance of an index with a portfolio of securities) one cannot in average earn abnormal returns, and if he does, it would be due to luck rather than considered strategy. Every theory we have seen pointed out this size effect but with taking all the common listed stocks into account. So we proved that indices do not show the same size anomaly and that there are (in average) no opportunities to take advantage of. Besides the previous point, the study shows that the size effect appear to be a set of factors because risk alone is not able to explain the entire abnormal returns generated by the small and mid caps stocks.

Such studies could be useful for small caps fund managers, looking for adding a passive strategy for a portfolio (see appendix 1). Understanding the size effect as a whole is the key to be successful in such investment strategy. Our study is just a piece of the puzzle.


7. CREDIBILITY CRITERIA

This chapter aims at measuring the reliability, replication and validity of the thesis

The research trustworthiness has high importance, so in order to analyze this issue, some criteria can be used. These criteria, according to Bryman et al (2003), are mainly three: reliability, replication and validity.

7.1 Reliability

During our research we utilized the formulas described in Chapter 4 (return, adjusted return, volatility and cumulated volatility) through two softwares (Microsoft Excel and SPSS) to calculate the results showed in Chapter 7. We believe that as these two softwares are commonly used for statistical purposes there are no doubts about their reliability.

Also regarding the formulas there are not many considerations to be done as the volatility is calculated through the formula we used in several literatures we used as one can see in Bodie et al. (2005). The returns formulas were based on the knowledge obtained from the “financial data analysis course” while the adjusted return formula is the same that Basu (1983) used in his article used in this research.

About the data reliability one can verify its authenticity as they were acquired from the public access websites which show only historical data that cannot be modified as they represent past events.

7.2 Replication

Concerning the replication, by providing all the research processes descriptions along this paper with the formulas descriptions, the indices methodologies and theories explanation, the data collection and analysis our study can be replicated in any market during any time period.

The replication can be applied not only for indices, but also for stocks as they are used in the articles that this study is based on. Regarding the data availability, it is important to mention that the initial data was obtained from public access websites as any public traded stock prices are accessible in the same websites.

7.3 Validity

In these criteria, our studied can be evaluated its trustworthiness according two validity’s types: internal and external validity.

For external validity we believe that using historical data of the indices in four different time horizons (1, 2, 5 and 10 years) our findings are consistent by testing our hypothesis with results originated from real market data.

Adding to this, for the internal validity we believe that using the data analysis methodology provided by our supporting literature through the formulas described in Chapter 4 there is a link established between
this formulas and the theories described in Chapter 5 as the main results’ measurement (adjusted return) is based on most of these theories
References

Books:


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Articles:


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✓ Thaler, R. H., *Anomalies the January Effect*, Economic Perspectives, Volume 1, Number 1, 1987

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✓ http://www.russell.com

✓ http://www2.standardandpoors.coml

✓ http://www.wikupedia.com

✓ http://finance.yahoo.com
APPENDIX

Appendix 1: Dow Theory Forecasts; small still beautiful

DOW THEORY FORECASTS

Small-company stocks have led large-company stocks for four consecutive quarters and five straight years. While there is no denying that small stocks have been the place to be in recent years, the question is whether the winning streak will continue.

The short answer is we don’t know. However, small stocks remain reasonably valued relative to large stocks given their superior growth prospects. Moreover, small stocks have a habit of consistently beating large stocks. Based on annual return data from Ibbotson Associates, small stocks have topped large stocks in 15 of the last 25 years (see chart above).

Small stocks are capable of outperforming for extended periods. In four separate periods since 1926, small stocks outpaced large stocks for at least five consecutive years. The longest run was the 10 years ended 1983. During that span, small stocks beat large stocks by an average of 18 percentage points per year. Only once have large stocks topped small stocks for five straight years or more, and that was a six-year run that ended in 1931.

The longer your holding period, the better the odds that small stocks will outperform. In the 74 rolling five-year periods since 1926, small stocks outperformed large stocks 42 times. In the 69 rolling 10-year periods, small stocks won 45 times. Small stocks posted positive returns in every 10-year holding period ending in 1939 or later.

Growth or value?

Small-company value stocks have dominated their growth peers. Based on Ibbotson data since 1969, small value stocks have notched an annualized return of 15.2% — higher than all other market segments and well above the 9.2% return for small growth stocks. In fact, $1,000 invested in small value stocks in 1969 would have grown to $142,440 at the end of 2003, compared to $21,750 for the same investment in small growth stocks.

Small value stocks outperform more often with less downside risk. Over the last 35 years, small value stocks delivered positive one-year returns 27 times, versus 23 times for growth stocks. The best single year for small value and small growth stocks was 1975, when both soared 59%. 1973 marked the worst performance, when value lost 25% and growth tumbled 41%.

In 2003, small growth stocks jumped 40%, beating the 10% return for small value stocks and ending a three-year winning streak for value. Small value has been the growth in nine of the last 12 years and 14 of the last 20 years. The longest stretch of outperformance by value stocks was the eight-year run starting in 1981.

Fund selections

If you are considering adding a small-company fund to your portfolio, shop first among value funds. One drawback in selection — many top funds are closed to new investors. Just last month, Forecast recommended Royce Opportunity (RYFNX) shut its doors to new investors.

Dow Theory Forecasts, April 19, 2004