The Impact of a Firm's Payout Policy on Stock Prices and Shareholders' Wealth in an Inefficient Market

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Recent literature has almost exclusively focused on the announcement effects of payout policy. However, in an inefficient stock market payout policy may not only affect stock prices at the announcement date but also at the payment date. Our theoretical approach is based on the rational demand of risk-averse investors and passive investors holding shares in a firm which may or may not pay out free cash flow. The joint existence of both investor types in an inefficient market may lead to a positive price impact at the payment date. We predict a positive effect for a share buyback and a dividend payment that is associated with reinvestment, e.g. via a dividend reinvestment plan (DRIP). This price impact affects shareholders' current and long run net wealth. Both buyback and dividend with DRIP cause a wealth transfer between smart and passive investors in the long run, with the direction of the wealth transfer depending on the level of the firm's market valuation relatively to expected future value.
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1. Introduction

Firms can either retain and reinvest free cash flow or distribute it to its shareholders via dividends or share buybacks. The payout policy may have an effect on stock prices. A broad literature has already analyzed price effects within signalling models. Those models predict mainly announcement effects, whereas price effects of payouts caused by market inefficiency due to limited arbitrage have been widely ignored. Even more missing is a profound comparison of price effects of the various payout policies in inefficient markets.

We show that paying out free cash flow may have a positive price impact if investors' demand is not perfectly elastic, as it would be with perfect arbitrage, and less than fully rational investors are involved. Then, a buyback or a dividend in combination with reinvestment, e.g. via a dividend reinvestment plan (DRIP)[1], leads to a positive price impact. Hence, management may indeed use payouts to increase share price as often mentioned by practitioners. Furthermore, we show that the price impact causes an increase in current investor wealth and a long run wealth-transfer between the involved investor groups.

Our paper adds to the literature on the relevance of payout policies in several important ways. Firstly, it predicts that in case of inefficient stock markets positive price effects show up at the payment date rather than only at the announcement date. Secondly, we show how the various payout policies differ with respect to the magnitude of the price effects they cause. Thirdly, we consider long run wealth transfers due to short run price effects of certain payout policies.

Our theoretical approach strongly contrasts the signalling-type approaches of payout policies based on information asymmetries, which predict a price effect at the announcement date. Most signalling theories can be categorized in two broad groups. The first group analyzes only single payout policies. Well known are e.g. the papers of Bhattacharya (1979) and Miller and Rock (1985) considering dividends, while e.g. McNally (1999) and Oded (2005) consider open market share

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[1] DRIPs are widely available to shareholders in the US. About 29 of the 30 firms listed in the Dow Jones Industrial Average Index in 2006 offered DRIPs to their shareholders. In Europe, on the other hand, only 2 of the 50 firms listed in the EURO STOXX 50 index regularly offer DRIPs to their shareholders. Another 5 firms offer a DRIP only to investors holding American Depository Receipts (ADRs). Overall, DRIPs are still quite rare for European firms.

repurchases. The second group compares price effects of various payout policies. Ofer and Thakor (1987) show the announcement effect of a repurchase to be stronger, on average, than the announcement effect of a dividend. The model by Brennan and Thakor (1990) predicts dividends for small payouts, open market repurchases for intermediate and tender offers for large distributions. Under the assumption of asymmetric information between shareholders and better informed management and adverse selection costs of share repurchases, the model by Lucas and McDonald (1998) predicts that small payouts are made through dividends and large payouts through dividends with a repurchase component. Jagannathan *et al.* (2000)) argue that managers tend to use dividends to pay out permanent cash flows, while repurchases are used to pay out temporary cash flows relatively quickly. Jain *et al.* (2009) evaluate dividends and share repurchases as alternative mechanisms available to firms to initiate post-IPO cash flow payouts.

Also in contrast to our model is the work of DeAngelo and DeAngelo (2006), who expand the well known work of Miller and Modigliani (1961). DeAngelo and DeAngelo (2006) argue in the setting of frictionless markets that the irrelevance theorem of Miller and Modigliani (1961) is only a product of the implicit assumption ruling out the retention of free cash flow. If retention is allowed and the NPV of investment policy is fixed, a firm can reduce its value by paying out less than the full present value of free cash flow. Therefore payout policy matters and investment policy is not the sole determinant of the firms' value in frictionless markets. This reasoning presupposes that retained free cash flow may be invested in zero NPV projects, but not distributed in the future (see also Handley (2008); DeAngelo and DeAngelo (2008)).

Closest to our theoretical approach is the work of Isagawa (2002), since he analyzes a buyback in an inefficient market. He shows that the information effect of a repurchase announcement based on asymmetric information is incomplete, when arbitrage is limited by refinancing costs. Share price increases over time after the repurchase announcement because of diminishing refinancing costs of arbitrage.[2] The buyback itself has no impact on share price, because smart money is risk neutral in this model and so the buybacks' influence on the risk of holding shares is irrelevant for the equilibrium share price.

In contrast to all of the previous mentioned asymmetric information theories we do not look for announcement effects, but for price effects when a payout is exercised. Therefore we build a model based on downward sloping demand for shares and the existence of so called passive investors. Downward sloping demand[3] results from risk aversion of smart investors and missing perfect arbitrage. Limits of arbitrage may result from the lack of perfect substitutes, which have been shown by Wurgler and Zhuravskaya (2002), or it may result from the risk aversion of potential arbitrageurs, as has been shown by Shleifer and Vishny (1997), De Long *et al.* (1990) and De Long *et al.* (1991). Hodrick (1999) suggests that stock price elasticity may be an important determinant in some corporate financial decisions, particularly for the choice of Dutch auctions instead of fixed-price tender offers.

The second important building block of our model is the existence of so called passive investors. They simply hold stock without fully rationally maximizing their wealth subject to current share price and expected future values after the firm's payout decision. Due to the involvement of passive investors in combination with the risk-aversion of smart investors a share repurchase or a dividend with reinvestment leads to a price increase and raises shareholders' current wealth. A positive price impact of a buyback for downward sloping demand was already suggested by Shleifer (1986). But for an actual positive price effect it is necessary that the shift of the supply due to a buyback is not accompanied by an equal shift in total demand function, as it would be if all investors were fully

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[2] The impact of diminishing refinancing costs to arbitrage is originally considered by Shleifer and Vishny (1990).

[3] Whether the demand for stock actually slopes downward, is a long-debated issue in Finance. Scholes (1972) identifies the price impact of large block trades and finds some evidence for the price pressure hypothesis which is strongly related to the downward sloping demand curve. Shleifer (1986) also finds broad evidence for a downward sloping demand and Bagwell (1992) documents that firms face upward-sloping supply curves when they repurchase shares in a Dutch auction.

rational. Therefore we also need to build on passive, less than fully rational investors. Downward sloping demand is *per se* not sufficient for a positive price impact of payout.

The results of recent empirical literature are broadly compatible with the general predictions of our model and reflect the evidence of downward sloping demand when considering payout policy. McNally et al. (2006) document a positive price impact of open market repurchases. Ogden (1994) reports evidence of a price pressure impact of a dividend payment which is explained by reinvestment. Price pressure is substantially higher when a DRIP is offered. Furthermore Blouin and Cloyd (2005) find evidence of price pressure when a DRIP is offered by closed end funds. An empirical study comparing the price effects of alternative modes of distributing free cash flow on prices and shareholder value is – to our knowledge – not yet available.

Our model predicting abnormal returns at the payment date integrates corporate finance and the inefficient markets literature. This is yet a comparatively new approach. Consequences of inefficient markets for corporate finance decision are still widely neglected, perhaps because the literature that derives inefficiencies in substantiated models with noise traders and rational but limited arbitrageurs is still quite new. Without reference to the insights of this literature the analysis of corporate finance decisions in inefficient markets was hardly possible without the risk of generating results that might be considered arbitrary.

The paper is organized as follows: Section 2 introduces the model with a firm ready to payout free cash flow and investors holding, buying or selling shares in the firm. In section 3 we solve for the equilibrium share prices considering the various modes to pay out the firm's free cash flow. Furthermore, the current values of investors' holdings depending on the payout policy are compared. Sections 4 and 5 consider the "long run" wealth effects of payout policy and show that short run price effects of payout result in long run wealth transfers between investor groups.

2. The model

2.1. The firm

Consider a firm with a free cash flow (FCF), net of corporate tax, available for retention or distribution via dividend or share buyback. Payout or retention is considered at $t=0$. We are interested in the impact of the firm's payout policy on its current price per share in an inefficient market. Hence we will look at the price S_0 immediately after the payout or retention in $t=0$. This price depends on the firm's policy. The firm may retain the FCF, it may pay a regular dividend, it may pay a dividend and offer DRIP, or it may buy back own shares.

If FCF is distributed to shareholders in $t=0$ the firm's value after one period, in $t=1$, is an uncertain $\tilde{V} \sim$ $)$. With retention of FCF the firm's future value also depends on the return on the additional investments. Assume for simplicity that the return on reinvested FCF equals the riskless rate, which shall be normalized to zero. Therefore, reinvestment is a zero NPV-Project with a gross return of one. Firm value in $t=1$ is hence $\tilde{V}$ in case of retaining FCF. The assumption of zero NPV reinvestment of FCF aims at focusing on price impact due to market inefficiency only, instead of e.g. agency problems of free cash flow.

Let the number of outstanding shares be normalized to 1. Therefore the end of period share price in case of retaining (*RT*) the FCF is

$$. \tag{1}$$

In case of using FCF for a dividend payment (*DP*) the share price in $t=1$ is

$$. \tag{2}$$

If the firm uses the FCF to buyback (*BB*) a fraction

$$q^F = \frac{FCF}{S_0^{BB}} \tag{3}$$

of its own shares on the open market in $t=0$, the uncertain share price in $t=1$ is

$$\frac{\tilde{}}{1-q^F} = \frac{}{S_0^{BB} - FCF}, \tag{4}$$

with S_0^{BB} as the equilibrium share price in $t=0$.

2.2. Investors and demand for stocks

There are two types of investors in our model, i.e. passive investors and smart investors. Their demand for the above described firms' shares determines the market clearing price in the payout period $t=0$.

Passive investors are born in $t=-1$. In this past period they bought $q^P > 0$ shares of the firm at a price of S_{-1}. We take this number as exogenous. In $t=0$ passive investors do not reconsider their investment in the firm based on the payout decision. They do not change the number of shares, q^P, in their portfolio but pursue a buy and hold strategy. That's why we call those investors passive. This behaviour may or may not be rational depending on how the firm's payout decision affects expected future share prices and risk. The only case for passive investors to trade is when a DRIP is offered. As will be discussed later we assume that passive investors participate to some degree in a DRIP and end up holding additional shares.

Passive investors are not uncommon in reality. There are private investors without a rational investment background, investment funds that follow passive investment strategies, i.e. index-funds, as well as banks which have emitted derivatives and hedge their positions.

Given that passive investors hold q^P shares, and given a share price of S_0 in $t=0$, the value of their total dollar investment in $t=0$ is

$$Q_0^P = q^P S_0. \tag{5}$$

Smart investors are also born in $t=-1$. Since passive investors hold q^P shares in the firm at $t=0$, smart investors must arrive at $t=0$ holding the complement $q^S = 1-q^P$. They also bought their shares in $t=-1$ at a price of S_{-1}. But smart investors reconsider their investment in $t=0$ after learning about the firm's payout policy. They maximize their expected utility of end of period wealth $\tilde{V}$, given the exponential utility function

$$UW^S = -e^{-\theta \tilde{V}}, \tag{6}$$

with a risk aversion of $\theta > 0$. Due to the assumption of normally distributed firm value smart investors' optimal dollar investment, $Q_0^S = q^S S_0$, is determined by:

$$E\left[\tilde{V}\right] \quad 2 \quad \left[\tilde{\ }\right] \quad Q_0^S, \tag{7}$$

with:

$$\tilde{V} \quad - Q_0^S + Q_0^S \frac{\tilde{}}{S_0} - \tau \left(\frac{\tilde{}}{S_0} - 1\right) Q_0 = W_0^S + (1-\tau^{CG}) Q_0^S \left(\frac{\tilde{}}{S_0}\right), \tag{8}$$

where W_0^S is the smart investors' initial wealth in $t=0$, $\tilde{}$ is the uncertain share price in the future period $t=1$, and τ^{CG} the tax rate on capital gains.

Smart investors' expected end of period wealth is hence

$$E\left[\tilde{V}\right] \quad + (1-\tau^{CG}) Q_0^S \frac{E\left[\tilde{}\right]}{S_0}, \tag{9}$$

and the variance of $\tilde{V}$ is given by:

$$Var\left[\tilde{V}\right] \quad \tau^{CG})^2 \left(Q_0^S\right)^2 Var\left[\frac{\tilde{}}{S_0} - 1\right]. \tag{10}$$

Note that the variance of the share return, $Var\left[\frac{\tilde{S}_1}{S_0}-1\right]$, in (10) depends on the payout policy the firm chooses, see (1), (2) and (4).

From (7), considering (8), (9) and (10), the first order condition for the optimal demand of the smart investors leads to:

$$Q_0^S = \frac{1}{(1-\tau^{CG})\theta Var\left[\frac{\tilde{S}_1}{S_0}-1\right]}\left(\frac{E\left[\tilde{S}_1\right]}{S_0}-1\right). \tag{11}$$

The sign of smart investors' optimal demand depends on the sign of the expected share return. For $S_0 < E\left[\tilde{S}_1\right]$ the expected return is positive and hence $Q_0^S > 0$. For $S_0 > E\left[\tilde{S}_1\right]$ smart investors sell short, i.e. $Q_0^S < 0$. Furthermore, if the investment were riskless, $Var\left[\frac{\tilde{S}_1}{S_0}-1\right] = 0$, or smart investors were risk neutral, $\theta = 0$, smart investors' demand would be infinitely high or low if $S_0 \neq E\left[\tilde{S}_1\right]$. Consequently, current share price would never exceed or fall short of the expected future value $E\left[\tilde{S}_1\right]$ if $\theta Var\left[\frac{\tilde{S}_1}{S_0}-1\right] = 0$.

Note that total demand for shares, $q^S + q^P = (Q_0^S + Q_0^P)/S_0$ slopes downward due to price sensitivity of the risk-averse smart investors. None of the investors acts as a perfect arbitrageur so that total demand is not perfectly elastic. Our market is hence potentially inefficient.

If a perfect substitute for the firm's shares existed, smart investors would not have to bear risk when buying or short selling shares. Smart investors' demand would then be perfectly elastic and arbitrage hence not limited. Therefore we assume that no perfect substitute exists and arbitrage is limited as in Wurgler and Zhuravskaya (2002).

3. Market equilibria for various payout policies

3.1. Retaining the free cash flow

The scenario with the firm retaining and reinvesting FCF is the starting point of our analysis of price and welfare effects of payout policy under market inefficiency. If the FCF is retained unbiased expected share price in $t=1$ is

$$E\left[\tilde{S}_1^{RT}\right] = \bar{V} + FCF\,, \tag{12}$$

and the variance of the net return of investing in shares is

$$Var\left[\frac{\tilde{S}_1^{RT}}{S_0^{RT}}-1\right] = \frac{1}{\left(S_0^{RT}\right)^2}\sigma_V^2\,. \tag{13}$$

Considering (12) and (13) smart investors' demand from (11) in case of retaining FCF becomes

$$Q_0^{S,RT} = \frac{\left(\bar{V} + FCF - S_0^{RT}\right)S_0^{RT}}{(1-\tau^{CG})\theta\sigma_V^2}\,. \tag{14}$$

Passive investors' dollar demand is determined by the given number q^P of shares in their portfolio:

$$Q_0^{P,RT} = q^P S_0^{RT}\,. \tag{15}$$

Market clearing requires that total dollar demand of all investors equals the firm's market capitalization of S_0^{RT} (given the assumption of 1 outstanding share):

$$Q_0^{S,RT} + Q_0^{P,RT} = S_0^{RT} \quad \Leftrightarrow \quad \frac{\left(\bar{V} + FCF - S_0^{RT}\right)S_0^{RT}}{(1-\tau^{CG})\theta\sigma_V^2} + q^P S_0^{RT} = S_0^{RT}\,. \tag{16}$$

Therefore the equilibrium market price in case of retaining free cash flow in $t=0$ is

$$S_0^{RT} = \bar{V} + FCF - (1-q^P)(1-\tau^{CG})\theta\sigma_V^2\,. \tag{17}$$

S_0^{RT} is increasing in the passive investors' demand q^P, and the capital gains tax rate, τ^{CG}, due to risk sharing with the government. Equilibrium share price, S_0^{RT}, is decreasing in smart investors' aggregate risk aversion θ and the firms' fundamental risk σ_V^2.

Given that $\theta > 0$, $\sigma_V^2 > 0$, and $0 < \tau^{CG} < 1$, we find:

Lemma 1: If passive investors hold less (more) than 100% of the firm's shares, i.e. $q^P < 1$ ($q^P > 1$), equilibrium price falls short of (exceeds) the unbiased expected future price, $\bar{V} + FCF$.
Proof: Obvious from (17).

In case of $q^P > 1$ smart investors sold short in $t = -1$ and passive investors end up in $t = 0$ holding shares at a price that exceeds the unbiased expected future price. This may result from irrational behavior in $t = -1$ or from misperception of the "true" expected value.

For the analysis of current wealth effects of payout policy we start with calculating the value of passive investors' holdings in the firm immediately after the decision to retain FCF:

$$\omega_0^{P,RT} = q^P \left[(1-\tau^{CG}) S_0^{RT} + \tau^{CG} S_{-1} \right]. \tag{18}$$

S_{-1} is the price passive investors paid for their shares in the past, and hence $\tau^{CG}(S_0^{RT} - S_{-1})$ is the tax on capital gains they would have to pay, if they decide to sell their holdings. We include this as pending tax in our analysis.

Since passive investors hold q^P shares, smart investors must continue to hold the counterpart of $q^S = 1 - q^P$ shares in equilibrium. The value of their holdings in $t = 0$, net of pending tax, is hence

$$\omega_0^{S,RT} = (1-q^P) \left[(1-\tau^{CG}) S_0^{RT} + \tau^{CG} S_{-1} \right], \tag{19}$$

if FCF is retained.

3.2. Paying a dividend

Paying out the FCF as a dividend does not change the number of outstanding shares, but the share price in $t = 1$ is $\tilde{S}_1$ [illegible] (see (2)). Therefore the expected share price in $t = 1$ is

$$E\left[\tilde{S}_1\right] \text{[illegible]}, \tag{20}$$

and the variance of share return is

$$Var\left[\frac{\tilde{S}_1}{S_0^{DP}} - 1 \right] = \frac{1}{\left(S_0^{DP}\right)^2} \sigma_V^2 . \tag{21}$$

Considering (20) and (21) in (11) the smart investors' demand for shares immediately after the dividend payment is

$$Q_0^{S,DP} = \frac{\left(\bar{V} - S_0^{DP}\right) S_0^{DP}}{(1-\tau^{CG})\theta\sigma_V^2} . \tag{22}$$

Passive investors' demand is

$$Q_0^{P,DP} = q^P S_0^{DP}, \tag{23}$$

and thus the market clears if

$$Q_0^{S,DP} + Q_0^{P,DP} = S_0^{DP} \quad \Leftrightarrow \quad \frac{\left(\bar{V} - S_0^{DP}\right) S_0^{DP}}{(1-\tau^{CG})\theta\sigma_V^2} + q^P S_0^{DP} = S_0^{DP} . \tag{24}$$

Therefore the equilibrium share price in case of paying out free cash flow as dividend is:

$$S_0^{DP} = \bar{V} - (1-q^P)(1-\tau^{CG})\theta\sigma_V^2 . \tag{25}$$

This share price from (25) has the same comparative statistics as the one with retention in (17). S_0^{DP} is increasing in the passive investors' demand q^P and the capital gains tax rate τ^{CG}. S_0^{DP} is decreasing in the firms' fundamental risk σ_V^2 and in smart investors' aggregated risk aversion θ.

Comparing S_0^{DP} from (25) adjusted for the dividend in the amount of FCF with S_0^{RT} from (17) leads to:

Proposition 1: Paying out a dividend results in a share price, which equals exactly the share price in case of retention minus the amount of the gross dividend:

$$S_0^{DP} + FCF = S_0^{RT} . \tag{26}$$

Proof: Obvious from comparison of (17) with (25).

Hence payment of a dividend will not alter the adjusted share price. To this respect our market is efficient.

When it comes to the current value of investors' holdings we assume that they have to pay taxes on dividends. Let the tax rate on dividends be $1 > \tau^D \geq 0$, so that the net dividend is $(1-\tau^D)FCF$. Adding up the value of shares in passive investors' portfolios, net of pending tax, and their net dividends gives

$$\omega_0^{P,DP} = q^P \left[(1-\tau^{CG})S_0^{DP} + (1-\tau^D)FCF + \tau^{CG} S_{-1}\right]. \tag{27}$$

The value of smart investors' holdings in $t=0$ is

$$\omega_0^{S,DP} = (1-q^P)\left[(1-\tau^{CG})S_0^{DP} + (1-\tau^D)FCF + \tau^{CG} S_{-1}\right], \tag{28}$$

if the firm pays out FCF as a dividend.

3.3. Paying a dividend with a DRIP

In this section we analyze dividend payments that are at least partially reinvested in the firm's stock by shareholders. Reinvesting the dividend in shares is not an unrealistic behavior for several types of investor. It is standard procedure for index funds and banks trading shares to hedge derivatives. Private investors may be inclined to reinvest some of their dividends if they have no actual need for liquidity. For simplicity we include all these reasons for dividend reinvestment under the label of a dividend reinvestment plan (DRIP). A DRIP is the institutionalised opportunity of dividend reinvestment. A DRIP offers shareholders a convenient opportunity to reinvest net dividends in additional shares of the firm and hence may at least increase passive investors' reinvestments. In a DRIP additional shares for participating investors can be bought on the open market, or they can be newly issued by the firm. We will examine the former case; the latter alternative has been already analyzed for example by Bernheim (1991), Bierman (1997) or Peterson et al. (1987).

Paying a dividend with a DRIP leads to the same expected share price in $t=1$ as a sole dividend payment i.e. $E[\ldots]$ (see (20)). The variance of the return is structurally the same as for a sole dividend payment and for retaining and reinvesting the FCF, i.e.

$$Var\left[\frac{\tilde{S}_1}{S_0^{DRIP}} - 1\right] = \frac{1}{\left(S_0^{DRIP}\right)^2}\sigma_V^2 , \tag{29}$$

because the number of shares is unchanged. Hence the rational demand of smart investors, $Q_0^{S,DRIP}$, deduced from (11), is similar to the case of a sole dividend payment:

$$Q_0^{S,DRIP} = \frac{\left(\bar{V} - S_0^{DRIP}\right)S_0^{DRIP}}{(1-\tau^{CG})\theta\sigma_V^2} . \tag{30}$$

The only difference a DRIP makes is that it may change passive investors' demand. We assume that, notwithstanding our nomenclature, passive investors participate in the DRIP to reinvest at least part of their net dividend in shares of the firm.

Let $\lambda \le 1$ be the fraction of passive investors' net dividend, $q^P(1-\tau^D)FCF$, they are going to reinvest e.g. via the DRIP in additional shares. If we consider our case of "dividend with DRIP" more broadly as a synonym for any reinvestment by passive investors, λ might be increased by implementing a formal DRIP.

With reinvestment at a degree of λ the passive investors' total share demand becomes

$$Q_0^{P,DRIP} = q^P \left(1 + \lambda(1-\tau^D)\frac{FCF}{S_0^{DRIP}}\right) S_0^{DRIP} . \tag{31}$$

Now market clearing requires

$$\begin{aligned} & Q_0^{S,DRIP} + Q_0^{P,DRIP} = S_0^{DRIP} \\ \Leftrightarrow \quad & \frac{\left(\bar{V} - S_0^{DRIP}\right) S_0^{DRIP}}{(1-\tau^{CG})\theta\sigma_V^2} + q^P \left(1 + \lambda \frac{(1-\tau^D)FCF}{S_0^{DRIP}}\right) S_0^{DRIP} = S_0^{DRIP} . \end{aligned} \tag{32}$$

Therefore the equilibrium price in case of paying out free cash flow in $t=0$ as dividends and offering a DRIP is

$$S_0^{DRIP} = \bar{V} - (1-q^P)(1-\tau^{CG})\theta\sigma_V^2 + q^P \left(\lambda \frac{(1-\tau^D)FCF}{S_0^{DRIP}}\right)(1-\tau^{CG})\theta\sigma_V^2 \tag{33}$$

$$\begin{aligned} \Leftrightarrow \quad S_0^{DRIP} = & \frac{\bar{V} - (1-q^P)(1-\tau^{CG})\theta\sigma_V^2}{2} \\ & + \sqrt{\left(\frac{\bar{V} - (1-q^P)(1-\tau^{CG})\theta\sigma_V^2}{2}\right)^2 + q^P\lambda(1-\tau^D)FCF(1-\tau^{CG})\theta\sigma_V^2} . \end{aligned} \tag{34}$$

Comparing this share price with the share price in case of a sole dividend payment (see(25)) leads to the following proposition.

Proposition 2: The equilibrium price in case of a dividend payment in association with a DRIP is higher than without a DRIP if passive investors participate at least to some degree in the DRIP, $\lambda > 0$, and smart investors are risk-averse, i.e. $\theta\sigma_V^2 > 0$:

$$S_0^{DRIP} > S_0^{DP} \quad \Leftrightarrow \quad \lambda q^P(1-\tau^D)FCF\theta\sigma_V^2 > 0. \tag{35}$$

Proof: Obvious from comparison of (33) and (25), given that $1 > \tau^D \ge 0$, $FCF > 0$, and $S_0^{DRIP} > 0$, if $0 < q^P < 1$. But even for $q^P > 1$ $S_0^{DRIP} > S_0^{DP}$ holds, see appendix.

Hence implementing a DRIP increases the share price as long as passive investors are in the market, $q^P > 0$. The positive price impact is due to passive investors increasing their share holdings by participating in the DRIP. This additional demand of passive investors in combination with the downward sloping demand function of risk-averse smart investors leads to a positive price pressure, whereas a price pressure would not be observable in a perfect market with unlimited arbitrage. Smart investors indeed sell shares in equilibrium and hence partly compensate the price pressure, but only limitedly so. Their investment decisions have only limited arbitrage as a side effect. Only if smart investors were risk neutral no price pressure would result. Then, for any payout policy the difference between current share price, adjusted for dividend, and expected future price would be zero.

When passive investors participate in the DRIP by reinvesting a share of $\lambda \le 1$ of their net dividend, $q^P(1-\tau^D)FCF$, the net value of their holdings in $t=0$ is

$$\begin{aligned} \omega_0^{P,DRIP} &= q^P \left[\left(1 + \lambda(1-\tau^D)\frac{FCF}{S_0^{DRIP}}\right) S_0^{DRIP} - \tau^{CG}\left(S_0^{DRIP} - S_{-1}\right) + (1-\lambda)(1-\tau^D)FCF\right] \\ &= q^P \left[(1-\tau^{CG})S_0^{DRIP} + (1-\tau^D)FCF + \tau^{CG}S_{-1}\right]. \end{aligned} \tag{36}$$

The position in (36) is composed of the value of the holdings at $t=0$, $q^P\left(1+\lambda(1-\tau^D)FCF/S_0^{DRIP}\right)S_0^{DRIP}$, which includes the shares that have already been in passive investors portfolios and the shares they bought via DRIP as well as the net dividend that is not reinvested, $q^P(1-\lambda)(1-\tau^D)FCF$. The pending capital gains tax for the shares they have bought before $t=0$, $q^P\tau^{CG}(S_0^{DRIP}-S_{-1})$, reduces the value of their holdings.

If passive investors participate in a DRIP, smart investors sell off shares in equilibrium. Their demand of shares in equilibrium is $1-q^P(1+\lambda(1-\tau^D)FCF/S_0^{DRIP})$. Hence they do not only receive their share of net dividend, $(1-q^P)(1-\tau^D)FCF$, but also sell shares in number of $\lambda q^P(1-\tau^D)FCF/S_0^{DRIP}$ to the passive investors. Total capital gains tax in $t=0$ (actual and pending) is $\tau^{CG}(1-q^P)(S_0^{DRIP}-S_{-1})$. Thus the value of smart investors' holdings in $t=0$ is

$$\begin{aligned}\omega_0^{S,DRIP} &= \left(1-q^P\left(1+\lambda(1-\tau^D)\frac{FCF}{S_0^{DRIP}}\right)\right)S_0^{DRIP}+(1-q^P)(1-\tau^D)FCF \\ &\quad +\lambda q^P(1-\tau^D)FCF\cdot S_0^{DRIP}-\tau^{CG}(1-q^P)\left(S_0^{DRIP}-S_{-1}\right) \\ &= (1-q^P)\left[(1-\tau^{CG})S_0^{DRIP}+(1-\tau^D)FCF+\tau^{CG}S_{-1}\right],\end{aligned} \tag{37}$$

if the firm pays out FCF as a dividend and offers a DRIP.

3.4. Buying back own shares

Instead of paying a dividend the firm may distribute its free cash flow by buying back own shares. We consider a share buyback (*BB*) on the open market at the current equilibrium market price. Given the market clearing price of S_0^{BB} the firm has to buy back $q^F=FCF/S_0^{BB}$ shares to distribute the free cash flow (see (3)). After the buyback the firm's uncertain value in $t=1$ is the same as in case of paying a dividend, i.e. $\tilde{V}$. But since the number of outstanding shares is reduced, the uncertain price per share in $t=1$, $\tilde{S}_1^{BB}$, is higher (see (4)). The expected $t=1$ share price in case of a buyback is

$$E\left[\tilde{S}_1^{BB}\right]=\frac{\bar{V}}{1-q^F}=\frac{\bar{V}\cdot S_0^{BB}}{S_0^{BB}-FCF}, \tag{38}$$

and the variance of the share return is

$$Var\left[\frac{\tilde{S}_1^{BB}}{S_0^{BB}}-1\right]=\frac{1}{\left(S_0^{BB}-FCF\right)^2}\sigma_V^2. \tag{39}$$

This risk in the return per share differs from the previous cases since the number of shares is reduced and hence fewer shares have to bear the unchanged business risk.
Considering (38) and (39) the $t=0$ demand of smart investors from (11) becomes

$$Q_0^{S,BB}=\frac{\left(\bar{V}+FCF-S_0^{BB}\right)\left(S_0^{BB}-FCF\right)}{(1-\tau^{CG})\theta\sigma_V^2}. \tag{40}$$

Passive investors' dollar demand is again given by the initial number of shares in their portfolio and the price per share:

$$Q_0^{P,BB}=q^P S_0^{BB}. \tag{41}$$

In case of buying back own shares, market clears if the investors' demand equals the initial market capitalization minus the buyback volume:

$$\begin{aligned} & Q_0^{S,BB}+Q_0^{P,BB}=S_0^{BB}-q^F S_0^{BB} \\ \Leftrightarrow\quad & S_0^{BB}-FCF=\frac{\left(\bar{V}+FCF-S_0^{BB}\right)\left(S_0^{BB}-FCF\right)}{(1-\tau^{CG})\theta\sigma_V^2}+q^P S_0^{BB}.\end{aligned} \tag{42}$$

From this market clearing condition follows the equilibrium price in case of paying out free cash flow in $t=0$ via repurchasing:

$$S_0^{BB} = \bar{V} + FCF - \left(1 - q^P \frac{S_0^{BB}}{S_0^{BB} - FCF}\right)(1-\tau^{CG})\theta\sigma_V^2 \tag{43}$$

$$\Leftrightarrow S_0^{BB} = \frac{\bar{V} + 2FCF - (1-q^P)(1-\tau^{CG})\theta\sigma_V^2}{2} + \sqrt{\left(\frac{\bar{V} + 2FCF - (1-q^P)(1-\tau^{CG})\theta\sigma_V^2}{2}\right)^2 - FCF\left(\bar{V} + FCF - (1-\tau^{CG})\theta\sigma_V^2\right)}. \tag{44}$$

Comparing S_0^{BB} with the equilibrium price in case of reinvesting FCF, S_0^{RT} from (17), leads to

Proposition 3: If the firm buys back own shares, the equilibrium share price rises if smart traders are risk-averse, i.e. $\theta\sigma_V^2 > 0$:

$$S_0^{BB} > S_0^{RT} \quad \Leftrightarrow \quad q^P(1-\tau^{CG})\theta\sigma_V^2 > 0\,. \tag{45}$$

Proof: Almost obvious from the comparison of (43) and (17) given that $S_0^{BB} > S_0^{BB} - FCF > 0$. For a complete proof see appendix.

The reason for the result in Proposition 3 is that even though the risk per share increases (see (39)), smart investors have to bear less risk after the buyback, since they sell shares to the firm. Hence smart investors demand a smaller total risk premium. This leads to a higher price per share in equilibrium.

Note that a buyback would have no price impact if all investors were smart, i.e. $q^P = 0$. In that case the shift in share supply is exactly compensated by an equal shift in demand. Even though smart investors' demand function slopes down, a buyback does not result in price increase. To this respect our market without passive investors is efficient. Therefore passive investors are a second important building block of our model.

Comparing the equilibrium price with DRIP, S_0^{DRIP} from (34), adjusted for the gross dividend, with the share price in case of a buyback, S_0^{BB} from (44), shows that a buyback results in a higher share price unless tax on dividends is zero *and* passive investors reinvest all of their dividends in a DRIP:

Proposition 4: The adjusted share price in case of a DRIP is lower than the price in case of buying back shares if $\tau^D > 0$ or $\lambda < 1$:

$$S_0^{DRIP} + FCF < S_0^{BB} \quad \Leftrightarrow \quad \lambda(1-\tau^D) < 1\,. \tag{46}$$

Proof: See appendix.

Note that for $\tau^D = 0$ and $\lambda = 1$ the demand of passive investors participating in the DRIP is exactly what the firm would demand in a buyback. Hence, in this special case there is no difference in adjusted prices, i.e. $S_0^{DRIP} + FCF = S_0^{BB}$. For $\tau^D > 0$ or $\lambda < 1$ the passive investors' additional share demand in the DRIP case is less than the firm's demand when buying back own shares. Therefore the adjusted price with DRIP is less then the price with repurchase – because the price pressure effect with DRIP is smaller.

Passive investors' share in the firm is not affected by a buyback. Hence the value of their net holdings is

$$\omega_0^{P,BB} = q^P\left[(1-\tau^{CG})S_0^{BB} + \tau^{CG}S_{-1}\right]. \tag{47}$$

Smart investors are left with $1 - q^P - FCF / S_0^{BB}$ shares in equilibrium. Therefore the value of their net holdings at $t=0$ is

$$\begin{aligned}\omega_0^{S,BB} &= \left(1-q^P-\frac{FCF}{S_0^{BB}}\right)S_0^{BB}+\frac{FCF}{S_0^{BB}}S_0^{BB}-\tau^{CG}(1-q^P)\left(S_0^{BB}-S_{-1}\right)\\ &=(1-q^P)\left[(1-\tau^{CG})S_0^{BB}+\tau^{CG}S_{-1}\right]\end{aligned} \tag{48}$$

if the firm buys back shares.

3.5. Summary of sections' results

3.5.1. Share prices

Proposition 1 to Proposition 4 specify that for $1>\lambda>0$, and $1>\tau^D>0$ the adjusted share prices for the considered alternatives of dealing with the FCF can be ranked as follows:

$$S_0^{BB}>S_0^{DRIP}+FCF>S_0^{DP}+FCF=S_0^{RT}. \tag{49}$$

Insofar buying back shares is the best of the four payout policies analysed. Second is the adjusted share price if the firm pays a dividend and offers a DRIP, third is the adjusted share price in case of a sole dividend payment, and that equals the share price with retention of the FCF.

The results summarized in (49) stem from the positive price pressure of a payout due to a shift in shareholdings, that is, when the smart investors' share in the firm drops relatively to the share of passive investors. This is the case with DRIP or with a buyback. Then, smart investors have to bear less risk and hence demand a smaller risk premium. As long as no perfect arbitrage balances this effect on share price we observe a higher adjusted price with DRIP or buyback.

The price pressure is greater for buyback than for DRIP because in the DRIP case some part of the FCF is not used for shifting shareholdings from smart to passive investors due to taxation. And furthermore, passive investors may only participate partially in the DRIP, i.e. $\lambda<1$. Only for $\lambda=1$ and $\tau^D=0$ the price pressure in case of buyback is the same as for DRIP (see Proposition 4).

3.5.2. Comparison of the values of investors' holdings

Comparing the values of the respective holdings of passive and smart investors in $t=0$ shows that investors unanimously prefer the same payout policy. Investors benefit most when free cash flow is paid out, either via buyback or as dividend with DRIP:

Proposition 5: For $\tau^D=\tau^{CG}$ passive investors and smart investors in $t=0$ unanimously prefer a buyback to a dividend with DRIP, and furthermore prefer dividend with DRIP to a sole dividend. Passive investors and smart investors are indifferent between a sole dividend payment and retaining free cash flow:

$$\omega_0^{P,BB}>\omega_0^{P,DRIP}>\omega_0^{P,DP}=\omega_0^{P,RT}, \tag{50}$$

and

$$\omega_0^{S,BB}>\omega_0^{S,DRIP}>\omega_0^{S,DP}=\omega_0^{S,RT}. \tag{51}$$

Proof: See appendix.

For $\tau^D>\tau^{CG}$ we also find that a buyback leads to the highest short run net wealth for passive and smart investors:

$$\omega_0^{P,BB}>\omega_0^{P,DRIP}>\omega_0^{P,DP}, \tag{52}$$

and

$$\omega_0^{S,BB}>\omega_0^{S,DRIP}>\omega_0^{S,DP}. \tag{53}$$

But a sole dividend is definitely not in shareholders' interest, i.e. $\omega_0^{P,DP}<\omega_0^{P,RT}$ and $\omega_0^{S,DP}<\omega_0^{S,RT}$ due to the tax disadvantage.

For the rather unusual case of higher tax on capital gains, $\tau^D<\tau^{CG}$, dividend is obviously preferable to retention:

$$\omega_0^{P,DRIP}>\omega_0^{P,DP}>\omega_0^{P,RT}, \tag{54}$$

and

$$\omega_0^{S,DRIP}>\omega_0^{S,DP}>\omega_0^{S,RT}. \tag{55}$$

But there is no longer a definite ranking of buyback versus dividend with DRIP possible. If the tax advantage of dividends dominates the higher price effect of the buyback we have $\omega_0^{P,DRIP} > \omega_0^{P,BB}$ and $\omega_0^{S,DRIP} > \omega_0^{S,BB}$.

Proof: See appendix.

So in any case investors prefer a payout. Concerning the price effect a buyback benefits them most. A tax advantage of capital gains, i.e. $\tau^D > \tau^{CG}$, strengthens the case for a buy back. Only under a less common tax regime with higher taxes on capital gains than on dividends, $\tau^{CG} > \tau^D$, the tax advantage of dividends may dominate the higher price pressure effect of a buyback. Then, the firm should pay a dividend and offer a DRIP, since $\omega_0^{P,DRIP} > \omega_0^{P,DP}$ and $\omega_0^{S,DRIP} > \omega_0^{S,DP}$ always hold as long as passive investors participate in the DRIP, $\lambda > 0$.

4. Total shareholders' expected future wealth

In the following section we consider the expected long run wealth effects of the different modes of payout policy mentioned before. Therefore we look at investors' expected wealth $E\left[\tilde{V} \quad \right]$ in the final period $t = 1$, net of any returns from investments other than in the firm and net of taxes. We thereby assume that future share price is no longer affected by market inefficiency. That is, price pressure is only transitory and future share price on average equals the unbiased expected future share price, i.e. $E\left[\tilde{S} \quad \right] \quad FCF$ in case of retention (see (1)), or $E\left[\tilde{S} \quad \right]$ in case of paying a dividend (see (2)), or $E\left[\tilde{S} \quad \right] \quad {}^{BB} / \left(S_0^{BB} - FCF\right)$ after a buyback (see (4)). Given these expected prices in $t = 1$ we will consider if and to what extent investors benefit from the firms' payout policy in the long run.

4.1. Retaining free cash flow

If the firm retains its free cash flow, neither passive nor smart investors change their demand of shares in $t = 0$. Passive investors' expected end of period wealth is

$$\bar{W}_1^{P,RT} = q^P \left[(1-\tau^{CG})\left(\bar{V} + FCF\right) + \tau^{CG} S_{-1} \right]. \tag{56}$$

Smart investors' expected end of period wealth is different only for the number of shares:

$$\bar{W}_1^{S,RT} = (1-q^P)\left[(1-\tau^{CG})\left(\bar{V} + FCF\right) + \tau^{CG} S_{-1} \right]. \tag{57}$$

Summing up gives the following total expected wealth of all investors in case of retention:

$$\bar{W}_1^{P,RT} + \bar{W}_1^{S,RT} = (1-\tau^{CG})\left(\bar{V} + FCF\right) + \tau^{CG} S_{-1}. \tag{58}$$

4.2. Paying a dividend

After a dividend of FCF in $t = 0$ passive investors' expected wealth in $t = 1$ is

$$\bar{W}_1^{P,DP} = q^P \left[(1-\tau^{CG})\bar{V} + (1-\tau^D) FCF + \tau^{CG} S_{-1} \right]. \tag{59}$$

For smart investors we find

$$\bar{W}_1^{S,DP} = (1-q^P)\left[(1-\tau^{CG})\bar{V} + (1-\tau^D) FCF + \tau^{CG} S_{-1} \right]. \tag{60}$$

Summing up gives as the total expected wealth of all investors in case of dividend payment:

$$\bar{W}_1^{P,DP} + \bar{W}_1^{S,DP} = (1-\tau^{CG})\bar{V} + (1-\tau^D) FCF + \tau^{CG} S_{-1}. \tag{61}$$

Comparing this total expected wealth with the one in case of retention from (58) leads to:

Proposition 6: In the long run investors as a whole loose from dividend payment iff the tax on dividends is higher than the tax on capital gains:

$$\bar{W}_1^{P,DP} + \bar{W}_1^{S,DP} < \bar{W}_1^{P,RT} + \bar{W}_1^{S,RT} \quad \Leftrightarrow \quad \tau^{CG} < \tau^D. \tag{62}$$

Proof: obvious from comparison of (61) and (58). □

Since price pressure effects vanish in the long run, only the well known argument based on differences in taxation is relevant for the assessment of payout via dividends.

4.3. Paying a dividend with a DRIP

If the firm pays a dividend of FCF and offers a DRIP, passive investors' expected final wealth is

$$\bar{W}_1^{P,DRIP} = q^P \Big[(1-\tau^{CG})\bar{V} + (1-\tau^{CG})\lambda(1-\tau^D)\frac{FCF}{S_0^{DRIP}}\bar{V} + (1-\lambda)(1-\tau^D)FCF + \tau^{CG}\left(\lambda(1-\tau^D)FCF + S_{-1}\right)\Big]. \tag{63}$$

For smart investors we get

$$\bar{W}_1^{S,DRIP} = \left(1 - q^P\left(1 + \lambda(1-\tau^D)\frac{FCF}{S_0^{DRIP}}\right)\right)(1-\tau^{CG})\bar{V} + \tau^{CG}(1-q^P)S_{-1} + q^P\lambda(1-\tau^D)(1-\tau^{CG})FCF + (1-q^P)(1-\tau^D)FCF. \tag{64}$$

Summing up both individual wealth positions leads to:

Proposition 7: The total expected wealth of all investors in case of dividend payment with DRIP is identical to the total expected wealth in case of a dividend without DRIP:

$$\bar{W}_1^{P,DRIP} + \bar{W}_1^{S,DRIP} = \bar{W}_1^{P,DP} + \bar{W}_1^{S,DP}. \tag{65}$$

Proof: From (63) and (64) the total expected wealth in case with DRIP is

$$\bar{W}_1^{P,DRIP} + \bar{W}_1^{S,DRIP} = (1-\tau^{CG})\bar{V} + (1-\tau^D)FCF + \tau^{CG}S_{-1}. \tag{66}$$

This is exactly what we got for the total expected wealth in case without DRIP in (61). □

Therefore we find that in the long run offering a DRIP is irrelevant for investors' total expected wealth. With or without DRIP, a dividend payment harms investors as a whole if dividends are taxed at a higher rate than capital gains, i.e. $\tau^D > \tau^{CG}$. But we will see later on that the price pressure effect in $t=0$ results in differences between $\bar{W}_1^{P,DRIP}$ and $\bar{W}_1^{P,DP}$, as well as between $\bar{W}_1^{S,DRIP}$ and $\bar{W}_1^{S,DP}$. Hence offering a DRIP causes a wealth transfer between investors.

4.4. Buying back own shares

If the firm buys back shares to pay out FCF passive investors' expected final wealth is

$$\bar{W}_1^{P,BB} = q^P\left[(1-\tau^{CG})\frac{\bar{V}\cdot S_0^{BB}}{S_0^{BB} - FCF} + \tau^{CG}S_{-1}\right]. \tag{67}$$

For smart investors we find

$$\bar{W}_1^{S,BB} = (1-\tau^{CG})\left(1 - q^P - \frac{FCF}{S_0^{BB}}\right)\frac{\bar{V}\cdot S_0^{BB}}{S_0^{BB} - FCF} + (1-\tau^{CG})FCF + \tau^{CG}(1-q^P)S_{-1}. \tag{68}$$

Summing up both individual expected wealth positions leads to:

Proposition 8: The total expected future wealth of all investors in case of a buyback is identical to the total expected future wealth in case of retention:

$$\bar{W}_1^{P,BB} + \bar{W}_1^{S,BB} = \bar{W}_1^{P,RT} + \bar{W}_1^{S,RT}. \tag{69}$$

Proof: From (67) and (68) the total wealth in case with DRIP is

$$\bar{W}_1^{P,BB} + \bar{W}_1^{S,BB} = (1-\tau^{CG})\left(\bar{V} + FCF\right) + \tau^{CG}S_{-1}, \tag{70}$$

which is exactly what we got for the total wealth in case of retention in (58). □

The result in Proposition 8 is of course due to the fact that the price pressure effect vanishes in the long run. Hence a buyback of shares is beneficial for investors compared to a dividend if and only if retention is, i.e. if dividends are taxed at a higher rate than capital gains, $\tau^{CG} < \tau^D$. But as for DRIP versus sole dividend we will see that a buyback instead of retention causes a wealth transfer from one investor clientele to the other.

4.5. Summary of sections' results

Since price pressure effects do not persist in the long run retention and buyback of shares gives the same expected total shareholder wealth,

$$\bar{W}_1^{P,BB} + \bar{W}_1^{S,BB} = \bar{W}_1^{P,RT} + \bar{W}_1^{S,RT}, \tag{71}$$

as does the payment of a dividend with or without DRIP

$$\bar{W}_1^{P,DRIP} + \bar{W}_1^{S,DRIP} = \bar{W}_1^{P,DP} + \bar{W}_1^{S,DP}. \tag{72}$$

Hence considering investors' wealth in total, the firm faces the simple decision problem of paying out dividend or not. Offering a DRIP is irrelevant in the long run and a buyback results in the same wealth as retention. Abstaining from a dividend payment benefits investors as a whole in the long run iff there is a tax advantage of capital gains, i.e. $\tau^{CG} < \tau^{D}$.

Considering the impact of the firms' payout policy on the investors' individual expected wealth positions gives a more complicated picture that we will consider in the following.

5. Wealth transfer between investors

In this section we take a look at the individual expected end of period wealth for the two groups of investors. Comparing the individual wealth positions already stated in section 0 shows the wealth transfer effects of a dividend with DRIP and a buyback under the considered market inefficiency.

5.1. Paying a dividend with and without offering a DRIP

Comparing individual expected end of period wealth for a sole dividend payment with the expected wealth in case of retention shows no other result than for total investors expected wealth: Passive investors gain from retention iff the tax on dividends exceeds the tax on capital gains

$$\bar{W}_1^{P,RT} > \bar{W}_1^{P,DP} \quad \Leftrightarrow \quad \tau^{D} > \tau^{CG}, \tag{73}$$

and the same is true for the smart investors:

$$\bar{W}_1^{S,RT} > \bar{W}_1^{S,DP} \quad \Leftrightarrow \quad \tau^{D} > \tau^{CG}. \tag{74}$$

Therefore, each group gains from retention iff total investors wealth is increased (see (62)). A *pro rata* dividend has of course no potential for a wealth transfer by itself.

This is different for a dividend with a DRIP if passive investors participate in ($\lambda > 0$). For the passive investors the expected end of period wealth with DRIP (see (63)) exceeds the expected wealth with a sole dividend (see (59)), if

$$\bar{W}_1^{P,DRIP} > \bar{W}_1^{P,DP} \Leftrightarrow (1-\tau^{CG})(1-\tau^{D})q^{P}\lambda\frac{FCF}{S_0^{DRIP}}\left(\bar{V} - S_0^{DRIP}\right) > 0 \Leftrightarrow \bar{V} > S_0^{DRIP}. \tag{75}$$

Paying a dividend and offering a DRIP raises the passive investors' expected wealth in $t=1$ in comparison to a sole dividend payment, if the expected future value per share exceeds the $t=0$ share price. Then, passive investors buy shares via the DRIP at a discount and hence gain in expected values.

With S_0^{DRIP} from (34) we find that condition (75) holds iff

$$\frac{\bar{V}}{\bar{V} + \lambda(1-\tau^{D})FCF} > q^{P}. \tag{76}$$

Therefore $\bar{V} > S_0^{DRIP}$ holds if passive investors' initial share holdings, q^{P}, and the degree of participation in the DRIP, λ, which determines the additional demand for shares, are sufficiently low. This is because the equilibrium price S_0^{DRIP} increases in q^{P} and λ.

We have learned from Proposition 7 that offering a DRIP has no effect on shareholders' total expected wealth. Thus, if passive investors gain from a DRIP, smart investors lose and *vice versa*. Comparing $\bar{W}_1^{S,DRIP}$ from (63) with $\bar{W}_1^{S,DP}$ from (60) shows this explicitly

$$\begin{aligned} \bar{W}_1^{S,DRIP} > \bar{W}_1^{S,DP} \quad &\Leftrightarrow \quad q^P \lambda (1-\tau^D)(1-\tau^{CG}) FCF \left(1 - \frac{\bar{V}}{S_0^{DRIP}}\right) > 0 \\ &\Leftrightarrow \quad S_0^{DRIP} > \bar{V} \\ &\Leftrightarrow \quad \frac{\bar{V}}{\bar{V} + \lambda(1-\tau^D)FCF} < q^P . \end{aligned} \tag{77}$$

Paying a dividend and offering a DRIP raises smart investors' expected future wealth in comparison to a sole dividend payment, only if the share price exceeds the expected future value. This is exactly opposite to what we know from (75) for passive investors. For $S_0^{DRIP} > \bar{V}$ smart investors sell shares in $t = 0$ at a premium and hence gain in expected values.

5.2. Buying back own shares

Using FCF for a buyback instead of retaining has no impact on total investors' wealth (see Proposition 8). But for each single group of investors the picture is different. A buyback causes a wealth transfer from one group to the other. The direction of the wealth transfer depends on the relation between share price in $t = 0$ and expected future price.

Comparing $\bar{W}_1^{P,BB}$ from (67) with $\bar{W}_1^{P,RT}$ from (56) shows that a buyback raises the expected wealth for the passive investors, who do not sell their shares iff the buyback takes place at a share price below the expected future firm value with retention:

$$\bar{W}_1^{P,BB} > \bar{W}_1^{P,RT} \quad \Leftrightarrow \quad \bar{V} + FCF > S_0^{BB} . \tag{78}$$

Using the equilibrium value for S_0^{BB} from (44) and rearranging condition (78) leads to

$$\frac{\bar{V}}{\bar{V} + FCF} > q^P . \tag{79}$$

If condition (79) holds, the number of shares in passive investors' portfolios is "small", and consequently smart investors' initial holdings are "large". To induce smart investors to hold a large share in the firm, share price must be at a low level.

Since investors' total expected wealth is not influenced by a buyback, passive investors' gain (loss) in wealth equals smart investors' loss (gain). Comparing $\bar{W}_1^{S,BB}$ from (68) with $\bar{W}_1^{S,RT}$ from (57) shows this explicitly

$$\begin{aligned} \bar{W}_1^{S,BB} > \bar{W}_1^{S,RT} \quad &\Leftrightarrow \quad S_0^{BB} > \bar{V} + FCF \\ &\Leftrightarrow \quad \frac{\bar{V}}{\bar{V} + FCF} < q^P . \end{aligned} \tag{80}$$

Buying back shares benefits smart investors only if they can sell shares at a premium to the firm, i.e. $S_0^{BB} > \bar{V} + FCF$. This is exactly the opposite of what we know from (78) for passive investors. Smart investors gain and passive investors lose if $S_0^{BB} > \bar{V} + FCF$, and *vice versa* if $S_0^{BB} < \bar{V} + FCF$. This is similar to what we found in case of dividend payout with DRIP versus without DRIP. Passive investors gain (lose) and smart investors lose (gain), if the shares are traded in $t = 0$ at a discount (premium) compared to the expected future value.

5.3. Summary of sections' results

The pro rata payment of a sole dividend implies no potential for a transfer of wealth from one investor group to another. All investors gain from retaining FCF instead of paying a dividend iff there is a tax disadvantage for dividends:

$$\tau^D > \tau^{CG} \Rightarrow \begin{cases} \bar{W}_1^{P,RT} > \bar{W}_1^{P,DP} \\ \bar{W}_1^{S,RT} > \bar{W}_1^{S,DP} . \end{cases} \tag{81}$$

If the firm pays a dividend a wealth transfer results from offering a DRIP, which is at least partially used. The direction of the wealth transfer depends on the relation of expected future value per share and the equilibrium share price that passive investors have to pay in $t=0$ when participating in the DRIP. For a discount in the equilibrium price passive investors gain and smart investors lose in expected terms, and *vice versa* for a premium in the equilibrium price:

$$\bar{V} > S_0^{DRIP} \quad \Rightarrow \quad \begin{cases} \bar{W}_1^{P,DRIP} > \bar{W}_1^{P,DP} \\ \bar{W}_1^{S,DRIP} < \bar{W}_1^{S,DP} \end{cases} \tag{82}$$

and

$$\bar{V} < S_0^{DRIP} \quad \Rightarrow \quad \begin{cases} \bar{W}_1^{P,DRIP} < \bar{W}_1^{P,DP} \\ \bar{W}_1^{S,DRIP} > \bar{W}_1^{S,DP} \end{cases} \tag{83}$$

with

$$\bar{W}_1^{P,DRIP} - \bar{W}_1^{P,DP} = \bar{W}_1^{S,DP} - \bar{W}_1^{S,DRIP}. \tag{84}$$

Hence, with a tax disadvantage for dividends, i.e. $\tau^D < \tau^{CG}$, investors collectively loose from distributing FCF via dividend (see (81)). But if FCF is paid out one group prefers a sole dividend, the other gains from implementing a DRIP.

Buying back own shares also leads to a wealth transfer between selling and staying shareholders. If the firm buys shares at a discount the staying passive investors gain and smart investors lose in expected terms (and *vice versa* for a premium in the equilibrium price):

$$\bar{V} + FCF > S_0^{BB} \quad \Rightarrow \quad \begin{cases} \bar{W}_1^{P,BB} > \bar{W}_1^{P,RT} \\ \bar{W}_1^{S,BB} < \bar{W}_1^{S,RT} \end{cases} \tag{85}$$

and

$$\bar{V} + FCF < S_0^{BB} \quad \Rightarrow \quad \begin{cases} \bar{W}_1^{P,BB} < \bar{W}_1^{P,RT} \\ \bar{W}_1^{S,BB} > \bar{W}_1^{S,RT} \end{cases} \tag{86}$$

with

$$\bar{W}_1^{P,BB} - \bar{W}_1^{P,RT} = \bar{W}_1^{S,RT} - W_1^{S,BB}. \tag{87}$$

Given the usual tax disadvantage of dividends, $\tau^D > \tau^{CG}$, we conclude from (81) that investors would collectively vote against a dividend. But from (85) and (86) follows that one group prefers retention, and the other prefers a buyback.

6. Concluding Remarks and Empirical Predictions

Traditionally, financial theory attributes any impact of a firm's payout policy to informational effects. Repurchase and dividend announcements may convey managements' private information that will be instantaneously incorporated into share prices and influence shareholders' wealth. Given that information is disseminated by announcement, the actual payout has no further interesting impact on prices and investors' wealth. This is a theoretical view which implicitly assumes efficient markets. But, since there seems to be considerable empirical evidence of market inefficiencies, we believe that informational asymmetries are not the only factor of relevance for a firm's payout policy.

In our model we use risk aversion of smart investors to generate a downward sloping demand function. A second building block is the assumption of passive investors holding shares in the firm. Absent perfect arbitrage share price depends on the firm's payout policy, even though information asymmetries or agency problems are excluded. The relevance of payout policy results from market inefficiency. Particularly we find that paying out free cash flow as a dividend with dividend reinvestment, e.g. via a dividend reinvestment plan (DRIP), has a positive impact on share price adjusted for the dividend discount.[4] Even higher is the price impact of a share buyback. In both cases the positive price impact results from an increase in passive investors' share in the firm. If passive investors' share increases, risk-averse smart investors' share in the firm decreases. To induce

[4] This finding with regard to share price is consistent with the empirical findings of Ogden (1994) and may be one explanation for the popularity of DRIPs among firms that are listed in the US capital market. In the US, we can observe a great importance of DRIPs, whereas in the European capital market DRIPs are not very popular yet (see footnote 1).

smart investors to hold a smaller share the risk premium in the firm's market valuation must fall. Hence equilibrium share price is higher. A dividend payment *per se* has no impact on adjusted price since relative shares of passive and smart investors in the firm are not affected.

Given the positive price impact of a dividend payment with DRIP or a buyback current investors' wealth also increases. Whether a dividend payment with DRIP or a buyback results in the highest increase in investors' current wealth depends partly on taxation. For a tax system with a tax on dividends that is no less than the tax on capital gains a buyback is definitely preferable in the short run. For a tax system that discriminates capital gains, a dividend with DRIP may be preferable in the short run.

We assumed that price effects of payout vanish in the long run so that only the tax advantage or disadvantage of dividends remains as a relevant factor for the expected long run total wealth effects. Therefore a dividend with or without DRIP increases shareholders' expected total wealth in the long run only if capital gains are taxed at a higher rate. If instead dividends are taxed at a higher rate, paying out a dividend decreases shareholders' expected total wealth in the long run. Buying back shares or retaining free cash flow is equivalent with respect to shareholders' total expected wealth. But due to short run price effects of payout policy a wealth transfer between the two investor groups results. Passive investors gain (lose) and smart investors lose (gain) by a payout via dividend with DRIP or buyback if the respective equilibrium market valuation of the firm is lower (higher) than the expected future value. Therefore, with respect to the expected long run wealth effects investors would not unanimously prefer a certain payout policy.

The main empirical predictions of our model can be summarized as follows:

- If a firm distributes its cash through a dividend, the adjusted *ex* dividend share price exceeds the *cum* price if dividends are reinvested at some degree, and in particular if a DRIP is offered.
- If a firm buys back own shares at the open market the price per share rises.
- The positive impact on share price (adjusted for dividend) is higher for a buyback than for a dividend payment with dividend reinvestment, e.g. via a DRIP.
- If the tax on dividends is no less than tax on capital gains, all investors benefit most from a buyback in the short run.
- Investors' expected total wealth in long run is the same for a sole dividend or a dividend payment with DRIP,
- Investors' expected total wealth in long run is the same for retention or buyback.
- Even for a tax disadvantage of dividends, smart investors with a long term investment perspective might vote for a dividend payment with DRIP instead of a buyback or retention, if the firm's current market value is "high". This is due to a wealth transfer that comes along with passive investors' participation in the DRIP.

At least some of our predictions should to be testable with well established methodology. To uncover the price effects of the alternatives to payout policies an event study should be used to test for abnormal returns around the payment date.

Our finding of a positive price impact of share buybacks may add to the explanation of the growing importance of this instrument for distributing cash to shareholders (see Skinner (2008) among many others). The more managers are concerned about short run growth of stock prices and shareholder value, the more they might be interested in buybacks instead of dividend payments. If dividends are preferable for reasons outside our model, firms should consider offering a DRIP. Especially for European firms DRIPs are still an almost unknown opportunity to enhance their payout effectiveness.

Appendix

Proof of Proposition 2:

Comparing S_0^{DRIP} from (34) with S_0^{DP} from (25) leads to:

$$S_0^{DRIP} > S_0^{DP} \Leftrightarrow \sqrt{\left(\frac{\bar{V}-(1-q^P)(1-\tau^{CG})\theta\sigma_V^2}{2}\right)^2 + q^P\lambda(1-\tau^D)FCF(1-\tau^{CG})\theta\sigma_V^2}$$
$$+\frac{\bar{V}-(1-q^P)(1-\tau^{CG})\theta\sigma_V^2}{2} > \bar{V}-(1-q^P)(1-\tau^{CG})\theta\sigma_V^2 \quad \Leftrightarrow$$
$$\left(\frac{\bar{V}-(1-q^P)(1-\tau^{CG})\theta\sigma_V^2}{2}\right)^2 + q^P\lambda(1-\tau^D)FCF(1-\tau^{CG})\theta\sigma_V^2 \tag{88}$$
$$> \left(\frac{\bar{V}-(1-q^P)(1-\tau^{CG})\theta\sigma_V^2}{2}\right)^2 \Leftrightarrow$$
$$q^P\lambda(1-\tau^D)\theta\sigma_V^2 > 0.$$

□

Proof of Proposition 3:

Comparing S_0^{BB} from (44) with S_0^{RT} from (17) leads to:

$$S_0^{BB} > S_0^{RT} \quad \Leftrightarrow$$
$$\sqrt{\left(\frac{\bar{V}+2FCF-(1-q^P)(1-\tau^{CG})\theta\sigma_V^2}{2}\right)^2 - FCF\left(\bar{V}+FCF-(1-\tau^{CG})\theta\sigma_V^2\right)}$$
$$+\frac{\bar{V}+2FCF-(1-q^P)(1-\tau^{CG})\theta\sigma_V^2}{2} > \bar{V}+FCF-(1-q^P)(1-\tau^{CG})\theta\sigma_V^2 \quad \Leftrightarrow$$
$$\left(\frac{\bar{V}+2FCF-(1-q^P)(1-\tau^{CG})\theta\sigma_V^2}{2}\right)^2 \tag{89}$$
$$-FCF\left(\bar{V}+FCF-(1-\tau^{CG})\theta\sigma_V^2\right) > \left(\frac{\bar{V}-(1-q^P)(1-\tau^{CG})\theta\sigma_V^2}{2}\right)^2 \quad \Leftrightarrow$$
$$q^P(1-\tau^{CG})\theta\sigma_V^2 > 0$$

□

Proof of Proposition 4:

Comparing S_0^{DRIP} from (34), adjusted by FCF, with S_0^{BB} from (44) leads to

$$\begin{aligned}
& S_0^{DRIP} + FCF < S_0^{BB} \\
\Leftrightarrow\ & \sqrt{\left(\frac{\bar{V} - (1-q^P)(1-\tau^{CG})\theta\sigma_V^2}{2}\right)^2 + q^P\lambda(1-\tau^D)FCF(1-\tau^{CG})\theta\sigma_V^2} \\
& + \frac{\bar{V} - (1-q^P)(1-\tau^{CG})\theta\sigma_V^2}{2} + FCF \\
& \quad < \frac{\bar{V} + 2FCF - (1-q^P)(1-\tau^{CG})\theta\sigma_V^2}{2} \\
& \quad + \sqrt{\left(\frac{\bar{V} + 2FCF - (1-q^P)(1-\tau^{CG})\theta\sigma_V^2}{2}\right)^2 - FCF\left(\bar{V} + FCF - (1-\tau^{CG})\theta\sigma_V^2\right)} \\
\Leftrightarrow\ & \left(\frac{\bar{V} - (1-q^P)(1-\tau^{CG})\theta\sigma_V^2}{2}\right)^2 + q^P\lambda(1-\tau^D)FCF(1-\tau^{CG})\theta\sigma_V^2 \\
& \quad < \left(\frac{\bar{V} + 2FCF - (1-q^P)(1-\tau^{CG})\theta\sigma_V^2}{2}\right)^2 - FCF\left(\bar{V} + FCF - (1-\tau^{CG})\theta\sigma_V^2\right) \\
\Leftrightarrow\ & \lambda(1-\tau^D) < 1
\end{aligned} \tag{90}$$

□

Proof of Proposition 5:

Comparing $\omega_0^{P,DP}$ from (27) with $\omega_0^{P,RT}$ from (18) and comparing $\omega_0^{S,DP}$ from (28) with $\omega_0^{S,RT}$ from (48), leads to

$$\left.\begin{aligned} \omega_0^{P,DP} < \omega_0^{P,RT} \\ \omega_0^{S,DP} < \omega_0^{S,RT} \end{aligned}\right\} \Leftrightarrow \quad \tau^{CG} < \tau^D . \tag{91}$$

For $\tau^D = \tau^{CG}$ follows $\omega_0^{P,DP} = \omega_0^{P,RT}$ and $\omega_0^{S,DP} = \omega_0^{S,RT}$, for $\tau^D > \tau^{CG}$ follows $\omega_0^{P,DP} < \omega_0^{P,RT}$ and $\omega_0^{S,DP} < \omega_0^{S,RT}$

Comparing $\omega_0^{P,DRIP}$ from (36) with $\omega_0^{P,DP}$ from (27) and comparing $\omega_0^{S,DRIP}$ from (37) with $\omega_0^{S,DP}$ from (28) leads to

$$\left.\begin{aligned} \omega_0^{P,DRIP} > \omega_0^{P,DP} \\ \omega_0^{S,DRIP} > \omega_0^{S,DP} \end{aligned}\right\} \Leftrightarrow \quad S_0^{DRIP} > S_0^{DP} \tag{92}$$

From Proposition 2 we know that $S_0^{DRIP} > S_0^{DP}$ always holds, besides for the degenerated case with $q^P\lambda(1-\tau^D)\theta\sigma_V^2 = 0$. Hence (92) holds irrespective of the relation between tax rates.

Comparison of $\omega_0^{P,BB}$ from (47) with $\omega_0^{P,DRIP}$ from (36) and comparing $\omega_0^{S,BB}$ from (48) with $\omega_0^{S,DRIP}$ from (37) leads to

$$\left.\begin{aligned} \omega_0^{P,BB} > \omega_0^{P,DRIP} \\ \omega_0^{S,BB} > \omega_0^{S,DRIP} \end{aligned}\right\} \Leftrightarrow \quad S_0^{BB} > S_0^{DRIP} + \frac{1-\tau^D}{1-\tau^{CG}} FCF. \tag{93}$$

From Proposition 4 we know that $S_0^{BB} > S_0^{DRIP} + FCF$ always holds for $\lambda(1-\tau^D) < 1$. Hence in this non degenerated case $\tau^{CG} \le \tau^D$ is a sufficient condition for (93) to hold. For $\tau^{CG} > \tau^D$ we may have $\omega_0^{P,DRIP} > \omega_0^{P,BB}$ and $\omega_0^{S,DRIP} > \omega_0^{S,BB}$.

□

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