Network for Studies on Pensions, Aging and Retirement

Netspar THESES

Gijs van Hunsel

The Impact of the Retirement Age Increase Announcement on the Dutch Stock Market

MSc Thesis 2013-042

TILBURG UNIVERSITY

The impact of the retirement age increase announcement on the Dutch stock market

Gijs van Hunsel

415891

12/12/2013

Academic Supervisor

Prof. dr. B. Melenberg

Second Reader

Dr. S.J. Sender

Abstract

This thesis studies the reaction of the announcement of the retirement age increase in the Dutch media on the Dutch stock market. This is done by an event study approach, which uses the market model as benchmark for obtaining the predicted abnormal returns. Goyal (2004) pointed out that an increase in the relative size of the pre-retirement cohort will lead to lower stock returns. Furthermore, Geanakoplos, Magill, and Quinzii (2004) pointed out that an increase in the ratio of the pre-retirement cohort to the young cohort will lead to lower stock returns as well. Consequently, this thesis tests the hypothesis that the announcement of the retirement age increase has a negative impact on the Dutch stock market. When looking at the results, the data reveals a negative abnormal return pattern around the event data which is driven by the period prior to the event. This can be explained by the fact that rumors about the new legislation were discussed earlier in several newspapers. Besides this, the abnormal return pattern prior to the announcement data is driven by Dutch large- and small-cap firms for all investigated windows. On the other hand, mid-cap firms do not seem to have any abnormal return pattern. However, the mid-cap result is driven by one outlier in the dataset. As a robustness check the same event study is performed for the German stock market. This test reveals no significant abnormal stock behavior in Germany strengthening the hypothesis of abnormal stock market returns around the retirement age announcement in the Dutch stock market. Furthermore, when the firms are categorized in basic materials, consumer goods, finance, health, industrials, media, oil & gas, retail, technology, or telecom & services, data reveals that financial firms are negatively correlated with cumulative abnormal returns, whereas companies which are classified in the category media and telecom & services are positively correlated with cumulative abnormal returns.

Table of Contents

1. Introduction

Nowadays ageing societies are a hot topic in the scientific literature. The core of researches are focused on the consequences of changing demographics on asset prices, however, the consequences of an increasing retirement age was never investigated. Goyal (2004) presented a negative correlation with the fraction of people in the pre-retirement cohort aged between 45 and 65 and outflows from the stock market. Furthermore, Geanakoplos et al. (2004) show that there is a negative relationship between the ratio of the pre-retirement cohort to the younger cohort and stock returns.

When looking at the Dutch case, on the 16th of May 2012 the Dutch government decided to let the retirement age increase one month in the years 2014 and 2015. The years after, it will increase with 2 months per year resulting in a retirement age of 66 in 2019. In the year 2023, this will result in a retirement age of 67. This announcement was contradictory to the initial plans of the government. When the retirement age increases at a certain point in time, this means that the relative share of the pre-retirement cohort increases as well when executed. As this new legislation let the pre-retirement cohort become bigger, stock returns for the Dutch market will decline according to Goyal (2004) and Geanakoplos et al. (2004). However, the information about this event was already available at the market on the 16th of May 2012, markets can react to the news before the actual event takes place when they are efficient.

In order to investigate whether this is the case for the Netherlands, an event study is used in this thesis. In this way, the returns around the event date are tested in order to check whether they behave abnormally around, before, and after the event of interest. In order to perform this research, data on the stock returns are needed and henceforth are retrieved from the AEX, AMX, ASCX and DAX. These in return are retrieved from the Thomson-Reuters database.

When looking at the data, it reveals that for the full sample the negative abnormal returns are driven by negative abnormal returns prior to the event date. This pattern can be explained by the fact that rumors about the new legislation were discussed already earlier in several newspapers. Furthermore, the abnormal return pattern prior to the announcement data is driven by Dutch large- and small-cap firms for all investigated windows. On the other hand, mid-cap firms do not seem to have any abnormal return pattern, however this result is driven by an outlier in the data. Besides this, the abnormal return subsequent to the announcement at three periods appear not to be statistically significant in any of the large-, mid-, and small-cap subsamples. As these results are possibly a lucky shot, since these results can be driven by other factors, the same study is performed for the German stock market. Doing so can rule out the chance that the results for the Dutch market are driven by global factors rather than the retirement age announcement.

When looking at the German market, the data reveals no significant market reaction around the announcement of the Dutch retirement age increase. These findings strengthen the prior found results, as it rules out global factors.

Furthermore, when firms are categorized in basic materials, consumer goods, finance, health, industrials, media, Oil & Gas, retail, technology, or telecom & Services, data reveals that firms which are classified as financial firms are negatively correlated with cumulative abnormal returns over the windows before the 16th of May 2012 whereas companies which are classified in the category media and telecom & services are positively correlated with cumulative abnormal returns over those windows.

Although this research is performed with great care, there are some limitations. The results of an event study are hard to interpret as the results are possibly driven by another factor than assumed. Although this work tries to diminish the chance of that occurrence by performing the same study for the German market, it does not fully prove that the retirement age announcement influences stock market behavior. Future research can focus on another economy where the same announcement took place in order to establish whether that economy encounters the same abnormal return pattern as this thesis did.

The rest of this thesis is organized as follows: section 2 gives an overview of the available literature on the efficient market hypothesis and how it is tested. Section 3 describes both the theoretical as the empirical literature on changing demographics and asset prices whereafter the hypothesis for this thesis is stated. Hereafter, section 4 describes the methodology used for this research gives insight in the way the data is collected. Hereafter, section 5 provides the empirical results of the results, which are summarized in section 6.

2. The Efficient market hypothesis

Kendall and Hill (1953) argued that stock prices behave randomly and, therefore, stock prices show no serial correlation. From day to day prices were equally likely to go up or down, regardless of what had happened before. Consequently, Kendall and Hill (1953) questioned what the drivers of stock prices are.

When past performance is such a driver, investors are able to model stock price behavior. When this is the case, investors could have made large profits without taking substantial risk. Furthermore, if every individual had done this, rising stocks would be rising more and more as they are attractive for investors. On the other hand, individuals who are holding the stock do not want to sell it. This suggests that the market uses all available information on a company for pricing the stock.

2.1 Definition

The definition of market efficiency has changed substantially from the beginning until now. A clear and well stated definition is given by Malkiel (1992).

> "A capital market is said to be efficient if it fully and correctly reflects all relevant information in determining security prices. Formally, the market is said to be efficient with respect to some information set, Ω_t, if security prices would be unaffected by revealing that information to all participants. Moreover, efficiency with respect to an information set, Ω_t, implies that it is impossible to make economic profits by trading on basis of Ω_t."

The stock market, thus, is said to be efficient when the stock prices on the market are fully determined by all the available information on the market. As a result, one should be able to show that stock prices immediately, without a significant delay, respond to additional information on the market. From the definition, it immediately follows that market efficiency does not imply that price changes are impossible. Fama (1965) argued about the random walk hypothesis. This hypothesis states that stock prices cannot be predicted perfectly as they behave randomly. However, it does imply that markets work sound. As a result, stock prices are impossible to be under- or overvalued in perfect markets.

2.2 Forms of market efficiency

The ´fair game model´ of market efficiency is divided in three categories by Fama (1970). Every separate category is based on the type of information set which is used to make judgments. This division is as follows:

2.2.1 Weak form of market efficiency

Within this form of market efficiency, share prices include all information contained in historical prices. As a result, investors are thus not able to achieve any abnormal returns when they use investment methods which are based on historical price and return information (Fama, 1970).

2.2.2 Semi-strong form of market efficiency

This form states that stock prices reflect all publicly available information fully. An important fact to mention is that this information is provided without any costs to all participants. Therefore, investors cannot obtain any abnormal returns if they use historical price and return information as well as publicly available information, such as annual- and investment reports (Shleifer, 2003).

2.2.3 Strong form of market efficiency

The strong form of market efficiency states that stock prices fully reflect all information, both publicly and not publicly available. Even when investors have confidential inside information of certain companies, they will not be able to use strategies which will yield abnormal expected returns.

This subdivision into three categories proved to be useful as it enabled the 'fair game model' to be empirically tested regarding different information sets. This in its own way brought a great cluster of ongoing empirical studies, concentrating on the relationship between different information sets and share prices (Fama, 1970).

2.3 Testing Market Efficiency

Initially, literature appears to be consistent with the first two types of market efficiency. Tests regarding the weak form of market efficiency, examine the results on whether a passive investment strategy, buy-and-hold, can be outperformed by actively trading on historical changes in equity prices. This is done as analysts claim that market prices have memory, this memory let future price movements, to some extent be predictable, based on historical price movements. These tests suggest that technical analysis perform better than a buy-and-hold strategy. However, this outperformance cancels out when considering the costs of active management: such as transaction fees, time and effort (Dyckman, Downes and Magee, 1975).

Several approaches can be used to test predictability of returns based on historical data. Obviously, all these approaches are related to each other. First of all, one can use a serial correlation test. In this test, the relationship between returns and historical returns is determined (Moore, 1964). Next to this, one has the filter rule test. When using the filter rule test, the main assumption is made that there is some certainty in price momentum. Furthermore, the belief is uttered that rising prices tend to rise even more and falling prices tend to fall even more. Hence, a share is purchased when the price of that share exceeds the previous price of the share with a certain percentage (Alexander, 1961). The last test is called the cyclical test. In this test, a time series regression is used in order to test stock return behavior.

Some common behavior is the Monday-effect: stock prices tend to be higher on Mondays than on other days; and the January effect: stock prices tend to be higher in January than in December (Dyckman et al., 1975).

2.4 Literature review

Within the literature there are two schools. On the one hand you have believers in the efficient market hypothesis and on the other hand you have the non-believers. One of the most influential believers of the efficient market hypothesis is Fama (1970, 1998). In his researches, he classified three forms of market efficiency, which were explained in section 2.3. Those three categories become the standard for describing market efficiency.

However, Fama (1970) was not the first researcher who paid attention to this phenomenon. Bachelier (1900) was the first researcher to address a study to stock price behavior in competitive markets. He noticed that stock prices followed a random walk and therefore, it was impossible to model their behavior. Working (1943) and Cowles and Jones (1937) found evidence for the view of Bachelier (1900), although Working (1943) and Cowles and Jones (1937) were analyzing time-series data more so than making investments decisions, this way they found evidence for the EMH. Kendall (1953) had found evidence in his data that it is impossible to predict future stock behavior. The core explanation for this was again the EMH, which came as a shock to the scientific world. However, it did not take long before the academic world took over the idea of the EMH and studied its validity.

Moore (1964) and Fama (1965) took a look at serial correlations of stock prices in order to test whether they follow a random walk. By doing this, Moore (1964) looked to what extent the stock price for week t is correlated with the stock price for week $t-1$ and he found an autocorrelation of -0.06. This can be interpreted as a slight tendency to reverse itself, however it is not statistically significantly different from zero. Fama (1965) looked at daily stock prices during a five year period and obtained a correlation coefficient of 0.03. This correlation is, again, not statistically significantly different than zero. Consequently, both Moore (1964) and Fama (1965) are not able to reject the random walk hypothesis and the EMH. Alexander (1961) and Fama and Blume (1966) performed a filtered rule test. In this test one looks whether abnormal returns can be obtained by using historical data. Alexander (1961) found large rates of return when performing this test, especially when the filter is small. Though, when Alexander (1961) takes transaction costs into account in his study, these abnormal returns diminish towards zero. Fama and Blume (1966) on the other hand were not able to show abnormal returns at all.

As a result, Alexander (1961) is able to question the random walk hypothesis; however he was not able to reject the weak form of the EMH.

Scholes (1972) researched the effect of secondary stock issues on the price. He found that when the issuer was a corporation, stock prices declined. Scholes (1972) argued that the market looked at this issue of secondary stock as bad news about the firm. On the other hand, when the issuer were individuals, banks or insurance companies, Scholes (1972) did not find a significant negative relationship between the stock issues and stock price. As the price changes occurred within six days of the issuance, Scholes (1972) argues that this supports the EMH as the market adjusts to new information.

In order to be able to test the EMH, models have to be established which model market prices. One of the most well-known models are the fair game model (Fama, 1970) and the capital asset pricing model (Sharpe, 1964; Lintner 1965; and Mossin, 1966). Most studies which used either the CAPM or the fair game model argued in favor of the EMH. Besides the fair game model and capital asset pricing model, there are also models which take the volatility of the stocks as a core distinctive. Shiller (1981) used such a model in his research and argued that price behavior was having a higher variance than the dividend payouts, which results in doubt whether it was efficient. The finding of Shiller (1981) came as a shock to the profession and sparked a huge debate about market efficiency and as a result it provided a new class of models trying to explain the excess volatility puzzle. Marsh and Merton (1986) showed that the findings of Shiller (1981) do not hold anymore when slight alterations are made in the dividend model.

De Bondt and Thaler (1985) sorted stocks in a portfolio of winners and losers every year, based on which stocks have gone up and down the most over the last three years. De Bondt and Thaler (1985) documented that stock prices overreacted substantially and that this showed great market inefficiencies, as there was long-term reversal present and as there is a substantial negative serial correlation in the data. Jegadeesh and Titman (1993) executed a strategy were historical winners were bought and historical losers were sold. They found one of the biggest anomalies which literature has so far: short-run winners tend to do well over the next one to twelve months.

Schwert (2003) replicated several anomalies found in the literature. One of his findings is that many of the well-known anomalies within the literature, do not hold in different sample periods. Particularly, the size and value effects appear to have disappeared after the publications of papers which addressed these anomalies. Thus, Schwert (2003) argues that research findings cause the market to solve its anomalies.

Toth and Kertesz (2006) analyze returns on the NYSE and particularly the cross-correlations of the returns of all listed stocks on the NYSE for the last 20 years. They found that the correlation between the stock return and its lagged counterpart disappeared within 20 years. Besides this, they revealed that this even holds for high-frequency data. Consequently, Toth and Kertesz (2006) argue that the American market is becoming more and more efficient. Wilson and Marashdeh (2007) showed that co-integrated stock prices do support the Efficient Market Hypothesis in the long run; however in the short run market efficiency was not supported. Wilson and Marashdeh (2007) clarify that the abolition of arbitrage opportunities let the stock market be inefficient in the short-run, but warrants the efficiency in the long-run.

Borges (2010) tested the weak form of the efficient market hypothesis on the stock market indexed of France, Germany, UK, Greece, Portugal and Spain for a pre-crisis window. In order to see whether the stock markets of these countries do so, she uses a serial correlation tests, a Dickey-Fuller test, and a runs test. Borges (2010) found that monthly prices and returns follow random walks in all of the countries in her study. When looking at daily stock prices, the data only reveals a random walk pattern after 2003.

Lee, Lee, and Lee (2010) investigated to what extent stock prices for both developed and developing countries are stationary with help of panel data stationary test with structural breaks. The findings showed that real stock prices appeared to be stationary in almost their entire dataset, which is inconsistent according to the efficient market hypothesis.

3. Relation between retirement age and asset prices

Within the scientific literature, many researchers have examined what happens with financial asset returns when a baby boom generation faces retirement. There are two general views about what happens when the age distribution in a country changes. On the one hand, the baby boom generation can sell their assets to the smaller cohort of young people, which leads to declining asset prices. As a result, this yields smaller retirement savings for the retiring cohort (Mankiw and Weil, 1989). On the other hand, when markets are efficient the ageing of the baby boomers' cohort is already incorporated in the asset prices. Thus, the expected market meltdown will not occur in this scenario.

3.1 Review of research upon ageing and financial markets

The relation between an ageing cohort and financial returns is studied in two different ways. On the one hand a theoretical analysis can be used and on the other hand an empirical approach can be used.

3.1.1 Empirical

In order to study the link between an aging society and asset prices empirically, Yoo (1994) firstly uses an overlapping generations model. The model reveals that when the retiring cohort increases, the returns on financial assets decline. Furthermore, Yoo(1994) runs regressions with returns on several US financial assets on several measures of age distributions. When examining US Treasury bills, the data reveals a negative significant relationship between ageing and return. However, as the standard errors are very high in his regressions, it is hard to conclude any causal relationship between changing demographics and asset returns.

Bergantino (1998) examined the effect of the changing demographics on housing, stock, and bond prices over the post-World War II period 1946 through 1997. Due to large shifts in the age distributions in the post-World War II period, huge macro-economic consequences arose. Even after controlling for fluctuations in real GDP and dividend payments, the data reveals a statistically significant link between demographic changes of the U.S. population in the post-World War II period and housing, stock and bond prices.

Poterba (2001) looked at the relation between the share of the population in the prime saving years, 40 to 64, and returns on Treasury bills, bonds, and stocks. Poterba (2001) found some minor evidence that the share of the population in the prime saving year is linked to returns on Treasury bills. Furthermore, evidence between price-dividend ratios and changing demographics is found. This link suggests that return volatility possibly conceals a link to a low frequency source as variation, such as demographic changes (Poterba, 2001).

Goyal (2004) showed a positive correlation between the cohort of retired people and outflows from the stock market and a negative correlation between the fraction of people aged between 45 and 65 and outflows from the stock market. Ang and Maddaloni (2004) obtained a similar result using pooled international data and concluded that the share of retired people is a strong determinant of international excess returns.

Davis and Li (2003) explore the link between ageing and financial asset prices for seven countries. Their data reveals that when the share of people in the prime saving years increases, real asset prices are boosted. On the contrary, when the middle-aged people cohort declines the asset prices will weaken. Even after controlling for non-demographic factors these results hold. Geanakoplos et al. (2004) built a model and tested it. Their data revealed a significant link between stock prices and differences between cohorts measured by the ratio of the middle aged cohort to the young cohort. When Geanakoplos et al. (2004) extrapolated their model, a decline in return of 60 basis points for the period 2000-2050 was found. After checking their model, Geanakoplos et al. (2004) investigated some individual countries. However, not all investigated countries had a significant link between the ratio between middle and young cohorts and stock prices, though France and Japan did. Poterba (2004) finds a modest correlation between stock returns and the US age distribution. A possible explanation for this is the few degrees of freedom the statistical tests of Poterba (2004) have.

Overall, the empirical literature finds a minor link between demographics and the returns of financial assets.

3.1.2 Theoretical

In the theoretical field overlapping generations models (OLG) are frequently used for examining the link between demographic changes and returns on assets. Brooks (2002) uses an OLG model where a distinction is made between risky and non-risky assets. Using this model Brooks (2002) finds evidence for a link between demographic changes and asset returns. As in the life-cycle model the asset allocation changes over time, the difference between the returns increases.

Furthermore, Abel (2000, 2003) used the OLG model and added a social security system and bequest motive to the model. When Abel (2000, 2001) simulated a baby boom, the rate of return decreases relatively to what it would be without the baby boom. Consequently, the big cohort of the baby boomers has less attractive opportunities in the capital market than the other smaller cohorts. This asset meltdown in stock prices is not prevented by the social security system in the model. The OLG model of Geanakoplos et al. (2004) tried to model the US population structure. Their findings suggest that the post-World War II shocks generate major swings in asset values; however, the actual stock market movements were three times as big as the model could explain.

Attanasio and Violante (2000) constructed a general equilibrium OLG model in order to evaluate what happens when there is falling mortality and fertility within an economy. Attanasio and Violante (2000) showed using the general equilibrium OLG model that international cash flows seem to weaken the adverse effects of changing demographics on financial markets. Brooks (2003) and Börsch-Supan, Ludwig, and Winter (2005) also used an OLG model to obtain the effects of changing demographics on saving-investment balances. These researchers found evidence that international capital flows tend to diminish the adverse effects of changing demographics on the financial markets. However, these papers are not able to match historical data with their findings which possibly makes them less relevant.

Poterba (2001) controlled for the fact that wealth rises with age and that different cohorts have different risk preferences. When taking this into account, Poterba (2001) is not able to find changes in estimated age-wealth profiles. Consequently, the studied effects are negligible.

When evaluating these theoretical works, the literature advocates that the baby boom cohort will have lower returns on their savings than what was expected before. However, these effects will be small.

3.2 Hypothesis

Although the relationship between retirement and asset prices was researched extensively over the last decades, the effect of an increasing retirement age was never investigated by the best of my knowledge. However, with help of the literature presented in sections 3.1.1 and 3.1.2 a hypothesis can be formulated.

Goyal (2004) presented a negative correlation in his research, with the fraction of people in the pre-retirement cohort aged between 45 and the 65 and outflows from the stock market. Consequently, when the pre-retirement cohort grows, stock outflows will diminish. Besides this, Geanakoplos et al. (2004) show, that there is a negative relationship between the ratio pre-retirement cohort and the younger cohort and stock returns. When looking at the Dutch case, on the 16th of May2012 Dutch government decided to let the retirement age increase one month in the years of 2014 and 2015. The years after that, it increases with 2 months per year resulting in a retirement age of 66 in 2019. In the year 2023, this will result in a retirement age of 67. This announcement was contradictory to the initial plans of the government, in which the retirement age was increased by one year to 66 in 2020 and to 67 in 2025 (ANP, 2012). Consequently, this increase came quicker than the Dutch population had expected.

When the retirement age increases at a certain point in time, this means that the relative share of the pre-retirement cohort increases as well. According to Goyal (2004) and Geanakoplos et al. (2004) this will lead to declining returns from the stock market. As a result, this research is going to examine whether the Dutch stock market behaved abnormally around the date the new legislation was announced. The core reason for this is that the information about this event was already available at the market on the 16th of May 2012. When markets are efficient they react to this before the actual event takes place when they are efficient.

4. Methodology

In order to examine the effect of the increased retirement age on stock returns, an event study is used. This event study will measure the behavior of stock returns around an event when new information is available to the market. Furthermore, it will clarify whether stock returns behave abnormally around the event of interest. In order to conduct an event study, five steps have to be followed (Bowman, 1983). For this study, the initial plan of Bowman (1983) is reduced to the following four steps:

1) Identification of the event of interest and the timing of it
2) Specify a benchmark model for normal stock return behavior
3) Calculate abnormal returns
4) Analyze abnormal returns

For the particular event in the research done, these four steps will be carried out in detail in the following paragraphs.

4.1 Identification of the event of interest

In this thesis, the event of interest is the announcement of the increase in Dutch retirement ages. As this announcement was contradictory to the initial plans of the government in which the retirement age was increased by one year to 66 in 2020 and to 67 in 2025 (ANP, 2012), this increase came unexpected to the Dutch population.

As a result, this change of plans should generate a negative abnormal return pattern around the event date when the hypothesis is true and the efficient market hypothesis holds as well. As event date, the date the ANP (Netherlands national news agency) announced the new policy was taken. The ANP announced it, and as a result Dutch news sites placed it, on the 16th of May 2012.

4.2 Calculating benchmark returns

In order to conduct a proper event study, a model which models how stocks behave in general has to be used. Within the event study methodology literature there are several models for this. The purpose of these models is calculating abnormal results. The abnormal returns (AR) are calculated as the difference between observed returns (R) and the return predicted by the model (NR).

$$AR_{i,t} = R_{i,t} - NR_{i,t} \tag{1}$$

When trying to obtain the benchmark returns, some important parameters have to be estimated. When doing so, an estimation window is needed, $[T_1, T_2]$, which foregoes the event window, $[t_1, t_2]$. The event of interest is located at time $t = 0$ and the event period is located around this event (de Goeij & de Jong, 2011). However, when the hypothesis whether a market reaction occurs before or after the event of interest is tested, the event is not included in the event window.

In the next paragraphs I will elaborate on three models which can be used for calculating the normal or benchmark returns. These are: the mean-adjusted return model, the market-adjusted return model, and the market model.

4.2.1 Mean-adjusted return model

In this model, the benchmark is the average return over a certain window, $[T_1, T_2]$. As a result, $NR_{i,t}$ is defined as:

$$NR_{i,t} = \frac{1}{T} \sum_{s=T_1}^{T_2} R_{i,s} \quad with\ T = T_1 + T_2 + 1 \tag{2}$$

In this model, T depicts the numbers of time periods used to compute the average return, so the size of the estimation window. Scientific literature has not found a consensus for the estimation period for an event study. Copeland and Mayers (1982) believe that one has to use a period after the actual event, whereas Brown and Warner (1980) and Mackinlay (1998) propose a period before the event date.

4.2.2 The Market-adjusted Model

The major flaw of the mean-adjusted model depicted in equation (2) is the omission of systematic stock market behavior from the benchmark return (de Goeij & de Jong, 2011). This is particularly important for our event as the events for all stocks of interest take place at the same point in time, as the results then are possibly biased if the whole market makes an up- or downward movement around the event period. As a result, there is a chance that significant results will be obtained, although this may not be driven by the event of interest. This omission problem can be solved by choosing a certain market index as benchmark.

$$NR_{i,t} = R_{m,t} \tag{3}$$

When using equation (3) market-adjusted returns are obtained. However, one of the major issues when using the market-adjusted model is the choice of the market index.

4.2.3 The Market Model

When looking at equation (3), one notices that it indirectly assumes that every stock has a beta which equals one as the normal return correlates perfectly with the index (de Goeij & de Jong, 2011). As one has to know, this is a strong assumption as every stock has a different exposure to the market. Consequently, a more optimal model should have the possibility to include different betas for different companies in order to define abnormal returns. A way to capture this in defining abnormal returns, is by using an OLS regression of the firms on the market:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t} \tag{4}$$

In equation (4) both α_i and β_i capture the relationship between a stock return from a certain company i and the market return, whereas $\varepsilon_{i,t}$ is the error term which is assumed to behave according the Gauss-Markov assumptions (Binder, 1998). Furthermore, β_i depicts the sensitivity of the return of a particular stock towards the market overall. After estimating this equation, values of α_i and β_i are plugged in, in order to find the error terms. The abnormal returns are defined as the residual errors of equation (4).

$$NR_{i,t} = \hat{\alpha}_i + \hat{\beta}_i R_{m,t} \tag{5}$$

Again, it is important to mention that there is no consensus in the finance literature about over what period the market return has to be estimated.

As the major flaw of the mean-adjusted model is the omission of systematic stock market behavior from the benchmark return and the market-adjusted model assumes that every stock correlates perfectly with the index, the market model is used as benchmark model for this event study.

4.3 Calculating Abnormal Returns

Whenever performing an event study, the focus lies on calculating abnormal returns obtained around the event date. In event studies, the event date is labeled as $t = 0$. As seen before, the event window generally takes place within the interval $[t_1, t_2]$.

As an event study typically looks at more firms, each firm´s return can be analyzed separately. Nevertheless, this is not the best way to perform the analysis, as some stock price movements are possibly caused by other sources next to the event of interest. In order to improve the degree of trustworthiness of the analysis, the average of the sample of firms is taken. In most cases, one takes the unweighted cross-sectional average of abnormal returns (AAR) (De Goeij & De Jong, 2012):

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{i,t} \tag{8}$$

When the average abnormal returns deviate significantly from zero, this indicates certain abnormal performance in the market. As abnormal returns are centered around our event of interest, averaging this should reflect the impact of this event. When doing this, all information which causes abnormal returns but are unrelated to our event of interest, should cancel out on average.

Most of the time, the period of interest is not solely the event date: $t = 0$. When analyzing whether a certain event causes stock return changes, it is important to look at longer periods surrounding or after the event. The general way to perform this is by using cumulative abnormal returns in the analysis. This is done by aggregating the abnormal returns over the event period.

$$CAR_i = AR_{i,t_1} + \cdots + AR_{i,t_2} = \sum_{t=t_2}^{t_1} AR_{i,t} \tag{9}$$

For the population when $n \to \infty$ the following holds:

$$E(CAR_i) = \theta \tag{10}$$

4.4 Analyzing Abnormal Returns

As event studies in general look at whether obtained abnormal returns are statistically different from zero, all event students are supported with some statistical testing. After performing those tests, the question, if there is abnormal stock behavior around the event of interest, can be answered. At first, a hypothesis should be denoted:

$$H_0 : \theta = 0 \quad vs. \quad H_1 : \theta \neq 0 \tag{11}$$

In order to test the null-hypothesis a student t-test is used. When N is large enough, the t-distribution approximates the normal distribution. Furthermore, using the standardization approach, we have to use the standard deviation of the CAAR:

$$sd_{CAAR} = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(CAR_i - CAAR)^2} \tag{12}$$

The test statistic (TS) for the hypothesis is therefore:

$$TS: \sqrt{N}\frac{CAAR}{sd_{CAAR}} \approx N(0,1) \tag{13}$$

The test statistics in equation (13) is used for testing the hypothesis denoted in equation (11), no abnormal stock market behavior around the event holds. The null-hypothesis is rejected when the absolute value found in equation (13) is large enough. So when $|TS| \geq t_{\alpha}$, where α is the significance level of the test.

After the first part of the research is done, the firms in this research are categorized in 10 different industries; basic materials, consumer goods, finance, health, industrials, media, Oil & Gas, retail, technology, and telecom & Services. For every industry a dummy is made which is incorporated in the following regression:

$$CAR_i = \alpha_i + \sum_{i=2}^{N} \beta_i I_i + e_i \tag{14}$$

After these regressions have been run, the t-statistics and p-value of each dummy variable indicate to what extent these industries are driving the abnormal results found around the event date.

4.5. Data retrieval

In order to conduct the event study described above, data has to be collected on the stock prices on the Dutch large-, mid- and small-cap; the AEX, AMX and AScX. These stock prices are obtained from the Thomson-Reuters Datastream database. Besides, in order to perform the robustness test, the data on the German market index DAX are retrieved from the Thomson-Reuters Datastream database as well. In order to calculate the daily returns these prices are adjusted for dividend payments and stock splits. Afterwards, the natural logarithm is taken from the stock return divided by the lagged stock return; $ln(P_t/P_{t-1})$. This logarithmic transformation yields the continuously compounded stock price returns for each particular firm in the dataset. Table 1 depicts the summary statistics for this event study.

Table 1: Summary Statistics

This table reports the summary statistics for this event study. Data are retrieved from the Thomson Reuters database.

	Mean	Std. dev.	Minimum	Maximum	N
AEX	-0.0001	0.0241	-0.1315	0.4731	2530
AMX	-0.0002	0.0220	-0.1300	0.1680	2530
ASCX	-0.0016	0.0726	-0.6931	0.3321	2530
DAX	-0.0007	0.0264	-0.3012	0.4463	3663

As this event study uses the market model for calculating the normal or benchmark returns. As a proxy for the market return, the Amsterdam All-share Index is used when testing the full sample with all Dutch listed large-, mid- and small-cap stocks. When the sample is divided into subsamples according to market capitalization, the AEX, AMX and AScX are used as a proxy for market return.

5. Results

This section provides the results of an event study on the increase of the retirement age. This section starts with an evaluation of the full sample, where the impact of the increasing retirement age on all Dutch listed stocks is examined. Hereafter, the sample will be divided in three subsamples: large-, mid- and small-cap stocks. At last, the determinants of the abnormal returns will be examined in a regression of the cumulative abnormal returns on different industry-dummies.

5.1 Full sample

Table 1 shows the market reaction to the increasing retirement age announcement at the 16th of May 2012 measured by the cumulative average abnormal returns (CAAR) for the full sample. These CAARs have been calculated over four different event windows surrounding the event of interest and these are depicted in Panel A. When looking at panel A one can see that negative abnormal returns show up for the event windows (-10,10), (-5,5), (-3,3), (-1,1): -5.6%, -2.7%, -3.5% and -1.0% respectively. The first three event windows yield abnormal returns which are significant at the 1% level, whereas the last and shortest event windows yield abnormal returns which are significant at the 10% level.

Panel B investigates whether the abnormal returns in the full sample are driven by the period prior to the announcement. This panel shows that for the windows (-10,-1), (-5,-1) and (-3,-1) the CAARS are -4.4%, -2.5% and -2.0% respectively. All three windows generate abnormal returns which are significant at the 1% level. When comparing these results to the results from panel A, we see that these abnormal returns are even more significant in the period before the event than the period around the event.

Panel C examines whether the abnormal returns in the full sample are driven by the period subsequent to the announcement. For the event windows of (1,10) and (1,5) the data reveals abnormal returns of -1.3% and -0.3%. However, both abnormal returns appear to be insignificant. When looking at the (1,3) window one notices that an abnormal return of -1.4% is obtained, which is significant at the 5% level.

When evaluating these three panels carefully, the data reveals a strong reaction prior to the event. This can be explained by the fact that rumors play an import role on financial markets nowadays. Antweiler and Frank (2004) have shown that rumors have substantial impact on stock prices, which results in abnormal returns prior to the event date. Bettman et al. (2010) find that after rumors, abnormal return patterns can be found. As Dutch politics were openly discussing the increasing retirement before the announcement dates, the abnormal returns before the event date can be explained by the views of Antweiler and Frank (2004) and Bettman et al. (2010). When looking at the reaction subsequent to the announcement, one notices that there is a very short time of abnormal returns after the event date. This is odd as one should predict that the market fully reacts to the new information at the announcement date.

Table 2: Market reaction to increasing retirement age announcement – full sample

This table shows the cumulative average abnormal returns for the increasing retirement age announcement for several event windows around the announcement date. For this event study, the Amsterdam AllShare index is used as market return and all data is retrieved from Thompson Reuters Datastream. Statistical significance levels of 10%, 5% and 1% are indicated by *, ** and *** respectively.

Panel A:	(-10,10)	(-5,5)	(-3,3)	(-1,1)
CAAR	-0.056***	-0.027***	-0.035***	-0.010*
T-statistic	-3.510	-3.104	-3.551	-1.725
p-value	0.001	0.003	0.001	0.089
Panel B:	(-10,-1)	(-5,-1)	(-3,-1)	
CAAR	-0.044***	-0.025***	-0.020***	
T-statistic	-3.629	-3.949	-4.281	
p-value	0.001	0.000	0.000	
Panel C:	(1,10)	(1,5)	(1,3)	
CAAR	-0.013	-0.003	-0.014**	
T-statistic	-1.321	-0.404	-2.495	
p-value	0.191	0.687	0.015	

5.2 Large-cap

Table 2 provides the market reaction during, before and after the increasing retirement age announcement for the large-cap companies in my dataset. As done before, the CAARs have been calculated over four different event windows surrounding the event of interest and these are depicted in Panel A. After evaluating panel A, one observes that negative abnormal returns show up for the event windows (-10,10), (-5,5), (-3,3), (-1,1): -4.3%, -2.9%, -3.3% and -0.9% respectively. The abnormal return for the biggest window is significant at the 10% level, whereas the two middle windows are significant at the 5% level. When looking at the smallest window (-1,1) it appears to be insignificant.

When evaluating panel B and C, one sees that for the windows (-10,-1), (-5,-1) and (-3,-1) the CAARS are -2.7%, -1.9% and -1.0%. All three windows yield a statistical significant abnormal return: (-10,-1) at the 10%, and (-5, -1) and (-3,-1) at the 5% level. For the event windows of (1,10), (1,5), (1,3) the data does reveal abnormal returns of -1.5% and -0.9% and -0.7%. However, these abnormal returns appear to be insignificant.

As we have already seen in section 5.1, rumors tend to play a role in the behavior of financial markets. This subsample argues in favor of these thoughts as all the windows prior the event date are revealing negative and significant abnormal returns.

Table 3: Market reaction to increasing retirement age announcement – Large-cap

This table shows the cumulative average abnormal returns for the increasing retirement age announcement for several event windows around the announcement date. For this event study, the AEX index is used as market return and all data is retrieved from Thompson Reuters Datastream. Statistical significance levels of 10%, 5% and 1% are indicated by *, ** and *** respectively.

Panel A:	(-10,10)	(-5,5)	(-3,3)	(-1,1)
CAAR	-0.043*	-0.029**	-0.019**	-0.009
T-statistic	-2.031	-2.241	-2.084	-1.557
p-value	0.055	0.036	0.050	0.134
Panel B:	(-10,-1)	(-5,-1)	(-3,-1)	
CAAR	-0.027*	-0.019**	-0.010**	
T-statistic	-1.760	-2.294	-2.293	
p-value	0.093	0.032	0.032	
Panel C:	(1,10)	(1,5)	(1,3)	
CAAR	-0.015	-0.009	-0.007	
T-statistic	-1.702	-1.449	-1.131	
p-value	0.101	0.162	0.271	

5.3 Mid-cap

Table 3 provides the market reaction during, before, and after the increasing retirement age announcement for the mid-cap companies in the dataset. The CAARs are calculated as before. After evaluating panel A, one observes that compared to table 1 and 2, the CAARs at table 3 are much lower for all windows. Furthermore, the data reveals that CAARs for the mid-cap companies are not significant at the windows surrounding the event.

When looking at panel B and C, one sees that for the windows (-10,-1), (-5,-1) and (-3,-1) and (-10,-1), (-5, -1) and (-3,-1) the abnormal returns are not significant. One can conclude that the market reaction to the increasing retirement age announcement is not significantly different from zero. Consequently, the dataset is not able to reject the null-hypothesis of no abnormal stock market behavior for the mid-cap companies. However, looking at the underlying data suggest that this result is driven by one outlier. When this outlier is excluded from the dataset, the obtained results are comparable to those in table 3.

Table 4: Market reaction to increasing retirement age announcement – Mid-cap

This table shows the cumulative average abnormal returns for the increasing retirement age announcement for several event windows around the announcement date. For this event study, the AMX index is used as market return and all data is retrieved from Thompson Reuters Datastream. Statistical significance levels of 10%, 5% and 1% are indicated by *, ** and *** respectively.

Panel A:	(-10,10)	(-5,5)	(-3,3)	(-1,1)
CAAR	-0.008	0.004	-0.010	-0.009
T-statistic	-0.370	0.301	-0.823	-0.947
p-value	0.715	0.766	0.419	0.354
Panel B:	(-10,-1)	(-5,-1)	(-3,-1)	
CAAR	-0.006	-0.000	-0.004	
T-statistic	-0.332	-0.016	-0.603	
p-value	0.743	0.987	0.552	
Panel C:	(1,10)	(1,5)	(1,3)	
CAAR	0.000	0.006	-0.002	
T-statistic	0.103	0.971	-0.497	
p-value	0.918	0.342	0.624	

5.4 Small-cap

In table 4 the market reaction during, before and after the increasing retirement age announcement for the small cap companies in the dataset is depicted. The CAARs are calculated in the same way that was used before, over four different event windows surrounding the event of interest and these are depicted in Panel A.

When looking at panel A, one observes that negative abnormal returns show up for the event windows (-10,10), (-5,5), and (-3,3): -6.2%, -2.1%, and -4.9% respectively. The windows (-10,10) and (-3,3) are statistically significant, however the window (-5,5) is not. On the other hand, the window (-1,1) has a positive abnormal return, but this is statistically indifferent from zero.

Panel B investigates whether the abnormal returns in the small-cap subsample are driven by the period prior to the announcement. This panel shows that for the windows (-10,-1), (-5,-1) and (-3,-1) the CAARS are -5.3%, -2.4% and -2.9%, respectively. All three windows generate abnormal returns which are significant at the 5%, 10% and 5% level, respectively. When these results are again compared to the

Table 5: Market reaction to increasing retirement age announcement – Small-cap

This table shows the cumulative average abnormal returns for the increasing retirement age announcement for several event windows around the announcement date. For this event study, the AScX index is used as market return and all data is retrieved from Thompson Reuters Datastream. Statistical significance levels of 10%, 5% and 1% are indicated by *, ** and *** respectively.

Panel A:	(-10,10)	(-5,5)	(-3,3)	(-1,1)
CAAR	-0.062*	-0.021	-0.049**	0.002
T-statistic	-1.924	-1.090	-2.253	0.110
p-value	0.067	0.287	0.035	0.913
Panel B:	(-10,-1)	(-5,-1)	(-3,-1)	
CAAR	-0.053**	-0.024*	-0.029**	
T-statistic	-2.165	-1.757	-2.773	
p-value	0.041	0.093	0.011	
Panel C:	(1,10)	(1,5)	(1,3)	
CAAR	-0.008	0.004	-0.020	
T-statistic	-0.317	0.256	-1.492	
p-value	0.754	0.801	0.150	

results from panel A, the data reveals that these abnormal returns are even more significant in the period before the event than the period around the event.

Panel C examines whether the abnormal returns in the small-cap subsample are driven by the period subsequent to the announcement. For the event windows of (1,10) , (1,5) and (1,3) the data reveals abnormal returns of -0.8%, 0.04%, and -2.0%. However, both abnormal returns appear to be insignificant.

When looking at table 4 the data reveals that overall there is an abnormal return pattern in the data before the announcement of the retirement age increase. One of the explanations of this is that Dutch politics were discussing the increase in retirement age before the actual announcement date. As financial markets are prone to rumors (Rose, 1951; Koenig, 1985) before the announcement, abnormal returns can occur if rumors about the announcement occur before the announcement.

5.5 Robustness test

When the retirement age announcement effectively influenced stock market behavior in the Netherlands, you should see no abnormal market reactions at other stock markets. When you observe significant abnormal market reactions at other stock markets, the reaction around the event date is possibly driven by another factor than the retirement age announcement.

In order to check whether this is the case for the study, the same event study as in section 5.1 is conducted however this time for the German stock market.

Table 5 provides the market reaction during, before and after the increasing retirement age announcement date for the German stock market. The CAARs are calculated as before. After evaluating panel A, B and C it becomes clear that around, before and after the 16th of May, no significant market reaction occurs in the German stock market. Consequently, this makes the findings in the previous sections stronger as an economy comparable to the Dutch one does not have significant abnormal stock market behavior around the 16th of May 2012.

One important remark has to be made about the sample sizes. The robustness test has a total amount of observations of 3663 whereas the full sample of the event study has 7590 observations. A drawback of an event study is that the bigger the sample size is, the more likely it gets that significant results are obtained what can be seen in equation (13). As a result, this small sample can drive the insignificance of my robustness test.

Table 6: Market reaction to increasing retirement age announcement – DAX

This table shows the cumulative average abnormal returns for the increasing retirement age announcement for several event windows around the announcement date in the German stock market. For this event study, the DAX index is used as market return and all data is retrieved from Thompson Reuters Datastream. Statistical significance levels of 10%, 5% and 1% are indicated by *, ** and *** respectively.

Panel A:	(-10,10)	(-5,5)	(-3,3)	(-1,1)
CAAR	-0.015	-0.010	-0.002	0.003
T-statistic	-1.256	-1.554	-0.358	-0.977
p-value	0.219	0.131	0.723	0.337
Panel B:	(-10,-1)	(-5,-1)	(-3,-1)	
CAAR	-0.006	-0.005	-0.003	
T-statistic	-0.760	-1.139	-0.678	
p-value	0.453	0.264	0.504	
Panel C:	(1,10)	(1,5)	(1,3)	
CAAR	-0.007	-0.003	0.003	
T-statistic	-1.054	-0.796	0.807	
p-value	0.301	0.433	0.426	

5.6 Determinants of cumulative abnormal returns

As the data revealed that for both the full-sample as the three sub-samples small-, mid- and large-cap there was a significant market reaction before the announcement date, this section examines what industries drive their market reaction. For this purpose, the entire dataset is divided in 10 different industries: basic materials, consumer goods, finance, health, industrials, media, oil & gas, retail, technology, and telecom & services. After the dataset is categorized into industries, a dummy is added for every industry and these are incorporated in the regression with cumulative abnormal returns as dependent variable. In all three regressions, the basic materials dummy is taken as base level. The summary statistics for this regression are reported in table 6.

Table 7 provides the determinants of the cumulative abnormal returns for the full sample for the windows (-10,-1), (-5,-1), and (-3,1). The first regression in the set reveals that no industries are significantly related to the cumulative abnormal returns in the window (-10,-1).

Table 7: Summary Statistics

This table reports the summary statistics for this research. Data are retrieved from the Thomson Reuters database.

Industry	Mean	Std. dev.	Minimum	Maximum	N
Basic materials	0.0002	0.0175	-0.0365	0.0597	111
Consumer Goods	-0.0004	0.0609	-0.2877	0.0986	888
Financials	-0.0019	0.0309	-0.1759	0.3677	1554
Health	-0.0001	0.0160	-0.0743	0.0942	444
Industrials	-0.0008	0.0753	-0.6931	0.6931	1776
Media	-0.0007	0.0149	-0.0712	0.0537	333
Oil & Gas	0.0001	0.0194	-0.1314	0.1455	555
Retail	-0.0003	0.0148	-0.1300	0.0666	666
Technology	-0.0006	0.0221	-0.0976	0.1414	444
Telecom	-0.0016	0.0229	-0.0745	0.1572	111
Services	0.0007	0.0234	-0.0711	0.1053	777

The second regression of the regression set shows the determinants of the cumulative abnormal returns of the (-5,-1) window. This regression reveals that again media- and telecom and services firms are positive determinants of cumulative abnormal returns, whereas financial firms are negative determinants of cumulative abnormal returns. When looking at financial and telecom and services firms, one can see that they are statistically significant at a 5% level. Furthermore, firms which are classified as media firms are statistically significant at a 10% level.

The third regression of the regression set shows the determinants of the cumulative abnormal returns of the (-3,-1) window. The third regression in the set shows the same relationship between media- and financial firms and the cumulative abnormal returns as for the window (-5,-1). However, the statistical significance of financial and telecom and services firms has increased.

The positive relationship between firms which are classified as telecom & services and cumulative abnormal relation can be explained by the fact that during the period of the event there were rumours that América Móvil was interested in buying the Dutch telecom provider KPN. These rumours had a positive impact on the stock price during the event window. The positive relation between Media firms and cumulative abnormal returns can possibly be explained by a reorganization announcement by the Telegraaf Media Group during the event window.

When looking at tables 2, 3 and 4 the data reveals that this abnormal return pattern before the announcement data is driven by Dutch large- and small-cap firms for all three windows. On the other hand, mid-cap firms seem not to have any abnormal return pattern. Besides this, the abnormal returns subsequent to the announcement at the (1,3), (1,5), and (1,10) windows appear not to be statistically significant in any of the large-, mid-, and small-cap subsamples.

Table 8: Determinants of cumulative abnormal returns

This table reports the results from the regressions all with the cumulative abnormal returns as dependent variable on a set of dummy variables which represent the different industries the firms in the sample belong to. Data are retrieved from the Thomson Reuters database. Statistical significance levels of 10%, 5% and 1% are indicated by *, ** and *** respectively, whereas p-values are reported in brackets.

	Event window		
Variable	(-10,-1)	(-5,-1)	(-3,-1)
Constant	-0.031***	-0.016***	0.002***
	(0.000)	(0.000)	(0.000)
Consumer Goods	0.018	0.019	-0.007
	(0.797)	(0.368)	(0.792)
Finance	-0.150	-0.035**	-0.037***
	(0.287)	(0.042)	(0.000)
Health	-0.004	-0.004	0.018
	(0.868)	(0.697)	(0.107)
Industrials	-0.023	-0.018	-0.014
	(0.255)	(0.280)	(0.195)
Media	0.025	0.011***	0.006***
	(0.132)	(0.000)	(0.007)
Oil & Gas	-0.007	0.008	-0.009
	(0.699)	(0.433)	(0.406)
Retail	0.007	-0.003	-0.010
	(0.672)	(0.680)	(0.113)
Technology	0.023	0.037	0.004
	(0.496)	(0.127)	(0.523)
Telecom & Services	-0.004	0.021**	0.032***
	(0.923)	(0.064)	(0.007)
R^2	0.066	0.186	0.110

Furthermore, when looking at table 5 in general, firms which are classified as financial companies are negatively correlated with cumulative abnormal returns over the windows (-10,-1), (-5,-1), and (-3,-1), whereas companies which are classified in the category media and telecom & services are positively correlated with cumulative abnormal returns over those windows.

6. Conclusion

This thesis studied the effects of the announcement of the retirement age increase on the Dutch stock markets at the 16th of May 2012. As Goyal (2004) and Geanakoplos et al. (2004) pointed out that an increase in the relative size of the pre-retirement cohort and an increase in the ratio of the pre-retirement cohort to the young cohort will lead to lower stock returns. In order to examine whether this was also the case for the Dutch stock market, an event approach was used. This approach firstly estimated normal results using a benchmark model. Hereafter, tests were carried out in order to see whether the actual returns were statistically different compared with the benchmark returns. This approach watched for abnormal stock behavior around, before and subsequent to the announcement date in case the efficient market hypothesis held.

When looking at the data, it reveals that for the full sample the negative abnormal returns are driven by negative abnormal returns prior to the event date. This pattern can be explained by the fact that rumors about the new legislation were discussed already earlier in several newspapers. Besides this, the abnormal return pattern prior to the announcement data is driven by Dutch large- and small-cap firms for all investigated windows. On the other hand, mid-cap firms do not seem to have any abnormal return pattern. Other than that, the abnormal returns subsequent to the announcement at the (1,3), (1,5), and (1,10) windows appear not to be statistically significant in any of the large-, mid-, and small-cap subsamples.

As these results are possibly a lucky shot since these results can be driven by other factors, the same study is performed for the German stock market. Doing so can rule out the chance that the results for the Dutch market are driven by global factors rather than the retirement age announcement. When looking at the German market, the data reveals no significant market reaction around the announcement of the Dutch retirement age increase. These findings strengthen the prior found results, as it rules out global factors on the research.

Furthermore, when looking at the categorized results, firms which are classified as financial firms are negatively correlated with cumulative abnormal returns over the windows (-10,-1), (-5,-1), and (-3,-1), whereas companies which are classified in the category media are positively correlated with cumulative abnormal returns over those windows.

Although this research is performed with great care, there are some limitations in this work. The results of an event study are hard to interpret as the results are possible driven by another factor than researched upon. Although this work tries to diminish the chance of that occurrence by performing the same study for the German market, it does not fully prove that the retirement age announcement influences stock market behavior as the robustness test has a lower sample size as the original sample. Future research can focus on another economy where the same announcement took place in order to establish whether that economy encounters the same abnormal return pattern as this thesis did, or extend the amount of countries in the robustness test in this thesis.

7. Reference List

Abel, A. B. (2001). Will bequests attenuate the predicted meltdown in stock prices when baby boomers retire?. *Review of Economics and Statistics*, *83*(4), 589-595.

Abel, A. B. (2003). The effects of a baby boom on stock prices and capital accumulation in the presence of social security. *Econometrica*, *71*(2), 551-578.

Alexander, S. S. (1961). Price movements in speculative markets: Trends or random walks. *Industrial Management Review*, *2*, 7-26.

Ang, A., & Maddaloni, A. (2004). *Do demographic changes affect risk premiums? Evidence from international data* (No. w9677). National Bureau of Economic Research.

ANP. (May 26, 2012). Nu.nl. In Pensioenleeftijd in 2023 naar 67 jaar. Retrieved January 21, 2013, from http://www.nu.nl/economie/2812395/pensioenleeftijd-in-2013-67-jaar.html.

Antweiler, W., & Frank, M. Z. (2004). Is all that talk just noise? The information content of internet stock message boards. *The Journal of Finance*, *59*(3), 1259-1294.

Attanasio, O. P., & Violante, G. L. (2000). *The demographic transition in closed and open economy: A tale of two regions*. Working Paper 412, Research Department, Inter-American Development Bank, Washington, DC.

Bachelier, L. (1900). *Théorie de la spéculation*. Gauthier-Villars.

Bergantino, S. M. (1998). *Life cycle investment behavior, demographics and asset prices* (Doctoral dissertation, Massachusetts Institute of Technology).

Bettman, J., Hallett, A., & Sault, S. (2011, August). Rumortrage: Can investors profit on takeover rumors on internet stock message boards?. In *Finance and Corporate Governance Conference*.

Binder, J. (1998). The event study methodology since 1969. *Review of quantitative Finance and Accounting*, *11*(2), 111-137.

Bondt, W. F., & Thaler, R. (1985). Does the stock market overreact?. *The Journal of finance*, *40*(3), 793-805.

Börsch-Supan, A. X. E. L., Ludwig, A., & Winter, J. (2006). Ageing, Pension Reform and Capital Flows: A Multi-Country Simulation Model. *Economica*, *73*(292), 625-658.

Bowman, R. G. (1983). Understanding and conducting event studies. *Journal of Business Finance & Accounting*, *10*(4), 561-584.

Borges, M. R. (2010). Efficient market hypothesis in European stock markets. *The European Journal of Finance, 16(7)*, 711-726

Brooks, R. (2002). Asset-market effects of the baby boom and social-security reform. *The American Economic Review*, *92*(2), 402-406.

Brooks, R. (2003). Population aging and global capital flows in a parallel universe. *IMF staff papers*, 200-221.

Brown, S. J., & Warner, J. B. (1980). Measuring security price performance. *Journal of financial Economics*, *8*(3), 205-258.

Copeland, T. E., & Mayers, D. (1982). The value line enigma (1965–1978): A case study of performance evaluation issues. *Journal of Financial Economics*, *10*(3), 289-321.

Cowles, A., & Jones, H. E. (1937). Some a posteriori probabilities in stock market action. *Econometrica, Journal of the Econometric Society*, 280-294.

Davis, E. P., & Li, C. (2003). Demographics and financial asset prices in the major industrial economies. *Economics*.

De Goeij, P., de Jong, F., (2011), 'Event Study Methodology'.

Dyckman, T. R., Downes, D. H., & Magee, R. P. (1975). *Efficient capital markets and accounting: a critical analysis*. Englewood Cliffs, New Jersey: Prentice-Hall.

Fama, E. F. (1965). The behavior of stock-market prices. *The journal of Business*, *38*(1), 34-105.

Fama, E. F. (1970). Efficient Capital Markets: A Review Of Theory And Empirical Work*. *The journal of Finance*, *25*(2), 383-417.

Fama, E. F. (1998). Market efficiency, long-term returns, and behavioral finance. *Journal of financial economics*, *49*(3), 283-306.

Fama, E. F., & Blume, M. E. (1966). Filter rules and stock-market trading. *The Journal of Business*, *39*(1), 226-241.

Geanakoplos, J., Magill, M., & Quinzii, M. (2004). Demography and the long-run predictability of the stock market. *Brookings Papers on Economic Activity*, *2004*(1), 241-325.

Goyal, A. (2004). Demographics, stock market flows, and stock returns. *Journal of Financial and Quantitative Analysis*, *39*(1), 115-142.

Jegadeesh, N., & Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *The Journal of Finance*, *48*(1), 65-91.

Kendall, M. G., & Hill, A. B. (1953). The analysis of economic time-series-part i: Prices. *Journal of the Royal Statistical Society. Series A (General)*, *116*(1), 11-34.

Koenig, F. (1985). *Rumor in the marketplace: The social psychology of commercial hearsay*. Auburn House Publishing Company.

Lintner, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *The review of economics and statistics*, *47*(1), 13-37.

MacKinlay, A. C. (1997). Event studies in economics and finance. *Journal of economic literature*, *35*(1), 13-39.

Malkiel, B. G. (1992). Efficient Market Hypothesis in New Palgrave Dictionary of Money and Finance.

Malkiel, B. G., & Fama, E. F. (1970). Efficient Capital Markets: A Review Of Theory And Empirical Work*. *The journal of Finance*, *25*(2), 383-417.

Malkiel, B.G., 2003, "The efficient market hypothesis and its critics," Journal of Economic Perspectives, 17 (1), 59–82.

Marsh, T. A., & Merton, R. C. (1986). Dividend variability and variance bounds tests for the rationality of stock market prices. *The American Economic Review*, *76*(3), 483-498.

Moore, A. B. (1964). Some characteristics of changes in common stock prices.*The random character of stock market prices*, 139-61.

Mossin, J. (1966). Equilibrium in a capital asset market. *Econometrica: Journal of the Econometric Society*, 768-783.

Poterba, J. M. (2001). Demographic structure and asset returns. *Review of Economics and Statistics*, *83*(4), 565-584.

Poterba, J. (2004). *The impact of population aging on financial markets* (No. w10851). National Bureau of Economic Research.

Rose, A. M. (1951). Rumor in the stock market. *Public Opinion Quarterly*, *15*(3), 461-486.

Scholes, M. S. (1972). The market for securities: Substitution versus price pressure and the effects of information on share prices. *The Journal of Business*, *45*(2), 179-211.

Schwert, G. W. (2003). Anomalies and market efficiency. *Handbook of the Economics of Finance*, *1*, 939-974.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The journal of finance*, *19*(3), 425-442.

Shiller, R. J. (1981). Do stock prices move too much to be justified by subsequent changes in dividends?, The American Economic Review 71(3), 421-436.

Shleifer, A. (2003). *Inefficient markets: An introduction to behavioral finance*. Oxford university press.

Tóth, B., & Kertész, J. (2006). Increasing market efficiency: Evolution of cross-correlations of stock returns. *Physica A: Statistical Mechanics and its Applications*, *360*(2), 505-515.

Wilson, E. J., & Marashdeh, H. A. (2007). Are Co-integrated Stock Prices Consistent with the Efficient Market Hypothesis?. *Economic Record*, *83*(s1), S87-S93.

Working, H. (1934). A random-difference series for use in the analysis of time series. *Journal of the American Statistical Association*, *29*(185), 11-24.

Yoo, P. S. (1994). Age distributions and returns of financial assets. *Federal Reserve Bank of St. Louis Working Paper Series*.