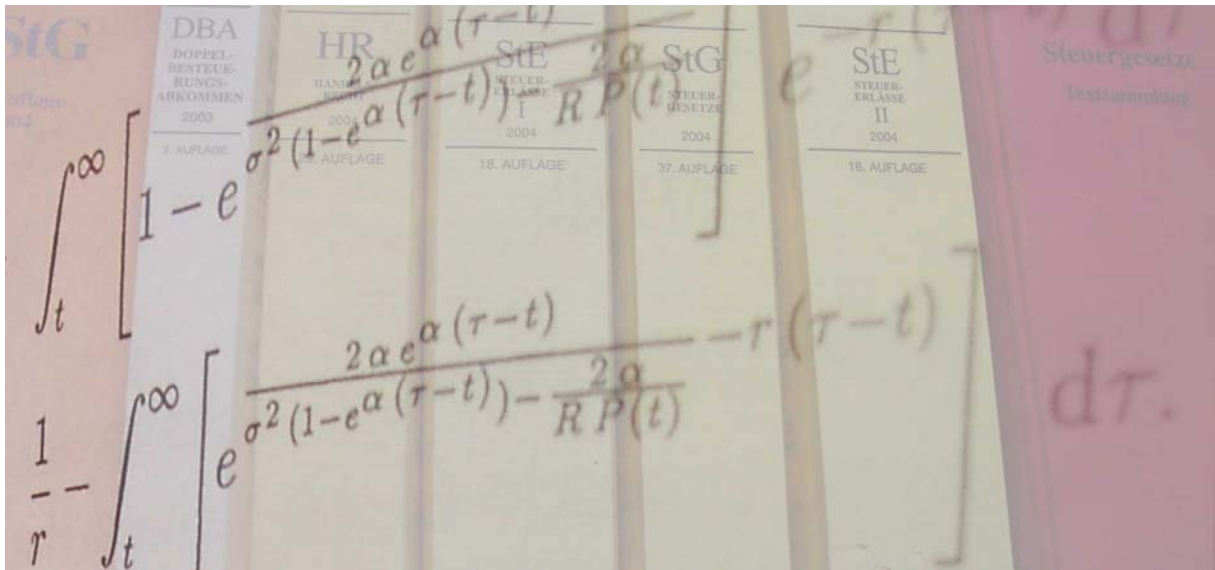


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# Stock Price Reactions to Share Repurchase Announcements in Germany

Evidence from a Tax Perspective

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## Abstract

In this study we analyse stock price reactions to share buyback announcements from a tax perspective in Germany. To determine the influence of taxes on stock prices on the announcement day of share buybacks two different tax regimes – the corporate imputation system and the classical corporate tax system – are analysed. Taking the shareholder structure into account, we find evidence that the share price reaction on share repurchase announcements was significantly larger under the full imputation system than under the classical corporate tax system with shareholder relief. Furthermore, we find evidence for the substitution hypothesis and the dividend clientele effect: High dividend paying companies have smaller positive price reactions than non- or lower dividend paying companies.

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# 1 Introduction

Are individuals' and firms' decisions affected by taxes? This question is of high interest, e.g. for policy makers. An area which is extremely suitable for answering this question is the distribution policy of corporations and the reactions of their shareholders on distributions, because different forms of distributions are typically differently taxed. These different tax levels can be used to analyse whether firms choose tax-optimal ways of distributing their free cash flow and how shareholders value the tax savings. Nevertheless, we know from the literature that different distribution forms such as dividends and share repurchases are influenced by many factors: Signaling effects and agency conflicts are good examples.<sup>1</sup> Thus, it is rather complicated to separate the tax influence on those decisions. One way of solving the problem is to analyse the effect of a tax reform on distributions and shareholders reactions.

An ideal setting for such an analysis can be found in Germany in the last ten years. In 2002, the corporate tax system was fundamentally reformed<sup>2</sup> and the relation of taxes on dividends and taxes on share repurchases has been radically changed. In Germany, stock repurchases were generally prohibited until 1998. Since then, they have been an increasingly popular instrument for distributing corporate profits to shareholders. As capital gains are taxed preferentially over dividends in Germany and in other countries, taxation can be expected to have an impact on distribution policy.<sup>3</sup>

The corporate full imputation system which was in effect since 1977 was replaced by a classical corporation tax with shareholder relief elements. Before, the corporate income tax on distributed profits was fully credited against the shareholder's personal income tax liability. In contrast, capital gains did not entitle to tax credits. Since the tax reform, the corporate income tax cannot be credited anymore. Only half of the

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<sup>1</sup> See Dittmar (2000); Grullon / Michaely (2004); Jagannathan / Stephens (2003) and Jagannathan / Stephens / Weisbach (2000) for the US and Hackethal / Zdantchouk (2004) for Germany.

<sup>2</sup> See Schreiber (2000); Homburg (2000).

<sup>3</sup> See f.i. Grullon / Michaely (2002) for the US; Amihud / Murgia (1997) for Germany.

dividends are subject to the individual income tax (half-income system). Obviously, the relative advantage of share repurchases over dividends changed due to the tax reform. Capital gains from selling shares are taxable only if an individual shareholder owns a substantial interest in the corporation. Tightening capital gains taxation by lowering the critical threshold for substantial interest was another element of the tax reform.

We analyse how this tax reform influences market reactions to stock repurchases. We measure the market reaction on the announcement day of share repurchases. The ad hoc announcement of a share repurchase is obligatory if the event has a likely impact on share prices. In an event study, we compare abnormal returns around the ad hoc announcement day before and after the tax reform, respectively. As capital gains taxation depends on the shareholder's stake in the corporation, we distinguish between shareholders with a stake of more or less than 1% or 10% (between 1999 and 2001), respectively. The investigation period covers the years 1998 to 2006 in order to include several years before and after the corporate tax reform.

We find evidence that the 2002 tax reform has a significant influence on the share price reaction on the announcement day of share buybacks. We observe a significantly higher share price reaction under the full imputation system in comparison to the half income system. This evidence can also be found in a regression analysis where we separate tax and non-tax influences.

Focussing on differently taxed shareholder groups, we fail to find evidence supporting our hypothesis that companies which are dominated by individual shareholders with a high tax advantage from share repurchases show the highest share price reaction on share buyback announcements. Instead, non-tax factors dominate the price reactions on the announcement day. Nevertheless, by dividing the whole observation period into the full imputation system and the half income system for our created shareholder portfolios, we can show that the share price reaction for companies, which are domi-

nated by individuals with substantial and non-substantial interest is larger under the full imputation system than under the half income system.

A handful of other studies have looked at share price reactions to the announcement of share buybacks in Germany.<sup>4</sup> In distinction to our study, there does not exist empirical work, which measures the effects of different tax systems on the share price reaction of share buyback announcements in Germany.

Most closely related to this article are Grullon/ Michaely (2002). They find a different share price reaction to share buyback announcements before and after the US Tax Reform Act in 1986. They conclude that the decreasing tax advantage of capital gains over dividends after the tax reform is responsible for the stock price reaction in the US.<sup>5</sup>

The remainder of the article is organised as follows: section 2 describes the legal framework, before our hypotheses are developed. Section 3 details the database and the methodology. Section 4 presents the main results, including the event study and the regression analysis. Section 5 concludes.

## 2 Hypotheses

### 2.1 Impact of share repurchase announcements on stock prices

Because of the tax advantage of capital gains over dividends there exists an incentive for the substitution of dividends through share buybacks since the adoption of the KonTraG in 1998 (substitution hypothesis).<sup>6</sup> Alternatively, share buybacks can

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<sup>4</sup> Publications for the German stock markets are, for example: Schremper (2002), Gerke / Fischer / Langer (2003), Pertlwieser (2006), Seifert (2006).

<sup>5</sup> See Grullon / Michaely (2002), p. 1673–1674.

<sup>6</sup> The German act “Gesetz zur Kontrolle und Transparenz im Unternehmensbereich (KonTraG)“ was enacted on May, 1st 1998.

be considered as complements to dividends (complement hypothesis). Companies can be reluctant to cut dividend payments (Lintner-Model<sup>7</sup>) but want to implement share buybacks in order to transfer extra-ordinary cash flows to the shareholders. A dividend increase would be interpreted as a signal for permanently higher prospective dividend payments. Therefore, a dividend increase is not practicable. In this case, share buybacks are used as a new opportunity to transfer cash to the shareholders.

The basic fundamental principle to conduct this study is the semi-strong information efficiency of the stock market.<sup>8</sup> The semi-strong efficiency assumption implies that the relative tax advantage of share buybacks over dividends must be priced into the stock market rates on the announcement day of the share buyback. In a first step, the following alternative hypothesis proves whether the announcement of a share buyback provides additional information for the stock market:

**H1: The announcement of the share buyback has an information content on the announcement day.**

If the alternative hypothesis H1 can be approved, then the announcement of share buybacks has an information content for the stock market. However, it is ambiguous whether the tax reform has an influence on the stock market. In section 2.2 we show that most shareholders gain more from a share buyback under the full imputation system in comparison to the half income system. To analyze the effects of the change of the corporate tax system, we formulate a second alternative hypothesis:

**H2: The size of the abnormal returns differs between the half income system and the full imputation system.**

In a third step, we create several portfolios, which represent three different dominant shareholder groups, separated by tax law. The different portfolios mirror the different

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<sup>7</sup> See Lintner (1956).

<sup>8</sup> A semi-strong efficient stock market implies, that all publicly available information is already priced into the stock market rates. See Fama (1970), p. 383 ff.

relative tax advantages of capital gains over dividends depending on the shareholder structure. These different tax advantages should be reflected by the stock price reaction on the announcement day of the share buyback.

The first portfolio consists of companies, whose shareholders are dominated (more than 50% of the voting rights) by individuals with non-substantial interest. The second portfolio consists of companies, whose shareholders are dominated (more than 50% of the voting rights) by individuals with substantial interest. The third portfolio consists of companies, whose shareholders are dominated (more than 50% of the voting rights) by corporations.<sup>9</sup>

To show the effect of the tax reform 2002, every portfolio must be separated in two subsamples. The first subsample corresponds to the observation period from 1 May 1998 to 31 December 2001 (imputation system), the second subsample corresponds to the observation period from 1 January 2002 to 31 December 2006 (half income system).

## **2.2 Taxation of shareholders**

Prior to the tax reform, until 2001, dividends received from domestic corporations entitled domestic individuals<sup>10</sup> to a tax credit. As a consequence, distributed profits of corporations were effectively subject only to the individual income tax at the tax

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<sup>9</sup> A portfolio consisting of companies which are dominated by investment funds is not formed. Investment funds are taxed according to the transparency principle. Their taxation depends on the tax status of their shareholders. In the following, investment funds are subsumed under individuals with non-substantial interest.

<sup>10</sup> We consider the “first shareholder level”. The taxation of “downstream shareholders” is ignored. Implicitly, it is assumed, that the shareholders are optimizing the cash flow between them and their company without recognizing – in case of a corporation – their own shareholders. This assumption is reasonable, because a corporation as a first level shareholder can optimise its cash flow to its owner after receiving dividends from its holdings.

rate  $\tau_i$ .<sup>11</sup> The maximum personal income tax rate including solidarity surcharge<sup>12</sup> decreased from 55.92% in 1998 to 44.31% in 2006. Long-term capital gains from stocks held for more than one year were tax-exempt for shareholders with non-substantial interest. The threshold for non-substantial interest was defined as a stake of less than 25% up to 1998, a stake of less than 10% from 1999 to 2001, and a stake of less than 1% as from 2002. The underlying profit was only subject to the corporate income tax at the rate  $\tau_c$ .

Until 2001, the value of retained profits was higher than its pre-tax value because of the inherent tax credit. Thus, domestic buyers of the shares were willing to pay for the tax credit. Assuming that the whole tax credit was comprised in the price calculation of the buyer, then the effective tax rate of the seller was zero, because the corporate tax payments were refunded by the buyer and no additional personal income taxes had to be paid.<sup>13</sup>

In case of non-substantial interest, tax rates on dividends  $\tau_d$  and capital gains  $\tau_g$  under the full imputation system are computed as  $\tau_d^{FI} = \tau_i$  and  $\tau_g^{FI} = 0$ . Tax rates on dividends  $\tau_d$  and capital gains  $\tau_g$  under the half-income system are computed as  $\tau_d^{HI} = \tau_c + (1 - \tau_c) \cdot 0.5 \cdot \tau_i$  and  $\tau_g^{HI} = \tau_c$ .

Table 1 displays the effective tax rates on dividends and capital gains. The difference  $\Delta^{FI} = \tau_d^{FI} - \tau_g^{FI}$  of 55.92% indicates that capital gains carried a substantial tax preference over dividends. As a consequence, there is a strong tax-induced incentive in favor of share repurchases for high-income shareholders under the imputation system.

Under the half income system since 2002 corporate profits were taxed at the corporate

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<sup>11</sup>The German local business tax is neglected because it is levied on both retained and distributed earnings and has not been changed systematically in the course of the 2002 tax reform.

<sup>12</sup>In the following, we will only take top marginal tax rates including solidarity surcharge into account. The solidarity surcharge is a 5.5% tax on top of the personal income tax and the corporate income tax. Germany has introduced this tax in order to finance the German reunification.

<sup>13</sup>The maximum pretax value for 1 DM cash dividend is 1.4286 DM to a taxable German investor. McDonald (2001) finds that the empirically tested value is 1.26 DM.



Year	System	Threshold	Dividend tax rate $\tau_d$ (%)	Capital gains tax rate $\tau_g$ (%)	Difference $\Delta$ (%)
1998	FI	25%	55.92	0.00	55.92
1999	FI	10%	55.92	0.00	55.92
2000	FI	10%	53.81	0.00	53.81
2001	FI	10%	51.17	0.00	51.17
2002	HI	1%	45.21	26.38	18.83
2003	HI	1%	46.38	27.95	18.43
2004	HI	1%	43.86	26.38	17.48
2005	HI	1%	42.69	26.38	16.31
2006	HI	1%	42.69	26.38	16.31

**Table 1:** Tax rates on dividends and capital gains for shareholders with non-substantial interest. FI: Full imputation system, HI: Half-income system.

income tax rate of 26.38%. Additionally, distributed profits after corporate taxes were subject to the half-income system on the individual level. A total tax burden of  $\tau_g^{HI} = 26.38\% + (1 - 26.38\%) \cdot 0.5 \cdot 51.17\% = 45.21\%$  results. From the decreasing  $\Delta$ -values it can be seen that the tax incentive to repurchase stocks decreased substantially compared to the full imputation system.

The decreasing tax preference for capital gains leads to the following hypothesis:

**H2.1: Under the half-income system, the abnormal return for stock repurchase announcements is lower than under the imputation system for corporations which are dominated by individual shareholders with tax-exempt capital gains.**

Capital gains of shareholders with substantial interest were taxable under both tax systems. From 1998 to 2001, capital gains were fully taxed, but slightly reduced tax rates  $\tau_i^{reduced}$  were applied.<sup>14</sup>

<sup>14</sup>In 1998, capital gains were taxed at half of the individual income tax rate. In the following years, preferential tax rates between 45.37% and 47.48% were applied to capital gains of shareholders with substantial interest. Again we assume that the corporate income tax was refunded by the buyer who received a claim on the tax credit.

In case of substantial interest, the tax rates on dividends  $\tau_d$  and capital gains  $\tau_g$  under the full imputation system are computed as  $\tau_d^{FI} = \tau_i$  and  $\tau_g^{FI} = \tau_i^{reduced}$ . The tax rates on dividends  $\tau_d$  and capital gains  $\tau_g$  under the half-income system are computed as  $\tau_d^{HI} = \tau_g^{HI} = \tau_c + (1 - \tau_c) \cdot 0.5 \cdot \tau_i$ .

Year	System	Threshold	Dividend tax rate $\tau_d$ (%)	Capital gains tax rate $\tau_g$ (%)	Difference $\Delta$ (%)
1998	FI	25%	55.92	24.79	31.12
1999	FI	10%	55.92	47.48	8.44
2000	FI	10%	53.81	45.37	8.44
2001	FI	10%	51.17	45.37	5.80
2002	HI	1%	45.21	45.21	0
2003	HI	1%	46.38	46.38	0
2004	HI	1%	43.86	43.86	0
2005	HI	1%	42.69	42.69	0
2006	HI	1%	42.69	42.69	0

**Table 2:** Tax rates on dividends and capital gains for individual shareholders with substantial interest. FI: Full imputation system, HI: Half-income system.

Obviously, the full imputation system for major shareholders provided strong incentives to repurchase shares. Under the half-income system, major individual shareholders are indifferent between dividends and share repurchases.<sup>15</sup>

Summarizing, the incentives for share repurchases are lower under the half-income system.

**H2.2: Under the half-income system, the abnormal return for stock repurchase announcements is lower than under the imputation system for corporations which are dominated by individual shareholders with taxable capital gains.**

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<sup>15</sup>The different incentives between the full imputation system and the half income system are even higher when we take the decrease of the threshold for substantial interest into account. Capital gains that were formerly tax-exempt became taxable due to the reduction of the substantial interest threshold.

Under the full imputation system, dividends received by other corporations, henceforth corporate shareholders, were fully taxed on the corporate level. However, a full tax credit was granted to corporate shareholders. As a result, corporate income tax was levied exactly once, regardless of the corporate structure. In contrast, capital gains did not entitle to a tax credit. Again we assume that the buyer was willing to pay for the tax credit because it reduces the later dividend taxation. Thus, the tax rate for capital gains was the statutory corporate tax rate.

The tax rates on dividends  $\tau_d$  and capital gains  $\tau_g$  of corporations under the full imputation system are computed as  $\tau_d^{FI} = \tau_g^{FI} = \tau_c$ . Under the half income system, the corporate tax rate was reduced and capital gains and dividends were 95% tax-exempt for corporations with no tax credit granted. Thus, both alternatives are taxed identically. The tax rates on dividends  $\tau_d$  and capital gains  $\tau_g$  under the half-income system are computed as  $\tau_d^{HI} = \tau_g^{HI} = \tau_c + (1 - \tau_c) \cdot 0.05 \cdot \tau_c$ .

Table 3 shows the tax advantage of capital gains over dividends for corporations as shareholders.

Year	System	Dividend tax rate $\tau_d$ (%)	Capital gains tax rate $\tau_g$ (%)	Difference $\Delta$ (%)
1998	FI	47.48	47.48	0
1999	FI	42.20	42.20	0
2000	FI	42.20	42.20	0
2001	FI	42.20	42.20	0
2002	HI	27.35	27.35	0
2003	HI	28.96	28.96	0
2004	HI	27.35	27.35	0
2005	HI	27.35	27.35	0
2006	HI	27.35	27.35	0

**Table 3:** Tax rates on dividends and capital gains for corporate shareholders FI: Full imputation system, HI: Half-income system.

If corporations are the dominant shareholder, then there is no tax advantage of cap-

ital gains (share buybacks) over dividends.<sup>16</sup> This result implies that the stock price reaction between the two samples should not differ significantly.

**H2.3: The abnormal return does not differ significantly between the two samples (imputation system versus half income system) if corporations are the dominant shareholders.**

### **2.3 Alternative measures for tax effects**

Tax effects are measured directly by tax variable dummies and, indirectly, through proxy variables. The proxy variables are the adjusted dividend and the dividend yield.

Hypothesis H3 approves the relationship between the abnormal return and the adjusted dividend payment in the event window. If there is a substitution effect, then the abnormal returns should decrease with an increasing adjusted dividend. Higher dividend payments reduce the potential for prospective share buybacks. If share buybacks are used as complements, then the abnormal returns should increase with an increasing adjusted dividend.

**H3: An increasing dividend influences the share price reaction in the event window (substitution versus complement hypothesis).**

Apart from the substitution effect, the dividend clientele effect could provide an explanatory content under a tax perspective. Corporations, which follow a high dividend yield strategy, could be dominated by shareholders with a low marginal income tax rate. If these corporations try to substitute dividends through share buybacks, their shareholders should profit less than shareholders with a high marginal income tax rate.

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<sup>16</sup>There could be different reasons to carry out share buybacks, such as changes of the capital structure or stock option plans. These reasons can lead to positive stock price reactions on the announcement day of share buybacks in spite of the tax irrelevance.

**H4: Corporations with a higher dividend yield show a lower share price reaction in the event window.**

## 3 Sample and data description

### 3.1 Data base

Electronically distributed ad hoc announcements serve as the data base to identify share buyback announcements.<sup>17</sup> The time frame investigated starts on 1 May 1998 and ends on 31 December 2006. 418 ad hoc announcements of 244 German CDAX companies have been identified.<sup>18</sup>

Stock returns on a daily basis were calculated by using data obtained from the Datastream data base by Thomson Financial.<sup>19</sup> The Datastream data base also provides dividends per share, the market value and the index membership to the “New Market Index“ of all companies in the investigated sample. The shareholder structure is taken from the Hoppenstedt Aktienführer.

### 3.2 Selection criteria

Table 4 shows the process of adjusting the data for our analysis:

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<sup>17</sup>The following data bases are searched for ad hoc announcements of companies which are listed on the stock exchange: Deutsche Gesellschaft für Ad-hoc Mitteilungen ([www.dgap.de](http://www.dgap.de)), Hugin ([www.huginonline.de](http://www.huginonline.de)), Euro adhoc Portal ([www.euroadhoc.com](http://www.euroadhoc.com)).

<sup>18</sup>Companies which were not listed on the CDAX at the time of announcement were excluded from the analysis. CDAX measures the development of the German stock market. Companies which are traded at the over-the-counter market are excluded. See Deutsche Börse (2007a), p. 9.

<sup>19</sup>The share prices are adapted to the Return Index. The Return Index adjusts for dividends and capital changes and uses the (Xetra) closing prices of the respective domain stock exchange. For better comparability the CDAX Performance index, based on the closing prices of the domain stock exchange, is used to calculate the market rate of return.

<b>Data Adjustments</b>	<b>Number of Announcements</b>
starting point	418
preferred stocks	3
unknown event date	-33
sec. 71 subsec. 1 nr. 1-7 AktG	-3
“contaminated“ ad hocs	-50
overlapping ad hocs	-16
over-the-counter trading	-5
missing data for estimation period	-7
Total	307

**Table 4:** Data adjustment.

Starting point of the analysis are 418 ad hoc announcements.<sup>20</sup> Our own investigation must be reduced by three announcements which lead to a stock repurchase according to sec. 71 subsec. 1 nr. 1-7 AktG.<sup>21</sup> Five announcements are excluded because companies are traded over the counter. Ad hoc announcements for common and preferred stock are considered twice in the investigation. This increases our own dataset by three ad hoc announcements. Since it was not possible to identify the exact date for 33 ad hoc announcements these were eliminated. 50 ad hoc announcements containing additional information for the capital market besides the stock repurchase announcement are eliminated, because market reactions may not result from the share buyback announcements only.<sup>22</sup> 16 announcements which overlap in the event window are deleted to guarantee that the calculated returns in the event window are not biased by additional occurrences. 7 announcements are deleted because return data are missing for the total estimation period. The final dataset consists of a total of 307 ad hoc announcements.

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<sup>20</sup>153 of these announcements are based upon our own investigation for the time period between 1 April 2003 and 31 December 2006. 265 ad hoc announcements are based upon a data base used in Pertlwieser (2006) for the time between 1 May 1998 and 31 March 2003.

<sup>21</sup>An adjustment for ad hoc announcements according to sec. 71 subsec. 1 nr. 1-7 AktG is necessary because those share buybacks relate to non-payout policy conditions.

<sup>22</sup>Additional information could be: suggestions to raise dividends, change of managing board or supervisory board, business year forecasts or purchase of business units.

### 3.3 Methodology

In order to analyse the hypotheses from section 2, an event study is applied to quantify the capital market reaction to stock repurchase announcements.<sup>23</sup>

First, we model the returns for the estimation window which is defined as the return that would be expected if the event did not take place. Second, we calculate the deviation of the actual return from the expected return, and the so-called abnormal return is tested for significance. If the abnormal return differs significantly from the expected return at the time of the event (stock repurchase announcement), then the announcement contains relevant information for the stock market. Then we investigate whether the abnormal return changes significantly as the full imputation system is replaced by the half-income system.

The market model<sup>24</sup> is estimated by calculating the alpha and beta factor for the estimation window and serves to model the expected return of the event window:

$$R_{it} = \alpha_i + \beta_i \cdot R_{mt} + \epsilon_{it}, \quad (1)$$

$$E(\epsilon_{it}) = 0, Var(\epsilon_{it}) = \sigma^2. \quad (2)$$

The deviation between the realized return  $R_{it}$  and the expected return  $\hat{\alpha}_i + \hat{\beta}_i \cdot R_{mt}$  is defined as the abnormal return:

$$AR_{it} = R_{it} - \hat{\alpha}_i - \hat{\beta}_i \cdot R_{mt}. \quad (3)$$

$R_{it}$  is the logarithmic return of security  $i$  on day  $t$ , whereas  $R_{mt}$  is the logarithmic return of the CDAX performance index on day  $t$ .  $\alpha_i$  und  $\beta_i$  are the estimating parameters of

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<sup>23</sup>See Schremper (2002), p. 123–130.

<sup>24</sup>See MacKinlay (1997), p. 18.

the market model, which are calculated according to formula (1) for a 125-days window from  $-145$  to  $-21$  days by applying the least squares method and  $\epsilon_{it}$  is the error term of security  $i$  on day  $t$ . The market model assumes a linear timely uncorrelated relationship between the market return and the security return and a normal distribution of the abnormal returns with a zero conditional mean.<sup>25</sup>

The calculated daily abnormal returns for each security  $i$  ( $AR_{it}$ ) from a sample with  $N$  events are aggregated for every day of the event window to derive an average abnormal return ( $AAR_t$ ):

$$AAR_t = \frac{1}{N} \sum_{i=1}^N AR_{it} \quad \text{with } t = -20, \dots, 20. \quad (4)$$

To draw conclusions concerning a longer period of time we aggregate the daily abnormal returns of every security  $i$  ( $AR_{it}$ ) for the event windows before  $[-20; -2]$ , during  $[-1; 1]$ , and after  $[2; 20]$  the announcement. This leads to cumulated abnormal returns ( $CAR_i(t_1; t_2)$ ) of security  $i$  for the respective periods from  $t_1$  to  $t_2$ . For the average cumulated abnormal return we have<sup>26</sup>:

$$\overline{CAR(t_1; t_2)} = \frac{1}{N} \sum_{i=1}^N CAR_i(t_1; t_2). \quad (5)$$

We use the two-sided t-test and the Wilcoxon rank sum test for testing the hypotheses. The t-test is based on the assumption of a normal distribution which could be contradicted. Thus, the Wilcoxon rank sum test<sup>27</sup> is used to check the test statistic.

In the course of univariate statistics we derive abnormal returns. In the multivariate statistics we explain their influencing factors – especially tax aspects – by applying a regression analysis. As a first explanatory variable we introduce the  $Sys_t$  dummy

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<sup>25</sup>See Campbell / Lo / MacKinlay (1997), p. 151–155.

<sup>26</sup>An alternative aggregation is to aggregate the average abnormal returns  $AAR_t$ . Both methods differ by the variance. See Campbell / Lo / MacKinlay (1997), p. 160 ff.

<sup>27</sup>The Wilcoxon rank sum test is a non-parametric test which can also be used for small samples since it is not based on any particular distribution.



variable. This variable divides the whole observation period into a period under the full imputation system (1 May 1998 to 31 December 2001) and into a period under the half income system (1 January 2002 to 31 December 2006).

In a further model alternative dummy variables ( $NonSubSys_{i,t}$ ,  $SubSys_{i,t}$  and  $CorpSys_{i,t}$ ) are used to test hypotheses H2.1 to H2.3. For example, the dummy variable  $NonSubSys_{i,t}$  has a value of one if non-substantial interest shareholders dominate the corporation (at least 50% share property) and the share buyback announcement was made under the full imputation system. Otherwise the dummy variable has a value of zero. For the dummy variables  $SubSys_{i,t}$  and  $CorpSys_{i,t}$  the dominant shareholders change.

We also include dividend per share  $DPS_{i,t}$  as another tax proxy in the regression. It serves as a further estimator of possible substitution effects between dividends and stock repurchases. A next tax relevant variable which is integrated in the regression model is the dividend yield per share  $DivY_{i,t}$ . It is used to show a possible dividend clientele effect.

As control variables we include the fraction of non-substantial ownership in percent. Further we include the company size to control for the signalling hypothesis. Small companies are expected to have a higher information asymmetry between investors and management.<sup>28</sup> Investors from companies with low growth rates and high cash flows should profit stronger from share buyback programs, because non-profitable investments are prevented. To control for this argument, we integrate the net operating cash flows ( $NOCF_{i,t}$ ) and the price-to-book-ratio ( $PBRatio_{i,t}$ ) in our model. Further, share buybacks can be used to change the capital structure of an company. The optimization of the capital structure could lead to lower weighted costs of capital.<sup>29</sup> To control for this effect the leverage ratio ( $Lev_{i,t}$ ) is included into the regression. Further, a dummy

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<sup>28</sup>See Vermaelen (1981), p. 164.

<sup>29</sup>See Schremper (2003), p. 593–597.

variable for bull and bear markets, and a dummy variable for an index membership in the “New Market Index“, which was established in 1998 and closed on 5 June 2003 is integrated in the regression. The observation period was dominated from a rising (bull market) and falling stock market (bear market). The perception of investors can be influenced by different market situations.<sup>30</sup> We use the control variable “ $NewM_{i,t}$ “ to detect companies listed on the “New Market Index“. Thereby we can figure out the influence of the market segmentation on the results.<sup>31</sup>

An overview of the regression variables is given in table 12 in the appendix.

The regression equations used are estimated according to the method of ordinary least squares. We adjust standard errors according to White (1980).

## 4 Results

### 4.1 Descriptive Statistics

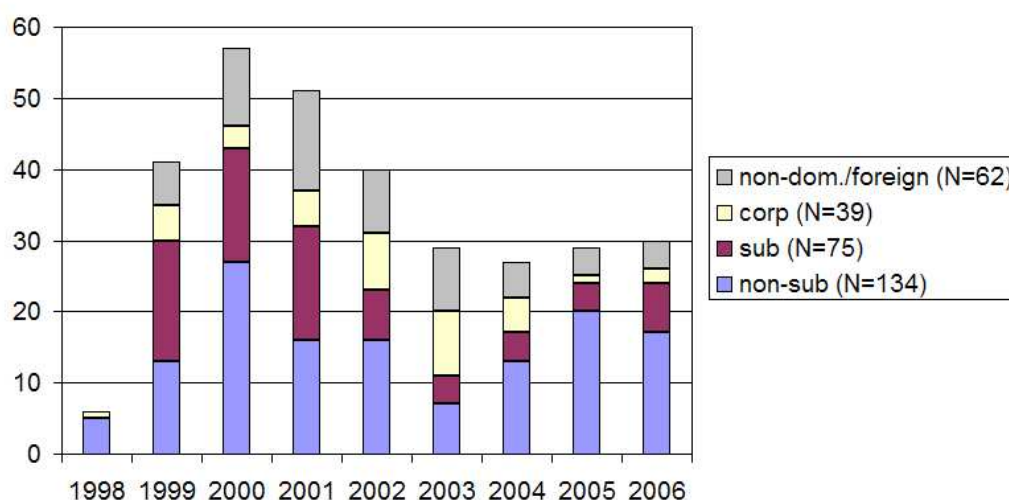
Figure 1 shows the number of share buyback announcements depending on the dominant shareholder group.

In the whole time period, except for the year 2003, corporations dominated by non-substantial interest shareholders announce the majority of share buybacks (43,22%). Under the full imputation system (1998 to 2001) we observe higher amounts of share buyback announcements (average per year: 38,75) in comparison to the time period under the half income system (average per year: 31). Corporations with non-substantial interest shareholders have higher numbers of share buyback announcements under the full imputation system (average per year: 15,25) than under the half income system

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<sup>30</sup>See Gombola / Liu (1993).

<sup>31</sup>For univariate statistics Gerke et al. (2003) carried out different results ( $AAR_t$ ) for different market segments at the announcement days, see Gerke / Fischer / Langer (2003).



**Figure 1:** Numbers of share buyback announcements depending on shareholder structure.

(average per year: 14,6).

## 4.2 Univariate statistics

Table 5 shows the results for the total time period considered:

time period	$\overline{CAR(t_1; t_2)} / AAR_t$	t-value	z-value
-1	-0.012%	-0.06	-0.50
0	4.595%***	12.75	12.64
1	0.383%	1.59	1.49
-20 to -2	-3.578%***	-3.75	-4.21
2 to 20	0.981%	1.25	1.38
-1 to 1	4.966%***	10.98	10.44

*Notation:* t- and z-values are significant with 1.65, 1.96 and 2.58 to the 10%-(\*), 5%-(\*\*) and 1%-(\*\*\*) level of significance.

**Table 5:** Average abnormal return ( $AAR_t$ ) and cumulated average abnormal return  $\overline{CAR(t_1; t_2)}$  for the whole observation period.

The first column of table 5 shows the average abnormal return ( $AAR_t$ ) one day before

$[-1]$ , on the event day  $[0]$  and on the day after the event  $[1]$ . The values  $[-20;-2]$  and  $[2; 20]$  represent the time period before and after the event day. For this time period we calculate the cumulated average abnormal return  $\overline{CAR}(t_1; t_2)$ . The second and third columns display the t-value and the z-value of the Wilcoxon signed-rank test.

We find a significantly negative abnormal share price development of  $-3.578\%$  for the time period  $[-20;2]$ . Corporate managers tend to announce share buybacks especially after a significant decline of share prices. A possible explanation for the announcement could be undervaluation perceived by the management (signaling). On the day prior to the announcement  $[-1]$  there is no significant positive abnormal return. Thus, insider trading before the stock repurchase announcement is unlikely. On the announcement day we find a significantly positive price jump of  $4.595\%$ . The announcement is judged positive by the stock market.

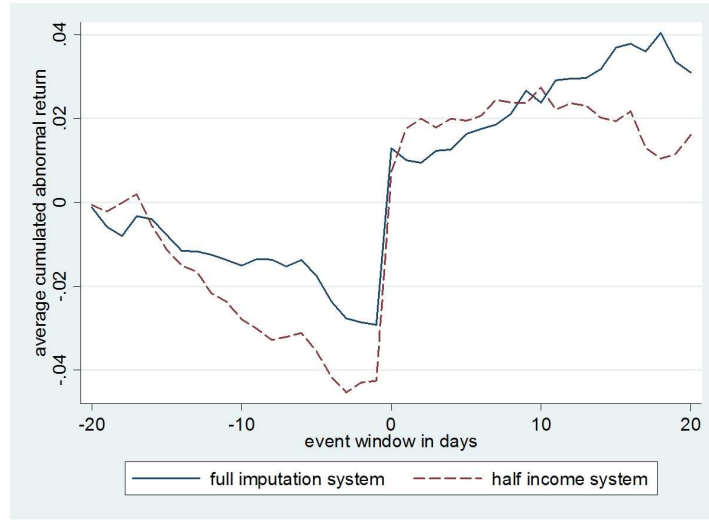
As a result we find evidence supporting the alternative hypothesis H1. The stock repurchase announcement contains relevant information for the stock market.

The considered sample of the total time period is divided into two subsamples with differing time periods. The first subsample serves to investigate share price reactions to announcements at the time of the full imputation system. The second subsample looks at share price reactions when the half-income system is applied.

Table 10 in the appendix shows the results for the two samples. Figure 2 displays the results graphically.

Figure 2 demonstrates that on the announcement day share price reactions are higher under the full imputation system ( $4.977\%$  vs.  $4.210\%$ ). However, the difference between the two samples is not significant.

Looking at the average cumulated abnormal return over  $[-1;1]$  as opposed to the average abnormal return on the event day we observe a significant difference between the full imputation system and the half income system. The average cumulated abnormal



**Figure 2:** History of the average cumulated abnormal return  $\overline{CAR}(t_1; t_2)$ , separated by the tax regime.

return under the full imputation system is 6.068%. For the same time period  $[-1;1]$  it is 3.856% under the half-income system. We can conclude that the average cumulated abnormal return  $[-1;1]$  differs significantly between the full imputation system and the half-income system.<sup>32</sup> The alternative hypothesis 2, measured by the cumulated abnormal returns  $[-1;1]$ , is supported in the univariate statistics. Considering the whole sample investors seem to anticipate tax differences.

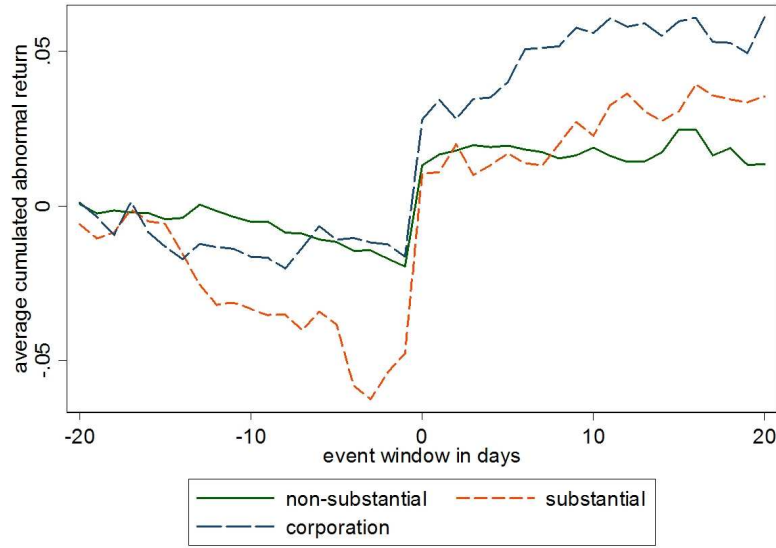
Nevertheless, the presented results for the total sample could be influenced substantially by different shareholder structures of the firm. The different tax treatment of shareholder groups could bias the share price reactions.

For the investigation of the alternative hypotheses H2.1 to H2.3 we divide the total sample into three portfolios. Portfolio 1 contains the ad hoc announcements of companies with at least 50% shareholders with non-substantial interest. Portfolio 2 consists of companies which are dominated by shareholders of substantial interest with at least

<sup>32</sup>This conclusion is based on the t-test as well as on the Wilcoxon signed-rank test which is not based on any particular distribution and does not overweight outliers.

50% of the votes. Companies in portfolio 3 are dominated by corporations with at least 50% of the votes.

Figure 3 shows the development of the average cumulated abnormal returns  $\overline{CAR}(t_1; t_2)$  for each shareholder group over time.



**Figure 3:** History of the average cumulated abnormal return  $\overline{CAR}(t_1; t_2)$  for the whole observation period, separated shareholder groups.

Table 11 in the appendix displays the average abnormal returns ( $AAR_t$ ) and the average cumulated abnormal returns  $\overline{CAR}[-1; 1]$  for all three portfolios for the total time period considered.

On the event day  $[0]$  ad hoc announcements of companies with shareholders of substantial interest show the most significant share price reactions of  $AAR_0 = 5.836\%$ . Regarding the average cumulated abnormal return  $[-1; 1]$  the share price reaction increases to significant  $6.475\%$ . In contrast, companies with shareholders of non-substantial interest display a significant abnormal return of  $3.308\%$  on the day of the announcement and an average cumulated abnormal return of  $3.377\%$  over  $[-1; 1]$ . For companies with mainly corporate shareholders the average abnormal return is  $4.443\%$  on the event day.

The average cumulated abnormal return over  $[-1; 1]$  is 4.679% for this portfolio.

From a tax perspective one would expect share price reactions to be the highest for companies with mainly shareholders with non-substantial interest since the shareholders of these companies profit most from realizing capital gains. One would also expect share price reactions to be lower for companies with mainly shareholders with substantial interest since these shareholders profit less in comparison to shareholders with non-substantial interest. This argument applies even more for corporate shareholders. From a tax perspective corporations have no tax advantage for capital gains over dividends. The share price reaction is expected to be the lowest if corporations are dominant shareholders.

A possible explanation for these results can be found in the signaling theory. Ad hoc announcements by companies with mostly shareholders of substantial interest display the highest abnormal negative share price development. Due to the corporate governance structure information policy could be worse and information asymmetry larger in the case of dominating shareholders with substantial interest. The reduction of increased information asymmetry could lead to higher price reactions on the announcement day.

Another possible explanation for the results is liquidity and trading volume of the share. Shares with a high stake of non-substantial shareholders are more frequently traded than shares with a low stake. High liquidity could lead to lower price reactions due to better information processing as opposed to shares with lower liquidity.

For testing the hypotheses H2.1 to H2.3 it is necessary to divide the portfolios into two time periods: the full imputation and the half income system.

Table 6 shows the average abnormal returns and the cumulated average returns  $[-1; 1]$  for the full imputation and the half income system regarding companies dominated by shareholders with non-substantial interest.

From table 6 we can see the significantly positive price reaction on the event day which

time	FI (N=63)			HI (N=75)			Difference	
	$\overline{CAR}$ / $AAR_t$	t value	z value	$\overline{CAR}$ / $AAR_t$	t value	z value	t value	z value
-1	-0.325%	-0.820	-0.815	-0.171%	-0.735	-0.544	0.332	0.317
0	3.483%***	8.401	6.490	3.160%***	6.507	5.856	-0.506	-1.019
1	1.231%***	2.813	2.561	-0.439%	-1.364	-1.548	-3.028	-2.786
-1 to +1	4.400%***	4.950	4.945	2.521%***	4.162	3.450	-1.720	-1.521

Notation: t- and z-values are significant with 1.65, 1.96 and 2.58 to the 10%-(\*), 5%-(\*\*) and 1%-(\*\*\*) level of significance.

**Table 6:** Average abnormal return  $AAR_t$  and average cumulated abnormal return  $\overline{CAR}(-1; 1)$  for individuals with non-substantial interest as shareholders, separated by the tax regime.

is 3.483% under the full imputation system (FI) and 3.160% under the half income system (HI). From the t- and z-values we know that the two samples do not differ significantly. Nevertheless we find a significant difference between the two samples one day after the announcement day [+1].  $AAR_1$  takes on significant 1.231% under FI and insignificant -0.439% under HI. The distributions of abnormal returns on the day after the event also differ significantly. If we calculate the cumulated average abnormal return for [-1;1] we get a significant value of 4.400% under FI and a significant result of 2.521% under HI. The distribution of the cumulated abnormal returns between the two samples is only weakly significant according to the t-value but not the z-value.

Table 7 displays the average abnormal return  $AAR_t$  and the average cumulated abnormal return  $\overline{CAR}(-1; 1)$  under the full imputation and the half income system for companies with dominating shareholders of substantial interest:

The difference of  $\overline{CAR}[-1; +1]$  between full imputation and half income system is significant, which supports hypothesis H2. As a result, tax aspects seem to play a role in this portfolio.

Table 9 shows the average abnormal return  $AAR_t$  and the average cumulated abnormal return  $\overline{CAR}(-1; 1)$  for companies dominated by corporations under the full imputation and the half income system.



time	FI (N=49)			HI (N=26)			Difference	
	$\overline{CAR}$ / $AAR_t$	t value	z value	$\overline{CAR}$ / $AAR_t$	t value	z value	t value	z value
-1	1.211% *	1.652	1.726	-0.566%	-0.662	-0.648	-1.577	-1.492
0	5.830%***	5.161	4.690	5.847%***	5.146	4.077	0.011	0.356
1	1.127%	1.173	1.318	-1.997%*	-2.301	-1.765	-2.413	-2.215
-1 to +1	8.168%***	5.129	4.945	3.284%**	1.973	3.450	-2.120	-1.815

Notation: t- and z-values are significant with 1.65, 1.96 and 2.58 to the 10%-(\*), 5%-(\*\*) and 1%-(\*\*\*) level of significance.

**Table 7:** Average abnormal return  $AAR_t$  and average cumulated abnormal return  $\overline{CAR}(-1; 1)$  for individuals with substantial interest as shareholders, separated by the tax regime.

time	FI (N=14)			HI (N=25)			Difference	
	$\overline{CAR}$ / $AAR_t$	t value	z value	$\overline{CAR}$ / $AAR_t$	t value	z value	t value	z value
-1	-1.684%*	-1.965	-1.161	0.327%	0.634	-0.525	1.601	0.937
0	3.999%***	3.934	2.668	4.692%**	2.553	3.162	0.303	0.966
1	0.548%	1.663	0.973	0.677%	0.740	0.229	0.128	-0.615
-1 to +1	2.862%**	2.682	2.103	5.696%***	2.987	3.081	1.190	1.083

Notation: t- and z-values are significant with 1.65, 1.96 and 2.58 to the 10%-(\*), 5%-(\*\*) and 1%-(\*\*\*) level of significance.

**Table 8:** Average abnormal return  $AAR_t$  and average cumulated abnormal return  $\overline{CAR}(-1; 1)$  for corporations as shareholders, separated by the tax regime.

Share buybacks have no advantages over dividends for corporations as shareholders. This is true for FI and HI. Therefore, we do not expect differing price reactions between HI and FI according to the alternative hypothesis H2.3. Considering the results from table 9 we can find no significant differences regarding the distribution of abnormal returns on the event day [0].

Note that the small sample size reduces the significance of the results for portfolios with substantial interest and corporations. Nevertheless, if we combined the two portfolios we could not validate the hypotheses which were developed on the basis of our calculations. This is why significance could only be increased and standard errors decreased

by larger samples which can be obtained in the future.

### 4.3 Multivariate Statistics

In this section a regression analysis is used to isolate the tax effects on the average cumulated abnormal return  $[-1; 1]$ . In regression (1) the switch of the tax regime from the imputation system to the half income system is integrated with a dummy variable ( $Sys_t$ ). Alternatively, in regression (2) the dummy variable ( $Sys_t$ ) is removed and replaced by the the dummy variables “ $NonSubSys_{i,t}$ “, “ $SubSys_{i,t}$ “ and “ $CorpSys_{i,t}$ “, defined in section 3.3. These dummy variables are necessary to test hypotheses H2.1 to H2.3.

As additional explanatory variables for the substitution effect the adjusted dividend per share ( $DPS_{i,t}$ ) and the dividend yield ( $DivY_{i,t}$ ) on the announcement day of the share buyback is used. As control variables the company size ( $Size_{i,t}$ ), the Net Operating Cash Flows ( $NOCF_{i,t}$ ), the Price-Book-Ratio ( $PBRatio_{i,t}$ ), the Leverage Ratio ( $Lev_{i,t}$ ), the cumulated abnormal returns ( $CAR[-20; -2]_{i,t}$ ), a dummy variable controlling for bull and bear markets ( $StockEx_t$ ), and a dummy variable controlling for “New Market“ ( $NewM_{i,t}$ ) companies is used.<sup>33</sup> The variable  $\epsilon_i$  is the residual.

Formally, regression model 1 is estimated:

$$\begin{aligned} CAR_i[-1; 1] = & \alpha + \beta_1 \cdot Sys_t + \beta_2 \cdot NonSub_{i,t} + \beta_3 \cdot DPS_{i,t} \\ & + \beta_4 \cdot DivY_{i,t} + \beta_5 \cdot Size_{i,t} + \beta_6 \cdot NOCF_{i,t} + \beta_7 \cdot PBRatio_{i,t} \\ & + \beta_8 \cdot Lev + \beta_9 \cdot CAR_{i,[-20;-2]} + \beta_{10} \cdot StockEx_t + \beta_{11} \cdot NewM_{i,t} + \epsilon_i. \end{aligned} \quad (6)$$

In regression model 2 three dummy variables ( $NonSubSys_{i,t}$ ,  $SubSys_{i,t}$ ,  $CorpSys_{i,t}$ ) are

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<sup>33</sup>The details of the definitions of these variables are explained in section 3.3.

integrated to test hypothesis H2.1 to H2.3. Because of multicollinearity the tax system dummy variable ( $Sys_t$ ) and the variable, controlling for non-substantial shareholders ( $NonSub_{i,t}$ ), are eliminated. Formally, regression model (2) has the following equation:

$$\begin{aligned} CAR_i[-1; 1] = & \alpha + \beta_1 \cdot NonSubSys_{i,t} + \beta_2 \cdot SubSys_{i,t} + \beta_3 \cdot CorpSys_{i,t} \\ & + \beta_4 \cdot DPS_{i,t} + \beta_5 \cdot DivY_{i,t} + \beta_6 \cdot Size_{i,t} + \beta_7 \cdot NOCF_{i,t} + \beta_8 \cdot PBRatio_{i,t} \quad (7) \\ & + \beta_9 \cdot Lev_{i,t} + \beta_{10} \cdot CAR_{i,[-20;-2]} + \beta_{11} \cdot StockEx_t + \beta_{12} \cdot NewM_{i,t} + \epsilon_i. \end{aligned}$$

Table 9 shows the results of the estimated regression model 1 and 2 for the whole observation period (1 May 1998 to 31 December 2006):

The explanatory power of both regression models 1 and 2 is rather limited ( $R^2=16.46\%$  and  $R^2=15.72\%$ ). Nevertheless, the estimated regression explains the tax influence on the cumulated abnormal return ( $CAR[-1; 1]$ ). The coefficient of the tax system variable  $Sys_t$  is significantly positive. The cumulated average abnormal return ( $CAR[-1; 1]$ ) is significantly higher (2.04%) under the imputation system in comparison to the half-income system. The alternative hypothesis H2 is also supported in the multivariate setting. The coefficient of the fraction of non-substantial interest shareholders ( $NonSub_{i,t}$ ) is very small and not significant. In regression 1 we could not find evidence that an increasing fraction of non-substantial interest shareholders leads to higher share price reactions. In regression (2) we test hypotheses H2.1 to H2.3. The signs of all three dummy variables ( $NonSubSys_{i,t}$ ,  $SubSys_{i,t}$  and  $CorpSys_{i,t}$ ) are positive as we expect, but the results are insignificant. This means, hypothesis H2.1 and H2.2 are not supported in the multivariate setting. Nevertheless, we find evidence supporting alternative hypothesis H2.3, because the different price reactions between the full imputation system and the half income system are not significant, as we expected. This means, corporations which are dominated by corporate shareholders show similar price

Variable	Regression (1)		Regression (2)	
	Coefficient	t value	Coefficient	t value
<i>Sys</i>	0.02038**	2.34	—	—
<i>Non-Sub</i>	−0.00002	−0.14	—	—
<i>NonSubSys</i>	—	—	0.00872	0.81
<i>SubSys</i>	—	—	0.02235	1.51
<i>CorpSys</i>	—	—	0.01988	0.96
<i>DPS</i>	−0.00478**	−2.41	−0.00429**	−2.37
<i>DivY</i>	−0.36880*	−1.83	−0.29684	−1.56
<i>Size</i>	−0.00340**	−1.99	−0.00368**	−2.14
<i>NOCF</i>	0.00402***	2.85	0.00356**	2.26
<i>PB-Ratio</i>	−0.00120	−0.80	−0.00080	−0.53
<i>Lev</i>	0.00000	0.73	0.00000	0.80
<i>BHAR[−20;−2]</i>	−0.08200	−1.55	−0.08239	−1.62
<i>StockEx</i>	−0.02055**	−2.34	−0.02360***	−2.71
<i>NewM</i>	0.02478	1.58	0.02401	1.49
<i>Intercept</i>	0.07018***	3.88	0.07367***	4.60
N	249		256	
R <sup>2</sup>	0.16458		0.15717	
F <sub>(11,237)</sub>	3.72291		F <sub>(12,243)</sub>	3.4022
Significance levels	* 10%	** 5%	*** 1%	

**Table 9:** Regression results for Regression model 1 and 2.

*Annotation:* Because of heteroskedasticity we corrected the standard errors in model (1) and (2) according to White (1980). We checked for multicollinearity by calculating the Pearson-correlation matrix and the variance inflation factors (largest VIF: 1.31 in model (1) and 1.32 in model (2)). The values are in an acceptable range. Because of the sample size we decided us for a cross-section regression analysis. Therefore we did not check for autocorrelation.

reactions under the full imputation system as under the half income system.<sup>34</sup>

The coefficient of the adjusted dividend per share ( $DPS_{i,t}$ ) and the significant impact serve as evidence supporting the substitution hypothesis. Companies with higher dividend payments have a lower potential for further share buybacks. Therefore, the value of share buybacks decreases for investors, which induces smaller share price reactions. We also find evidence for the dividend clientele effect. Higher dividend yields lead to smaller share price reactions (significant in model 1, but not significant in model 2), because companies with a high dividend yield are dominated by investors with a low marginal income tax rate. The control variable “ $Size_{i,t}$ ” affects the cumulated abnormal return  $[-1; 1]$ . An increasing company size leads to significantly lower share price reactions in regression 1 and 2. This result is a further evidence for the signalling hypothesis.<sup>35</sup> The coefficient of the variable “ $NOCF_{i,t}$ ” is positively significant at the 1% level in model 1 and 2. Investors prefer companies which reduce liquidity by buying back shares (Free Cash flow Hypothesis). The coefficient of the dummy variable for the bull and bear markets  $StockEx_t$  shows a significantly lower share price reaction (2.05% in model 1 and 2.36% in model 2) in an increasing stock market compared to a decreasing stock market. The investors sentiment change with the market situation.

## 5 Conclusion

From a tax perspective, share buybacks have a tax advantage over cash dividends. It can be shown that the change of the tax system on 1 January 2002 has a significant

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<sup>34</sup>Alternatively to the regression models 1 and 2, the switch of the tax regime in 2002 can be analysed by integrating the shareholder structure into artificially generated tax variables. The *Tax-1* variable uses the tax advantage (capital gains over dividend taxation) of the dominant shareholder group. In contrast, the *Tax-2* variable weights the tax advantage with the shareholder structure. The coefficients of the *Tax-1* and *Tax-2* variables in the regression models are positive but they are not significant. The result do not support the hypotheses that a higher tax advantage of capital gains over dividends should lead to higher share price reactions (hypotheses H2.1 to H2.3).

<sup>35</sup>See Vermaelen (1981), p. 164.

influence on the share price reaction on the announcement day of share buybacks. We observe a significantly higher share price reaction under the full imputation system in comparison to the half income system. This result is consistent with our predictions. Due to the tax reform 2002 the relative tax advantage of capital gains over dividends decreased.

In a second step we created portfolios consisting of different shareholder groups with different tax characteristics. As a result, companies which are dominated by individual shareholders with substantial interest show the highest significant share price reaction. The portfolio, which is dominated by non-substantial shareholders shows the lowest significant share price reaction. This result contradicts our prediction, because the tax advantage of share buybacks is the highest for non-substantial shareholders. Obviously, non-tax factors dominate the price reactions on the announcement day.

Dividing the whole observation period into the full imputation system and the half income system and if we retain the created portfolios, we can show that the share price reaction for companies, which are dominated by individuals with substantial and non-substantial interest is larger under the full imputation system than under the half income system. This result is consistent with our prediction. The tax advantage for share buybacks over dividends is higher under the full imputation system.

In a third step we use a regression analysis and try to separate tax factors from non-tax factors influencing the share price reaction on the announcement day. In the multivariate setting the tax-variables support the proposition, that the share price reactions are higher under the full imputation system in comparison to the shareholder relief system. Further results support the substitution hypothesis and the dividend clientele effect. Non-tax factors, f. i. the company size and the net operating cash flows, have a strong influence on the share price reaction at the announcement day of share buybacks. These factors contribute significantly to the explanation of share buyback announcements.

## Appendix

time	FI			HI			Difference	
	$\overline{CAR}$ / $AAR_t$	t value	z value	$\overline{CAR}$ / $AAR_t$	t value	z value	t value	z value
-1	0.042%	0.120	0.084	-0.067%	-0.281	-0.832	-0.258	-0.492
0	4.977%***	9.267	9.016	4.210%***	8.774	8.795	-1.066	-0.872
1	1.049%***	2.732	3.041	-0.287%	-1.021	-1.195	-2.808	-3.097
-20 to -2	-4.297%***	-2.663	-3.464	-2.855%***	-2.808	-2.281	0.756	1.368
2 to 20	-0.328%	-0.297	-0.769	2.249%***	2.324	2.903	1.645	2.430
-1 to 1	6.068%***	8.710	8.103	3.856%***	6.841	6.542	-2.469	-1.976

*Notation:* t- and z-values are significant with 1.65, 1.96 and 2.58 to the 10%-(\*), 5%-(\*\*) and 1%-(\*\*\*) level of significance.

**Table 10:** Average abnormal returns  $AAR_t$  and average cumulated abnormal returns  $CAR(t_1; t_2)$ , separated by the tax regime.

Dominance criteria	time	$\overline{CAR}$ / $AAR_t$	t value	z value
<b>non-sub (N=138)</b>	-1	-0.239%	-1.095	-1.030
	0	3.308%***	10.21	8.749
	1	0.321%	1.173	0.601
	-1 to +1	3.377%***	6.414	5.964
<b>sub (N=75)</b>	-1	0.595%	1.046	1.072
	0	5.836%***	7.015	6.168
	1	0.044%	0.062	0.106
	-1 to +1	6.475%***	5.336	4.774
<b>corp (N=39)</b>	-1	-0.395%	-0.729	-0.949
	0	4.443%***	3.516	4.145
	1	0.631%	1.047	0.572
	-1 to +1	4.679%***	3.516	3.768

*Notation:* t- and z-values are significant with 1.65, 1.96 and 2.58 to the 10%-(\*), 5%-(\*\*) and 1%-(\*\*\*) level of significance.

**Table 11:** Average abnormal returns  $AAR_t$  and average cumulated abnormal returns  $\overline{CAR}(t_1; t_2)$ , separated by the shareholder structure for the whole observation period.



Variable	Reason	Definition	Expected Sign
$CAR_i[-1; 1]$	dependent variable	$\sum_{t=-1}^{t=1} AR_i$	n.r.
$Sys_t$	Hypothesis 2	1 FI 0 HI	+
$NonSubSys_{i,t}$	Hypothesis 2.1	1 FI and non-substantial interest 0 otherwise	+
$SubSys_{i,t}$	Hypothesis 2.2	1 FI and substantial interest 0 otherwise	+
$CorpSys_{i,t}$	Hypothesis 2.3	1 FI and corporation 0 otherwise	not sig.
$DPS_{i,t}$	Hypothesis 3	$\frac{div_{i,t}}{number\ of\ shares_{i,t}}$	+/-
$DivY_{i,t}$	Hypothesis 4	$\frac{dividend\ per\ share_{i,t}}{stock\ price_{i,t-1}}$	+/-
$NonSub$	shareholder structure	non-sub. interest shareholders (%) 0 otherwise	+
$Size_{i,t}$	Signalling	$\ln (marketvalue_{i,t})$	-
$NOCF_{i,t}$	Liquidity	$\frac{Net\ Operating\ Cash\ Flows_{i,t}}{Total\ Assets_{i,t}}$	+
$PBRatio_{i,t}$	Liquidity	$\frac{\frac{shareprice_{i,High} + shareprice_{i,Low}}{2}}{Book\ Value\ per\ Share_{i,t}}$	-
$CAR_i[-20; -2]$	Undervaluation	$\sum_{t=-20}^{t=-2} AR_i$	+
$Lev_{i,t}$	capital structure	$\frac{Book\ Value\ of\ Liabilities_{i,t}}{Book\ Value\ of\ Equity_{i,t}}$	-
$StockEx_t$	bull/bear market	1 rising stock markets 0 falling stock markets	+
$NewM_{i,t}$	Segmentation	1 for listing in „New Market“ segment 0 otherwise	+

**Table 12:** Overview of Regression Variables.

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