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MASTER'S THESIS

Stock Valuation, Dividends and Learning Through Age

how learning about a firm and its dividend policy affects its valuation

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Declaration of Authorship

We, Yousef KADDOURA and Marius RRAPUSHAJ, declare that this thesis titled, "Stock Valuation, Dividends and Learning Through Age: how learning about a firm and its dividend policy affects its valuation" and the work presented in it are our own. We confirm that:

- This work was completed while studying for a Master's degree at Lund University.
- Where the work done in this thesis was done by us only.
- The supervisor was only responsible for the supervision and not the content.
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Abstract

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Stock Valuation, Dividends and Learning Through Age

how learning about a firm and its dividend policy affects its valuation

by Yousef KADDOURA
& Marius RRAPUSHAJ

This paper looks into how learning about firms and their dividend policy affects their valuation, while comparing the results between North American and German firms. Learning is observed through the age of a firm, where the market-to-book ratio (M/B) is predicted to decline over a firm's lifespan. M/B is expected to be affected positively by the uncertainty of growth, and this effect is associated more with dividend non-payers than dividend payers. In other words, because of the uncertainty that firms exhibit at their young age, M/B should increase, especially for dividend non-payers. Also, young newly-listed firms that do not pay dividends are expected to have a higher M/B than firms that do pay dividends. These expectations held when conducting the study on North American firms, but when testing for German firms, the results differed from the expectations. M/B does not seem to have any relationship with age when conducting the study on German dividend-paying firms. German firms that do not pay dividends exhibit a high M/B in the first year followed by a steep decline as firms grow in age. However, this high valuation and the decline in M/B can be explained by over-optimism. These predictions are tested using the Fama-MacBeth two step regression and are reported in the empirical results subsection. Finally, the data was collected using Compustat and Datastream for North American and German firms respectively.

Keywords: Market-to-Book Ratio, Firm value, Learning effects, Dividends, Uncertainty, Over optimism, Fama-MacBeth.

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Contents

List of Figures

List of Tables

Introduction

The amount of publicly listed firms has been in fluctuation for the past thirty years. According to Fama and French (2001b), the number of publicly listed firms has risen tremendously between 1978 and 1997. Fast forward to today, Brown et al. (2017) observed a steep decline in the number of North American listed firms because of major financial crises and bubbles that occurred around that time. A lot of research has been done about Initial Public Offerings (IPOs) and the ups and downs related to them, but surprisingly, not much research has been done about how learning more about these firms affects their valuation. According to Pástor and Veronesi (2003), newly-listed firms in their younger age are valued higher than their book value because of their high expected growth. Coad, Sagarra and Teruel (2016) consider a firm as young when its age is less than 10 years old, and as old if its age is above than 10 years. However, this is not considered a rule, but is mentioned just to give a clarification on what is considered young and what is considered old. Pástor and Veronesi (2003) argue that the uncertainty that comes with young firms contributes to their high valuation. This might be due to that investors have higher expectations for firms that are in their young stages, where after some years, investors gain more knowledge and insight about these firms which usually leads to a drop in their initial valuation. In this paper, the market-to-book ratio (M/B) is used following Pástor and Veronesi (2003) as a proxy for firm value. Learning is observed by looking at the age, whereas age increases, the more knowledge investors have about a firm's expected profitability.

The purpose of this paper is to observe how learning about a firm and its dividend policy could affect its valuation. This paper intends to explain the behavior of a firm's value as a firm grows in age. In other words, studying the relationship between the value and the age of a firm. This relationship is also studied while taking the dividend policy into account to see which are affected more by learning, dividend payers or non-payers. The study is undertaken on two different economies (North America & Germany). No previous research was done outside of the North American scope, which is why it seemed interesting to compare the results with another country. In addition, some limitations worth mentioning were faced when conducting the research on German firms. The data sources available for Germany provided data that goes back only to 1980 and the number of firms available was 725 in comparison to 23,946 firms for North American firms. Nevertheless, this does not necessarily mean that there is a problem because the amount of firms was sufficient enough to conduct a study and draw a conclusion from.

The firm value is observed according to Pástor and Veronesi (2003) through the market-to-book ratio (M/B). They argue that M/B increases with the uncertainty of expected growth in the book value of equity. They show that uncertainty declines as the firm ages, which means that younger firms typically have higher uncertainty and thus a higher M/B. This gives an intuition on why firms are argued to be valued higher in their younger stages. This is tested empirically in this paper for North American and German firms. The empirical testing was done over a sample of panel data of two major economies, North America and Germany. Data for North American firms was collected from 1962 to 2018 and data for German firms was collected from 1980 to 2017.

A common hurdle that young firms usually face is external financing. Pástor and Veronesi (2003) observe lower growth rates in young firms that pay dividends, which is intuitive given that they usually face financing problems at the beginning. This is tested empirically in this paper, where the general expectation is that young dividend non-payers should have a higher M/B than that of young dividend payers. This is considered the case because of the argument that uncertainty associated with young non-dividend payers leads to a higher valuation. It is also argued that this only holds when the firm is still in its younger stages and that after a significant amount of years have passed, dividend payers' valuation should start stabilizing, whereas non-dividend payers' valuation should keep on declining with time. This is also intuitive because mature and successful firms usually are expected to pay dividends. According to Miller and Modigliani (1961), dividends are irrelevant to the valuation of a firm, while DeAngelo and DeAngelo (2006) found that dividends are relevant to a certain extent for the firm's valuation. This paper argues that dividends are relevant for firms in both their young and mature ages, where it is expected that dividends lower the valuation of a firm in its younger age while signaling that a firm is doing well in its mature ages. DeAngelo and DeAngelo (2007) show that if mature firms start giving fewer dividends, the valuation of a firm is affected negatively. Different regressions and methods are used in this paper to tackle these arguments.

Pástor and Veronesi (2003) raise an important issue about the irrationality of investors. The problem is the possibility of having over-optimistic investors valuing newly-listed firms. According to Pástor and Veronesi (2003), The issue is tackled by adding future returns $(RETURN)$ and future profitability (ROE) in the model. If the empirical results show a significant relationship between M/B and the future determinants, then there is no irrational over-optimism. It is also argued that every time an extra future determinant is added to the model, although it might stay significant and negatively correlated with M/B, age loses more power. These arguments are tested empirically in the empirical results subsection.

The methodology adopted in this paper is the Fama-MacBeth two-step regression.

The regression shows how exposed M/B is to learning (age) and uncertainty. The regression will be run multiple times by adding more future determinants for each regression. In addition, M/B is regressed against age once for dividend payers and another time for non-dividend payers to closely observe the different impact learning has on each group. This is also tested using the Fama-Macbeth two step regression.

This paper starts by discussing previous literature related to the topic at hand, while also mentioning the distinguishing aspects of this paper. Afterward, the methodology section is reported in 3 different subsections. The first subsection explains how the data was collected and how the variables were created. The second subsection discusses the model and the assumptions behind the model. The third and last subsection included in the methodology section presents the continuous time-framework of the model. Then, econometric testing is discussed. Next, the results are reported and analyzed in the results and analysis section. This section is divided into three subsections. The first subsection reports the descriptive statistics of the data collected, the second subsection visualize the data into figures and the third subsection tests the data empirically and analyzes the results. After this, a robustness section is added to ensure the correctness of the tests done. The conclusion is then given as a summary of the findings reported in this paper. Finally, some ideas about future research are discussed.

Previous Research

The previous research mentioned in this section includes literature that is associated with the effects of learning and dividends on a firm's valuation. This section starts by briefly mentioning topics that are of some relevance to the topic at hand, summarizing the results of the "main" papers used to construct the methodology and finally discussing what is new in this paper. This paper follows the method used by Pástor and Veronesi (2003) for both dividends and learning.

Previous Research: Dividends

The topic regarding the relevance of paying dividends on a firm's value has been debated upon for quite a while. As mentioned before, Miller and Modigliani (1961) argue for the irrelevance of dividends. In their paper, they come up with a theoretical structure based on a perfect market, rational behavior and complete certainty which concludes with the irrelevance of dividends. Other papers supported this argument including Brennan (1971), Black and Scholes (1974), Hakansson (1982), and others. Nevertheless, this paper focuses more on the relevance of dividends and how it affects the firm's valuation. Again, DeAngelo and DeAngelo (2006) argued against Miller and Modigliani (1961) and concluded that dividends are relevant even in a frictionless market.

Baker and Wurgler (2004) examined three kinds of samples, surviving dividend payers, surviving dividend non-payers and new lists. They used a two-stage regression approach on data collected from Compustat between the years 1962 and 2000. The first stage of their regression was a series of Fama-MacBeth regressions, where dividend payments were regressed on firm characteristics. The second stage was a regression of the average annual errors on dividends. The conclusion they got is based on a theory called “A Catering Theory of Dividends”, where they showed that dividends are relevant and related to the firm’s valuation.

Gordon (1963) and Lintner (1962) came up with the “bird-in-hand” philosophy, where they suggested that rational investors should prefer dividends as it is more certain than capital gains. They concluded the same for firms, where they claimed that one percent drop in dividend payout has to be negated by more than one percent of future growth. In other words, they believed that a firm’s cost of holding retained earning is higher than that of dividend payout.

Moreover, the theoretical model by Miller and Rock (1985) suggested that an increase in dividends indicates that a firm has a healthy and prosperous future and a decrease in it would lead to the opposite. This is widely known as the “signaling effect” and is discussed in other papers such as in John and Williams (1985), Bhattacharya (1979). Another theory worth mentioning is the Agency Cost Theory suggested by Jensen and Meckling (1976). Their paper suggested that their is an “agency cost” caused by the difficulty of aligning the “principal’s” and “agent’s” interests. The general argument is that paying dividends decreases the “agency cost” problem. All these papers argued with the relevance of dividends regardless of the impact it has on a firm’s value.

Finally, Pástor and Veronesi (2003) found that younger firms that pay no dividends are usually associated with higher volatility. Their general finding on dividends is that it has a negative correlation with M/B because of lower volatility. They found that M/B is typically higher for young firms and that not paying dividends makes this relationship even stronger. They also did separate regressions on dividend and non-dividend payers, where they found that the learning effect is stronger on firms that pay no dividends. Their paper was supported empirically, where they regressed the natural logarithm of M/B on several variables including a dummy variable that accounted for dividends. The method used was a Fama-MacBeth regression on annual data collected from the CRSP/Compustat database.

Previous Research: Learning

Although the topic on how learning affects a stock's valuation sounds interesting, there hasn't been much research regarding this topic at hand. Nevertheless, there was enough literature that gives a deep understanding and insight on the matter. Timmerman (1993) argued, using a simple learning model, that learning generates excess volatility and predictability in stock prices. Brennan and Xia (2001) studied the importance of learning on hedge demand and optimal dynamic portfolio rules and the opportunity cost suffered from ignoring predictability or learning. Their paper showed that ignoring market timing can lead to investors suffering large opportunity costs. The methods they used were an OLS regression and a Vector auto-regression (VAR) done over data collected from CRSP and Datastream. They explained that learning is introduced due to the non-observability of the expected dividend growth. Lewellen and Shanken (2002) argued that Predictability arises solely from the learning process because of the revision done on past mistakes. They showed that asset-pricing tests can be significantly affected by learning. Their method was to implode Fama-MacBeth regressions across 2500 simulations. These articles mostly touched on the relationship between learning and variables such as excess volatility and predictability. Although interesting, none of these articles discussed the relationship of learning and stock valuation (M/B).

Pástor and Veronesi (2003) discussed in detail the relationship between learning and stock valuation. They used a mathematical continuous-time framework to explain how M/B is affected by learning. Age is used by them as a variable to observe how learning affects M/B. With some assumptions, they were able to show that volatility and M/B are positively correlated and that uncertainty increases volatility and thus M/B as well. It was safe for them to assume that uncertainty decreases as a firm grows in age because it allowed investors to revise their high valuations. They finally concluded that even after controlling for known determinants of M/B, young firms that are associated with uncertainty have a higher M/B than old firms. The method used by them was a Fama-MacBeth regression done by regressing the natural logarithm of M/B on several variables while focusing mainly on age. All their findings were proven empirically and the data was extracted on an annual frequency from the CRSP/Compustat database between 1962 and 2000.

Distinguishing Aspects of The Paper

This paper has some aspects that distinguishes it from other papers. Pástor and Veronesi (2003) collected data from 1962 to 2000, whereas this paper uses data from 1962 till 2017. Also, the same tests were done on another country (Germany) to observe if there are any differences that deviates from the main expectations. Using another country is interesting because the previous research was only done on North American firms.

Methodology

Data Collection

This subsection focuses on data collection and variables' creation. To begin with, a large sample of annual data was collected for both North American and German firms and was rearranged into a panel. Data for North American firms was collected between the years of 1962 and 2017 using the Compustat data base, whereas data for German firms was collected between the years of 1980 and 2017 using the Worldscope database from Datastream. 23946 firms were collected for North American firms, whereas only 725 firms were collected for German firms. Datastream had sufficient data only for "alive" firms and hence the 725 firms were listed under the "alive" group in Datastream. The number of firms, the year horizons, and the data sources were selected according to availability. As mentioned before, learning is observed using the age of the firm, where it is calculated according to the first appearance of the firm in the database. For example, Microsoft Corporate appeared in 1986 according to Compustat and hence the age is 1 at that data point. According to Pástor and Veronesi (2003), the *AGE* variable is constructed by taking minus the reciprocal of 1 plus age, $-1/(1 + age)$. They chose to do this because uncertainty has a linear function of age in the denominator according to equation 17. They also explained that it is possible to take the natural logarithm of age or just plain age. Using either of these choices to construct the *AGE* variable yields approximately the same results. This paper uses minus the reciprocal of 1 plus age because the results are slightly better, but nevertheless very similar. Dividends are simply dividends available to common stockholders.

A dividend dummy (DD) is then created and is equal to 1 when firms pay dividends and 0 otherwise. Market value is calculated by multiplying the number of common shares outstanding by the common price of equity at the end of the fiscal year. Book value is calculated according to Fama and French (1993) by adding deferred taxes and investment credit and then deducting the book value of preferred stock from stockholders' equity. M/B is then calculated as the market value divided by the book value. According to Pástor and Veronesi (2003), leverage is calculated as debt divided by total assets, where debt is the total long-term debt. Return on equity is calculated as earnings divided by book equity. According to them, earnings are calculated as Income before extraordinary items, available to common stockholders, plus investment tax credit, plus deferred taxes from the income statement. The size ($SIZE$) is created by taking the natural logarithm of total assets. Total assets, market value and book value were collected in millions. Moreover, volatility was calculated as the standard deviation of monthly returns for each year. Outliers were controlled for following Pástor and Veronesi (2003) by removing the values of M/B smaller than 0.01 and greater than 100, and also the values of market value, book value and total assets smaller than 1. When dropping volatility data points greater than 100%, the significance of the results does not change, and that could be because there was not enough outliers above the 100th percentile to alter the results. Also, when dropping ROE under -200% and above 1000%, the significance does not change for the same reason. It is good to note that Datastream provides most of the variables without doing any of the previously mentioned calculations. Either getting the variables ready from Datastream or creating them is sufficient. Compustat does not provide the variables, and hence, it is a must to create them. The currencies used were the US Dollar and the Euro for North America and Germany respectively. Finally, tables 11 and 12 in the appendix present information about each item needed when constructing the variables.

Model

In this paper, M/B is to be tested and regressed over age, dividends, and other determinants. The method used in this paper is the Fama-MacBeth Two-Step regression following Fama and MacBeth (1973). The method is generally used to determine the exposure of a dependent variable on some other determinant factors. According to them, the first step is a time series regression, where the dependent variable (M/B) is regressed on other factors to observe how exposed it is to each one. The second step is then performed by regressing the cross-section of the dependent variable (M/B) on the factor exposures at each point in time to generate time-series coefficients for each one. Finally, they take the average of the coefficients for each factor in order to understand the level of exposure on the dependent variable (M/B). Luckily, this method could be replicated without much effort using modern programming languages. The program used to get the empirical results in this paper is Stata.

The main model used follows Pástor and Veronesi (2003) using the previous mentioned Fama-MacBeth Two-Step regression. M/B is regressed on age, dividends, and other determinants at each point in time between 1962 and 2017 for North American firms and between 1980 and 2017 for German firms:

$$\begin{aligned} log(M/B)_i = \; & \alpha + \beta AGE_i + \gamma DD_i + \theta LEVERAGE_i + \delta SIZE_i + \lambda VOL_i \\ & + \xi_0 ROE_i + \xi_1 ROE_{i,t+1} + \ldots + \xi_q ROE_{i,t+q} \\ & + \psi_1 RETURN_{i,t+1} + \ldots + \psi_q RETURN_{i,t+q} + \varepsilon, \quad i = 1, \ldots, N \end{aligned} \tag{1}$$

where M/B is the market-to-book ratio, AGE is minus the reciprocal of 1 plus the age of the firm, DD is a Dividend Dummy capturing whether the firm is paying dividends or not, $SIZE$ is the natural logarithm of total assets, $LEVERAGE$ is the long term debt divided by total assets, VOL is volatility calculated as the standard deviation of monthly returns for each year, ROE is return on equity calculated as earnings divided by book equity, $RETURN$ is simply annual returns, and ε is an error term. ROE and $RETURN$ act as proxies for future predictability. It is good to note that i and t represent the firm and the year respectively. Moreover, adding industry dummies to distinguish between M/B of different sectors should normally be considered because of the absence of intangible assets from the firm's book value. Nevertheless, this is not a problem according to Pástor and Veronesi (2003) because all the values go through when $M_T = (1 + \Xi)B_T$, where Ξ is a constant. The idea is not testing M/B for different industries, but to see the behavior that M/B exhibits over the age of a firm regardless of its industry.

The general idea of this model depends on how market-to-book ratio (M/B) is perceived. According to Pástor and Veronesi (2003), B is denoted as the book value of equity and g as the long-term growth rate, and thus the book value of equity at some time T is equal to $Be^{(gT)}$. Some assumptions they make are the high competitiveness in the market eliminating abnormal earnings at time T, the firm market value at time T being equal to its book value, the market value today being equal to the expected book value of equity with a discount rate r, and that g is unknown and normally distributed and hence M/B:

$$\frac{M}{B} = E\{exp[(g - r)T]\} = exp[(\bar{g} + \sigma^2/2 - r)T] \tag{2}$$

$$g \sim \mathcal{N}(\bar{g}, \sigma^2)$$

This model predicts that M/B increases with expected growth of book equity (g). This prediction in the model is intuitive according to Pástor and Veronesi (2003) because of the convex relation between the growth rate and the terminal value. This paper focuses on the uncertainty factor of the expected growth, σ^2. It is easy to have a misconception and conclude that the growth factor on M/B is ignored as the topic goes further, but it is important to clarify that uncertainty (σ^2) is the variance of the normally distributed growth factor. In other words, if the knowledge about g is more uncertain, M/B is predicted to increase accordingly. Before discussing the model further, it is important to mention that these assumptions and this model are tailored based on the rigorous observations on North American firms and investors. The study on Germany was conducted to observe if the model holds when changing the market completely.

In this model, as previously argued, M/B is predicted to be high for firms that have high uncertainty. Pástor and Veronesi (2003) argued that the model should empirically show that firms have higher valuations at a younger age because they are associated with uncertainty and that over time, M/B should decline due to investors learning more about the firm's future capabilities. This implies that M/B should have a negative correlation with age even after controlling for the determinants of M/B. It also implies that M/B is expected to have a positive correlation with volatility of returns and a negative correlation DD because dividends is usually associated with less uncertainty. In addition, they argue that firms that do not usually pay dividends are associated with more uncertainty and that the effect of learning on M/B is higher on these firms than that of firms that pay dividends. This means that it is expected that M/B is higher for non-dividend payers than dividend payers. This is captured in the model by splitting the data the into two groups, dividend payers and dividend non-payers, and then testing for the learning effect on each group to see which is affected more by it. All these arguments are tested empirically in this paper for North American and German firms. However, it is possible to observe a deviation from the model depending on the country studied because of the different behavior exhibited by investors and governments in each specific country. In fact, when conducting the study on German firms, the results deviated from the main the model. This is okay because the model predicts that investors prefer uncertainty of growth, that increases the expected growth, on the stability that could be linked to dividends. The predictions in the model are plausible for a lot of investors and is expected to be seen in the study on North American firms. Again, this paper tests the model empirically on 2 different countries to check and explain any results that deviate from it.

Continuous Time-Framework

This subsection will briefly introduce a continuous time-framework for valuing stocks of a mean reverting profitability. It is important to mention that the mathematical proofs won't be reported in this paper and that all the assumptions and references are mentioned and proven by previous researchers. According to Pástor and Veronesi (2003), the expected profitability is defined as return on equity

$$P_t = \frac{Y_t}{B_t}$$

where Y_t is earnings at some time t and B_t is the book value of the firm at some time t. As mentioned above, profitability is argued to follow a mean reverting process.

$$dp_t = \kappa(\mu - p_t)dt + \sigma_p dW_t \tag{3}$$

This process follows the model of Vasicek (1977), where d is the difference, p_t is the profitability, μ is the mean of profitability, κ is the mean reversion, σ_p is the volatility of profitability and dW_t is a Wiener process. More specifically, according to Pástor and Veronesi (2003), σ_p is a 1x2 vector $(\sigma_{p,1}, \sigma_{p,2})$ of constans and dW_t is a 2x1 vector of independent brownian motions. This equation could also be written as the following

$$dp_t = (\alpha + \beta p_t)dt + \sigma_p dW_t \tag{4}$$

where $\kappa = -\beta$ and $\alpha = \kappa\mu$. σ is bigger than zero $(\sigma_p > 0)$ and The higher it gets, the higher the volatility of profitability. Also, following Vasicek (1977), κ is required to be above zero, meaning p_t will revert to μ depending on the speed of mean reversion $(\kappa > 0)$. Ohlson (1995) assumed that book value decreases by an equal amount of the dividend payout and hence

$$D_t = aB_t, \quad a \geq 0 \tag{5}$$

From this, it seems like the growth rate of book value decreases as dividend payout increases

$$dB_t = (p_t - a)B_t \, dt \tag{6}$$

Furthermore, according to the previous assumption that $M_T = B_T$ at some future time T and following Pástor and Veronesi (2003), the market value is then function of the sum of expected dividends and the expected value where $M_T = B_T$

$$M_t = E_t\left[\int_t^T \widetilde{x}_t D_s ds\right] + E_t\left[\widetilde{m}_t B_t\right] \tag{7}$$

where $\widetilde{m}_t = \frac{\pi_T}{\pi_t}$ and $\widetilde{x}_t = \frac{\pi_s}{\pi_t}$ and that π_t represents a stochastic discount factor (SDF). This means that M_t is defined as the expected value of the sum of dividends plus the book value, both discounted by a stochastic discount factor, π_t. Also, s is some additional time. In addition, According to Pástor and Veronesi (2003), π_t is assumed to follow a log-normal distribution, which means the logarithm is normally distributed.

$$\frac{d\pi_t}{\pi_t} = -rdt - \sigma_\pi dW_t \tag{8}$$

where r is the risk free rate and $\sigma_\pi = (\sigma_{\pi,1}, 0)$ is 1x2 vector. It is worth mentioning the model under the assumption of no uncertainty because the uncertainty model is based on it. According to Pástor and Veronesi (2003) Z is proved to be as the following function:

$$Z(\mu, p_t, s) = exp\left\{ -(r + a - \mu)s + \frac{1}{\kappa}(1 - e^{-\kappa s})(p_t - \mu) + Q(s) \right\} \tag{9}$$

where

$$Q(s) = \frac{\sigma_p \sigma_p'}{2\kappa^3}\left[\frac{1 - e^{-2\kappa s}}{2} + \kappa s - 2(1 - e^{-\kappa s})\right] + \frac{\sigma_\pi \sigma_p'}{\kappa^2}(1 - e^{-\kappa s} - \kappa s) \tag{10}$$

In the end they prove that $Z(\mu, p_t, s)$ has a simpler economic functional interpretation as a discounted growth in the book equity

$$Z(\mu, p_t, s) = E_t\left[\frac{\pi_{t+s} B_{t+s}}{\pi_t B_t}\right] \tag{11}$$

Under no uncertainty, they prove that M/B is given as

$$\frac{M_t}{B_t} = a\int_0^\tau Z(\mu, p_t, s)ds + Z(\mu, p_t, \tau) \equiv G(\mu, p_t, \tau) \tag{12}$$

where $\tau = T - t$. Without going into the mathematical interpretation, some economical intuition could be derived from the given model under no uncertainty. from equations 9 & 12, M/B is suggested to increase when expected profitability (μ) increases, when current profitability (p_t) increases, when the interest rate (r) decreases, and when the variance of profitability increases ($\sigma_p \sigma_p'$). According to Pástor and Veronesi (2003), these predictions come from the fact that $s\kappa > 1 - e^{-\kappa s} > 0 \quad \forall \; s > 0$. These predictions are intuitive, where an increase in current and expected profitability should increase the value of a firm (M/B). Also, a decrease in the interest rate should intuitively also increase (M/B). Pástor and Veronesi (2003) assume a convex relationship between the future pay off and expected growth rate. This makes it intuitive to assume that volatility ($\sigma_p \sigma_p'$) would increase M/B. The relation between a and M/B is a bit complex when looking closely at the model. a seems to increase and decrease M/B at the same time when looking at equations 9 & 12. As previously mentioned, dividends should decrease the book value of equity, which explains the negative sign of a in the model. The other positive impact done by the dividend payout is explained by Pástor and Veronesi (2003) as that higher dividend payout should lead to investors receiving their payoffs earlier. The model has further complexities about the speed of reversion (κ) because it also seems to increase and decrease M/B at the same time. This paper explains the most important aspects of the model that helps give a better idea about the main topic at hand.

Before discussing the model under uncertainty, Pástor and Veronesi (2003) described the process of the excess stock returns as

$$dR_t = \overline{R}_t dt + \sigma_{R,t} dW_t \tag{13}$$

where,

$$\overline{R}_t = F(p_t, \tau, a) \frac{\sigma_p \sigma_\pi}{\kappa}, \tag{14}$$

$$\sigma_{R,t} = F(p_t, \tau, a) \frac{1}{\kappa} \sigma_p \tag{15}$$

$F(p_t, \tau, a)$ is mentioned in the appendix. All the mathematical proofs depend heavily on the paper of Pástor and Veronesi (2003) and this paper only interprets the model economically without going into much mathematical details. The following step will use the law of iterated expectations. Hendry and Mizon (2010) give a detailed explanation of this law, where they state that the expected value of a random variable is formulated as the expected value of the random variable conditioned on a second random variable. The proof is represented in equation 21 in the appendix. This paper does not go into mathematical depth and explain this further, but the law is widely known and could be viewed in many papers such as the paper of Hendry and Mizon (2010).

According to Pástor and Veronesi (2003) and using the law of iterated expecations on equations 7 and 12, M/B under the assumption of uncertainty should then be an equation of the average of μ multiplied by the probabilities assigned to each

$$\frac{M_t}{B_t} = \int_R G(\mu, p_t, \tau) p_t(\mu) d\mu \tag{16}$$

where R represents stock returns. This equation shows that when there is uncertainty about μ increase the probability of expected growth rate and hence should increase M/B subsequently. The intuition behind this is that when a firm is still young and there is uncertainty about its growth rates, investors tend to value firms higher according to their high expected growth rates. Pástor and Veronesi (2003) also make the assumption that $G(\mu, p_t, \tau)$ is a convex function of μ. With this convexity assumption and the discovery that higher uncertainty about μ increases M/B led to the conclusion that high growth rates should impact M/B more than lower growth rates. As firms age, a learning curve occurs and leads to investors revising their valuation. Again, the learning effect could be seen in the empirical results as minus the reciprocal of one plus age. This definition was based on uncertainty having a linear function of age in the denominator. They proved that the mean squared error ($\widehat{\sigma}_t = E[(\mu - \widehat{p}_t)^2]$) is non-stochastic and given by

$$\widehat{\sigma}_t^2 = \frac{1}{\frac{1}{\sigma_0^2} + \frac{\kappa^2}{\sigma_{p,2}^2} t} \tag{17}$$

where as $t \to \infty$, $\widehat{\sigma}_t^2 \to 0$.

This framework was briefly explained in this paper and pinpointed the important aspects without going into much mathematical detail. Nevertheless, equation 2 could be referred to for a more simplified version of the model. Finally, it is stressed to mention that this model is based on assumptions and predictions that were observed in the North American market. This means that the assumption could change based on different economies with different investors. In fact, German firms exhibited results that deviate from the predictions of this model.

Econometric Testing

When conducting a Fama-MacBeth regression, it is required to run a lot of regressions. Specifically, running a cross-sectional regression at each time point. Because it is very cumbersome to run the econometric tests for each regression at a time, most researchers skip some econometric tests when conducting this regression. According to Brooks (2014), the following assumptions are discussed:

1. $E[u_t] = 0$
2. $var(u_t) = \sigma^2 < \infty$
3. $cov(u_i, u_j) = 0$
4. $cov(u_t, x_t) = 0$
5. $u_t \sim \mathcal{N}(0, \sigma^2)$

Assumption 1 suggests that the average of the error terms should be equal to zero. According to Brooks (2014), this problem is solved by construction from the fact that as long as an intercept term is included, this assumption will never be violated. Moreover, assumption 2 insinuates that the variance should always be constant, which is known as homoscedasticity. According to Brooks (2014), if the variance is not constant, then the problem of heteroscedasticity arises. Using the Newey-West estimator, devised by Newey and West (1987), in the regression provided no difference regarding the significance of the results. In other words, adjusting for or not adjusting the error terms led to the same results and did not affect the inference, even for insignificance. The estimator is used to solve heteroscedasticity and autocorrelation in the error terms. Also, assumption 3 implies that the error terms should be uncorrelated and as mentioned, the results are the same with or without adjusting the error terms. In addition, assumption 5 says that the residuals are normally distributed. Again, it is cumbersome to test this for each cross-sectional regression in Fama-MacBeth. Nevertheless, regardless if the problem arises or not, this paper follows the suggestions made by Brooks (2014) and take the natural logarithm of some of the variables and remove outliers to account for the non-normality problem. Assumption 4 is endogeneity, and it happens when an independent variable is correlated with an error term. According to Brooks (2014), endogeneity could happen as a result of simultaneity, omitted variables and/or measurement error. This paper is aware of the problem that could be caused by endogeneity between M/B and DD. Testing for endogeneity proved difficult using Fama-MacBeth because many regressions are required to be conducted and hence a test for each regression is needed. Assuming a test is done for each regression, a suitable Instrumental variable is required for each one to account for the problem. taking the difference of DD was thought of, but because DD is a dummy variable, the difference of it is probably not a sufficient substitute for an instrumental variable. However, Pástor and Veronesi (2003) and previous researchers running similar regressions assumed no problem regarding endogeneneity, and because of how cumbersome it is to test for in a Fama-MacBeth environment, this paper does not study this further.

Results and Analysis

Summary Statistics

This subsection discusses some of the summary statistics of the data collected on North American and German firms. It is important to look at the descriptive numbers before working on the regressions to make sense out of the results. Table 1 & 2 present the median of some of the variables studied. There were some differences between the countries.

Table 1 reports the median of variables collected on North American firms categorized over age. M/B, as argued, is observed to be declining as age increases. The median declines from 2.340 for newly listed firms and reaches 1.316 after ten years from being listed. The median of returns is positive at age one and becomes negative in the following 3 years. Moreover, ROE is observed to be around 8% in the first 5 years, then around 9% in the following 5 years. In addition, the size of the firm, as expected, has a consistent increasing trend as the firm grows older in age. Finally, leverage also has a consistent increasing trend with age, which is intuitive because of the observed increase in $SIZE$. In other words, firms become more levered and hence the increase in leverage. This makes sense because as firms become older, they become more known to investors, and it becomes easier to get more debt.

Table 2 discusses the summary statistics of German firms. The observations for German firms are quite similar to that of American firms, but with slight differences.

TABLE 1:
Median by Age: North American firms

Age	1	2	3	4	5	6	7	8	9	10
M/B	2.340	1.906	1.724	1.603	1.513	1.477	1.412	1.356	1.317	1.316
Leverage	0.048	0.070	0.086	0.096	0.105	0.110	0.115	0.121	0.125	0.126
Return	0.264	-0.041	-0.038	-0.036	0.000	-0.006	0.000	0.007	0.044	0.050
$SIZE$	48.176	62.415	74.537	85.646	97.350	105.811	115.655	132.766	147.328	165.941
ROE	0.082	0.089	0.087	0.088	0.086	0.090	0.093	0.095	0.096	0.096
Number of firms	23946	21849	19509	17395	15630	14088	12806	11718	10786	9935

M/B is declining as age increases, but at the age of 6 and 8, there was a slight increase to 1.650 and 1.660 respectively. Nevertheless, this is not considered a problem, as the increase was small for just one year and hence the conclusion of M/B declining is still the same. Return seems to be equal to 0.000 the first two years then becoming negative in the later two years. ROE stays around 5% in the first seven years and increases afterwards to around 7%. Moreover, $SIZE$ is observed to be fluctuating over time which seemed a bit odd at first. Before trying to reason why the $SIZE$ behaves this way and why it is this small, a sub-sample of the $SIZE$ was picked and compared with the annual reports of the firms to make sure it was not a mistake in the data. The data of the $SIZE$ (total assets) collected from Datastream was approximately the same as that of the annual reports of the firms. First, it does seem at first glance that the $SIZE$ is not increasing a lot, but that is because only 10 years are provided in table 2, whereas starting from 11 years and above, the size increases reaching approximately 33. Second, the issue that the size is small could be because of the size of the sample collected from Datastream, where only 725 firms were available from the Worldscope database. These firms could have been either small in size or from an industry such as information technology. Again, this is not considered a problem because what this paper focuses on, is the decline of M/B for newly listed firms regardless of which firms are chosen. Finally, leverage is observed to be increasing with age, but with a slight decrease at age 5 and 6. The median was focused on more than the mean because of it being less prone to outliers. Nevertheless, the conclusions derived from both measures are similar. the mean by age statistics are provided in the appendix reported in tables

9 & 10 for German and North American firms respectively. Finally, a correlation table done on a pooled regression for both economies is reported in table 13 & 14 in the appendix.

TABLE 2: Median by Age: German firms

Age	1	2	3	4	5	6	7	8	9	10
M/B	2.410	1.940	1.590	1.580	1.570	1.650	1.620	1.660	1.650	1.540
Leverage	0.112	0.173	0.232	0.247	0.241	0.224	0.232	0.260	0.272	0.291
Return	0.000	0.000	-0.090	-0.0900	0.000	0.000	0.016	0.000	-0.015	0.000
$SIZE$	3.159	3.458	3.632	3.823	3.928	3.4094	3.725	3.547	3.851	3.356
ROE	0.056	0.056	0.044	0.051	0.053	0.053	0.054	0.074	0.065	0.07
Number of firms	725	700	679	661	648	635	613	589	574	549

Figures

This subsection reports some crucial figures related to the study in order to give some intuition about the expected results. Figures 1 & 2 report M/B by age of North American firms (regardless of the calendar year) and show that as firms grow in age, M/B tends to decline as argued. The solid line represents the median of M/B for all firms, the dotted line represents the median of M/B of firms that do not pay dividends and the dashed line is for firms that pay dividends. The median of M/B peaks at 2.340 for newly-listed North American firms and then declines for about 10 years. Looking closely at figure 1, it is depicted that M/B is higher for firms that do not pay dividends and that M/B of dividend non-payers has a much stronger relationship with age than that of dividend payers. This means that any typical dividend non-payer has a higher M/B with a steeper decline for the first 20 years than any typical dividend payer. This could be explained as the theoretical model suggests that when firms pay dividends, their expected growth rate is not that high and hence, neither is M/B. In other words, dividend non-payers are associated with more uncertainty that contributes to their high M/B and dividend payers are more certain or stable.

FIGURE 1:
Median by Age (20 years): North American firms

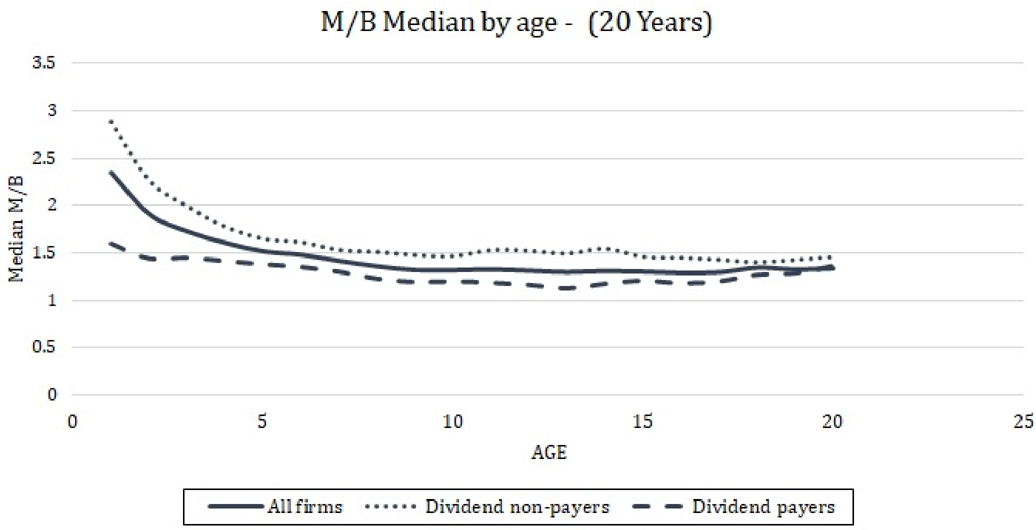
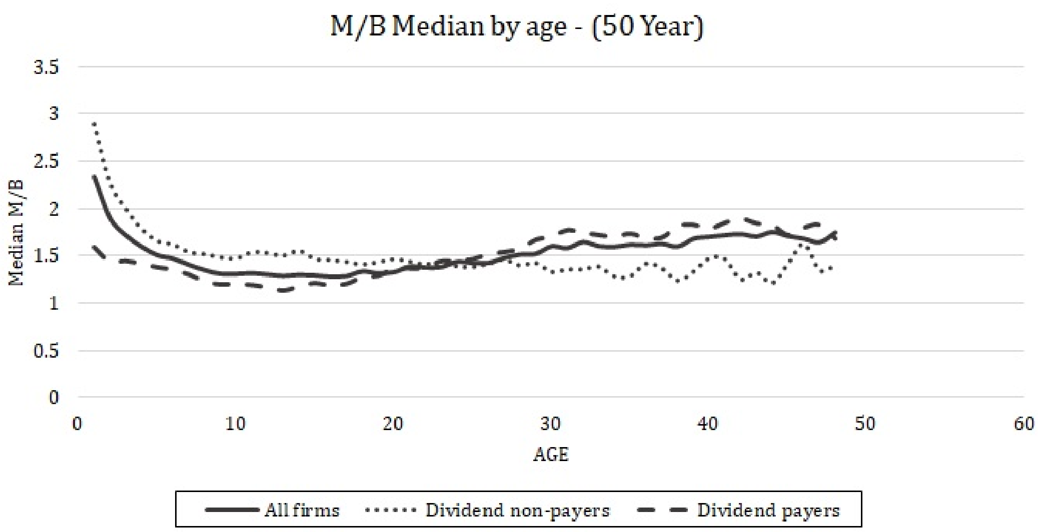


Figure 2 is just an extension of figure 1 and is plotted to observe what happens after firms get older. It is observed that at around 25 years of age, M/B for dividend non-payers keep on declining, whereas M/B for dividend payers starts increasing to reach a point where it is higher than that of non-payers. This is intuitive in a sense that investors start expecting firms to pay dividends as they become older.

FIGURE 2:
Median by Age (50 years): North American firms



For each age, figures 3 & 4 report the volatility of returns across firms of that age, regardless of the calendar year. It is observed from figure 3 that volatility declines as firms grow in age. It is also depicted that dividend non-payers have higher volatility than that of dividend payers, which has more of a flat line. The stable volatility of dividend payers could be a factor for why M/B is more stable for dividend payers than that of non-payers. Looking at the previous figures and relating them to what is observed now, it seems that there could be some kind of a positive correlation between M/B and volatility for North American firms.

FIGURE 3:
Volatility (20 years): North American firms

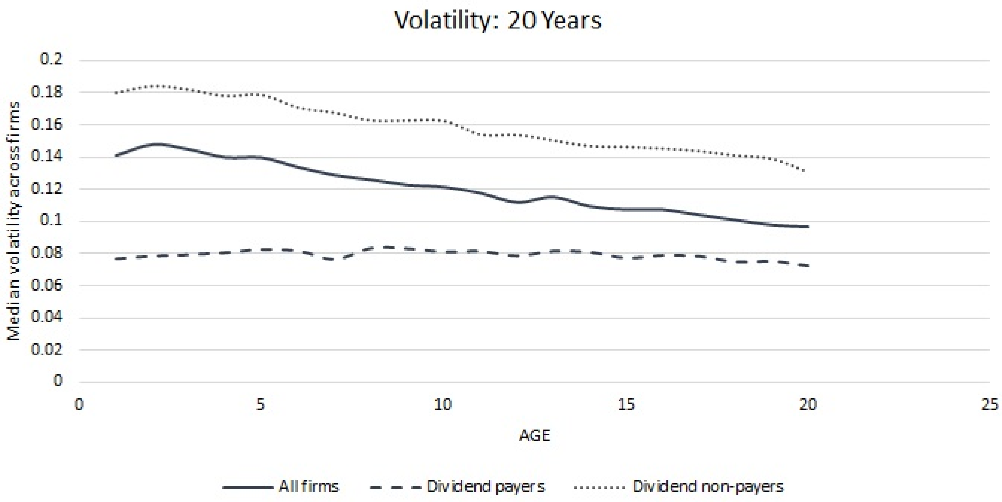
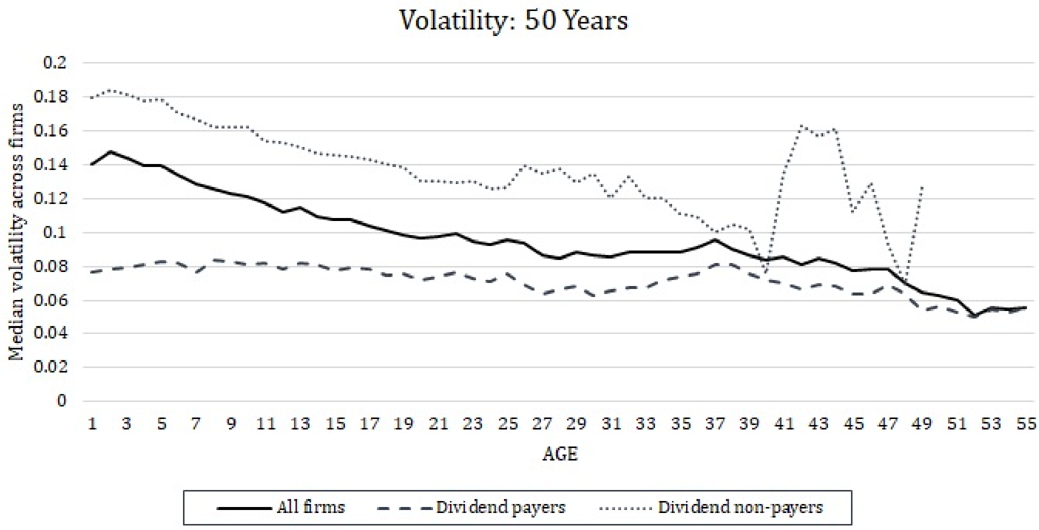


Figure 4 is just an extension of figure 3, it reports the same thing but over about 50 years of the firms' lifespan. The interesting observation from this figure, is that around the age of 40, volatility for firms that pay no dividends start fluctuating a lot. This could be because that investors prefer firms to pay dividends at that age. To give more clarification, more than 50 years of data was plotted and it seems that non-dividend payers "die" and only firms that pay dividends still exist. This again is an interesting observation to see that investors care heavily about dividends that far in a firm's lifespan.

FIGURE 4:
Volatility (50 years): North American firms



On the other hand, German firms had some interesting differences. Before mentioning the differences, it is important to note that due to limitations, the age horizon was not as big as that of North American firms. Figure 5 (solid line), shows a similar trend to that of North American firms, where M/B peaks at 2.410 and keeps on declining for about 3 years. M/B is higher for newly-listed firms that do not pay dividends, but this only holds for the first couple of years. M/B for dividend non-payers actually exhibits a steep decline in the 28 given years. This could mean that investors in Germany do not prefer firms that do not pay dividends. In addition, it does not seem like M/B decays for dividend payers in Germany. This could mean that there is no relationship between learning and M/B for German firms that pay dividends. Moreover, figure 6 shows a major difference in the volatility between the two economies. Volatility exhibits a semi-increasing trend instead of the expected decreasing trend following the theoretical model. Also, it is still observed that non-dividend payers have a higher and more fluctuating volatility than that of dividend payers. Finally, using only figures is not enough to draw any conclusion, but it is always important to visualize the data to give more intuition for the empirical results.

FIGURE 5:
Median by Age (28 years): German firms

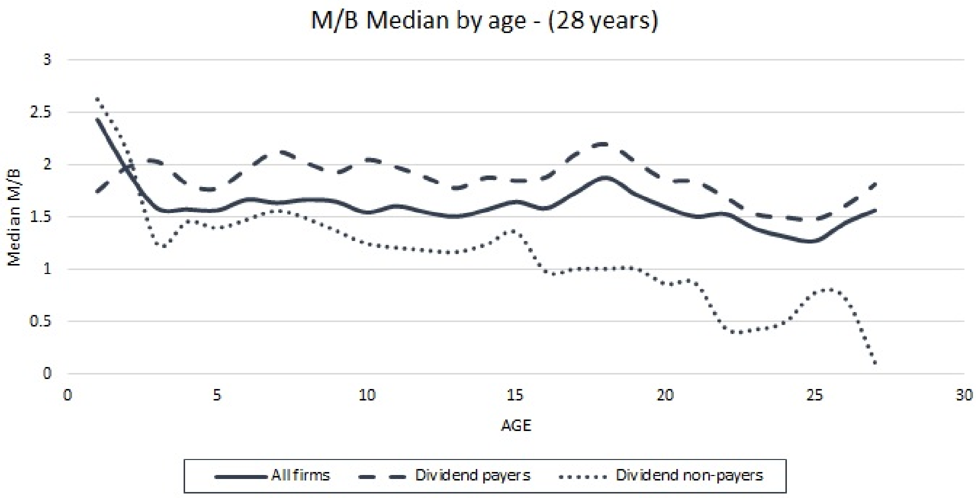
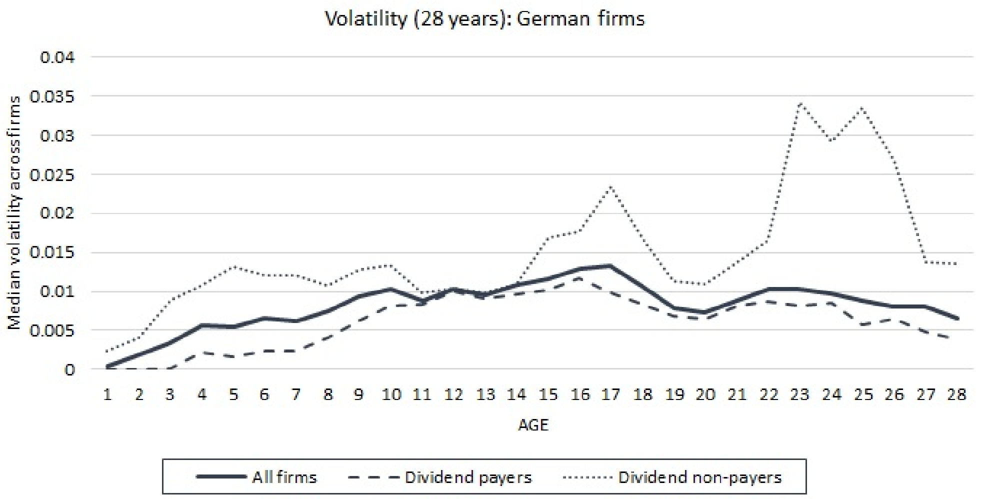


FIGURE 6:
Volatility (28 years): German firms



Figures 7 & 8 report M/B and volatility by calendar year (regardless of age) of North American firms respectively. In addition, figures 9 & 10 represent M/B and volatility by calendar year (regardless of age) of German firms respectively. These figures are categorized the same way as the previous figures. The argument that volatility is higher for dividend non-payers is also depicted from these figures, where volatility is observed be higher across the years for North American and German firms. M/B

is depicted to be higher for dividend non-payers across the years for North American firms, whereas it is more fluctuating for German firms. It might be interesting to look at the evolution of these variables across the calendar years in both economies, but the figures plotted across age are more crucial for this study.

Empirical Results

This subsection reports and discusses the empirical results derived from the main model mentioned before. Before analyzing the results, it is important according to Pástor and Veronesi (2003), to differentiate between age effects, time effects and cohort effects. Time effects occur due to how M/B vary over time and is accounted for by running a cross-sectional regression through each year in the second step of Fama-MacBeth. In other words, it does not matter if M/B is on average high or low for firms in a specific year since the results from the cross-sectional regressions are not affected. Cohort effects, according to Pástor and Veronesi (2003), are effects that occur because of the variation of different firms that are born in different years. This does not hold any problem in this case because the results do not depend on when the firm was born. This will be tested for in the robustness section where firms for certain years will be removed from the sample. This paper focuses on age effects on M/B.

Coefficients of North American firms and their t-statistics are summarized in table 3. As previously mentioned, regression (1) follows Fama and MacBeth (1973). There are several regressions conducted in table 3, where M/B is regressed on AGE only in the second column, on AGE and other previously mentioned variables in column 3 and then running the same regression as in column 3, but by adding and increasing the number of future ROE and $RETURN$ for the rest of the columns. Each time one future determinant is added to the regression, the AGE coefficient loses magnitude. For example, column 5 adds 5 future determinants ($q = 5$) and subsequently the

AGE coefficient decreases. This is done to study the correlation between M/B and the previously mentioned variables, and if this relation is affected by irrational optimism. According to table 3, AGE is significant and has a negative coefficient in all the specified regressions. The AGE coefficient is -1.064 when it is the only variable regressed. The magnitude of the coefficient declines to -0.851 as the variables DD, $LEVERAGE$, $SIZE$, VOL, and ROE are added to the regression and keeps on declining when adding more future determinants. For example, a typical firm regressed with only one future determinant (q=1) has an AGE coefficient of -0.682 and the transition to adding 5 future determinants (q=5) would lower AGE coefficient to -0.546. This shows that the impact of AGE on M/B is statistically and economically significant and that M/B declines as age increases. Moreover, the coefficient of VOL for North American firms is always positive and statistically significant for all regressions which asserts the argument that M/B and volatility are positively correlated. It also seems that as a firm becomes more levered, M/B declines accordingly. This is observed by looking at leverage in table 3, where its coefficient is negative and statistically significant in all the regressions. Dividends observed through DD is statistically significant and negatively correlated with M/B. In addition, all the coefficients of future $RETURN$ are negative and statistically significant across all the regressions. On the other hand, the coefficient for present and future ROE are all positive and statistically significant. It seems that the coefficient of ROE keeps on increasing across all the regressions.

TABLE 3:
Determinants of Market-to-Book Ratio: North American firms

The natural logarithm of the market-to-book ratio ($log(M/B)$) is regressed cross-sectionally on minus the reciprocal of one plus age, Dividend Dummy (DD), Leverage, the natural logarithm of total assets ($SIZE$), volatility (VOL), present return on equity (ROE_t), and a number of future returns on equity ROE and returns $RETURN$, where the number added depends on each column. The regressions were done for each year between 1962 and 2017. The coefficients reported are computed from the average of the time-series of the estimated cross-sectional coefficients. The t-statistics is reported in between the parenthesis. The last four rows represent, the average R^2 across the years, the number of observations, the number of firms, and the number of years for each regression respectively. The first column represents the regression of $log(M/B)$ on AGE only. Significant values are represented using *,** & ***.

		Number of future ROE and returns included					
Regressor		0	1	5	10	20	25
Intercept	0.332***	0.315***	0.444***	0.458***	0.447***	0.348***	0.305***
	(6.25)	(6.19)	(6.97)	(6.69)	(6.01)	(4.25)	(3.58)
AGE	-1.064***	-0.851***	-0.682***	-0.546***	-0.473***	-0.351***	-0.302**
	(-12.39)	(-9.86)	(-8.15)	(-6.86)	(-5.48)	(-3.63)	(-2.59)
DD		-0.048***	-0.037**	-0.103***	-0.163***	-0.209***	-2.53***
		(-2.87)	(-2.24)	(-6.97)	(-9.35)	(-10.45)	(-8.49)
Leverage		-0.106***	-0.114***	-0.211***	-0.286***	-0.359***	-0.437***
		(-2.80)	(-2.51)	(-5.95)	(-8.23)	(-6.98)	(-8.05)
$SIZE$		-0.025***	-0.024***	-0.024***	-0.023***	-0.035***	-0.038***
		(-5.79)	(-5.20)	(-5.04)	(-4.48)	(-8.56)	(-9.41)
VOL		0.504***	0.570***	0.668***	0.742***	1.117***	1.354***
		(4.29)	(4.89)	(5.57)	(5.76)	(6.64)	(7.15)
ROE_t		0.178***	0.209***	0.276***	0.386***	0.564***	0.643***
		(3.21)	(3.86)	(4.23)	(4.74)	(5.44)	(5.35)
ROE_{t+1}			0.148***	0.278***	0.388***	0.574***	0.728***
			(5.08)	(6.32)	(5.44)	(5.56)	(4.91)
ROE_{t+2}				0.195***	0.240***	0.378***	0.453***
				(4.11)	(5.15)	(4.69)	(3.66)
ROE_{t+3}				0.146***	0.162***	0.312***	0.330***
				(3.51)	(3.87)	(4.24)	(3.06)
$RETURN_{t+1}$			-0.114***	-0.177***	-0.221***	-0.329***	-0.386***
			(-6.12)	(-6.84)	(-7.43)	(-8.94)	(-9.13)
$RETURN_{t+2}$				-0.114***	-0.167***	-0.264***	-0.286***
				(-4.88)	(-6.07)	(-7.20)	(-6.99)
$RETURN_{t+3}$				-0.090***	-0.144***	-0.238***	-0.272***
				(-5.14)	(-5.45)	(-7.25)	(-7.39)
Average R^2	0.039	0.134	0.162	0.230	0.300	0.446	0.540
Observatuons	263680	256838	228933	150882	93773	35787	22245
Average N	23946	23946	21849	14088	9109	3773	2281
Years	55	55	54	50	45	35	30

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

An important part of this paper is to observe if learning through age affects dividend payers and dividend non-payers differently. The results of the study for North American firms are reported in table 4 and are conducted through running the regressions on two separate data groups, firms that pay dividends and firms that do not pay dividends. Table 4 runs the same regressions as in table 3, but only reporting the coefficients of AGE and its t-statistics. It is observed from the table that the coefficient of AGE is negative for both, payers and non-payers. It is also observed that the AGE coefficient of dividend non-payers is more negative than that of dividend payers. This supports the argument that the effect of AGE on M/B for dividend non-payers is stronger than that for dividend payers. This means that between two similar firms, one that pays dividends and the other does not, the firm that does not pay dividends is affected more by learning than the firm that does. Again, this is intuitive because dividend payers are considered more stable than dividend non-payers. AGE coefficient for dividend non-payers is always statistically significant and keeps on losing magnitude when adding future determinants until q=25, but when adding beyond that (q>20), the AGE coefficient starts increasing. The AGE coefficient for dividend payers is significant in most of the regressions, but is insignificant at $q = 20$ and $q = 25$. The valuation of dividend payers is more stable and less affected by learning than non-dividend payers, which might be why learning is not significant at $q = 20$ and $q = 25$. The coefficient of AGE ranges between -1.233 and -0.694 for dividend non-payers, whereas the range is between -0.316 and -0.103 for dividend payers (Only significant values). It is also beneficial to look at Figures 1, 2, 3 & 4 to give more intuition to the results.

TABLE 4:
AGE for Dividend Payers & Dividend Non-Payers: North American firms

The natural logarithm of the market-to-book ratio ($log(M/B)$) is regressed cross-sectionally on minus the reciprocal of one plus age, Dividend Dummy (DD), Leverage, the natural logarithm of total assets ($SIZE$), volatility (VOL), present return on equity (ROE_t), and a number of future returns on equity ROE and returns $RETURN$, where the number added depends on each column. The regressions were done for each year between 1962 and 2017. The coefficients reported are computed from the average of the time-series of the estimated cross-sectional coefficients. The t-statistics is reported in between the parenthesis. The last five rows represent, the average R^2 across the years for dividend non-payers, the average R^2 across the years for dividend payers, the number of observations for dividend non-payers, the number of observations for dividend payers, and the number of years for each regression respectively. The first column represents the regression of $log(M/B)$ on AGE only. To obtain these results, split the data into two groups, firms that frequently pay dividends and firms that do not pay dividends. Significant values are represented using *,** & ***.

		Number of future ROE and returns included					
		0	1	5	10	20	25
Non-payers	-1.233***	-1.033***	-0.981***	-0.895***	-0.798***	-0.694***	-0.846***
	(-9.35)	(-9.44)	(-11.12)	(-11.21)	(-6.50)	(-3.52)	(-7.18)
Payers	-0.316***	-0.147**	-0.103*	-0.111*	-0.121**	-0.051	-0.037
	(-5.40)	(-2.48)	(-1.84)	(-1.95)	(-2.08)	(-0.76)	(-0.45)
Average R^2: Non-Payers	0.051	0.142	0.170	0.230	0.297	0.481	0.615
Average R^2: Payers	0.017	0.136	0.219	0.356	0.428	0.559	0.624
Observations: Non-payers	145845	141860	122214	71668	39270	11248	5831
Observations: payers	117835	114978	106719	79214	54503	24539	16414
Years	55	55	54	50	45	35	30

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Before reporting the results of German firms, it is important to note that previous studies were focused mainly on North American firms and that the main model and assumptions discussed in the theoretical section were tailored and based on North American firms. This paper took the initiative to broaden the horizon into another country, mainly, if the model will or will not hold when testing for a different economy (Germany, in this case). Nevertheless, it is stressed to keep in mind that the amount of data collected was limited and not as big as that of North American firms. Also, due to this limitation, only up to 5 future determinants are tested and reported.

Referring to table 5 in the “All firm” section , it is observed that AGE has a negative coefficient and is statistically significant. This means that the argument that M/B declines with AGE is still intact. However, future determinants do not seem to be significant and this is argued to be a sign of irrational optimism. In the same section, It is also observed that dividends have a positive coefficient and volatility has a negative coefficient. This goes against the argument that uncertainty leads to investors valuing firms higher. This is okay because the model mentioned in this paper was structured based on assumptions made by previous researchers according to their rigorous observations and studies on North American firms and investors. It could be that the preferences of investors in Germany are different than that of the preferences in North America. Specifically, investors in the former may prefer certainty and stability on higher expectations of growth. This could be depicted from the same section in the DD and VOL rows, where DD has a positive coefficient and VOL has a negative coefficient. This is intuitive because firms that pay dividends are usually associated with less uncertainty. One other reason for this difference could be the size of the sample. This kind of study needs "all" or most of the data of the entire economy ,"dead" and "alive", but Datastream only provided 725 firms between 1980 & 2017. Other sources such as Compustat were looked into as well, but they provided fewer data and fewer time horizons than that of what Datastream provided.

Looking at the "Dividend payers" section of the table, AGE does not seem to be statistically significant. The reason behind this might be that learning through age does not affect the value of firms that pay dividends in Germany. This might also explain the trend of dividend payers in figure 5, where it does not seem like there is any relationship between M/B and age. Moving on to the "Dividend non-payers" section, it seems that AGE has a negative and statistically significant coefficient. The reason behind this higher valuation might not be the same reason as that of North American firms. Looking closely, future determinants do not seem to have any statistical significance, and as mentioned by Pástor and Veronesi (2003), this might be a sign of irrational optimism. In other words, investors valuing firms that do not pay dividends much higher based on their subjective optimism. Assuming that irrational optimism is what is causing M/B to be high for newly-listed dividend non-payers, investors should still be revising their valuation through learning as a firm ages. This can be observed in table 5 in the "dividend non-payers section", where M/B is observed to have a negative correlation with AGE. Unfortunately, due to limitations, testing beyond 5 future determinants was not possible. Looking at both, table 5 & figure 5, it could be argued that investors are revising their valuation of dividend non-payers in around 3 to 5 years and then afterwards, a much steeper decline is observed. This means that investors revise their irrational decisions and re-evaluate firms as they grow older. From this, it could be argued that investors in Germany prefer firms that pay dividends on firms that do not. Again, because of limitations, it was not possible to look at a huge horizon such as the 50 years given for North American firms. It is hard to state which will be valued higher as firms grow older, dividend payers or dividend non-payers, but referring to figure 5 and a lot of previous research, it could be argued that a firm should start paying dividends when becoming older to be looked at as successful. This is just a general perspective on the matter, and more data is needed to confirm the results on this specific study.

TABLE 5:
Regressions: German firms

The natural logarithm of the market-to-book ratio ($log(M/B)$) is regressed cross-sectionally on minus the reciprocal of one plus age, Dividend Dummy (DD), Leverage, the natural logarithm of total assets ($SIZE$), volatility (VOL), present return on equity (ROE_t), and a number of future returns on equity ROE and returns $RETURN$, where the number added depends on each column. DD is omitted for dividend payers and dividend non-payers because the data is split between both types. The regressions were done for each year between 1980 and 2017. The coefficients reported are computed from the average of the time-series of the estimated cross-sectional coefficients. The t-statistics is reported in between the parenthesis. The last thee rows represent the average of R^2 across the years, the number of observations and the number of years for each regression. The numbers in the second row represent the number of future determinants added (ROE & $RETURN$). To obtain the results of dividend payers and dividend non-payers, split the data into two groups, firms that pay dividends and firms that do not pay dividends. Significant values are represented using *,** & ***.

	All firms				Dividend payers				Dividend non-payers			
Regressor	1	2	3	5	1	2	3	5	1	2	3	5
AGE	-0.547**	-0.796*	-1.246**	-1.890**	-0.501	-0.312	-0.393	-1.07	-1.327**	-0.922***	-1.240*	-0.429*
	(-2.08)	(-1.83)	(-2.30)	(-2.31)	(-1.00)	(-0.41)	(-0.47)	(-0.63)	(-2.63)	(-3.84)	(-1.84)	(-2.01)
DD	0.391***	0.623***	0.704***	0.994*								
	(3.26)	(3.46)	(2.83)	(1.72)								
Leverage	-0.002**	-0.003*	-0.002	-0.001	-0.002*	-0.003*	-0.002	-0.001	0.001	0.002	-0.001	-0.001
	(-2.04)	(-1.99)	(-1.29)	(-0.14)	(-1.96)	(-1.97)	(-1.31)	(-0.14)	(0.75)	(1.54)	(-0.0)	(-0.57)
$SIZE$	-0.059***	-0.043**	-0.067**	-0.097**	-0.063***	-0.045***	-0.070**	-0.088**	-0.096**	-0.041	-0.008	-0.005
	(-4.79)	(-1.99)	(-2.37)	(-2.67)	(-5.31)	(-2.73)	(-2.49)	(-2.74)	(-2.31)	(-0.170)	(-0.18)	(-0.09)
VOL	-2.619**	-4.856**	-3.407*	-0.839	-2.904***	-5.200**	-3.401*	-1.163	0.062	-0.639	0.969	0.570
	(-2.52)	(-2.35)	(-1.80)	(-1.35)	(-2.88)	(-2.48)	(-1.75)	(-0.34)	(0.13)	(-0.56)	(1.28)	(1.20)
ROE	-0.001	0.009	-0.009	0.033	-0.002	0.007	-0.009	0.011	0.002	-0.002	-0.008	-0.002
	(-0.25)	(0.69)	(-0.25)	(0.90)	(-0.35)	(0.54)	(-0.26)	(0.14)	(0.74)	(-0.38)	(-0.73)	(-0.28)
ROE_{t+1}	0.009	-0.184	0.007	0.003	0.009	-0.017	0.007	0.147	0.008	0.05	0.013	0.007
	(3.78)	(-0.61)	(-0.34)	(0.06)	(1.33)	(-0.57)	(0.14)	(1.00)	(1.02)	(0.50)	(0.86)	(0.37)
ROE_{t+2}		0.023	-0.016	-0.014		0.024	-0.016	0.139		-0.009	-0.012	-0.024
		(1.10)	(-0.34)	(-0.26)		(1.14)	(-0.34)	(0.75)		(-1.55)	(-1.08)	(-1.39)
ROE_{t+3}			0.040	0.149**			0.040	-0.159			0.001	-0.003
			(1.14)	(2.18)			(1.15)	(-0.93)			(0.54)	(-0.46)
$RETURN_{t+1}$	0.448***	0.486***	0.187	0.085	0.447***	0.476***	0.200	1.085	0.017	0.006	0.088	0.066
	(3.78)	(3.64)	(1.27)	(0.47)	(3.51)	(3.06)	(1.26)	(1.19)	(0.09)	(0.04)	(0.64)	(0.37)
$RETURN_{t+2}$		-0.152	-0.603	-0.228		-0.117	-0.562	-1.457		0.58	0.381	-0.396
		(-1.05)	(-1.23)	(-0.91)		(-0.75)	(-1.14)	(-1.10)		(1.43)	(1.13)	(-0.51)
$RETURN_{t+3}$			-0.496	-0.060			-0.526	0.521			-0.218	-0.141**
			(-1.18)	(-0.38)			(-1.26)	(1.20)			(-1.50)	(-2.13)
Average R^2	0.249	0.392	0.458	0.550	0.340	0.412	0.551	0.541	0.441	0.530	0.562	0.608
Observations	5597	5080	4603	3729	3361	3067	2789	2287	2236	2013	1814	1442
Years	37	36	35	33	37	36	35	33	30	29	27	24

* p <0.1; ** p < 0.05; *** p <0.01

Robustness Tests

This section focuses on verifying the correctness of the tests done in this paper. There are different ways to test for robustness, and one suggestion is omitting firms that existed in a specific year and then rerunning the regressions. Compustat was established in 1962 and hence only has data starting from that year. This means that even for firms that existed before the year of 1962, they are considered one year old even though in reality they are not. This makes omitting the data of firms that existed at the year of 1962 an even stronger robustness test. Actually, several regressions were run while omitting data for firms that existed in different years. This paper reports only one test, where only North American firms that existed starting 1962 and 1963 according to Compustat are omitted. Also, more future determinants were added ($q = 28$ & $q = 30$) to further observe if the results stay significant. The results are reported in tables 6 & 7. The same conclusion that M/B declines with AGE is derived from table 6. Also, AGE coefficient is decreasing in magnitude as when adding more future determinants, which matches the main empirical results. The results that DD has a negative coefficient and that volatility has positive coefficient for North American firms are also attained from the robustness test in table 6. Table 7 reports similar results to that of the main empirical results, where it is still observed that dividend non-payers are affected more by AGE than dividend payers. Finally, even though the AGE coefficient is not significant only at 30 years of age for dividend payers, the same conclusion that AGE stops being significant is still intact.

TABLE 6:
Robustness Test: North American firms

The natural logarithm of the market-to-book ratio ($log(M/B)$) is regressed cross-sectionally on minus the reciprocal of one plus age, Dividend Dummy (DD), Leverage, the natural logarithm of total assets ($SIZE$), volatility (VOL), present return on equity (ROE_t), and a number of future returns on equity ROE and returns $RETURN$, where the number added depends on each column. The regressions were done for each year between 1964 and 2017. The coefficients reported are computed from the average of the time-series of the estimated cross-sectional coefficients. The t-statistics is reported in between the parenthesis. The last three rows represent, the average R^2 across the years, the number of observations and the number of years for each regression respectively. The first column represents the regression of $log(M/B)$ on AGE only. This table determines the robustness of the tests. Significant values are represented using *,** & ***.

		Number of future ROE and returns included						
Regressor		1	5	10	20	25	28	30
AGE	-1.202***	-0.845***	-0.705***	-0.647***	-0.596***	-0.561***	-0.511***	-0.432***
	(-18.39)	(-14.12)	(-12.33)	(-10.44)	(-8.83)	(-6.43)	(-5.64)	(-4.32)
DD		-0.032*	-0.102***	-0.161***	-0.204***	-0.169***	-0.271***	-0.358***
		(-1.91)	(-6.93)	(-9.48)	(-9.97)	(-4.00)	(-4.90)	(-3.25)
Leverage		-0.077	-0.175***	-0.255***	-0.319***	-0.277*	-0.277**	-0.352***
		(-1.59)	(-4.85)	(-8.02)	(-5.82)	(-2.04)	(-2.16)	(-5.22)
$SIZE$		-0.029***	-0.030***	-0.026***	-0.032***	-0.009	-0.020*	-0.037***
		(-6.48)	(-5.82)	(-4.83)	(-7.55)	(-0.46)	(-1.92)	(-3.11)
VOL		0.556***	0.669***	0.745***	1.000***	1.162***	1.382***	1.464***
		(4.54)	(5.23)	(5.50)	(5.66)	(5.18)	(6.59)	(7.08)
ROE_t		0.199***	0.259***	0.374***	0.584***	0.703***	0.694***	0.807***
		(3.42)	(3.82)	(4.20)	(4.67)	(4.12)	(3.78)	(3.60)
ROE_{t+1}		0.139***	0.287***	0.408***	0.653***	0.895***	0.926***	0.947***
		(4.97)	(6.51)	(5.72)	(5.39)	(5.33)	(4.28)	(4.49)
ROE_{t+2}			0.191***	0.231***	0.689***	0.632**	0.689**	0.731***
			(4.19)	(5.42)	(2.89)	(2.76)	(2.68)	(2.86)
ROE_{t+3}			0.118***	0.144***	0.245*	0.453***	0.527**	0.601**
			(2.98)	(3.82)	(1.73)	(2.89)	(2.59)	(2.23)
$RETURN_{t+1}$		-0.106***	-0.175***	-0.215***	-0.352***	-0.378***	-0.383***	-0.528***
		(-5.84)	(-6.83)	(-7.16)	(-8.42)	(-8.62)	(-7.28)	(-8.56)
$RETURN_{t+2}$			-0.120***	-0.164***	-0.254***	-0.199*	-0.264***	-0.324***
			(-5.33)	(-6.14)	(-6.64)	(-1.89)	(-3.13)	(-5.09)
$RETURN_{t+3}$			-0.095***	-0.140***	-0.218***	-0.144	-0.182**	-0.274***
			(-5.30)	(-5.58)	(-7.80)	(-1.50)	(-2.28)	(-6.29)
Average R^2	0.041	0.143	0.208	0.274	0.423	0.521	0.575	0.627
Observatios	245195	211806	136146	81765	28616	16956	12502	10067
Years	53	52	48	43	33	28	25	23

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

TABLE 7:
AGE for Dividend Payers & Dividend Non-Payers (Robustness Test)

The natural logarithm of the market-to-book ratio ($log(M/B)$) is regressed cross-sectionally on minus the reciprocal of one plus age, Dividend Dummy (DD), Leverage,the natural logarithm of total assets ($SIZE$), volatility (VOL), present return on equity (ROE_t), and a number of future returns on equity ROE and returns $RETURN$, where the number added depends on each column. The regressions were done for each year between 1964 and 2017. The coefficients reported are computed from the average of the time-series of the estimated cross-sectional coefficients. The t-statistics is reported in between the parenthesis. The last five rows represent, the average R^2 across the years for dividend non-payers, the average R^2 across the years for dividend payers, the number of observations for dividend non-payers, the number of observations for dividend payers, and the number of years for each regression respectively. The first column represents the regression of $log(M/B)$ on AGE only. To obtain these results, split the data into two groups, firms that frequently pay dividends and firms that do not pay dividends. This tables determines the robustness of the tests. Significant values are represented using *,** & ***.

		Number of future ROE and returns included					
		1	5	10	20	25	30
Non-payers	-1.427***	-1.083***	-0.953***	-0.856***	-0.965***	-1.257***	-0.816***
	(-20.26)	(-14.11)	(-13.91)	(-7.34)	(-10.13)	(-4.08)	(-4.98)
Payers	-0.447***	-0.241***	-0.217***	-0.237***	-0.206***	-0.225***	-0.168
	(-8.61)	(-4.88)	(-4.63)	(-5.34)	(-3.66)	(-2.97)	(-1.69)
Average R: Non-payers	0.051	0.1542	0.209	0.272	0.459	0.606	0.781
Average R: Payers	0.008	0.201	0.338	0.409	0.552	0.616	0.671
Observations: Non-payers	144685	121106	70714	38497	10803	5500	2770
Observations: payers	100510	90700	65432	43268	17813	11456	7297
Years	53	52	48	43	33	25	23

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

As for the study done on German firms, it is hard to conduct the same robustness test that was done on North American firms because the data is already limited. Karpavičiusa and Yu (2017) suggest taking the market value of assets divided by book value of assets (M/A) instead of dividing over book value of Equity. The regression should then be

$$\begin{aligned} log(M/A)_i = {} & \alpha + \beta AGE_i + \gamma DD_i + \theta(DEBT/A)_i + \delta SIZE_i + \lambda VOL_i \\ & + \xi_0 ROA_i + \xi_1 ROA_{i,t+1} + \ldots + \xi_q ROA_{i,t+q} \\ & + \psi_1 RETURN_{i,t+1} + \ldots + \psi_q RETURN_{i,t+q} + \varepsilon, \quad i = 1, \ldots, N \end{aligned} \tag{18}$$

where M/A is the market value of assets divided by book value of assets, AGE is minus the reciprocal of 1 plus the age of the firm, DD is a Dividend Dummy capturing whether the firm is paying dividends or not, $SIZE$ is the natural logarithm of total assets, $DEBT/A$ is the long-term debt divided by total assets, VOL is volatility calculated as the standard deviation of monthly returns for each year, ROA is the return on assets calculated as earnings divided by book value of assets, $RETURN$ is the annual returns, and ε is an error term.

Table 8 reports the results of the regression conducted on M/A and very similar results are yielded. The coefficient of AGE is negative and significant for dividend non-payers in most of the columns, whereas AGE coefficient is insignificant for dividend payers. Also, the same results are reported about the insignificance of the future determinants for dividend non-payers. Another way to test for robustness is to replace DD with a dummy that accounts for stock repurchases. This idea comes from many researches that argue that dividends and repurchases have similar effects. Nevertheless, there were insufficient data for stock repurchases which made the tests unreliable and hence not reported in this paper.

TABLE 8:
Robustness Test: German firms

The natural logarithm of market value of assets divided by book value of assets ($log(M/A)$) is regressed cross-sectionally on minus the reciprocal of one plus age, Dividend Dummy (DD), Leverage, the natural logarithm of total assets ($SIZE$), volatility (VOL), present return on Assets (ROA_t), and a number of future returns on equity ROA and returns $RETURN$, where the number added depends on each column. The regressions were done for each year between 1980 and 2017. The coefficients reported are computed from the average of the time-series of the estimated cross-sectional coefficients. The t-statistics is reported in between the parenthesis. The last three rows represent, the average R^2 across the years for dividend non-payers, the observations for each regression, and the number of years for each regression respectively. To obtain these results, split the data into two groups, firms that frequently pay dividends and firms that do not pay dividends. This tables determines the robustness of the tests. Significant values are represented using *,** & ***.

	Dividend payers			Dividend non-payers		
Regressor	1	2	5	1	2	5
AGE	0.433	0.503	-0.503	-1.803***	-1.050***	-1.122***
	(0.92)	(1.23)	(-0.60)	(-3.05)	(-3.38)	(-3.61)
Leverage	-0.004***	-0.005***	-0.003***	-0.001	-0.001	0.000
	(-4.14)	(-3.80)	(-2.90)	(-0.29)	(-0.25)	(0.06)
$SIZE$	-0.131***	-0.123***	-0.106***	-0.160***	-0.128***	-0.143***
	(-10.09)	(-8.72)	(-4.23)	(-3.54)	(-3.95)	(-3.14)
VOL	-0.135	-1.047	-3.066	-0.655	-1.241	0.291
	(-0.14)	(-1.17)	(-0.87)	(-1.02)	(-1.31)	(0.76)
ROA_t	8.353**	5.705*	10.263**	0.740	0.095	0.492
	(2.23)	(1.83)	(2.57)	(0.57)	(0.09)	(1.26)
ROA_{t+1}	-0.407	-2.378	4.754	3.569	0.861	0.094
	(-0.08)	(-0.40)	(0.74)	(1.21)	(0.97)	(0.19)
ROA_{t+2}		5.677*	-4.424		-0.247	0.155
		(1.80)	(-0.63)		(-0.60)	(0.90)
ROA_{t+3}			-0.171			0.613
			(-0.03)			(1.45)
$RETURN_{t+1}$	0.235*	0.281**	0.577		-0.107	0.062
	(1.87)	(2.36)	(1.65)		(-0.52)	(0.46)
$RETURN_{t+2}$		-0.250**	-0.107		0.072	-0.108
		(-2.73)	(-0.69)		(0.35)	(-0.52)
$RETURN_{t+3}$			-0.050			0.456
			(-0.13)			(1.10)
Average R^2	0.642	0.682	0.790	0.610	0.653	0.725
Observations	3423	3148	2389	2279	2028	1544
Year	37	36	33	31	30	26

Conclusion

This paper looked into how learning about firms and its dividend policy affects its valuation. The study was done on two economies, North America And Germany. The learning effect was observed through the relationship between the value and the age of firms. This relationship was also studied while taking the dividend policy into account to see which is affected more by learning, dividend payers or non-payers. Different results were concluded for the two different economies.

The study on North American firms yielded results that were predicted in the main model. The results showed that volatility and M/B were on average increasing with uncertainty for newly-listed North American firms. Therefore, M/B and volatility for North American firms were concluded to decline as firms grow in age. In other words, M/B for North American firms was shown to have a negative correlation with age and a positive correlation with volatility as the model predicted. Even after controlling for future determinants (ROE and $RETURN$), the empirical results showed that M/B is higher for young North American firms than old firms. This makes it reasonable to assume that there was no irrational optimism when valuing the firms. In addition, the negative relationship between M/B and age was concluded to be much stronger for firms that paid no dividends. This means that between two identical firms, one that pays dividends and one that does not, M/B has a much steeper decline for the firm that does not pay dividends. All of these conclusions about North American firms were in-line with what the model predicted.

The study on German firms still concluded that M/B is declining with age, where M/B has a negative correlation with age as argued in the model. Nevertheless, the study for German firms did not fit the model completely and had some differences. The study showed that M/B has a negative correlation with volatility and a positive correlation with dividends which goes against the predictions in the model. This could be explained by the difference between the two markets, where in North America, investors always look for the next "big thing" and in Germany, it is probably that investors do not value that as much. In other words, it could be possible that investors in North America value newly-listed firms higher because of their high expected growth, whereas in Germany, stability and less uncertainty that comes from dividends is valued more. In fact, when looking at firms that pay dividends in Germany, no significance was observed between M/B and age. Again, this could be because of the less uncertainty that comes with dividend payers. On the other hand, firms that do not pay dividends showed a significant negative correlation between M/B and age, but this relation could be because of irrational optimism. This probably means that investors did not value the firms based on some high growth expectation, but on subjective optimism that is revised over a short period of time. This shows that investors in Germany value certainty or stability more than high growth expectations.

Future Research

This section suggests some future ideas that could contribute or build upon what is studied in this paper. As mentioned before, most studies were done on North American firms, which is why this paper took the initiative to look into another economy. However, the data collected was limited for German firms, which is why it would be interesting to do some further research. First, collecting "all" or most of the data on German firms is important to have a more accurate empirical study. If the results show a difference from what is reported in this paper and are closer to what is reported for North American firms, then this would be similar to the theoretical model. If the results are similar to what is reported in this paper, then the theoretical model should be translated with different assumptions based on the results. Second, it would be interesting to do qualitative research to observe the motivations that drive investors when valuing different firms in different countries. Finally, when conducting the research on a higher scale, studying the legislation of the countries could give more intuition or clarify the reasons of why some countries might have different results.

Appendix

$F(p_t, \tau, a)$ is given according to Pástor and Veronesi (2003) as

$$F(p_t, \tau, a) = \frac{a \int_0^\tau (1 - e^{-\kappa s}) Z(\mu, p_t, s) ds + (1 - e^{-\kappa \tau}) Z(\mu, p_t, \tau)}{a \int_0^\tau Z(\mu, p_t, s) ds + Z(\mu, p_t, \tau)} \tag{19}$$

Most mathematical proofs are given in their paper if needed.

Law of iterated expectations according to Hendry and Mizon (2010)

$$E_z[E_y[y|z]] = E_y[y] \tag{20}$$

They also prove this law in their paper using the following

$$\begin{aligned} E_z[E_y[y|z]] &= \int_Z \left(\int_Y y f(y|z) dy \right) g(z) dz = \int_Z \int_Y y f(y|z) g(z) dz dy \\ &= \int_Y y \left(\int_Z h(y,z) dz \right) dy = \int_Y y p(y) dy = E_y[y] \end{aligned} \tag{21}$$

Where according to them, $h(y,z) = f(y|z)g(z) = p(y)\psi(z|y)$ is the joint distribution of (y, z) and:

$$\int_Z h(y,z) dz = p(y) \tag{22}$$

TABLE 9:
Mean by Age: German firms

Age	1	2	3	4	5	6	7	8	9	10
M/B	4.122	3.424	2.647	2.582	2.465	2.585	2.606	2.316	2.471	2.732
Leverage	0.740	0.807	0.912	0.955	0.957	0.998	1.04	1.016	1.089	0.941
Return	0.108	0.100	-0.061	-0.022	0.168	0.227	0.241	0.123	0.064	0.210
$SIZE$	15.116	14.190	14.832	15.874	16.818	17.488	17.488	18.079	19.223	16.01
ROE	0.077	0.036	0.109	0.124	0.160	0.089	0.480	0.129	0.156	0.137
Number of firms	725	700	679	661	648	635	613	589	574	549

TABLE 10:
Mean by Age: North American firms

Age	1	2	3	4	5	6	7	8	9	10
M/B	4.624	3.593	3.185	2.904	2.682	2.544	2.428	2.344	2.201	2.214
Leverage	0.132	0.148	0.157	0.160	0.165	0.167	0.170	0.173	0.174	0.173
Return	0.358	0.322	0.257	0.269	0.255	0.496	0.259	0.185	0.275	0.264
$SIZE$	1412	1707	2018	2363	2703.	3159	3694	4276	4907	5436
ROE	0.067	0.045	0.042	0.052	0.044	0.046	0.053	0.060	0.057	0.061
Number of firms	23946	21849	19509	17395	15630	14088	12806	11718	10786	9935

FIGURE 7:
Median M/B by Calendar Year: North American firms

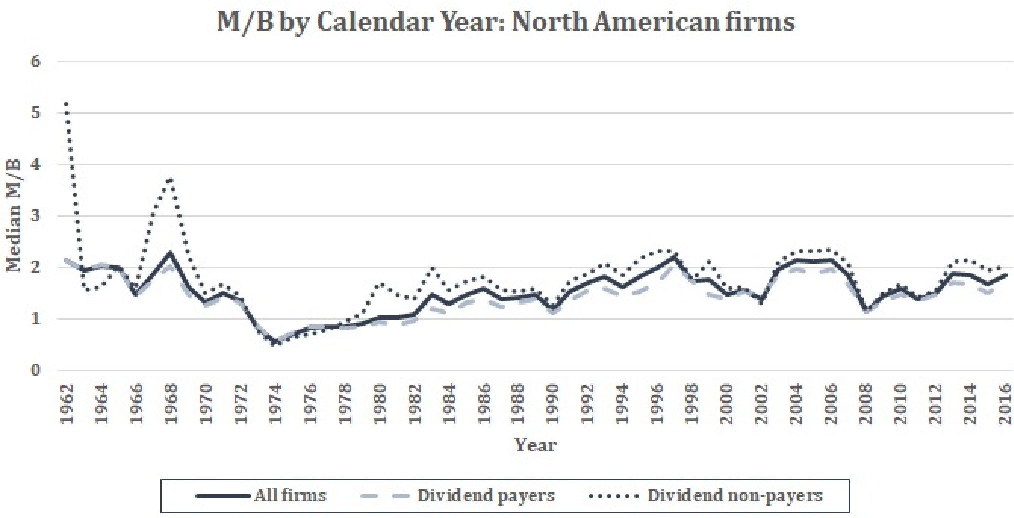


FIGURE 8:
Median Volatility by Calendar Year: North American firms

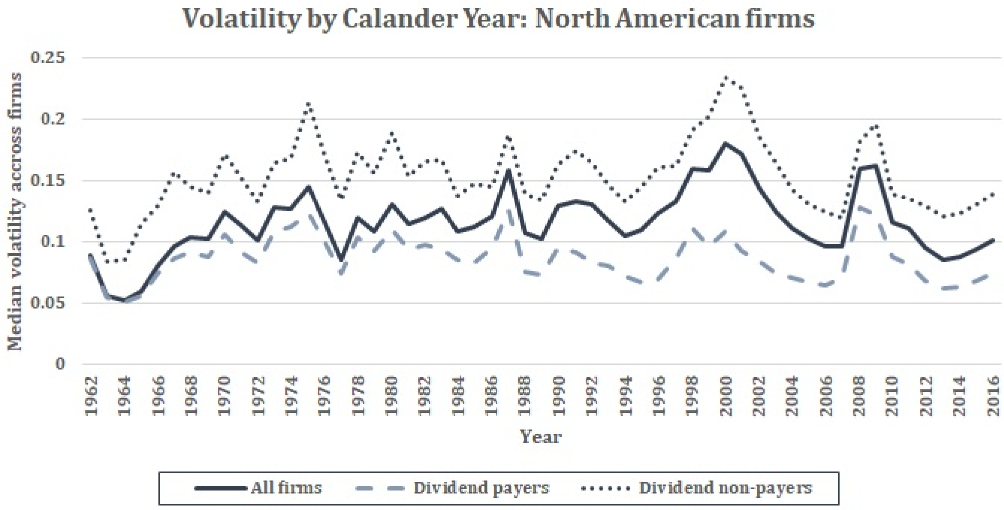


FIGURE 9:
Median M/B by Calendar Year: German firms

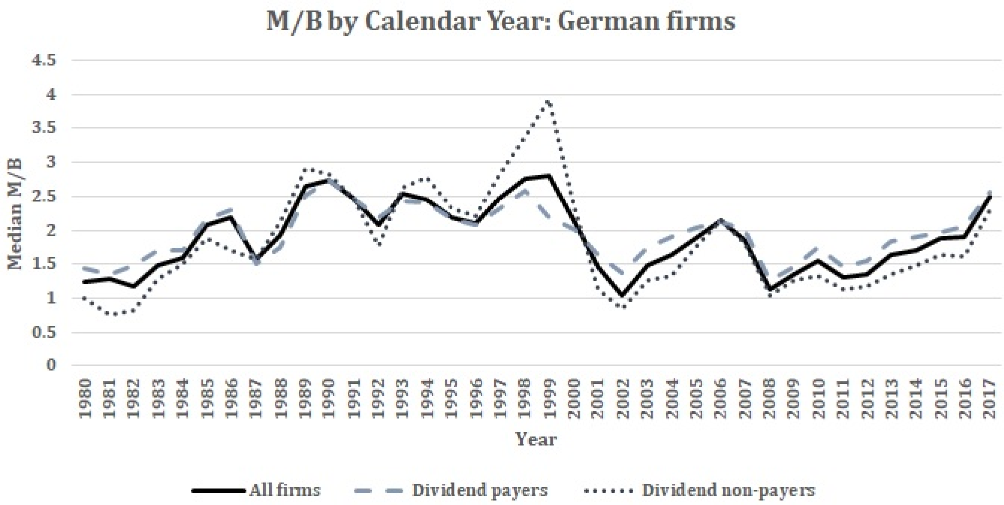


FIGURE 10:
Median Volatility by Calendar Year: German firms

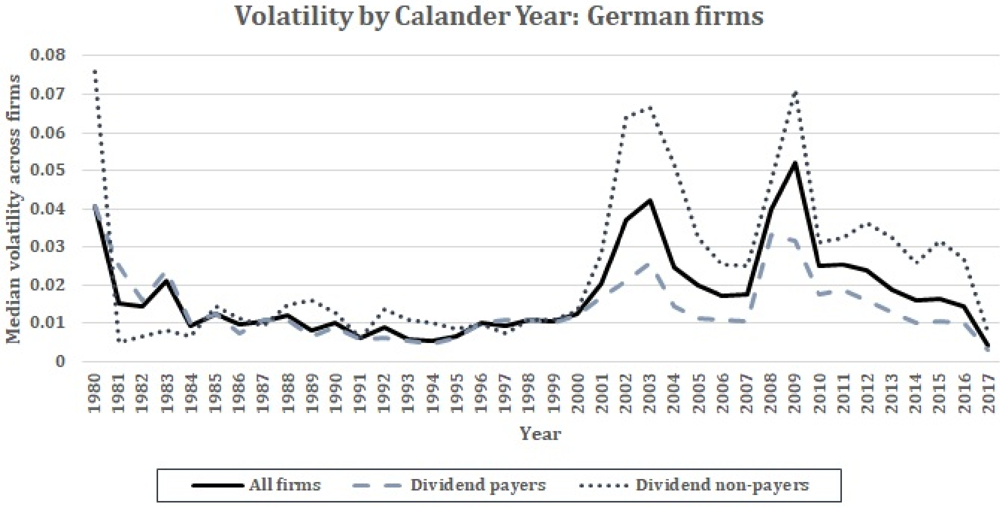


TABLE 11:
Items: German firms

Item description	Datastream Information
Price	Item: Price (Adjusted - Default) Symbol: P
Market to book	Item: Market Capitalization/Common Equity Symbol: WC09704
Dividends	Item: Dividend Per Share Symbol: DPS
Total Assets	Item: Total Assets Symbol: WC02999
Return On Equity	Item: Return On Equity total % Symbol: WC08301
Total Debt	Item: Total Debt Symbol: WC03255
Common Equity	Item: Common Equity Symbol: WC03501
Common Shares Outstanding	Item: Common Shares Outstanding Symbol: WC05301

TABLE 12:
Items: North American firms

Item description	Compustat Information
Deferred Taxes and Investment Tax Credit	Item name: TXDITC Item number: 35
Stockholder's equity	Item name: SEQ Item number: 216
Preferred stock	Item name: PSTKRV Item number: 56
Common stock price at the end of fiscal year	Item name: PRCC Item number: 199
Common shares outstanding	Item name: CSHO Item number: 25
Income before extraordinary items - common	Item name: IBCOM Item number: 237
Deferred taxes - Income statement	Item name: TXDI Item number 50
Investment tax credit - Income statement	Item name: ITCI Item number: 51
Debt	Item name: DLTT Item number: 9
Assets	Item name: AT Item number: 6
Dividends	Item name: DVC Item number: 21
Stock repurchases	Item name: PRSTKC Item number: 115

TABLE 13: Correlation Table: North American firms

This table is a correlation matrix of the variables, firm age (Age), dividends dummy (DD), Return on equity (ROE), the natural logarithm of total assets ($SIZE$), debt over common equity (*Leverage*), returns (Return), and volatility (VOL). The results are reported based on a pooled regression. Significant values are represented using *,** & ***.

Variables	Age	DD	ROE	$SIZE$	Leverage	Return	VOL
Age	1.000						
DD	0.218***	1.000					
ROE	0.027***	0.012***	1.000				
$SIZE$	0.051***	0.072***	0.009***	1.000			
Leverage	0.087***	0.078***	-0.006**	-0.007***	1.000		
Return	-0.011***	0.0019	0.001	0.000	-0.001	1.000	
VOL	0.001	0.000	0.001	0.000	-0.001	0.000	1.000

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

TABLE 14: Correlation Table: German firms

This table is a correlation matrix of the variables, firm age (Age), dividends dummy (DD), Return on equity (ROE), the natural logarithm of total assets ($SIZE$), debt over common equity (*Leverage*), returns (Return), and volatility (VOL). The results are reported based on a pooled regression. Significant values are represented using *, **, & ***.

Variables	Age	DD	ROE	$SIZE$	Leverage	Return	VOL
Age	1.000						
DD	0.222***	1.000					
ROE	0.033***	0.073***	1.000				
$SIZE$	0.114***	0.035*	-0.024	1.000			
Leverage	0.031***	-0.005	-0.031***	-0.189***	1.000		
Return	-0.015	-0.016	0.021**	-0.023	-0.0281***	1.000	
VOL	0.003	-0.019*	0.001	-0.028	-0.005	-0.002	1.000

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

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