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Why would firms choose dividends over share repurchases?

The relationship between payout policy and firms' value in Sweden

by

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Abstract

This study investigates the relationship between the two different payout policies, dividends and share repurchases, and firm value in the Swedish market. We aim to clarify how the lack of difference in taxation of dividends and capital gains in Sweden affects investors' preferences for different payout policies and whether a certain payout policy incentivizes investor to pay extra for a firm that applies this policy.

The study is performed through a panel regression on Swedish firms for the period 1987-2017. Market to book value is used as a proxy for firm value. The market to book value is defined in two different ways; market value over book value of asset and market value over book value of equity. To capture the most accurate relationships, several different regressions are defined. The sample is also divided into sub-periods in order to test for the robustness of the results.

The results show a significantly positive relationship between firm value and dividends. This implies that investors value dividend-paying firms higher than non-paying firms and are willing to pay extra for dividend-paying firms. Furthermore, no significant relationship could be found between firm value and share repurchase, implying that investors, in general, do not consider a repurchasing firm more or less valuable than a non-repurchasing firm. It can, therefore, be concluded that when the tax effect is removed, the significance of share repurchases is diminished while dividends still have a value-adding effect on firm value. However, looking at the evolution of the relationship between firm value and the two payout policies over time, it can be seen that the significance of share repurchases increases in the last three years of a sample period. Three possible explanations are presented to this change: an increase in investor protection, the financial crisis, and the shareholder heterogeneity.

The availability of data for share repurchases in Swedish firms is low and a limiting factor in this study. Few studies have been on this topic for the Swedish market and further research would, therefore, be desirable to confirm the implications of this study.

Keywords:

Dividend, Share repurchase, Firm value, Panel data

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1.Introduction

1.1.Introduction

What is the purpose of equity investment? A lot of people choose to invest savings for post-work years. Some may use it as a tool to shape their current financial situation. Regardless of the circumstances of the investment, there is one thing that investors have in common; the hope for returns. There are two ways for companies to reward their investors with returns: dividend payouts and share repurchases. Dividends are assets paid out of the profits of a corporation to the stockholders. They are usually paid in cash or stock resulting in a capital income for all investors owning a share in the company's stock. Similarly, share repurchases carry out capital income to investors when the company buys back shares. If the stock price has increased and reached a higher level than the purchasing price, the investor will realize a capital gain.

Over the past two decades, the number and fraction of public firms paying dividends show a downward trend in the US and Europe (Farre-Mensa et al., 2014). The US-listed firms paying cash dividends fell from 66.5% in 1978 to 20.8% in 1999 due to a shift in the population of public firms. Most listed companies are small firms with low profitability and strong growth opportunities. These small firms normally do not pay dividends (Fama and French, 2001, Grullon et al., 2002). The decrease in dividends can be explained by the tax structure that is unfavorable to dividends and beneficial to capital gains. In 2003, a new tax regulation in the US decreased the disparity between dividend taxation and capital gain taxation. This lead to an increase in dividend-paying firms (Blouin et al., 2011). However, instead of paying dividends, many firms use share repurchases to satisfy shareholders. Farre-Mensa et al. (2014) find that share repurchases are an increasingly important component of payouts since the early 1980s. The number of public US firms applying share repurchases reaches over 45%, compared to less than 20% in 1980. Not only the number of firms, but the aggregate dollar volume also rises, from less than $100 billion in the 1970s to $600 billion in 2012. Grullon and Michaely (2002) explain an increasing popularity in share repurchases is caused by tax advantages and beneficial regulations that have made it easier for firms to apply share repurchases.

Although share repurchases have become a current major trend, firms still pay dividends. Neither firms nor investors view dividends and repurchases as perfect substitutes. Guay (2002) and Jagannathan et al. (2000) find that firms will increase dividends when operating cash flow permanently increases while applying repurchase if the cash flow is temporary. Using a time-series vector autoregression analysis, Lee and Rui (2007) support that share repurchases are associated with temporary components of earnings, whereas dividends are not. The empirical evidence supports the prediction that share repurchases are more flexible than dividends. Repurchasing shares in a given year does not create an expectation that the firm will repurchase a similar number of shares in the following year (Jagannathan et al., 2000).

The beneficial flexibility of repurchases raises the question about why firms still pay dividends. The irrelevance theory by Miller and Modigliani (1961) states that dividends have no impact on firm value under frictionless conditions. Any payments can be replicated by purchases and sales of equity. However, in reality, markets are rarely frictionless and there is, therefore, a large number of studies arguing for the opposite conclusion, dividends do have an impact on firm value.

Most previous research is conducted based on US data, a few analyze the payout policies of non-US firms. Apparently, there are unresolved issues related to taxes and dividends. The US tax code rules different treatments to dividends and capital gains; therefore, the study of firm value and dividend provides an implicit result. Sweden is one of the European countries where there is no difference in tax advantages between dividends and capital gain (Swedish Tax Agency, 2016). A few academic studies examine Swedish companies. This research targets to study investors' attitudes to dividends and share repurchases through looking at the relationship between payout policies and firm value in Sweden. The Swedish market is an interesting environment to study payout policies because there is no tax benefit to either policy that can affect the investors' preferences and firm value.

1.2.Research purpose

The purpose of this thesis is to study how firm value of Swedish companies are affected by the companies' payout policies. The study aims to clarify whether investors in Swedish companies have stronger preferences for dividends or stock repurchases in a market with no tax advantages and whether this is shown through a difference in the effect of the two payout policies respectively on firm value.

1.3.Research limitation

The study is focused exclusively on Swedish companies listed in Stockholm Stock Exchange from 1987-2017. It is limited to publicly available information and consequently excludes companies without the market value of equity.

A closer look at the dependent variable shows that there are several ways to measure firm value and the results are possibly diverse among different methods. However, this study relies on Baker and Wurgler (2004) and Karpavičius and Yu (2018) who apply market-to-book ratios as a proxy of firm value since it is the most appropriate variable based on previous research.

The model used in this study might be affected by endogeneity since the explanatory variable might be correlated with the error terms. Although a panel data model with two-way fixed effects which is applied in this study can partially relieve the endogeneity problem, this issue may not be completely solved.

1.4.Research outline

The thesis is structured as follows. Chapter 2 covers a review of previous literature and empirical studies regarding firm value and dividend policies, together with the linkage to taxes. Chapter 3 presents the research hypothesis, data collection, and methodology. Chapter 4 provides the results obtained through the application of the methodology. Chapter 5 contains a discussion and an analysis of the results. The thesis ends up with chapter 6 which presents a conclusion and suggestions for further research.

2.Literature review

This chapter starts with a definition of the payout policies and the relationship between these payout policies with firm value, including theory and previous empirical studies. The chapter ends with a discussion about previous research on taxes and payout policies.

2.1.Definitions of payout policies

A firm's payout policy states how the firm should distribute cash to its shareholders. There are two main types of payout policy: paying dividends and repurchasing shares (Berk and Demarzo, 2017).

A dividend payment is made at the discretion of the corporation to its equity holders. Shareholders will receive a dividend payment which is proportional to the amount of stock they own. The dividend can be paid in terms of either cash or stock. Cash dividends are a common way for companies to return capital to their shareholders. The board of directors of a public company has the responsibility to determine the amount of the dividend. The dividend payment generally leads to a decrease in total asset value and total equity value. For a stock dividend, the firm issues additional shares instead of paying cash to the shareholders. Only the number of shares outstanding is changed which causes a decrease in stock price since an identical equity value is divided by a larger number of shares (Graham et al., 2013, Berk and Demarzo, 2017)

Another way to pay out cash to investors is through a share repurchase or a buyback which means that the firm buys back shares from investors. There are three main types of share repurchases. The most common one is called open market repurchase. The firm's intention to do buybacks will then be announced to the market before the repurchase is conducted and the share is bought at the current market price. Secondly, the firm can do a share repurchase through a tender offer which means that the price is pre-specified during a short period. The repurchase price is then normally higher than the current market prices. Finally, the firm can do a targeted repurchase directly from a major shareholder with a negotiated price. This method usually occurs when the market is illiquid, and the major shareholder wants to sell a large number of shares (Graham et al., 2013, Berk and Demarzo, 2017)

2.2. Dividends' effect on firm value

One of the central questions in corporate finance is whether dividends affect firm value. Miller and Modigliani (1961) show that the market value of a firm can be determined by its earning power and the asset's risk. They argue that dividends are irrelevant to investors in frictionless markets and therefore have no impact on firm value. The basic assumptions of the irrelevance proposition can be summarized into four parts. Firstly, there is no transaction costs, short sales constraints, taxes or bankruptcy costs in the capital markets. This state is what is called "Frictionless capital

markets". Secondly, every market participant can access information. Thirdly, every market participant is a price-taker. Finally, the firm's cash flow does not depend on its financial policy. Miller and Modigliani (1961) further argue that a firm's value can be achieved by discounting the firm's cash flows according to the discounted cash flow model (DCF). Under the DCF-model, the current firm value is dependent on the current dividend, the future values of the firm, and the new shares sold to outsiders during a current period. The general form of DCF can be written as in equation 1.

Equation 1 The discounted cash flow model

$$V_0 = \sum_{t=1}^{\infty} \frac{D_t + V_t - (m_t p_t)}{(1+r)^t}$$

Where V_0 and V_t are the firm values, t is the period, D_t is the dividend payout, m_t is the number of shares issued at period t with price p_t. Assuming that the capital market is frictionless and that Fisher's separation theorem where the investment is independent of the consumption holds, the firm's value is independent of its dividend policy. Only the investment policy determines the firm value in frictionless markets.

However, DeAngelo and DeAngelo (2006) prove that dividend policy is relevant to firm value if Miller and Modigliani's assumption that all feasible payout policies are optimal is relaxed together with allowing the retention to reinvest. They find that a decrease in dividend payments will lead to a reduction in stock value and firm value respectively.

2.2.1. Theory related to dividend and firm value

There are several theories explaining the relationship between firm value and dividends. The four main and widely known theories are bird-in-hand theory, dividend signaling theory, agency theory and catering theory.

2.2.1.1. Bird-in-hand theory

The bird-in-hand theory was first mentioned by Lintner (1962) and Gordon (1963). They claim that a relationship between dividend payout and firm value exists, and both investors and companies prefer dividends over capital gains. The empirical studies in four main industries in 1951 and 1954 confirm that the investors see firms that are expected to generate a capital gain as a riskier investment compared to firms that are expected to generate a dividend payout since there is no guarantee that firms will have a higher growth in the future. Better a bird in the hand than two in the bush (Black and Scholes, 1974). Money available today is preferable to money that may be available in the future. For firms, the costs of holding retained earnings and investments are higher than the costs of dividend payout. The higher cost of capital makes firms less competitive and less profitable. Therefore, dividend payouts and future dividend growth can be considered the

main sources of investor return and firm value. These relationships can be illustrated by the Gordon Growth model which explains how dividend increases share value and firm value.

Equation 2 The Gordon Growth model

$$V_0 = \frac{D_1}{r - g}$$

where V_0 is the current value of firm, $D_1$is the future dividends, r is the required rate of return for shareholders, and g represents the growth rate in dividend in perpetuity.

2.2.1.2. Dividend signaling theory

Spence (1973) is first to study signaling under information asymmetries. His study is based on a job-market model and assumes that there are two types of employees: skilled and unskilled labor. He argues that asymmetric information occurs between employers and employees, since employees always know their own ability, while employers cannot distinguish between the skilled employees and the unskilled employees. Thus, employers pay both employees equally. This increases the incentive for skilled labor who deserves to be paid more, to signal their level of skills to the employers through education credentials. A higher education level guarantees a higher ability. This enables the employers to distinguish between skilled and unskilled labor and to adjust salaries accordingly.

Ross (1977) and Miller and Rock (1985) investigate the effect of dividend announcements under asymmetric information between firm management and investors. Their theories give rise to the signaling model which concludes that under asymmetric information, managers can leverage dividends as a signaling tool, presenting current and future prospects of the firm. An announcement related to an increase in dividend payouts implies positive future firm prospects. Dividends are a proxy for earnings and signals the future business prospects. Aharony and Swary (1980) do the first empirical study on the signaling effect of dividends. They investigate whether dividend announcements bring any additional information about the firm's performance to shareholders in addition to what is already conveyed by earnings announcements. They find that quarterly dividend announcements convey useful information to the shareholders, resulting in positive effects on the share price. This is supported by Asquith and Mullins (1983) who show that the relationship between shareholders' wealth and dividend can be explained by the announcement and information transmission mechanism, using firms listed on New York Stock Exchange (NYSE) and Athens Stock Exchange General Index (ASE) in 1954-1980. Unlike most announcements, dividend announcements imply a cash signal which is stronger than other announcements and reflect the future earnings of the firms. This is further supported by Black (1976) and Baker et al. (2002) who find that dividend policy can convey future prospect of the company and by Lintner (1956) who concludes that dividends are a proxy for earnings.

Another empirical study is done by Fama and French (1998) who apply cross-sectional regressions to explain the relationship between firm value and firm characteristics including dividends during

1965 and 1992. The positive relationship between firm value and dividends can be explained by the signaling ability of dividends: they inform investors about the future business prospects and make implications on firm value. This is also mentioned by Amihud and Murgia (1997). Changes in dividends have a significant positive impact on stock prices, beyond the effect of the information contained in changes in earnings. Watts (1973) also shows that dividend policies convey information about the company's future earnings and thereby potentially affect firm value; however, this information is trivial, supported by close to zero coefficients of dividends as an explanatory variable of earnings. There are two explanations. Firstly, the return from this information does not exceed the transaction cost; therefore, this information does not significantly increase the firm's value. Another reason is related to an adjustment in the dividend model, including transforming the growth rate which causes a loss of information.

2.2.1.3. Agency theory

Miller and Modigliani (1961) assume that the goal of both shareholders and managers is to maximize shareholders' wealth and firm value. However, this is not always true in the business world. Jensen and Meckling (1976) explain that it is impossible to align the agent's objective to the principal's goal without cost. They call this cost "agency cost" which consists of the monitoring expenditures by the principal, the bonding expenditures by the agent, and the residual loss. This agency cost together with the principal-agent problem can be reduced by paying dividends. Jensen (1986) mentions that conflicts of interest between shareholders and managers are partly caused by the existence of free cash flow which is in excess of the required funds for investments. One of the benefits of debt is to reduce the agency costs of free cash flows. Debt reduces the cash flow available for spending on managers' discretion. In addition, debt can be substituted for dividends since managers are obligated to pay out the future cash flows to repay debt. A large increase in free cash flow in the oil industry in 1973 confirmed an importance of debts and dividends to reduce the free cash flow.

Pinkowitz et al. (2006) apply the Fama and French cross-sectional regressions and find a weak relationship between firm value and dividends in countries which have high investor protection and fewer agency problems. A much stronger relationship is found in countries which have weak investor protection and severe agency problems. This confirms that firm value is positively associated with dividends as investors assign high values to firms that reduce the agency costs of free cash flows by paying dividends. Furthermore, data from 49 countries including Sweden supports that countries with poor investor protection will develop substitute mechanisms to attract investors to invest which include dividend payments. This confirms the potential of dividends in terms of reducing the agency problem and increasing firm value (Porta et al., 1998).

2.2.1.4. Catering theory

Baker and Wurgler (2004) find that dividend payments are driven by investor demand, and that those dividends are highly relevant to firm value. This is shown by the dividend premium which

is the difference between the current stock prices of dividend-paying firms and non-dividend-paying firms. When investors prefer dividends, the payer's price premium is higher. On the other hand, the nonpayer's price premium increases during the period that investors do not prefer dividends. Based on a large sample of dividend decreases and increases from 1963 to 2000, the finding of Li and Lie (2006) supports the catering theory. When the dividend premium is higher, firms will increase the dividend. The market recognizes this higher dividend as good news and values payers as valuable companies. Apart from initiating dividends, the magnitude of changing dividends also depends on the dividend premium.

2.2.2. Relationship between dividends and firm value

According to the academic theories and empirical tests brought up in this section, the relationship between firm value and dividends should exist. Baker and Wurgler (2004) show that this linkage is not stable. It can be positive or negative as the dividend premium varies over time. Unlike Baker and Wurgler (2004), Kim et al. (2018) find a stable relationship between firm value and dividends in various countries including no dividend tax penalty countries as Sweden. They present that dividend-payers are valued higher than all other firms. In addition, this relationship is independent of firm characteristics. In conclusion, most previous research agrees that dividends have a positive effect on firm value.

2.3.Stock repurchases' effect on firm value

There are several different potential motives for firms to use stock repurchases to pay out cash to its investors. Stock repurchases are a more flexible payout policy than dividends and are therefore often preferred by management. Brav et al. (2005) argue that management can use the flexibility of the repurchasing policy to time the market, make the repurchase when the stock value is low and make fewer repurchases when there are good projects available to invest cash in. However, Bonaimé et al. (2016) show that the flexibility of the stock repurchase comes with a cost. They find that management rarely is able to time the fluctuations in the market and make repurchases when the stock price is low, especially not in the long-term. Thus, the flexibility of repurchases does not add value for long-term shareholders.

There are however other underlying incentives for repurchases. Vermaelen (1981) finds that firms which want to increase the stock price make repurchases with a price premium and in this way signal to the investors that there is a mispricing in the stock. The market, therefore, reacts positively to the announcement of a stock repurchase resulting in an increase in firm value.

The attitude towards stock repurchases may differ between different types of investors. Gaspar et al. (2012) show that investors' preferences for stock repurchases differ, depending on the investors' investment horizons. This may affect firms' decisions on payout policy depending on what type of investors are holding the firm. Firms with a larger share of short-term investors tend to choose

to do repurchases rather than paying out dividends. Both long-term and short-term investors react positively to repurchase announcements, but the positive reaction is larger for long-term investors. Short-term investors have an incentive to pressure the firms to do payouts through repurchases since they can benefit from the reaction to the repurchase announcement. This might have the effect that the market recognizes these incentives and changes its valuation of the firm. The signaling effect of the repurchase might therefore not be as large for firms with a large share of short-term investors as for a firm with a larger share of long-term investors.

Andriosopoulos and Lasfer (2015) consider investors' reactions to repurchase announcements in European firms. They find a significantly positive effect on firm value, but the effect is lower for European firms than for US firms. In addition, the reactions to the initial repurchase announcement are larger than the reactions to the following repurchases made. This case is often found in European countries. The information that is carried by a repurchase announcement seems to be conveyed within the first announcement and therefore has the largest impact on firm value. The following announcements cause a slimmer reaction among investors and the impact on firm value is much smaller.

2.3.1. Relationship between stock repurchases and firm value

It can be concluded from the previous research brought up in this section that stock repurchases generally have a positive effect on firm value. The magnitude of the effect is however dependent on several factors, such as what type of investors the market consists of and the continuity of the repurchases.

2.4.The choice between dividends and repurchases

As previously mentioned, according to the bird-in-hand theory mentioned by Lintner (1962) and Gordon (1963), investors generally prefer dividends over capital gains due to the more stable character of dividend payments. This is, however, depending on what conditions and what type of investors are considered. Jain (2007) shows that individual investors have stronger preferences for high-dividend-paying stocks while institutional investors rather prefer low dividend yields. Institutional investors also have a more positive attitude towards stock repurchases than individual investors due to asymmetric information. Institutional investors are better informed than individual investors (Allen et al., 2000). Hence, institutional investors gain advantage from their share price’s insight and prefer share repurchase to dividend payment. These results are unexpected since the tax structure at the time of the study, with higher tax rates on dividends intuitively, implies that preferences among individual investors should be aimed towards stock repurchases rather than dividends. The study, therefore, concludes that the tax structure is not enough implication to decide investors’ preferences considering dividends and stock repurchases. A similar study is done by Brennan and Thakor (1990). Apart from asymmetric information, size of distribution and

information collection costs also affect the choice between dividend and share repurchase. Most shareholders support a dividend payment for small distributions because it is not worthwhile to pay for the information. They are willing to pay for large share repurchase distributions.

Pinkowitz et al. (2006) show that investors in countries with low investor protection value dividend-paying firms higher than investors in countries with high investor protection. A similar study is done by Haw et al. (2011). They also find that dividends had a stronger effect on firm value in countries with low investor protection than in countries with high investor protection. Additionally, they notice that stock repurchases had a stronger effect on firm value in countries with high investor protection than in countries with low investor protection. Furthermore, comparing the contribution to firm value by dividends and stock repurchases in countries with low investor protection, dividends have a far larger effect than stock repurchases. In conclusion, investors seem to prefer dividends over stock repurchases in conditions of low investor protection. Dividends are an effective tool to handle agency conflicts whereas the flexibility of repurchases makes them more exposed to managerial control. Hence, investors in countries with low investor protection value stocks that pay dividends higher than stocks that do repurchase.

Considering the theories and empirical findings brought up in this section, it can be concluded that payout policies are relevant to firm value; however, the trend of payout in the past two decades in the US and Europe is decreasing in the number and the fraction of public firms paying dividends, while it is an upward trend in the number of firms using repurchases (Farre-Mensa et al., 2014).

2.5.Taxes and payout policies

Most of the literature in the twentieth century infer that taxes are the key factor in the choice between dividends and repurchases. Relaxing the frictionless market assumption, Miller and Modigliani (1961) conclude that if taxes and transaction costs exist, investors will have asymmetric preferences between a dollar of current dividends and a dollar of current capital gains which will impact the stock prices and firm values differently. Share repurchases are then preferable to investors when considering tax prospects; however, high transactions costs drive investors to invest in dividend payers instead (Black, 1976). This is supported by Brennan (1970), Farrar et al. (1967), Masulis and Trueman (1988), and Grullon and Michaely (2002). However, in a study of US firms, it finds that if repurchases are made frequently with an equal time period between every repurchase, the tax benefit of repurchases is removed. Without any tax benefit, the managerial discretion of repurchases makes them less attractive to investors than dividend payments (Asquith and Mullins, 1983).

Nonetheless, many argue that taxes do not significantly impact the payout policy. As previously mentioned, the study by Jain (2007) shows that tax structure is not enough implication for how preferences of investors are aimed. Furthermore, Black and Scholes (1974) claim that even if the tax structure is unfavorable for dividends, firms can alter the dividend levels without having a

lasting effect on the price, supported by the empirical tests in the New York Stock Exchange (NYSE) during 1926 and 1970. The survey of Brav et al. (2005) about the key factors of dividend and share repurchase policies confirms that although capital gains are more tax-efficient means of returning capital to investors than dividends, taxes are not the dominant factor affecting payout choices.

However, the taxation factor is irrelevant when considering the Swedish market. In Sweden, the taxation on dividends and capital gains are both 30 % (Swedish Tax Agency, 2016). Hence, there are no incentives for investors to value either payout policy higher than the other based on tax losses. This makes Sweden an interesting market to focus on when studying payout policies. As described above, many previous studies claim that taxes are one of the main factors affecting investors' preferences for payout policies. Considering Swedish market, taxes effect is completely removed. This makes it possible to look at how investors value dividends and stock repurchases without the effect of taxes.

3.Research methodology

This chapter describes the estimation methods applied to this study, starting with the research hypothesis and followed by data and method used.

3.1.Hypothesis

Based on previous research, the expectations of this study are to find a positive relationship between firm value and dividend, as well as firm value and stock repurchase. These expectations are expressed in the following hypotheses.

Hypothesis I: There is a positive relationship between dividend and firm value.

Hypothesis II: There is a positive relationship between stock repurchase and firm value.

Hypothesis III: Dividend is superior to stock repurchase in terms of increasing firm value.

3.2.Data

This section defines the database and time frame of the research and explains the procedure used to organize the data. The variable definition and construction are also presented. The data section ends with descriptive statistics of the variables.

3.2.1. Data collection and time frame

To study the relationship between Swedish firms' values and their dividend policies, large and highly quantitative databases are required. An appropriate database should have standardized tests and assessments for validity to make sure that conclusions made based on the data are accurate. This study is based on secondary data, which means that it is a set of research data that has been collected and partly used for previous studies (DePoy and Gitlin, 2016).

Compustat - Capital IQ from Standard & Poor's and Thomson Reuters DataStream, the research platform providing market and corporate fundamental data, are the main data sources for this study. The sample consists of 1,014 Swedish firms, collected on a yearly basis for the period 1987-2017, which gives 11,694 firm-year observations.

3.2.2. Data Processing

The fundamental corporate data and the stock prices are based on the Global Fundamental section and the Global Security section of Compustat - Capital IQ respectively. International Securities Identification Number (ISIN) which is a 12-digit code identifying specific securities (IMF, 2002)

is used as a key variable to match data from different sources. Firms that are missing ISIN, stock price, or the number of common shares outstanding are excluded from the study.

Due to missing data of share repurchases amounts in Compustat - Capital IQ, buyout data from DataStream is used instead. ISIN is used as the key variable to connect the two databases. After excluding firms with missing data, the study consists of 998 Swedish companies over 31 years, which gives 8,184 firm-year observations. The method of the data processing is shown in figure 1.

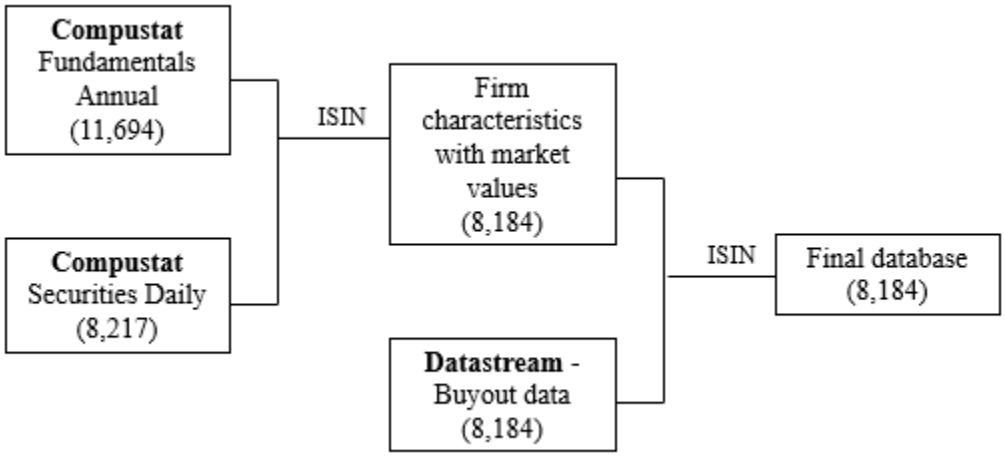

Figure 1 The method of the data processing

3.2.3. Variable definition and construction

The previous literature uses market value over book value of asset and equity (MA/A, ME/E) as proxies for firm value. Baker and Wurgler (2004) base their analysis of firm value and dividend premium on MA/A. However, Karpavičius and Yu (2018) find that market value of equity over book value of equity (ME/E) is a superior measure to MA/A since the best estimator for firm value is more important to shareholders than to bondholders. This study is of greater interest to shareholders than to bondholders, hence ME/E is the best measurement of firm value. For robustness, this study uses both MA/A and ME/E for analysis.

To study the effect of payout, dummies are created for dividend and stock repurchase. The dummy of dividend is assigned to 1 if the firm has paid out dividend during the year and zero if it has done neither a dividend payment nor a share repurchase. Paying out dividend includes both cash dividend and stock dividend. Similarly, the dummy of share repurchase is assigned to 1 if firm has made a share repurchase during the year and zero if it has done neither a dividend payment nor a share repurchase. All three categories of stock repurchases: open market repurchase, tender offer, and targeted repurchase, are included. This construction of dummy variables is different from the previous literature which does not separate the effect of dividend from share repurchase.

Karpavičius and Yu (2018) assign 1 for dividend payers and zero otherwise. Their studies, therefore, include the effect of share repurchase in the study of dividend.

Furthermore, several firm characteristics are added as control variables in order to achieve a precise relationship between firm value and the dividend policies. The variables are selected based on the study by Coles et al. (2008), Kalcheva and Lins (2007), and Karpavičius and Yu (2018), including firm size, profitability, leverage, cash, tangible assets, capital expenditures, research & development expenditures, age, and volatility. For consistency, the relevant independent variables are scaled by either book values of assets or book values of equity. The variable constructions are as follows.

I. Market to book value of asset

Baker and Wurgler (2004) and Karpavičius and Yu (2018) proxy the firm value by the market value over book value of asset. The market value of asset is the sum of book value of asset and market value of equity, netted by book value of equity.

$$\frac{MA}{A} = \frac{Market\ value\ of\ assets}{Book\ value\ of\ assets}$$

$$= \frac{Book\ value\ of\ assets\ -\ Book\ value\ of\ equity\ + market\ value\ of\ equity}{Book\ value\ of\ assets}$$

II. Market to book value of equity

Similarly, Baker and Wurgler (2004) and Karpavičius and Yu (2018) also proxy the firm value by the market value over book value of equity. To calculate the market value of equity, the current stock price is multiplied by the total number of shares outstanding.

$$\frac{ME}{E} = \frac{Market\ value\ of\ equity}{Book\ value\ of\ equity}$$

$$= \frac{Common\ shares\ outstanding\ \times\ Closing\ price\ at\ the\ end\ of\ fiscal\ year}{Book\ value\ of\ equity}$$

III. Dummy variable for dividends

$DIVD$ is the dummy variable for dividends. It equals to one if the firm only pays dividend and zero if the firm does nothing.

IV. Dummy variable for share repurchase

$REPD$ is the dummy variable for share repurchases. It equals to one if the firm only does a share repurchase and zero if the firm does nothing.

V. Firm size

Total assets are an indicator of firm size. According to Tobin's q model, an increase in total asset will generate a positive impact on the market to book of assets (Chung and Pruitt, 1994). This is supported by Kalcheva and Lins (2007) who find a positive relationship between the firm value and total assets. Hence, firm size is added and measured as the natural logarithm of book value of firm assets.

$$\text{ASSETS} = \ln(\text{book value of assets})$$

VI. Profitability

The profitability is one of the explanatory factors that affect share prices and firm growth. Coles et al. (2008) find that the profitability, proxied by ROA, is positively related to firm value. Profitability, calculated by the net income after excluding businesses expenses and operating costs, is added to the regression models.

$$\text{NI} = \text{Net income}$$

VII. Leverage

According to Tobin's q model, leverage is one of the factors adjusting the market value of firm (Chung and Pruitt, 1994). This is supported by Kalcheva and Lins (2007) who find a negative relationship between firm value and debt ratio. Leverage consists of long-term and short-term debt and is one of the explanatory variables in the regression models.

$$\text{DEBT} = \text{long} - \text{term debt} + \text{debt in current liabilities}$$

VIII. Cash

Kalcheva and Lins (2007) find that cash is positively related to firm value. This item includes cash and short-term investment.

$$\text{CASH} = \text{cash and short} - \text{term investment}$$

IX. Tangible assets

A higher amount of tangible asset results in higher firm value (Chung and Pruitt, 1994). Property, plant, and equipment are the best proxies of tangible assets as they are the highest proportion of fixed assets in most firm's financial statements (Koller et al., 2015). This study applies the value after excluding accumulated depreciation of the tangible assets.

$$\text{PPE} = \text{Net property, plant, and equipment}$$

X. Capital expenditures

According to Tobin's q model, capital expenditure is one of the factors affecting the firm market value to assets ratio (Chung and Pruitt, 1994). Supported by the finding of Kalcheva and Lins (2007), the capital expenditure has a positive impact on firm value. Thus, capital expenditures are added as one of the independent variables.

$$\text{CAPEX} = \text{Capital expenditures}$$

XI. Research & Development (R&D) expenditures

The empirical results of Coles et al. (2008) find a statistically positive and significant relationship between R&D spending and market value since investment in R&D is considered an investment in intangible assets which contributes to the long-term growth of the firm. Therefore, R&D expenditures are added as one of the independent variables.

$$\text{RD} = \text{Reseach and development expense}$$

A dummy variable of R&D expenditure is also created as Karpavičius and Yu (2018) claim that the availability of data for R&D expenses affects the relationship between firm value and dividend policy. RDD is constructed and equals to one if R&D expense is reported in Compustat and zero otherwise.

XII. Age

Karpavičius and Yu (2018) find that firms' age is a relevant factor to estimated firm value. Age can be estimated by deducting the current fiscal year with the first firm-year that appears in the Compustat database.

$$\text{AGE} = \text{Current fiscal year} - \text{Year when firm share prices first appears in Compustat}$$

However, it is difficult to obtain the accurate initial date of a share price observation for firms seeing as few firm's data is available before 1995. In order to obtain accurate estimators, age is therefore excluded from the regression. Moreover, age constantly increases over time in every company. Applying panel data regression will automatically capture the variation of this firm characteristic.

XIII. Volatility

Coles et al. (2008) and Karpavičius and Yu (2018) conclude that firm value is dependent on volatility. To control the impact of volatility on firm value, the standard deviation of monthly stock returns should be one of the explanatory variables. However, a large amount of missing data will lead to inefficient estimators and inaccurate implications. This study, therefore, excludes volatility from the regression models.

$$\text{VOL} = \text{Standard deviation of monthly stock returns over the last fiscal year}$$

3.2.4. Selection criteria and omitted data

To separate the effect of dividend and share repurchase on firm value, the sample is divided into 4 groups: firms that only do dividend payments, firms that only do share repurchases, firms that do both dividend payments and share repurchases, and firms that do nothing. The number of firm-years is shown in table 1. To study the relationship between dividends and firm value, a sample consisting of firms that only pay dividends and firms that apply neither payout policy is created. Similarly, to study the relationship between share repurchases and firm value, a sample containing firms that do only share repurchases and firms that applies neither payout policy is created. Firms which apply both dividends and share repurchases are excluded from the study in order to get a precise relationship between firm value and the payout policies.

Table 1 Four types of firm

Types of firm	**No. of firm-year**
Only dividend	4,390
Only share repurchase	38
Both share repurchase and dividend	214
Nothing	3,542
Total	**8,184**

Some outliers are found in the data for ME/E; some firms have a market over book value of equity greater than 100 as well as less than 0, as shown in figure 2. The theory of boxplots defines outliers as the points that are outside a confidence interval (Frigge et al., 1989). However, a 95% confidence interval of ME/E would limit the data to the interval [3.16,3.86]. A large amount of valuable data would be removed if this interval is applied. Considering the distribution of ME/E, it is decided that firms with ME/E outside the interval [0,10] would be excluded from the study. The new number of firm-years is shown in table 2.

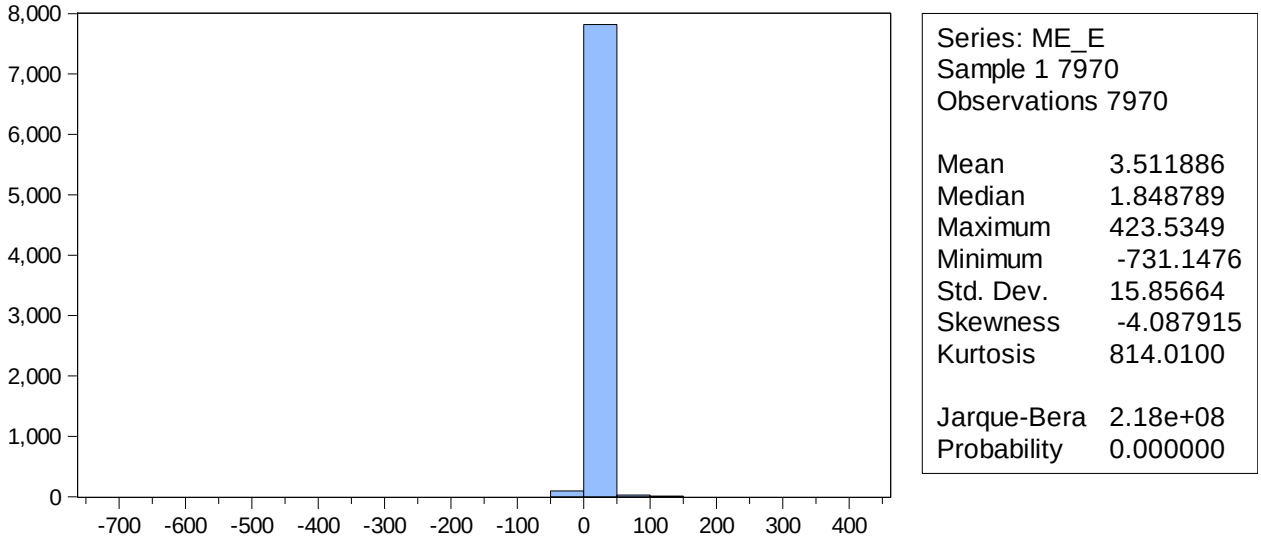

Figure 2 The distribution of ME/E

Table 2 Firms after excluding outliers

Types of firm	No. of firm-year
Only dividend	4,269
Only share repurchase	35
Nothing	3,115
Total	**7,419**

3.2.5. Descriptive statistics

Table 3 presents the descriptive statistics of the sample. Panel A is the ratios based on the dividend's sample which consists of 960 Swedish firms listed on the Stockholm Stock Exchange, 7,384 firm-year observations. Half of the sample consists of observations for dividend payers. Consistently with the previous literature, the average MA/A and ME/E are smaller for dividend payers. This implies that the dividend premium is negative (Baker and Wurgler, 2004, Karpavičius and Yu, 2018). Dividend payers are larger, more profitable, more leveraged, and have more tangible assets, but less cash and lower R&D expenditures compared to a firm without any policy. Results regarding capital expenditure are inclusive across the panels.

Most Swedish companies do not apply stock repurchase, as shown in Panel B in table 3. Larger size and higher profit are common characteristics of firms with share repurchase. In addition, most of them have lower cash holdings, lower tangible assets and smaller expenses in capital and R&D than firms without any payout policy. Results regarding leverage are inclusive across the panels.

Table 3 Descriptive statistics of the sample

Panel (A) Average value based on dividend

Variable	Dividend			Variable	Dividend		
	Non-payer	Payer	Average		Non-payer	Payer	Average
MA/A	1.9693	1.6040	1.7581	**ME/E**	2.6041	2.2659	2.4086
DIV/A	0.0000	0.0870	0.0503	**DIV/E**	0.0000	0.2079	0.1202
ASSETS	5.2591	7.7411	6.6940	**ASSETS**	5.2591	7.7411	6.6940
NI/A	-0.1648	0.0290	-0.0527	**NI/E**	-0.3706	0.0555	-0.1242
DEBT/A	0.1614	0.2100	0.1895	**DEBT/E**	0.7291	0.8131	0.7776
CASH/A	0.1960	0.1213	0.1528	**CASH/E**	0.3480	0.2517	0.2923
PPE/A	0.1314	0.1773	0.1579	**PPE/E**	0.4537	0.4641	0.4597
CAPEX/A	0.0268	0.0285	0.0278	**CAPEX/E**	0.1220	0.0732	0.0938
RD/A	0.0366	0.0191	0.0264	**RD/E**	0.0659	0.0379	0.0497
Observations	3115	4269	7384	**Observations**	3115	4269	7384

Panel (B) Average value based on repurchase

Variable	Repurchase		
	Non-purchaser	Purchaser	Average
MA/A	1.9693	1.4546	1.9636
REP/A	0.0000	1.6053	0.0163
ASSETS	5.2591	8.7225	5.2976
NI/A	-0.1648	0.0295	-0.1626
DEBT/A	0.1614	0.3546	0.1636
CASH/A	0.1960	0.0542	0.1944
PPE/A	0.1314	0.1059	0.1311
CAPEX/A	0.0268	0.0265	0.0268
RD/A	0.0366	0.0079	0.0362
Observations	3115	35	3150

Variable	Repurchase		
	Non-purchaser	Purchaser	Average
ME/E	2.6041	1.9349	2.5966
REP/E	0.0000	2.8173	0.0269
ASSETS	5.2591	8.7225	5.2976
NI/E	-0.3706	0.1055	-0.3653
DEBT/E	0.7291	1.7937	0.7409
CASH/E	0.3480	0.1030	0.3453
PPE/E	0.4537	0.2423	0.4513
CAPEX/E	0.1220	0.0576	0.1212
RD/E	0.0659	0.0164	0.0653
Observations	3115	35	3150

3.3.Method

The method section explains the panel data regression method used in this study, including types of regressions, assumptions, and regression models. Lastly, the robustness tests for the model are described in this section.

3.3.1. Panel data

The data used in this study is panel data with a cross-sectional dimension (firms) and a periodical dimension (years). Panel data is used since it contains more information than cross-sectional data which only gives information for a single point in time. It is also more preferable than time-series data that only can handle one entity. Furthermore, panel data can capture heterogeneity and time-specificity through adding effects to the cross-sectional or periodical dimension. These effects can be either fixed or random.

3.3.2. Fixed or Random Effects

There are several different ways to perform a regression on panel data. The simplest way to deal with such data would be to estimate a pooled regression or general OLS method. This technique will estimate all data together based on a single equation, assuming that there is no heterogeneity and no time-specificity.

However, the factors of firm value and firm characteristics contain unique characteristic. To capture the heterogeneity, there are mainly two classes of panel estimator approaches that can be employed in financial research: fixed effect models and random effect models. Fixed effects

models assume the intercept in the regression model to be constantly different either cross-sectionally or periodically or both. It can be written as in equation 3.

Equation 3 The fixed effects model

$$y_{it} = \alpha + \beta x_{it} + \mu_i + \lambda_t + \vartheta_{it}$$

where μ_i and λ_t are fixed for each cross-sectional and time-series unit respectively. A Least Square Dummy Variable regression can be used in order to test for fixed effects. Each cross-section unit or each time-period has a different intercept when using fixed effects, the intercepts can, therefore, be seen as dummy variables. The LSDV-regression tests whether the dummies are significantly different from zero and if fixed effects thereby are required. If the test cannot be rejected, a pooled regression is sufficient.

Random effects models allow variation across either entities or periods to be random. Equation 4 is the general formula of random effects model.

Equation 4 The random effects model

$$y_{it} = \alpha + \beta x_{it} + u_{it} \text{ where } u_{it} = \mu_i + \vartheta_{it}.$$

There are three additional assumptions for random effects model. Firstly, μ_i and ϑ_{it} are normally distributed with zero mean and having σ_μ^2 and σ_ϑ^2 as variance. Secondly, μ_i and ϑ_{it} are independent. Finally, both μ_i and ϑ_{it} are independent of other explanatory variables. The Hausman test can be used in order to determine whether random effects are necessary for the data (Brooks, 2008).

3.3.3. Key assumptions for panel data regression model

There are five main properties, known as Classical Linear Regression Model, which the multiple linear regression models should satisfy in order to obtain the Best Linear Unbiased Estimators (BLUE) and provide a reliable conclusion (Brooks, 2008, Gujarati and Porter, 2008).

1. The expected value of the error terms is zero.
2. The variance of the error terms is constant and finite over explanatory variables.
3. The error terms are uncorrelated.
4. There is no relationship between the independent variables and the error terms.
5. The errors terms are normally distributed.

Regarding Panel data, the problem caused by autocorrelation of error terms is always solved by using either fixed effect or random effect. This also partly solves the problem of correlation between the independent variable and the error terms which is called “Endogeneity”. Previous literature shows that payout policies can induce higher firm value. However, the firm value may affect the payout policies through profitability. When the profitability increases, the firms are more

likely to apply a payout policy. This endogeneity problem is partly solved by using fixed effects and controlling for profitability in the regression. In addition, endogeneity is likely to be a bigger problem for repurchases since repurchases are more flexible and sensitive to variation in performance over time than dividends that are more stable over time. The fixed effects, therefore, reduce the endogeneity problem to a greater extent for dividends. The study by Karpavičius and Yu (2018) which this paper relies on, does not bring up issues regarding endogeneity. Thus, there are three assumptions left to conduct tests for.

3.3.3.1.Multicollinearity

When one explanatory variable is linearly correlated with a set of other variables, the model is suffering from multicollinearity (Brooks, 2008). Although a model with multicollinearity can estimate BLUE and consistent estimators, the variance and standard deviation are estimated incorrectly, resulting in invalid inferences (Jamal, 2017). In addition, an estimate will become very sensitive to small changes in data.

Pairwise correlation's analysis of explanatory variables is a common method to detect multicollinearity. Statistically, there is no exact cutoff for severe multicollinearity. Some analysts set 0.80 correlation as the criteria of multicollinearity: if the correlation coefficient is greater than 0.80, it could possibly conclude that the model contains multicollinearity. Increasing the sample size, excluding one of the multicollinearity variables, or transforming multicollinearity variables into first differences or ratios are some possible ways to deal with multicollinearity (Brooks, 2008).

3.3.3.2.Heteroscedasticity

Constant and finite error terms are known as the property of homoscedasticity: variance of the error terms is independent of the observations. If the errors do not have a constant variance, they are heteroscedastic (Brooks, 2008). Generally, heteroscedasticity occurs in data with wide disparity and is mostly found in cross-sectional data rather than time-series data. The OLS estimators from a model with heteroscedasticity are still linear, unbiased, and consistent; however, they are not BLUE. Biased variance and false inference are the results of heteroscedasticity.

There are several ways testing for heteroscedasticity including Goldfeld and Quandt (1965) test and White (1980) test. Transforming the original equation to obtain constant variance is needed if the hypothesis of homoscedasticity is rejected (White, 1980). Applying White's Heteroscedasticity-robust standard errors is one of the solutions for heteroscedasticity which corrects only standard errors. The estimators remain identical to before applying robust standard errors (Brooks, 2008).

3.3.3.3.Normality

As normality is the preferable property of the error terms, a test for normality is needed in order to confirm the accuracy of the model's inferences. The Bera-Jarque test is one of the normality tests which assumes that error terms that are normally distributed must have zero skewness and zero excess kurtosis (Jarque and Bera, 1987).

Increasing the sample size, transforming variables into logarithm form, or applying dummy variables to capture the outliers are examples methods in order to remedy departure from normality (Brooks, 2008, Gujarati and Porter, 2008).

3.3.4. Regression model

The regression models that will be used to analyze the relationship between firm value and dividends are shown in equation 5 and 6.

Equation 5 The panel data regression model of MA/A on dividend

$$\begin{aligned}(MA/\mathrm{A})_{it} &= \propto_0 + \propto_1 (DIVD)_{it} + \propto_2 (ASSETS)_{it} + \propto_3 (NI/\mathrm{A})_{it} \\ &+ \propto_4 (DEBT/\mathrm{A})_{it} + \propto_5 (CASH/\mathrm{A})_{it} + \propto_6 (PPE/\mathrm{A})_{it} \\ &+ \propto_7 (CAPEX/\mathrm{A})_{it} + \propto_8 (RD/\mathrm{A})_{it} + \propto_9 (RD\mathrm{D})_{it} + \mu_i + \lambda_t + \varepsilon_{it}\end{aligned}$$

Equation 6 The panel data regression model of ME/E on dividend

$$\begin{aligned}(ME/\mathrm{E})_{it} &= \propto_0 + \propto_1 (DIVD)_{it} + \propto_2 (ASSETS)_{it} + \propto_3 (NI/\mathrm{E})_{it} \\ &+ \propto_4 (DEBT/\mathrm{E})_{it} + \propto_5 (CASH/\mathrm{E})_{it} + \propto_6 (PPE/\mathrm{E})_{it} \\ &+ \propto_7 (CAPEX/\mathrm{E})_{it} + \propto_8 (RD/\mathrm{E})_{it} + \propto_9 (RD\mathrm{D})_{it} + \mu_i + \lambda_t + \varepsilon_{it}\end{aligned}$$

Where the indices i and t correspond to firm and year, respectively. If the model contains two-way fixed effects, variables μ and λ are the firm and time fixed effects. If the model contains two-way random effects, variables μ and λ are the firm and time random effects.

To analyze whether share repurchases have similar effects on firm value as dividends have, equation 5 and 6 are re-estimated, replacing DIVD by REPD.

Equation 7 The panel data regression model of MA/A on share repurchase

$$\begin{aligned}(MA/\mathrm{A})_{it} &= \propto_0 + \propto_1 (REPD)_{it} + \propto_2 (ASSETS)_{it} + \propto_3 (NI/\mathrm{A})_{it} \\ &+ \propto_4 (DEBT/\mathrm{A})_{it} + \propto_5 (CASH/\mathrm{A})_{it} + \propto_6 (PPE/\mathrm{A})_{it} \\ &+ \propto_7 (CAPEX/\mathrm{A})_{it} + \propto_8 (RD/\mathrm{A})_{it} + \propto_9 (RD\mathrm{D})_{it} + \mu_i + \lambda_t + \varepsilon_{it}\end{aligned}$$

Equation 8 The panel data regression model of ME/E on share repurchase

$$\begin{aligned}(ME/\mathrm{E})_{it} &= \propto_0 + \propto_1 (REPD)_{it} + \propto_2 (ASSETS)_{it} + \propto_3 (NI/\mathrm{E})_{it} \\ &+ \propto_4 (DEBT/\mathrm{E})_{it} + \propto_5 (CASH/\mathrm{E})_{it} + \propto_6 (PPE/\mathrm{E})_{it} \\ &+ \propto_7 (CAPEX/\mathrm{E})_{it} + \propto_8 (RD/\mathrm{E})_{it} + \propto_9 (RD\mathrm{D})_{it} + \mu_i + \lambda_t + \varepsilon_{it}\end{aligned}$$

3.3.5. Robustness tests

Robustness testing is a quality assurance methodology, measuring how the result changes when the regression model is modified (Lu and White, 2014). Neumayer and Plümper (2017) state that this process can improve the validity of inferences and raises researchers' awareness, especially in the accuracy of the research design and the baseline model. There are two approaches applied to assess the validity of this research's regression model: replacing dummy variables with actual payout variables and re-estimating the model for different subsample periods.

3.3.5.1. Replace dummy variables with actual variables

For robustness, Karpavičius and Yu (2018) re-estimate their regression model by replacing the dummy variables with the actual variables used to create the dummy variables. This study leverages their approach and alter variables in equation 5-8 as follows.

Dummy variable		Actual variable
DIVD	→	DIV/A
		DIV/E
REPD	→	REP/A
		REP/E

3.3.5.2. Re-estimate for different subsample periods

Another way to assess the accuracy of the model is to re-estimate regression model for different subsample periods (Tsao and Ling, 2012). The four main regressions are then estimated for period pre-2008 (1987-2007) and since 2008 (2008-2017).

4. Empirical results

This chapter presents the empirical findings of the regression analysis. Firstly, the model selection and diagnostic tests to optimize the estimation and ensure the validity of the regression are discussed. The regression results are presented as the last part of chapter 4.

4.1. Model selection for Fixed and Random effects

Considering the residuals from a pooled regression in figure 3, it is clear that residuals are not homogenous. Residuals are systematically either below or above zero which would suggest that the errors are positive for some firms and negative for others. This pattern implies heterogeneity. Adding either fixed effects or random effects is required to obtain precise estimators.

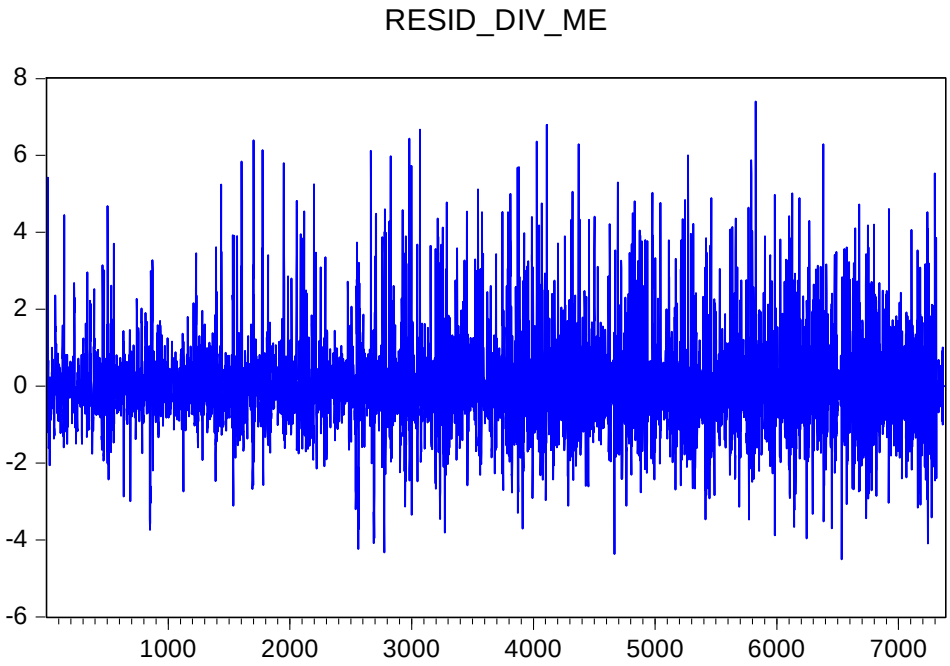

Figure 3 the residuals from a pooled regression of DIVED model

There are 2 main tests to determine the appropriate model for panel regression: the redundant fixed effect test and the Hausman test. The redundant fixed effect test or Chow test examines whether heterogeneity exists in the model. Chow (1960) assumes the null hypothesis is no heterogeneity across firms and periods and that the model should use an ordinary regression. Panel A in table 4 shows the redundant fixed effect tests in both cross-section and period. All statistical results reject the null hypothesis at 1% significance level and conclude that a pooled regression is not appropriate. Either fixed effects or random effects should be added to control heterogeneity, which aligns with the conclusion of figure 3.

In order to decide whether heterogeneity is constant or random, the Hausman test is applied. Rejecting the null hypothesis implies that there is constant heterogeneity in the model and it should be captured by fixed effects (Hausman, 1978). According to panel B in table 4, all statistical results reject the null hypothesis at 1% significance level and conclude that the fixed effects models are appropriate for this data. The statistic result in panel C of table 4 confirms the two-way fixed effects across firm and period.

Table 4 Test results of panel regression models

Tests	Dividend				Share repurchase			
	MA/A		ME/E		MA/A		ME/E	
Panel (A): Redundant Fixed Effects Tests[1]								
Test cross-section fixed effects								
Cross-section F	7.04939	***	6.89668	***	3.81742	***	3.64915	***
Cross-section Chi-square	5314.34	***	5231.8	***	2543.76	***	2465.88	***
Test period fixed effects								
Period F	16.5476	***	21.2569	***	9.28704	***	11.0651	***
Period Chi-square	482.986	***	614.857	***	244.029	***	288.667	***
Panel (B): Correlated Random Effects - Hausman Test[2]								
Test cross-section random effects								
Cross-section Chi-square	166.589	***	113.998	***	74.3122	***	52.7519	***
Test period random effects								
Period Chi-square	70.2465	***	57.9876	***	102.692	***	43.3341	***
Panel (C): Redundant Fixed Effects Tests[3]								
Test two-way fixed effects								
Cross-Section/Period F	7.99101	***	8.40647	***	4.25072	***	4.43087	***
Cross-Section/Period Chi-square	5947.63	***	6156.99	***	2820.58	***	2338.68	***
Cross-section effects	Fixed		Fixed		Fixed		Fixed	
Period effects	Fixed		Fixed		Fixed		Fixed	

Remark

1/ The null hypothesis assumes that there is no heterogeneity in cross-section or period. The alternative hypothesis assumes that heterogeneity is available in either cross-section or period, and fixed effects are required.

2/ The null hypothesis assumes that random effects are appropriate for model. The alternative hypothesis assumes that fixed effects are appropriate for model.

3/ The null hypothesis assumes that there is no heterogeneity in cross-section and period. The alternative hypothesis assumes that heterogeneity is available in both cross-section or period, and fixed effects are required.

4.2.Diagnostic test results

A pairwise correlation matrix is applied to check for potential multicollinearity. Regarding appendix B-1 and B-2, all pairwise correlations are within the interval [-0.43,0.67]. Hence, there is no serious multicollinearity problem using these variables in the regression.

Appendix B-3 illustrates the Breusch-Pagan-Godfrey test results for heteroscedasticity. It concludes that the variance of the errors is not constant over cross-section and period, supported by the rejection of the null hypothesis of homoscedasticity at 1% significance level. To remedy the problem of heteroscedasticity, White's Heteroscedasticity-robust standard errors are applied in order to correct inconstant variance.

The histogram and Bera-Jarque tests are expressed in appendix B-4 to appendix B-7. All results specify non-normality of errors: mean and median are unidentical, skewness and kurtosis do not equal to zero and three respectively, the hypothesis of normality is rejected at 1% significance level. Theoretically, an equation with non-normal residual will provide incorrect inference, but the estimators are still BLUE. In addition, the estimation from sufficiently large sample sizes will result in normally distributed estimators, based on the Central Limit Theorem (CLT) (Grinstead, 1997, Petrov, 2000). Thus, it is unnecessary to transform residuals into the normal distribution.

4.3.Regression results

4.3.1. Dividends

Model 1 in Table 5 and 6 shows the results of the regression of MA/A and ME/E respectively on dividends. In contrast to the descriptive statistics, there is a positive relationship between dividend policy and firm value. The coefficients for the dummy variables of dividend, DIVD, are positive and statistically significant at 1% significance level.

In addition, the results are economically significant. The coefficient estimate for DIVD in the MA/A regression is 0.1419. According to panel A in table 3, the average MA/A of all firms in the sample is 1.7581. Therefore, the asset dividend premium is 8.07% (0.1419/1.7581). Similarly, the estimated equity premium is equal to 13.19% (0.3178/2.4086). Thus, a price premium seems to be added to dividend-paying firms both in terms of asset value and equity value. Compared to the equity dividend premium, the asset dividend premium is lower since it is the weighted average of dividend premium for debt and equity. Higher dividend payout negatively impacts on debtholders through a decrease in cash holdings and an increase in the risk of default. Thus, dividend premium for debt is possibly negative. This conclusion aligns with Karpavičius and Yu (2018)'s finding which is based on US data.

Since ME/E is superior to MA/A in measuring firm value, the following analysis is based on the market value of equity scaled by book value of equity. According to table 6 in model 1, firm size, leverage, cash holdings, and capital expenditures significantly affect the firm value at 5% significance level, while profitability, tangible assets, and R&D expenditure are not significant. However, to study the precise relationship between dividend and firm value, adding those variables is necessary.

An increase in leverage ratio, cash holding, and R&D expenditure could rise the firm value. A 1 unit increase in debt over equity will rise the firm value by 0.10 units. Regarding the presence of corporate taxes, firm can increase value by taking more debt. Similarly, a 1 unit increase in cash over equity and R&D expenditure over equity will increase the firm value by 0.57 units and 0.24 units respectively. Higher amount of cash holdings can rise firm value, especially in a country with a higher level of financial and economic development (Pinkowitz et al., 2006). For R&D expenditure, Johnson and Pazderka (1993) examine the linkage between the stock market and R&D expenditures and explain the systematically positive relationship by announcement effects.

On the other hand, an increase in firm size, profitability, tangible assets, and capital expenditure negatively impact on firm value. A 1 unit increase in firm size causes a fall in firm value by 0.24 units. Likewise, a rise in net income and capital expenditure by 1 unit will result in a lower firm value by 0.04 units and 0.05 units approximately. This can be explained by the expectations treadmill in which shareholders' expectations are built into the company's stock price. If the company can beat expectations and the market believes that the improvement is sustainable, the company's stock price then rises. Generally, it is easier for a company with low expectations for success to outperform and meet shareholders' goals, compared to a large company with high expectation (Koller et al., 2015). For tangible assets, 1 unit increase in PPE over equity causes 0.003 units decrease in firm value.

For robustness, there are two approaches applied to assess the validity of the model. Firstly, the actual value of dividend (DIV/A and DIV/E) instead of the dummy variables are used and the results are shown in model 2 of table 5 and 6. Control variables in equation 6 (ME/E) provide the same sign as in model 1. Although the coefficient of dividends is positive as in model 1, it is not significant. Karpavičius and Yu (2018) explain that the conflicting results are possibly caused by an asymmetric impact of small and large dividends. Size of dividend does not matter when applying dummy variables; however, it is considered when using the actual variable. Since this study focuses on whether dividend has an impact on firm value, the size of the payout is not taken into consideration. Thus, it could be concluded that dividend positively affects Swedish firm value.

Another approach to assess the validity of the model is to re-estimate the equations 5 and 6 for different subsample periods: pre-2008 and since-2008. The results are provided in model 3-4 in table 5 and 6. Focusing on only the better predictive equation, it could be said that the model still infers the same conclusion even if the estimation period is changed. Although coefficients of

dividend in the ME/E regression in subsample 1987-2007 are not significant, the growing impact on dividend premium and its significance since 1999 in table 10 indicates that dividend induces a rise in firm value. In addition, there are a few Swedish firms each period in the 1990s, as shown in figure 4. Performing an inferential analysis, small sample size increases the likelihood of type II error, a situation which incorrectly not rejects a null hypothesis. The error will decrease the power of study and lead to insignificant result (Brooks, 2008).

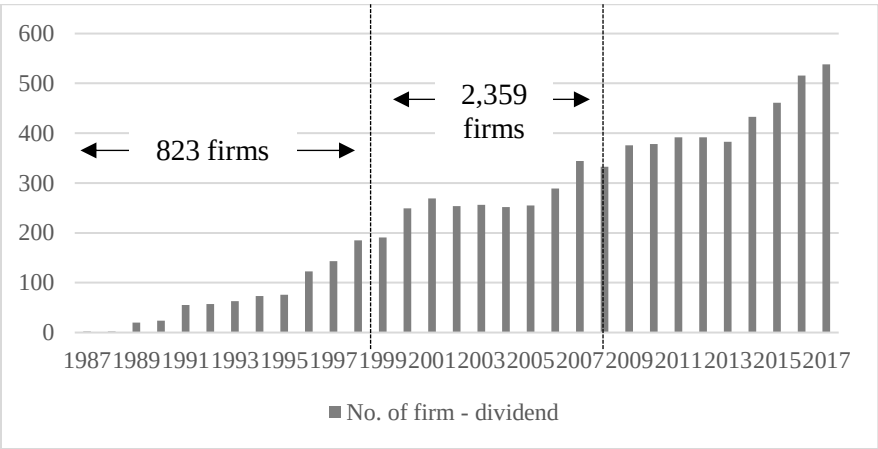

Figure 4 Firms in dividend's study

Overall, the dividend's models are reasonably robust. Although the variables are modified, and estimated periods are changed, the models still provide similar results and conclusions.

Table 5 Determinants of market value of asset scaled by book value of asset for dividend[1]

Dependent variable	Model 1 MA/A		Model 2 MA/A		Pre 2008 Model 3 MA/A		Since 2008 Model 4 MA/A	
DIVD	0.1419	***			0.0008		0.1658	***
	[0.0307]				[0.0523]		[0.0371]	
DIV/A			0.0677					
			[0.0412]					
ASSETS	-0.1273	***	-0.1173	***	0.0061		-0.2717	***
	[0.0286]		[0.0287]		[0.0427]		[0.0481]	
NI/A	0.1094	**	0.1092	**	0.2497	**	0.0339	
	[0.0494]		[0.0495]		[0.1117]		[0.0550]	
DEBT/A	-0.3471	***	-0.3865	***	-0.3943	***	-0.3872	**
	[0.0948]		[0.0943]		[0.1412]		[0.1625]	
CASH/A	0.8754	***	0.8896	***	0.6159	**	1.0375	***
	[0.1555]		[0.1557]		[0.2954]		[0.2104]	
PPE/A	0.0074		0.0040		-0.0281		0.2442	
	[0.1242]		[0.1245]		[0.1886]		[0.2272]	
CAPEX/A	1.2877	***	1.2924	***	1.3891	***	1.2025	***
	[0.2860]		[0.2876]		[0.4580]		[0.4366]	
RD/A	0.3103		0.3191		0.7525		0.0401	
	[0.2623]		[0.2612]		[0.7160]		[0.2992]	
RDD	-0.0640		-0.0564		-0.0268		-0.1419	**
	[0.0438]		[0.0439]		[0.0620]		[0.0702]	
Constant	2.4389	***	2.4541	***	1.5187	***	3.3647	***
	[0.1964]		[0.1965]		[0.3198]		[0.3038]	
Period effects	Yes		Yes		Yes		Yes	
Cross-section effects	Yes		Yes		Yes		Yes	
Observation	7384		7384		3182		4202	
Periods included	31		31		21		10	
Cross-sections included	960		960		534		778	
Adjusted R-squared	0.6079		0.6068		0.5946		0.6697	
Akaike info criterion	2.4619		2.4647		2.2056		2.5095	
Schwarz criterion	3.3964		3.3992		3.2787		3.7111	
Hannan-Quinn criterion	2.7831		2.7859		2.5904		2.9344	
Durbin-Watson stat	1.1336		1.1278		1.2919		1.3253	

[1] This table presents the results of least squares regressions: coefficient and standard error. Standard errors are based on standard errors robust to clustering at the firm and year levels are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

Table 6 Determinants of market value of equity scaled by book value of equity for dividend[2]

Dependent variable					Pre 2008		Since 2008	
	Model 1		Model 2		Model 3		Model 4	
	ME/E		ME/E		ME/E		ME/E	
DIVD	0.3178	***			0.0906		0.2986	***
	[0.0536]				[0.0898]		[0.0641]	
DIV/E			0.0279					
			[0.0454]					
ASSETS	-0.2388	***	-0.2208	***	-0.0764		-0.4509	***
	[0.0437]		[0.0439]		[0.0728]		[0.0639]	
NI/E	-0.0397		-0.0397		-0.0154		-0.0243	
	[0.0260]		[0.0261]		[0.0335]		[0.0403]	
DEBT/E	0.1021	***	0.1001	***	0.0975	***	0.0923	***
	[0.0156]		[0.0154]		[0.0231]		[0.0213]	
CASH/E	0.5666	***	0.5709	***	0.6355	***	0.5574	***
	[0.1016]		[0.1020]		[0.1493]		[0.1568]	
PPE/E	-0.0030		-0.0067		-0.1019	**	0.0539	
	[0.0349]		[0.0357]		[0.0405]		[0.0395]	
CAPEX/E	-0.0522	**	-0.0502	**	0.9765	***	-0.0814	***
	[0.0219]		[0.0228]		[0.3294]		[0.0202]	
RD/E	0.2406		0.2458		0.7795	*	0.0325	
	[0.1972]		[0.1985]		[0.4165]		[0.1669]	
RDD	-0.0754		-0.0579		-0.0717		-0.1464	
	[0.0747]		[0.0749]		[0.1034]		[0.1172]	
Constant	3.5890	***	3.6452	***	2.3947	***	5.0217	***
	[0.3006]		[0.3008]		[0.5493]		[0.4030]	
Period effects	Yes		Yes		Yes		Yes	
Cross-section effects	Yes		Yes		Yes		Yes	
Observation	7384		7384		3182		4202	
Periods included	31		31		21		10	
Cross-sections included	960		960		534		778	
Adjusted R-squared	0.5614		0.5589		0.5779		0.6380	
Akaike info criterion	3.4842		3.4898		3.3108		3.4355	
Schwarz criterion	4.4187		4.4243		4.3840		4.6371	
Hannan-Quinn criterion	3.8053		3.8109		3.6957		3.8604	
Durbin-Watson stat	1.1190		1.1084		1.3210		1.3401	

[2] This table presents the results of least squares regressions: coefficient and standard error. Standard errors are based on standard errors robust to clustering at the firm and year levels are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

4.3.2. Share repurchases

The regression results of share repurchase are expressed in model 1 of table 7 and 8. The impact of share repurchases on firm value is insignificant in both the regression for assets and the regression for equity.

The coefficient estimated for REPD in MA/A regression is 0.0245. According to panel B in table 3, the average MA/A in the sample is 1.9636. Therefore, asset dividend premium is 1.25% (0.0245/1.9636). Similarly, the estimated equity premium equal to 8.40% (0.2181/2.5967). Since ME/E is superior to MA/A for measuring firm value, the following analysis is based on the market value of equity scaled by book value of equity.

Model 1 in table 8 shows that share repurchase does not significantly affect firm value. However, all firm characteristics, except tangible assets and R&D expenses, significantly affect the firm value. Hence, it is accurate to consider these variables to control their linkage with firm value.

Consistent with the previous results, firm size, profitability, PPE, and capital expenditure have negative effects on firm value, while a growth in debt, cash holdings, and expenses associated with R&D stimulate an increase in firm value.

For validation, model 2-4 are created in table 8. Most of the results convey an identical conclusion as model 1 except for the sign of share repurchases in the period pre-2008. The opposite sign and insignificant coefficient can be explained by the problem of small sample size (Brooks, 2008). The number of firms in share repurchases' study is shown in figure 5. However, the dummies of share repurchase are still insignificant although using the entire sample.

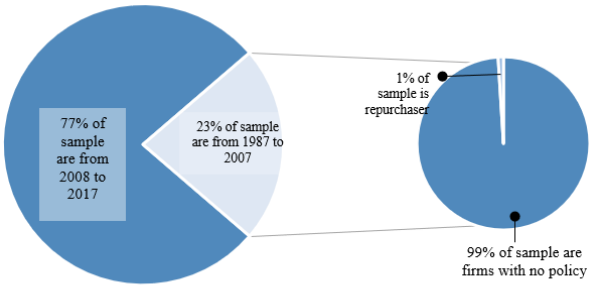

Figure 5 Firms in share repurchases' study

Overall, it can be concluded that only dividends increase firm value in Sweden, while share repurchases do not have any impact on firm value. The conclusion conflicts with the previous finding from Karpavičius and Yu (2018) in which share repurchases had a significantly negative impact on firm value, which explained why US firms would choose dividends over share repurchases as a return to shareholders.

Table 7 Determinants of market value of asset scaled by book value of asset for share repurchase[3]

Dependent variable					Pre 2008		Since 2008	
	Model 1		Model 2		Model 3		Model 4	
	MA/A		MA/A		MA/A		MA/A	
REPD	0.0245				-0.3684		0.0710	
	[0.2869]				[0.5182]		[0.2873]	
REP/A			0.0098	***				
			[0.0019]					
ASSETS	-0.2055	***	-0.2115	***	0.1093		-0.3126	***
	[0.0484]		[0.0483]		[0.1342]		[0.0611]	
NI/A	0.0363		0.0328		0.1228		0.0257	
	[0.0570]		[0.0568]		[0.2564]		[0.0618]	
DEBT/A	-0.4160	**	-0.4010	**	-1.2066	*	-0.2664	
	[0.1845]		[0.1816]		[0.6870]		[0.2198]	
CASH/A	0.8889	***	0.9023	***	1.2950		0.8964	***
	[0.2227]		[0.2226]		[0.9392]		[0.2543]	
PPE/A	0.3118		0.3300		0.1624		0.3124	
	[0.2530]		[0.2530]		[1.2403]		[0.2719]	
CAPEX/A	1.1423	**	1.1602	***	1.6887		1.0792	**
	[0.4437]		[0.4439]		[1.0358]		[0.5400]	
RD/A	0.1222		0.1192		0.4048		0.0928	
	[0.3182]		[0.3197]		[1.7063]		[0.3384]	
RDD	-0.1539		-0.1568		-0.2363		-0.2188	**
	[0.1011]		[0.1010]		[0.5763]		[0.1110]	
Constant	2.9142	***	2.9366	***	1.1057		3.4463	***
	[0.2624]		[0.2625]		[0.7735]		[0.3213]	
Period effects	Yes		Yes		Yes		Yes	
Cross-section effects	Yes		Yes		Yes		Yes	
Observation	3150		3150		711		2439	
Periods included	28		28		18		10	
Cross-sections included	772		772		333		639	
Adjusted R-squared	0.5808		0.5828		0.5266		0.6222	
Akaike info criterion	2.9950		2.9903		2.9500		2.9607	
Schwarz criterion	4.5482		4.5435		5.2558		4.5229	
Hannan-Quinn criterion	3.5523		3.5476		3.8407		3.5286	
Durbin-Watson stat	1.5412		1.5380		2.3924		1.6652	

[3] This table presents the results of least squares regressions: coefficient and standard error. Standard errors are based on standard errors robust to clustering at the firm and year levels are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

Table 8 Determinants of market value of equity scaled by book value of equity for share repurchase[4]

Dependent variable					Pre 2008		Since 2008	
	Model 1		Model 2		Model 3		Model 4	
	ME/E		ME/E		ME/E		ME/E	
REPD	0.2181				-0.9870		0.3310	
	[0.5125]				[1.2102]		[0.5619]	
REP/E			0.0068	**				
			[0.0034]					
ASSETS	-0.3929	***	-0.3955	***	0.0797		-0.5423	***
	[0.0694]		[0.0687]		[0.2241]		[0.0820]	
NI/E	-0.0766	**	-0.0775	**	-0.0730		-0.0409	
	[0.0329]		[0.0329]		[0.0782]		[0.0446]	
DEBT/E	0.1184	***	0.1164	***	0.2517		0.1037	***
	[0.0272]		[0.0266]		[0.2056]		[0.0248]	
CASH/E	0.4538	***	0.4509	***	1.0034	**	0.4588	***
	[0.1374]		[0.1369]		[0.4209]		[0.1754]	
PPE/E	-0.0266		-0.0226		-0.3792		0.0273	
	[0.0426]		[0.0420]		[0.2553]		[0.0419]	
CAPEX/E	-0.0440	**	-0.0442	**	0.7513	**	-0.0629	***
	[0.0182]		[0.0183]		[0.3341]		[0.0217]	
RD/E	0.0448		0.0436		0.6318		0.0175	
	[0.1917]		[0.1913]		[1.2272]		[0.1708]	
RDD	-0.0536		-0.0555		-0.3785		-0.1390	
	[0.1604]		[0.1600]		[0.8157]		[0.1771]	
Constant	4.4308	***	4.4440	***	1.6001		5.1689	***
	[0.3764]		[0.3731]		[1.3941]		[0.4280]	
Period effects	Yes		Yes		Yes		Yes	
Cross-section effects	Yes		Yes		Yes		Yes	
Observation	3150		3150		711		2439	
Periods included	28		28		18		10	
Cross-sections included	772		772		333		639	
Adjusted R-squared	0.5385		0.5406		0.5735		0.5743	
Akaike info criterion	3.8632		3.8588		3.7528		3.8222	
Schwarz criterion	5.4164		5.4120		6.0586		5.3843	
Hannan-Quinn criterion	4.4205		4.4161		4.6435		4.3900	
Durbin-Watson stat	1.5565		1.5558		2.5907		1.6715	

[4] This table presents the results of least squares regressions: coefficient and standard error. Standard errors are based on standard errors robust to clustering at the firm and year levels are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

4.3.3. Interactions among dummy variables

In order to support the results received from the previous regression, a regression including both the dividend dummy and the repurchase dummy is also performed. This regression also contains a third dummy variable (REP&DIVD) which is in charge of separating the effect from repurchases and dividend payments. It captures both dividends and repurchases and equals one only if the firm does both a dividend payment and a share repurchase in the same year.

Using three dummy variables, DIVD, REPD, and REP&DIVD, in the same regression makes it possible to use the entire sample since observations where both dividend payments and share repurchases are made does not have to be excluded. This regression is performed on both MA/A and ME/E in equation 9 and 10 respectively.

Equation 9 The panel data regression model of MA/A on both dividend and share repurchase

$$\begin{aligned}(MA/\mathrm{A})_{it} = {} & \propto_0 + \propto_1 (DIVD)_{it} + \propto_2 (REPD)_{it} + \propto_3 (REP\&DIVD)_{it} \\ & + \propto_4 (ASSETS)_{it} + \propto_5 (NI/\mathrm{A})_{it} + \propto_6 (DEBT/\mathrm{A})_{it} \\ & + \propto_7 (CASH/\mathrm{A})_{it} + \propto_8 (PPE/\mathrm{A})_{it} + \propto_9 (CAPEX/\mathrm{A})_{it} \\ & + \propto_{10} (RD/\mathrm{A})_{it} + \propto_{11} (RD\mathrm{D})_{it} + \mu_i + \lambda_t + \varepsilon_{it}\end{aligned}$$

Equation 10 The panel data regression model of MA/A on both dividend and share repurchase

$$\begin{aligned}(ME/\mathrm{E})_{it} = {} & \propto_0 + \propto_1 (DIVD)_{it} + \propto_2 (REPD)_{it} + \propto_3 (REP\&DIVD)_{it} \\ & + \propto_4 (ASSETS)_{it} + \propto_5 (NI/\mathrm{E})_{it} + \propto_6 (DEBT/\mathrm{E})_{it} \\ & + \propto_7 (CASH/\mathrm{E})_{it} + \propto_8 (PPE/\mathrm{E})_{it} + \propto_9 (CAPEX/\mathrm{E})_{it} \\ & + \propto_{10} (RD/\mathrm{E})_{it} + \propto_{11} (RD\mathrm{D})_{it} + \mu_i + \lambda_t + \varepsilon_{it}\end{aligned}$$

When putting both the dividend dummy and the repurchase dummy in the same regression together with the combined dummy for the case of both dividend payment and repurchase, the results, presented in table 9, are quite similar to previous regressions. The coefficient of the dividend dummy is significant and positive. With MA/A as a dependent variable, the dividend dummy has a coefficient of 0.1396 which is very close to the coefficient of the previous regression, 0.1419. For the case of ME/E as a dependent variable, the result is also very similar to the previous regression, 0.3139 compared to 0.3178. The consistency also holds for the control variables which give the same implications as mentioned for the previous regressions.

Regressing the dividend dummy, repurchase dummy and the combined dummy on firm value gives an insignificant relationship between the repurchase dummy and firm value. The coefficient, presented in table 9, is in this case slightly negative, -0.0470 with MA/A as a dependent variable and -0.0593 with ME/E as a dependent variable. The combined dummy is also insignificant. The coefficients, 0.1249 with MA/A and 0.4326 with ME/E, imply a large positive total effect on firm value when both dividend payments and repurchases are made. Conclusions made from these coefficients are however restricted by the insignificance of the test.

Table 9 Regression results with 3 dummy variables[5]

Dependent variable	MA/A		Dependent variable	ME/E	
DIVD	0.1396	***	**DIVD**	0.3139	***
	[0.0303]			[0.0533]	
REPD	-0.0470		**REPD**	-0.0593	
	[0.2123]			[0.3838]	
REP&DIVD	0.1249		**REP&DIVD**	0.4326	
	[0.2105]			[0.3843]	
ASSETS	-0.1239	***	**ASSETS**	-0.2381	***
	[0.0283]			[0.0434]	
NI/A	0.1154	**	**NI/E**	-0.0366	
	[0.0498]			[0.0260]	
DEBT/A	-0.3297	***	**DEBT/E**	0.1053	***
	[0.0910]			[0.0157]	
CASH/A	0.8507	***	**CASH/E**	0.5517	***
	[0.1539]			[0.1002]	
PPE/A	-0.0023		**PPE/E**	-0.0053	
	[0.1228]			[0.0347]	
CAPEX/A	1.2506	***	**CAPEX/E**	-0.0520	**
	[0.2836]			[0.0218]	
RD/A	0.3280		**RD/E**	0.2524	
	[0.2617]			[0.1967]	
RDD	-0.0643		**RDD**	-0.0651	
	[0.0430]			[0.0738]	
Constant	2.4236	***	**Constant**	3.5947	***
	[0.1963]			[0.3023]	
Period effects	Yes		**Period effects**	Yes	
Cross-section effects	Yes		**Cross-section effects**	Yes	
Observation	7611		**Observation**	7611	
Periods included	31		**Periods included**	31	
Cross-sections included	964		**Cross-sections included**	964	
Adjusted R-squared	0.6089		**Adjusted R-squared**	0.5633	
Akaike info criterion	2.4378		**Akaike info criterion**	3.4722	
Schwarz criterion	3.3538		**Schwarz criterion**	4.3882	
Hannan-Quinn criterion	2.7521		**Hannan-Quinn criterion**	3.7865	
Durbin-Watson stat	1.2501		**Durbin-Watson stat**	1.1216	

[5] This table presents the results of least squares regressions: coefficient and standard error. Standard errors are based on standard errors robust to clustering at the firm and year levels are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

4.3.4. Evolution of equity premium on dividend and share repurchase

Table 10 shows an estimation of the equity premium on dividend and share repurchase during the sample period. Dividend premium cannot be calculated before 1990 since there is no Swedish firm paying dividend in the sample at that time. Similarly, the premium on share repurchase cannot be estimated before 2000 due to unavailable data for share repurchases. Column (2) and (3) present coefficient estimates from the least squares regressions for DIVD and REPD respectively. Column (4) and (5) show equity premia for dividend and share repurchase.

Overall, coefficient estimates for DIVD after 1998 are positive and statistically significant, except in 1999 and 2004-2006, while REPD is positively significant since 2015. Before 2015, share repurchase does not have a significant impact on firm value. Averagely, equity dividend premia are between [-0.53,0.40].

The result presented in this subsection confirms our previous finding that dividend payers are more valuable, and share repurchase has no impact on firm value. However, firms with share repurchase are superior to firms with no policy since 2015. Comparing these equity premia, the dividend is superior to share repurchase until 2015. The reverse relationship is shown in the last three periods.

Table 10 Equity premium during the 1990-2017 period[6]

Year	DIVD		REPED		Equity premium for	
					Dividend	Share repurchase
1990	0.37				0.37	
1991	-0.16				-0.23	
1992	0.17				0.19	
1993	0.33				0.22	
1994	0.10				0.07	
1995	0.29				0.21	
1996	0.13				0.07	
1997	-0.18				-0.09	
1998	-0.07				-0.04	
1999	-1.03	***			-0.53	
2000	0.57	*	5.15		0.24	2.21
2001	0.65	**	-1.43		0.30	-0.66
2002	0.64	*	0.57		0.38	0.34
2003	0.91	**	1.30		0.40	0.58
2004	0.17		0.89		0.07	0.35
2005	-0.50	*	1.07		-0.18	0.42
2006	0.45		1.40		0.15	0.46
2007	0.63	**	1.35		0.25	0.53
2008	0.58	***	0.82		0.39	0.56
2009	0.73	***	0.80		0.31	0.35
2010	0.88	***	0.39		0.36	0.27
2011	0.46	**	-0.03		0.22	-0.01
2012	0.53	**	0.44		0.25	0.21
2013	0.41	*	-0.05		0.16	-0.02
2014	0.58	**	0.81		0.23	0.33
2015	0.27	**	0.60	*	0.09	0.21
2016	0.77	***	1.65	**	0.26	0.57
2017	0.89	***	4.47	**	0.33	1.53

[6] Column (2) and (3) present coefficient estimates for DIVD and REPD from the least square regressions where market value over book value of equity is the dependent variable. Regressions are estimated for each year. ***, **, * indicate significance at 1%, 5% and 10% levels respectively. Column (4) and (5) show equity premia for dividend and share repurchase.

5. Discussion

The discussion section contains an analysis regarding the empirical findings from the previous chapter compared with theory and previous studies. The discussion consists of three parts: effect of dividends on firm value, effect of share repurchases on firm value, and non-linear relationship between payout policies and Swedish firms.

5.1.Dividends affect firm value

According to the results of this study, there is a clear positive significant relationship between dividends and firm value. If a firm pays out dividends, its firm value is positively affected. The implication of this result is that investors tend to value firms that pay out dividends slightly higher than firms that do not. Investors are ready to pay more for a firm if it pays out dividends. An increase in market value compared to book value is therefore visible in these firms.

This result is in line with previous research and theory. According to the bird-in-hand theory (Lintner, 1962, Gordon, 1963), dividends are a safe and stable return that is received with continuity. This might be one of the reasons why investors appreciate dividends. They offer a reduction of the uncertainty in an investment. The uncertainty is also further reduced through the signaling effect of dividends. The signaling effect of announcing initiation or increase of dividend payments gives the investors additional information on how the firm is performing and how management expects the firm to perform in the future (Ross, 1977, Asquith and Mullins, 1983). This reduces the uncertainty of the investment which is valuable to investors. Furthermore, dividends are a way of controlling the agency costs between management and investors. Paying out free cash as dividends can prevent management from using cash for projects that rather aligns with self-interest than investors' interests (Jensen, 1986). This might also be a reason why investors are willing to pay extra for a firm that does dividend payments rather than buying a firm that does not.

Previous studies are mainly focused on the US market. Our study covers the Swedish market which is far less covered in the literature. An important aspect of the Swedish market is the lack of difference in tax structure between share repurchases and dividends which eliminates the effect that tax benefits may cause. It can be concluded from this study that even though the effect of tax structure is eliminated, the effect of dividends on firm value is similar to what has been shown in previous studies of US firms. Since the tax structure historically has been unfavorable to dividends one could expect that the magnitude of the effect of dividends on firm value would change when eliminating tax effects. This is however not observed in the results of this study. Differences in other factors between the countries might be the reason to why a larger effect on firm value is not observed. Such a factor could, for example, be differences in investor protection, economic, and proportion of institutional investor. For illustration, if the investor protection is very high in Sweden, the incentive for Swedish investors to choose dividend-paying firms in order to reduce

agency costs is not very large. There are then fewer factors increasing the benefit of dividend payments and the effect of dividends on firm value is therefore reduced. Investor protection, economic, and proportion of institutional investor as a potential explanatory factor to this study's results are further discussed in section 5.3.

5.2.Share repurchases have no impact on firm value

Even though several different regressions are defined in order to look for a relationship between share repurchases and firm value, no significant relationship could be found. All the results for share repurchases are insignificant and it is therefore not possible to give any certain conclusions about how a firm's value is affected by repurchases. The coefficients given by the different regressions are in some cases positive and in some cases negative, confirming the uncertainty of the relationship. This result implies that there is no general and collected attitude among investors towards repurchases. Investors are generally not willing to pay extra for a firm that does repurchases and neither do they generally see repurchases as a drawback that lowers the firm’s value.

Previous research on the relationship between repurchases and firm value does in most cases shows a positive effect, but the results are not as clear and unanimous as for the case of dividends. The positive relationship is quite weak, especially in the case of European countries as shown by Andriosopoulos and Lasfer (2015). The result of this study is therefore not completely unexpected.

The tax structure in Sweden does also support the results. In most previous research, the tax structure has been beneficial to repurchases, resulting in significantly positive coefficients for repurchases in most studies. Removing this beneficial effect should lead to a less positive attitude towards repurchases among the investors. This is what can be seen in this study. It is possible that a large part of the benefits that investors see in repurchases as a payout policy is the tax benefit. If this benefit is removed, there is no longer enough value-adding effects in repurchases for investors to pay extra for a repurchasing firm. Repurchases do not have the stable and reassuring characteristics which dividends have. They do not handle agency conflicts and do not give fairly certain returns continuously like dividends. Missing out on these value-adding aspects, there seem to be not enough benefits of repurchases in order to make them a determining factor of firm value in the eyes of the investors.

There is, however, a risk that the non-existing relationship between repurchases and firm value might be a result of the low number of observations of repurchases that is available for this study. Further research on the Swedish market with the larger availability of data on repurchases is desirable to confirm the implications of this study.

5.3.Comparing the effect of dividends and repurchases on firm value

As described above, the result of this study generally shows a significantly positive effect of dividends and an insignificant effect of repurchases on firm value. However, a study of the

evolution of equity premium presents that share repurchase has a significantly positive impact on firm value in the last three years, and the premia on share repurchase are greater than those of dividend. Considering previous literature, there are three main possible explanations for the relationship found: investor protection, financial crisis, and shareholder heterogeneity.

5.3.1. Investor protection

The level of investor protection affects the relationship between dividend policy and firm value. Pinkowitz et al. (2006) conclude that investors in countries with low investor protection value dividend payers higher than investors in countries with high investor protection. Their finding supports the principle of agency cost. In the countries with low investors protection, firms are normally controlled by large shareholders or management who are free to make decisions in their own interest (La Porta et al., 1999). If the interest of large shareholders and minority shareholders does not align, agency conflicts will occur. Paying dividends, which decreases free cash flow, can relieve the conflict and increase firm value; however, the impact of dividends is weakened in countries with high investor protection.

Considering the level of investor protection in Sweden at different points in time gives a deeper understanding of the relationship between the payout policies and firm value. The relationship between investor protection and dividend can be examined through comparing the "Doing Business indices" and coefficient of dividends. The "Doing Business indices" by World Bank are measurements of business regulation and enforcement across 190 economies. They consist of 11 areas of business regulation: starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting minority investors, paying taxes, trading across borders, enforcing contracts, resolving insolvency, and labor market regulation (World Bank, 2018). This study focuses on protecting minority investors.

According to table 11, there is a positive relationship between the coefficients estimated of dividends (DIVD) and rank of protecting investors in 2007-2011. It implies that dividends contribute more to firm value when Sweden has weak investor protection (far from 1st rank), while share repurchase has no impact due to insignificant estimators. However, a requirement of greater corporate disclosure and a new rulebook requiring shareholders' approval for transactions were imposed in the NASDAQ Stockholm Stock Exchange in January 2010 (International Finance Corporation and World Bank, 2010). These requirements offer stronger investor protections against self-dealing and improve score and rank of investor protection, from rank 57th in 2010 to rank 28th in 2011. The better investor protection weakens the linkage between dividend and firm value, together with strengthening the positive impact of share repurchase on firm value. It is supported by greater coefficients estimated of share repurchase than those of dividends since 2014, after an improvement in investor protection and the financial crisis. To conclude, weak investor protections possibly explain why the dividend premium is significantly higher than the share repurchase premium before 2014. After strengthening investor protections, share repurchase becomes superior to dividend payment.

Table 11 Equity premium and investor protection index of Sweden during the 2007-2017 period[7]

Year	DIVD		REPED		Equity premium on		World Bank index[1]	
					Dividend	Share repurchase	Rank of protecting investors[2]	Strength of investor protection index[3]
2007	0.63	**	1.35		0.25	0.53	46	5.7
2008	0.58	***	0.82		0.39	0.56	51	5.7
2009	0.73	***	0.80		0.31	0.35	53	5.7
2010	0.88	***	0.39		0.36	0.27	57	5.7
2011	0.46	**	-0.03		0.22	-0.01	28	6.3
2012	0.53	**	0.44		0.25	0.21	29	6.3
2013	0.41	*	-0.05		0.16	-0.02	32	6.3
2014	0.58	**	0.81		0.23	0.33	34	6.3
2015	0.27	**	0.60	*	0.09	0.21	32	6.3
2016	0.77	***	1.65	**	0.26	0.57	14	7.2
2017	0.89	***	4.47	**	0.33	1.53	19	7.2

Remark

1/ Doing Business index published by World Bank.

2/ World index measurement of the protection minority investors from conflicts of interest. Higher ranking (close to 1) implies a stronger investor protection against self-dealing.

3/ An average of conflict of interest regulation index and shareholder governance index. The data is collected from survey of corporate and securities lawyers, as well as securities regulations, company laws, civil procedure codes and court rules of evidence. It ranks between 0 and 10. A higher ranking (close to 10) implies a stronger investor protection against self-dealing

5.3.2. Financial crisis

During periods of higher economic uncertainty, the risk of investing in equities increases; therefore, dividend-paying stocks become more attractive to investors (Karpavičius and Yu, 2018). The investors' behavior under crises can be explained by the bird-in-hand theory which emphasizes that there is no guarantee for a higher stock price and capital gain in the future. A bird in the hand, which implies dividend, is therefore worth more than one in the bush. Dividend payers are then preferable to share repurchasing firms.

Rama and P. (2017) find that a financial crisis causes a greater reduction in share repurchase of repurchasing firms than a decrease in dividend of dividend payers due to the flexibility of share repurchase. A decrease in dividend leads to an adverse market reaction in a larger extent, compared to changing the share repurchase policy. The flexibility of share repurchases, combined with the stability and certainty suggested by the bird-in-hand theory, induces investors to value dividends higher than share repurchases under financial crises.

[7] 2007 is the first reported year of protecting minority investors' rank and strength of investor protection index.

Figure 6 and table 12 present the relationship between payout premiums and the economy over time. An inverse relationship between dividends and OMXS 30 growth rate implies that dividend payers are valued higher in bad times. Share repurchases and OMXS 30 growth rate follow a similar trend in some periods.

Sweden was a home country for a large IT multinational companies with large numbers of employees in the 1990s. However, per capita employment fell considerably, especially in IT business during 2000-2003. This is partly due to the dot-com crisis in 2000 (Fagerberg et al., 2009). The employment data from Nordic Council of Minister shows that a collapse of IT businesses affected Sweden the most among the Nordic economies, and this economic volatility also affected the stock market (Nordic Council of Ministers, 2005). Column (6) of table 12 presents the percentage change of OMXS 30. During 2000-2003, OMXS 30 fell by 30% on average while the equity premium of dividends rose significantly: dividend payers had higher firm value than firms without any policy by 24% in 2000. It could be said that investors prefer firms with dividends and value them higher during financial crises, while firms with share repurchase are unpleasant because of its flexibility. This assumption is confirmed by the figure in the financial crisis in 2008-2009 where the dividend estimators were highly significant again. Firms with share repurchase are preferable to dividend payers after crisis periods and improvements in investor protection in 2015, supported by greater coefficients and equity premium of share repurchase.

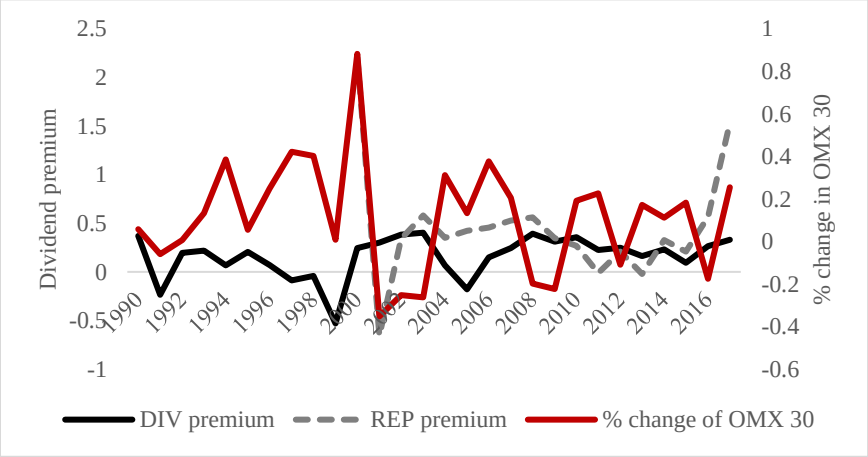

Figure 6 Equity premium with percentage change in OMX 30 index during the 1990-2017

Table 12 Equity premium with percentage change in OMX 30 index during the 1990-2017

Year	DIVD		REPED		Equity premium on		% change of OMX 30
					Dividend	Share repurchase	
1990	0.37				0.37		6%
1991	-0.16				-0.23		-6%
1992	0.17				0.19		1%
1993	0.33				0.22		13%
1994	0.10				0.07		39%
1995	0.29				0.21		5%
1996	0.13				0.07		25%
1997	-0.18				-0.09		42%
1998	-0.07				-0.04		40%
1999	-1.03	***			-0.53		1%
2000	0.57	*	5.15		0.24	2.21	88%
2001	0.65	**	-1.43		0.30	-0.66	-35%
2002	0.64	*	0.57		0.38	0.34	-25%
2003	0.91	**	1.30		0.40	0.58	-26%
2004	0.17		0.89		0.07	0.35	31%
2005	-0.50	*	1.07		-0.18	0.42	13%
2006	0.45		1.40		0.15	0.46	38%
2007	0.63	**	1.35		0.25	0.53	21%
2008	0.58	***	0.82		0.39	0.56	-20%
2009	0.73	***	0.80		0.31	0.35	-22%
2010	0.88	***	0.39		0.36	0.27	19%
2011	0.46	**	-0.03		0.22	-0.01	23%
2012	0.53	**	0.44		0.25	0.21	-11%
2013	0.41	*	-0.05		0.16	-0.02	17%
2014	0.58	**	0.81		0.23	0.33	11%
2015	0.27	**	0.60	*	0.09	0.21	18%
2016	0.77	***	1.65	**	0.26	0.57	-18%
2017	0.89	***	4.47	**	0.33	1.53	25%

5.3.3. Shareholder heterogeneity

The choice of method for cash distribution is also influenced by investor characteristics. Bagwell (1991) and Wesson et al. (2017) explain that companies with diverse characteristics of investor normally select a payout method like dividend payments which requires a low informational cost. On the other hand, firms with low variety of investors prefer a payment method that relies on insight in the stock prices such as share repurchase. A similar research is done by Jain (2007) whose study is based on the adverse selection model. Institutional investors generally have more information than individual investors and prefer firms with large share repurchases to firms that pay dividends since they gain advantages from their insight. Less informed individual investors conversely prefer dividend payers.

An institutional investor is an organization trading security in large amounts and investing on behalf of its members. Mutual funds, hedge funds, pension funds, investment funds, and insurance companies are an example of institutional investors (Berk and Demarzo, 2017, Graham et al., 2013). OECD (2017) classifies Swedish institutional investors into three main types: investment funds, insurance companies, and pension funds. Their impact on Sweden's financial system has grown significantly over recent years as shown in figure 7. The increase in financial assets and liabilities implies that investments by Swedish institutional investors have become a large portion of investment in the Swedish financial market. For illustration, the financial assets of investment funds are 47% of GDP in 2009 and surge to 82% of GDP in 2016. The upward trend in the percentage of GDP in the three types of institutional investors could explain the change in the relationship between payout policy and firm value. When institutional investors are a minority, the market has stronger preferences for dividend payers. However, firms with share repurchases are preferable to firm with dividend when institutional investors are the majority.

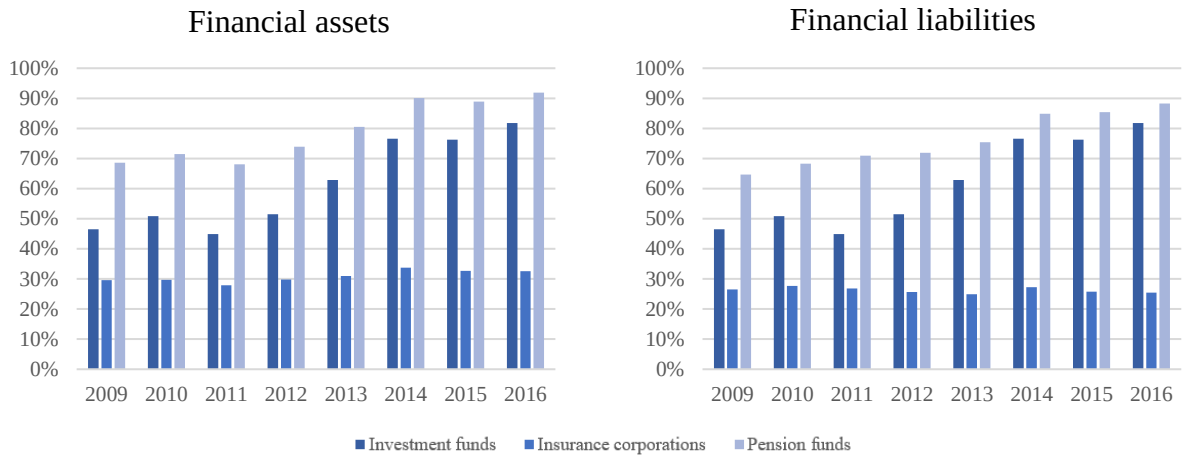

Figure 7 Financial assets and liabilities of Swedish institutional investors as a percentage of GDP

6. Conclusion

In the last three decades, share repurchases are an increasingly important component of payouts due to its flexibility; however, firms still pay dividends since they believe that dividend payouts can increase firm value. In this paper, we analyze whether dividend payouts impact Swedish firm value during the period 1987-2017. The study also aims to identify whether Swedish investors have stronger preferences for dividends or stock repurchases. Conducting panel data regression analysis to determine the linkage between two different payout methods and firm value, we answer the research question stated previously.

We find a positive relationship between firm value and dividends. The dividend premium is positive, consistent with previous findings in which the relationship is based on the bird-in-hand theory, dividend signaling theory, and agency theory. Panel data regressions show that dividend payers have higher firm value than firms without any policy by 8.07% when using MA/A as the dependent variable and 13.19% when using ME/E as the dependent variable. The difference in the dividend premium can be explained by an inverse relationship between dividends and the value for debtholders, which lowers the premium when using assets in the market to book variable.

No significant relationship could be found between firm value and share repurchases, suggesting that investors generally do not value firms with share repurchases higher than firms without any payout policy in terms of value of asset and equity. The insignificant relationship can be explained by the tax structure in Sweden where is no difference in the taxation on capital gains and dividends unlike other countries such as the US where repurchases are more beneficially taxed. The missing tax benefit of repurchases in the Swedish market seems to lower the importance of repurchases to investors and diminish the effect on firm value.

The significantly positive dividend premium and insignificant share repurchase premium implies that Swedish investors prefer dividends to capital gains from share repurchases. This differs from the expectation that Sweden as a country with high investor protection should be more positive towards share repurchases. However, the lack of tax benefit of repurchases in the Swedish market seems to have resulted in less interest in share repurchases among Swedish investors.

Furthermore, we analyze the evolution of dividend and share repurchase premia over 31 years and find that firms with share repurchases become preferable for Swedish investors to dividend payers in the last 3 years of the study. An equity premium of share repurchase is significantly greater than that of dividend by [0.11,1.20]. Previous studies claim that investor protections, economic uncertainty, and shareholders heterogeneity are the key determinant of the change in investors' preferences.

Future research

Few studies on this topic have been done on the Swedish market. The limitation of available data for share repurchases limits this study and risks imprecise results. Further research on the Swedish market with a larger amount of data on repurchases would be valuable to confirm the implications of this study. Furthermore, since this study takes all existing dividends and repurchases into

account, it would be interesting to complement this with an event study which investigates the announcement effects of share repurchases and dividends on the Swedish market, together with determining the difference in the effects of the payout policies when they are initially announced and when they are established. It would also be interesting to investigate payout policies' effect on firm value through an event study which could handle endogeneity issues better.

In addition, Vafeas (1997) and Caudill et al. (2006) find that two repurchase methods, tender offer, and open market share repurchase, serve different purposes for the repurchasing firm and impact firm value differently. To obtain a precise relationship between payout policy and firm value, we, therefore, recommend studying each type of share repurchase separately.

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Appendix A Variable definition and construction

Appendix A-1 Variable definition and construction from Compustat database

Variable	Compustat item	Definition
Any decrease in the par value of preferred stock	PRSTKC	This item represents any use of funds which decreases common and/or preferred stock.
Book value of assets	AT	This item represents the total assets of a company at a point in time.
Book value of equity	CEQ	This item represents the common shareholders' interest in the company. It is the sum of ordinary stock, capital surplus, share premium reserve and retained earnings; minus with treasury stock.
Capital expenditures	CAPX	This item represents the funds used for additions to property, plant, and equipment, excluding amounts arising from acquisitions.
Cash and short-term investment	CHE	This item represents cash and all securities readily transferable to cash.
Closing price at the end of fiscal year	PRCC	This item represents the closing trade price at the end of fiscal year.
Common shares outstanding	CSHOC	This item represents the total number of common shares outstanding.
Common stock dividends	DVC	This represents the total amount of dividends declared on the ordinary capital of the company, based on the current year's net income.
Debt in current liabilities	DLC	This item represents the total amount of short-term notes and the current portion of long-term debt.
Expenditures on the purchase of common and preferred stocks	PSTK	This item represents the net number of preferred shares at year-end multiplied by the par or stated value per share as presented in the company's Balance Sheet.
Long-term debt	DLTT	The item represents debt obligations due more than one year from the company's balance sheet date.
Net income	NICON	This item represents income calculated earnings per share as reported by the consolidated statement.
Net property, plant, and equipment	PPENT	This item represents the cost of tangible fixed property in the production of revenues, minus its accumulated depreciation.
Research & Development expense	XRD	This item represents all incurred costs related to the development of new products or services during the year.

Appendix A-2 Variable definition and construction from Datastream database

Variable	Datastream item	Definition
International Security ID	Code - ISIN	This item represents a unique number identifying a security.
Share buyback amount	Buyback	This item represents the total monetary value of the shares repurchased by the company during the fiscal year.

Appendix B Results from diagnostic tests

Appendix B-1 Pairwise correlation analysis for dividend

Panel (a) Variables scaled by book value of asset

Pairwise Correlation	DIVD		ASSETS		NI_A		DEBT_A		CASH_A		PPE_A		CAPEX_A		RD_A		RDD
DIVD	1.00																
ASSETS	0.50	***	1.00														
NI_A	0.30	***	0.35	***	1.00												
DEBT_A	0.13	***	0.41	***	0.10	***	1.00										
CASH_A	-0.19	***	-0.38	***	-0.21	***	-0.43	***	1.00								
PPE_A	0.11	***	0.20	***	0.08	***	0.27	***	-0.20	***	1.00						
CAPEX_A	0.02		0.01		0.03	**	0.06	***	-0.05	***	0.45	***	1.00				
RD_A	-0.09	***	-0.12	***	-0.26	***	-0.15	***	0.32	***	-0.11	***	-0.04	***	1.00		
RDD	0.07	***	0.11	***	-0.01		-0.09	***	0.15	***	-0.02	*	-0.01		0.46	***	1.00

Panel (b) Variables scaled by book value of equity

Pairwise Correlation	DIVD		ASSETS		NI_E		DEBT_E		CASH_E		PPE_E		CAPEX_E		RD_E		RDD
DIVD	1.00																
ASSETS	0.50	***	1.00														
NI_E	0.20	***	0.24	***	1.00												
DEBT_E	0.02		0.21	***	-0.16	***	1.00										
CASH_E	-0.12	***	-0.25	***	-0.18	***	0.11	***	1.00								
PPE_E	0.00		0.09	***	-0.14	***	0.60	***	0.19	***	1.00						
CAPEX_E	-0.02		0.00		-0.05	***	0.52	***	0.28	***	0.67	***	1.00				
RD_E	-0.07	***	-0.08	***	-0.23	***	-0.02		0.27	***	-0.03	***	-0.01		1.00		
RDD	0.07	***	0.11	***	0.01		-0.08	***	0.10	***	-0.04	***	-0.01		0.38	***	1.00

Appendix B-2 Pairwise correlation analysis for Share repurchase

Panel (a) Variables scaled by book value of asset

Pairwise Correlation	REPD		ASSETS		NI_A		DEBT_A		CASH_A		PPE_A		CAPEX_A		RD_A		RDD
REPD	1.00																
ASSETS	0.17	***	1.00														
NI_A	0.05	***	0.35	***	1.00												
DEBT_A	0.11	***	0.41	***	0.13	***	1.00										
CASH_A	-0.06	***	-0.25	***	-0.20	***	-0.40	***	1.00								
PPE_A	-0.01		0.23	***	0.09	***	0.38	***	-0.23	***	1.00						
CAPEX_A	0.00		0.07	***	0.04	**	0.13	***	-0.07	***	0.46	***	1.00				
RD_A	-0.03		-0.06	***	-0.22	***	-0.13	***	0.29	***	-0.11	***	-0.05	***	1.00		
RDD	-0.03	*	0.09	***	-0.02		-0.11	***	0.19	***	-0.14	***	-0.07	***	0.54	***	1.00

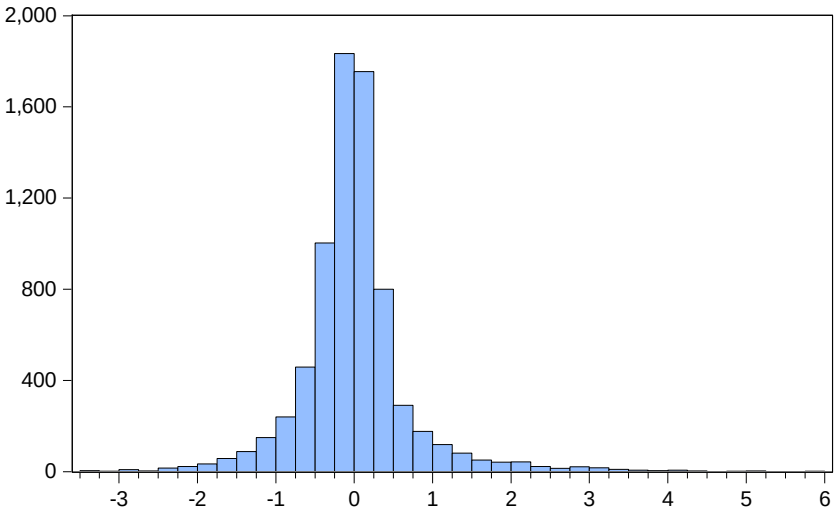
Panel (b) Variables scaled by book value of equity

Pairwise Correlation	REPD		ASSETS		NI_E		DEBT_E		CASH_E		PPE_E		CAPEX_E		RD_E		RDD
REPD	1.00																
ASSETS	0.17	***	1.00														
NI_E	0.04	**	0.23	***	1.00												
DEBT_E	0.04	**	0.14	***	-0.25	***	1.00										
CASH_E	-0.05	***	-0.15	***	-0.19	***	0.24	***	1.00								
PPE_E	-0.01		0.10	***	-0.20	***	0.60	***	0.24	***	1.00						
CAPEX_E	0.00		0.02		-0.06	***	0.62	***	0.33	***	0.60	***	1.00				
RD_E	-0.02		-0.05	***	-0.25	***	0.00		0.29	***	-0.03	*	-0.01		1.00		
RDD	-0.03	*	0.09	***	0.00		-0.06	***	0.10	***	-0.06	***	-0.02		0.41	***	1.00

Appendix B-3 Breusch-Pagan-Godfrey test results for heteroscedasticity

BPG test		F-statistic	
Dividend	MA/A	2.9950	***
	ME/E	2.5884	***
Share repurchase	MA/A	1.7479	***
	ME/E	1.7931	***

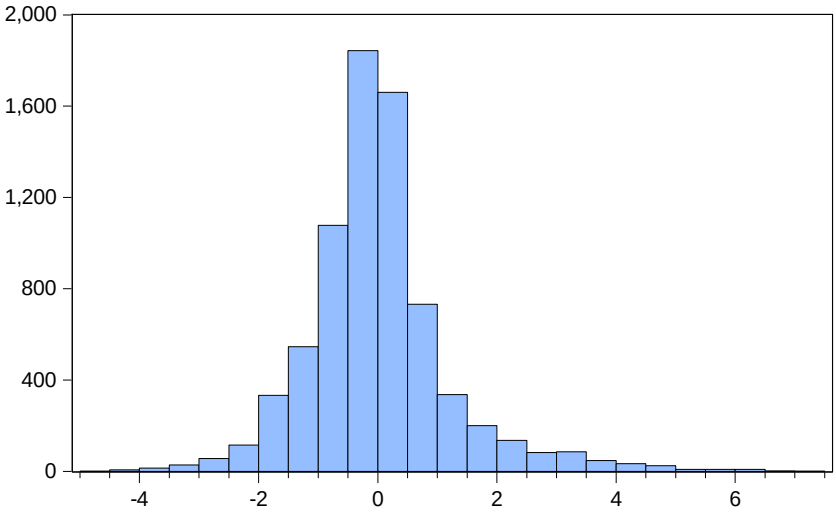
Appendix B-4 Normality test result for equation MA/A with DIVD



Series: Standardized Residuals
Sample 1987 2017
Observations 7384

Mean	-1.02e-18
Median	-0.026415
Maximum	5.855976
Minimum	-3.359559
Std. Dev.	0.723826
Skewness	1.424068
Kurtosis	12.09818
Jarque-Bera	27963.41
Probability	0.000000

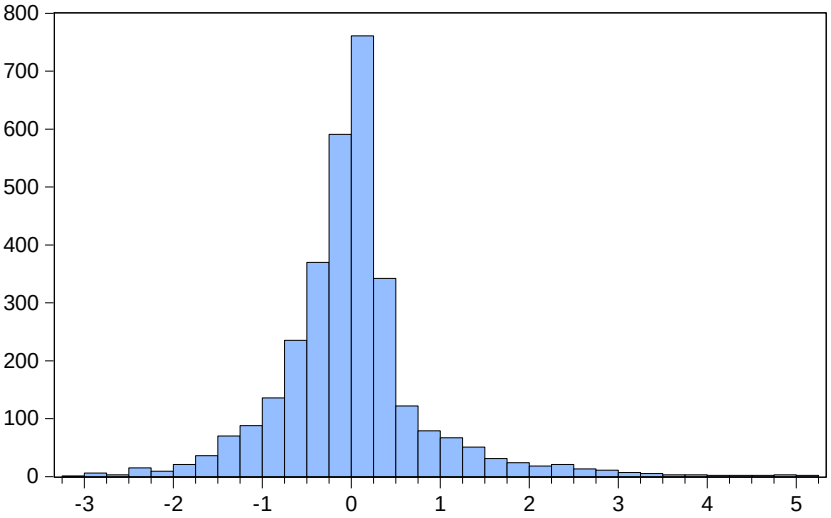
Appendix B-5 Normality test result for equation ME/E with DIVD



Series: Standardized Residuals
Sample 1987 2017
Observations 7384

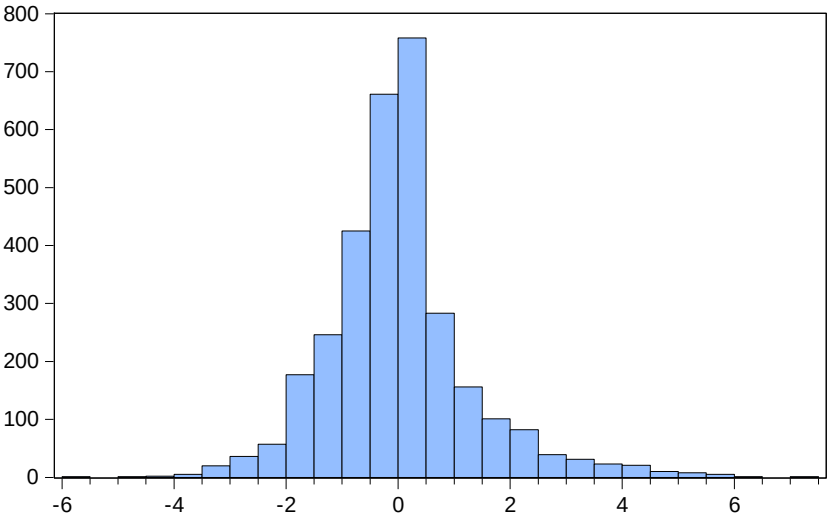
Mean	-2.70e-17
Median	-0.080005
Maximum	7.405201
Minimum	-4.505944
Std. Dev.	1.206743
Skewness	1.065263
Kurtosis	6.858254
Jarque-Bera	5976.505
Probability	0.000000

Appendix B-6 Normality test result for equation MA/A with REPD



Series: Standardized Residuals	
Sample 1990 2017	
Observations 3150	
Mean	-5.58e-19
Median	-0.003363
Maximum	5.246081
Minimum	-3.109166
Std. Dev.	0.837135
Skewness	1.163145
Kurtosis	8.711255
Jarque-Bera	4991.445
Probability	0.000000

Appendix B-7 Normality test result for equation ME/E with REPD



Series: Standardized Residuals	
Sample 1990 2017	
Observations 3150	
Mean	-1.59e-17
Median	-0.032417
Maximum	7.229056
Minimum	-5.542559
Std. Dev.	1.292182
Skewness	0.882532
Kurtosis	5.861462
Jarque-Bera	1483.573
Probability	0.000000