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Abstract

This paper re-examines the impact of the EU Market Abuse Directive (MAD) on the market reaction around share repurchase announcements. We use a unique hand-collected dataset of firms listed on the Athens Stock Exchange, and we find evidence that contrasts with previous conclusions for large European economies. The implementation of the MAD is followed by a significant increase in announcement abnormal returns, which is more pronounced in initial repurchase programs. Our results remain robust to a series of robustness tests. We attribute our findings to cross-country differences in institutional framework and pre-MAD existing national laws. Collectively, our results support the notion that EU directives do not have a uniform effect across Member States. Thus, the impact of such reforms should also be examined in individual capital market studies.

JEL classification: G14, G15, G35

Keywords: Share repurchases, Market Abuse Directive, safe harbor, signaling undervaluation.

1. Introduction

A strand of the literature on open-market share repurchases has shifted its empirical focus away from the U.S. market towards other countries with different institutional and legal characteristics. The obvious motive for the shift has been to identify factors affecting investors' reaction to buyback announcements, such as the degree of investor protection, transparency, rules of conduct, and other idiosyncrasies.[1]

The European Union is a single market comprising 28 individual states with a total GDP of €15.3 trillion ($18.4 trillion) in 2017, comparable to the US GDP of $19.4 trillion. Yet, the literature on EU open-market share repurchases is disproportionately thin, partly because of the different institutional settings in each state. The existing studies focus on large markets and point to a great diversity in terms of either repurchase explanations (Lee et al., 2010), or the effect of legislative changes on repurchases (Siems and De Cesari, 2012; Christensen et al., 2016). Thus, despite the high degree of unification in the EU, considerable disparities remain, especially in the legal and institutional framework of Member States.

There has been an ongoing effort to unify the rules governing the EU capital markets. The Market Abuse Directive 2003/6/EC (MAD) is a landmark piece of legislation which aims to harmonize securities regulations across Member States, prevent market manipulation practices, and introduce a safe harbor for share repurchases. In theory, the introduction of a safe harbor should have a positive effect on announcement abnormal returns, because a more transparent regulatory environment would enable investors to confirm whether share repurchase programs

[1] A partial literature includes: Andriosopoulos and Lasfer (2015) for France, Germany and UK; González and González (2004) for Spain; Ginglinger and L'her (2006) for France; Ikenberry et al. (2000) for Canada; Kang et al. (2011) for Japan; Otchere and Ross (2002) for Australia; Rau and Vermaelen (2002) for the UK; Von Eije and Megginson (2008) for Europe.

(SRPs) are driven by value-maximizing reasons. In practice however, empirical evidence on large European countries does not support this argument (Andriosopoulos and Lasfer, 2015). Therefore, our goal in this paper is to examine whether the MAD effect on the market reaction around SRP announcements is different in a small European economy such as Greece, and if so, why.

We focus our interest on a single country because the implementation of the MAD did not have a uniform effect across Member States. In fact, the impact of the safe harbor in each country depends on the differences between the MAD provisions and the pre-MAD existing national laws (Siems and De Cesari, 2012). In Greece, the enactment of the MAD resulted in some significant amendments of the national legislation, as it strengthened the market manipulation laws, and provided a more stringent regulatory framework for share repurchases (Drousia et al., 2019). By contrast, in France, Germany, and the UK, most of the MAD's provisions were already part of the national laws (Andriosopoulos and Lasfer, 2015). Therefore, we assume that the MAD effect, if any, should be more pronounced in Greece, which was a country with weak market manipulation regulations before the MAD's enactment.

To address our research question, we use a hand-collected dataset of 548 share repurchase programs (SRP) announcements by Greek firms. Our data sample covers the period 2000 to 2010, which is split in two roughly equal pre- and post-MAD sub-periods, as MAD was implemented in Greece in July, 2005. At the univariate level, our findings point to significant changes in market reaction after the implementation of the MAD. Over the [–1, +4] event window, SRP firms realize an average gain of 1.84% in the post-MAD period, while before the MAD, announcement abnormal returns are essentially zero. The magnitude of the differences in announcement abnormal returns between the two time periods indicates a compelling improvement in market reaction towards share repurchases announcements in Greece.

The findings of our cross-sectional regressions suggest that the positive MAD effect on announcement abnormal returns persists even when we control for any firm-specific characteristics and industry fixed effects. Furthermore, we test the validity of the two most frequently-cited explanations for initiating a repurchase program: (1) signaling undervaluation hypothesis, and (2) free cash flow hypothesis. We provide evidence consistent with the first explanation, since undervalued firms realize higher abnormal returns when they announce their intention to repurchase their shares (Peyer and Vermaelen, 2009; Manconi et al., 2019). Further, to account for any observed heterogeneity across the two time periods, we use the propensity score matching approach. We find that the post-MAD SRP firms consistently outperform their pre-MAD matches in terms of announcement abnormal returns.

We employ several robustness tests to validate our findings. First, we use the Heckman (1979) two-stage procedure, to control for the endogenous choice of firms to initiate a share repurchase. The results of this analysis complement the ones of our baseline regressions, suggesting that self-selection is not a major concern in our sample. Second, we examine whether any changes in the dividend policy may have an impact on our results. We find that the abnormal returns around the announcements of share repurchases are not influenced by any prior change in the dividend policy (either increase or decrease of the dividend). Third, we use the difference-in-differences methodology to examine whether the initial share repurchase programs realize higher announcement abnormal returns compared to subsequent programs in the post-MAD period. The intuition behind this analysis is that initial programs are considered to be more informative, and as such, their signaling effect could be higher in a more transparent environment. Our results are consistent with this prediction. Finally, we re-run our baseline regressions by excluding from the analysis the years of the financial crisis or the firms that belong in the financial sector. We also

control for the enactment of a subsequent EU directive (the Market in Financial Instruments Directive, MiFID) as in Anolick et al. (2021). In all cases, our results remain unchanged.

Our findings are important in a number of ways. First, they are important to regulators and EU policymakers, because they indicate that the "one-size-fits-all" approach of EU directives does not have a uniform effect across Member States. There are significant cross-country differences in institutional features, a fact which highlights the need to study the effect of such policies at the country level. Second, they can be of use to investors. The MAD aims to protect shareholders against share repurchases driven by value-destroying motives, such as stock price manipulation. Hence, in low investor protection countries like Greece, the adoption of a more transparent regulatory framework should motivate firms to announce SRPs for value-maximizing reasons, such as signaling undervaluation. Our results are consistent with this argument, since we document a positive and significant relationship between our measure of undervaluation and announcement abnormal returns in the post-MAD period. Finally, one interesting characteristic of the Greek market is that it is quite active in terms of SRPs. The number of share repurchases announced over our examination period is comparable, or even greater, than the ones reported in similar studies for larger European economies (Lee et al., 2010; Crawford and Wang, 2012; Andriosopoulos and Lasfer, 2015).

The rest of the paper is structured as follows. Section 2 reviews the relevant literature and analyzes the impact of the MAD on the Greek law. Section 3 describes our data collection process and summary statistics. Sections 4 and 5 present our main empirical results. Section 6 present our robustness tests. Section 7 concludes the paper.

2. Theoretical background

2.1. Share repurchase motives and announcement abnormal returns

Various hypotheses have been developed in the literature to explain the market reaction around the announcement of share repurchases.[2] Among them, the most widely cited is probably the signaling undervaluation hypothesis (Vermaelen, 1981). According to this hypothesis, firms announce share repurchase programs as a means of transmitting a signal that their shares are undervalued. Therefore, if managers believe that the economic value of the stock exceeds its market value, they can disclose this information via stock repurchases. This information signal should translate to positive announcement abnormal returns, as managers pass on their inside information to the firms' shareholders. Notably, several subsequent studies provide evidence consistent with this prediction (Asquith and Mullins, 1986; Ikenberry et al., 1995; Otchere and Ross, 2002; Brav et al., 2005; Louis and White, 2007; Bonaime et al., 2014).

In a more recent study, Manconi et al. (2019) examine a sample of share repurchase announcements around the world, and find that more undervalued firms generate higher announcement abnormal returns. To proxy for undervaluation, the authors use the U-index proposed by Peyer and Vermaelen (2009). Interestingly, the findings of the academic literature are also supported by market participants. In a large survey conducted by Brav et al. (2005), the 80% of surveyed U.S. executives stated that they announce share repurchases because they think their stock price is undervalued.

The second hypothesis that attempts to explain the market reaction around the announcement of share repurchases is the free cash flow hypothesis (Jensen, 1986). This

[2] In the literature there are many (and not necessarily mutually exclusive) motives for initiating SRPs, such as signaling undervaluation (Vermaelen, 1981), distribution of free cash flows (Jensen, 1986), dividend substitution (Grullon and Michaely, 2002), capital structure adjustment (Dittmar, 2000; Lie, 2002; Bonaime et al., 2014), option exercise in stock option plans (Fenn and Liang, 2001; Kahle, 2002; Bens et al., 2003), and takeover defense (Denis, 1990).

hypothesis is based on the rationale that managers in companies with low investment opportunities and free cash flows are likely to invest in projects that reduce firm value, a phenomenon usually referred to as "overinvestment". Therefore, when such firms use their excess cash to repurchase their shares, they are able to mitigate potential overinvestment, thereby decreasing agency costs.

Grullon and Ikenberry (2000) suggest that even if there is no agency problem, it is preferable to distribute the free cash flows to shareholders though a repurchase program, if the firm does not have profitable opportunities. The idea is that the shareholders could use this capital in other investments outside of the company. Furthermore, Grullon and Michaely (2004) argue that any agency problems related to the firms' free cash flow are more likely to arise as firms enter their maturity phase. In fact, mature firms have less investment opportunities and fewer options to grow. In this case, the firms' valuation would be based more on the firms' existing assets, which leads to a decrease in the firms' systemic risk and cost of capital. The decrease in the cost of capital should result in an increase in the free cash flows, which in turn increases the risk of overinvestment. To reduce this risk, managers of mature firms may choose to distribute cash to their shareholders than invest to projects with low or even negative net present value. Based on these arguments, firms are expected to announce more share repurchases when they move from a growth phase to a more mature phase.

Lie (2000) and Grullon and Michaely (2004) examine the market reaction around share repurchase announcements under the perspective of the free cash flow hypothesis, and find evidence consistent with Jensen's (1986) predictions. The authors document higher announcement abnormal returns for companies with excess cash and limited investment opportunities as measured by Tobin's *q*.

2.2. Regulatory framework, MAD implementation, and share repurchases

The legal framework on stock repurchases varies from country to country. For example, in France, repurchases were rare before 1998, not because the law prohibited it, but because the procedures required were deterring. In Germany, repurchases were prohibited before 1998 (Vermaelen, 2005). In the UK, repurchases have been allowed since 1981, and all shares bought had to be cancelled; however, since 2003, retention of shares has been allowed for the purpose of sale, distribution to personnel or cancelling. In Greece, stock repurchases have been allowed since 1993. Acquired shares can be resold to the public, distributed to personnel, or canceled within three years. In contrast to the U.S., where buyback decisions are made by the board of directors, SRPs in Greece are authorized by shareholder meetings, and all SRP-related information must be posted on the Daily Official List of the Athens Stock Exchange (ASE), notwithstanding prompt publication on the companies' website and other networks (Drousia et al., 2019).[3]

The European Parliament Directives aim at harmonizing market rules across member states. On January 28, 2003, the European Parliament and the Council of the European Union introduced the EU Market Abuse Directive 2003/6/EC (MAD). The aim of this legislation was to prohibit firms and investors from market manipulation. For instance, Article 2 of the MAD prohibits individuals who possess confidential information from using such information to acquire or sell financial instruments on their own behalf or on behalf of others. Following the adoption of the MAD, the European Commission passed a regulation on share repurchases (Regulation 2273/2003 of the European Parliament). This regulation was simultaneously adopted with the MAD by Member States, and provides a safe harbor for repurchasing stocks. In brief, it specifies the conditions to be met by buyback programs, including the aims of the stock repurchase

[3] Shareholder meeting approval is required in most developed European economies (Manconi et al., 2019).

programs, the repurchase price range, the volume of daily transactions, and disclosure requirements. In Greece, the MAD was implemented in July 2005 in accordance with the Greek Law 3340/2005.

Siems and De Cesari (2012) report that when companies carry out SRPs in line with the European directives, they are protected from possible penalties that could result from market manipulation. Therefore, the adoption of the MAD should lessen some companies' reluctance to buy back stock. Indeed, in studying nine European countries, they find that the proportion of companies that repurchase shares increases after the MAD enactment. Their results agree with those of Grullon and Michaely (2002) in the U.S., who find that the SEC Rule 10b-18 has led to a significant increase in the volume of repurchases.

Evidence on the impact of the MAD on the market reaction around SRP announcement is rather ambiguous. Andriosopoulos and Lasfer (2015) examine announcement abnormal returns for SRP both before and after the adoption of the MAD, using data from France, Germany, and the UK. Their univariate results differ across countries, however, regression results for the whole sample indicate that the EU legislation had an insignificant impact on announcement abnormal returns. A possible explanation for this finding is that any MAD impact would depend on the pre-MAD national laws of these countries (Siems and De Cesari, 2012). In comparison with Greece, these major European economies have more developed stock markets and stricter investor protection laws. Hence, it is less likely that the adoption of the safe harbor applied any significant changes in the way markets react to SRP announcements in France, Germany, and the UK. In our view, this difference in the pre-MAD national laws across Member States is what makes Greece an interesting case to examine.

2.3 The MAD amendments on the Greek law

In this section, we will briefly discuss the impact of the MAD on the Greek law regarding market manipulation and share repurchases. More specifically, we attempt to answer the following two questions: (1) was market manipulation prohibited by Greek law before the implementation of the MAD, and (2) were there any legal provisions specifying a "safe harbor" under the pre-MAD law?

First, as stated by the Hellenic Capital Market Commission (HCMC), the pre-MAD law did not include specific provisions on market manipulation, as defined by the MAD.[4] The most relevant provision of the pre-MAD law is included in the Article 72 of Law 1969/91. According to this Article, it is prohibited to natural or legal persons to convey any false or inaccurate information that can influence the stock price of a listed firm. However, the MAD introduces a stricter set of provisions for Greek firms with regards to market manipulation. More precisely, in line with the MAD, managers (and their relatives), members of the board of directors, auditors, as well as any other executive officer of a company that has access to privileged (inside) information should notify the company for any transactions effected on their behalf that are related to the shares of the company. Then, the company should notify the HCMC and publish the relevant information for the transaction in the next working day. In addition, pursuant to the MAD, Greek listed companies should announce for publication to the Athens Stock Exchange all inside information related to corporate events, such as tender offers, dividend distributions, or share repurchases. Finally, listed firms are also required to publish detailed information regarding leaks related to their business activities or corporate events.

Second, any pre-MAD provisions directly related to share repurchases were less stringent compared to the "safe harbor" introduced by the MAD. In detail, the Presidential Decree 14/1993,

[4] See the Appendix of Siems and De Cesari (2012). The authors had sent a questionnaire to the HCMC regarding market manipulation regulations and safe harbor provisions for stock repurchases in Greece.

which amended the corporation law 2190/1920, provided a general guideline for repurchasing firms. More specifically, it stated that a company traded in the ASE has the right to initiate a share repurchase program up to 10% of its market value, in order to support its market price. However, under the MAD, Greek firms have to comply with a stricter set of conditions in order to initiate a share repurchase program. According to the Regulation 2273/2003 of the European Parliament, a share repurchase program should only be allowed if the firm attempts to support its stock price, meet obligations arising from convertible securities, or pursue an employee share option program.[5] Furthermore, in order to prevent market manipulation, there are limits on the repurchase price and restrictions on the daily volume of share repurchases. More precisely, the repurchase price should not exceed the higher price of the last independent trade or the highest current independent bid. Also, repurchasing firm are not allowed to repurchase more than the 25% of the average daily trading volume of their shares. Finally, repurchasing firms are required to disclosure the full details of the SRP, because they are treated as insiders with privilege information under the EU directive.

Overall, it appears that the MAD's enactment brought substantial amendments to the Greek regulatory environment, as Greece was a country with weak market manipulation regulations in the pre-MAD era. In sum, the MAD provides a more transparent regulatory environment, and restricts firms from repurchasing their shares to manipulate their stock price. Therefore, it is reasonable to assume that a legal framework which offers better protection to shareholders will restrain managers from pursuing actions that are not aligned with the shareholders' interests (for instance, announcing a share repurchase program for non-value maximizing reasons). On the basis of this argument, we expect a positive MAD effect on share repurchase announcements in Greece.

[5] Regulation (EC) No 2273/2003, Article 3.

3. Data and statistics

3.1. SRP sample

We examine the whole population of SRP announcements in the Greek market from June 2000 to December 2010.[6] The SRP data were manually collected from the Government Gazette and the Daily Official List of the Athens Stock Exchange, and were cross-verified from the Greek daily and periodical press. Stock price and accounting data were extracted from Thomson Reuters DataStream and Thomson Reuters WorldScope, respectively.

During the examination period, 615 programs of share repurchase were announced. We exclude 29 programs due to the presence of confounding events (such as the announcement of a merger), and 13 programs because the company had both common and preferred shares on the announcement date. We also exclude 2 programs because the announcement date could not be determined with accuracy, and 14 programs with insufficient stock price data.[7] In addition, 9 programs are omitted due to unavailability of firms' accounting data. Our final set consists of 548 open market share repurchase announcements.

Table 1 shows the distribution of our sample by calendar year. The number of observations reaches its peak in 2008, but the volume of SRPs decreases in the next two years. Furthermore, the percentage of shares sought in the repurchase ranges from 7.70% to 9.33%. These figures are comparable to those reported in other relevant studies (Peyer and Vermaelen, 2009; Manconi et al., 2019).

[Insert **Table 1** here]

[6] Repurchase programs must be authorized by the shareholders in a general meeting. The board of directors proposes the agenda topics, and publicizes them at least 20 days ahead of the meeting. Our data start in June 2000 when the Daily Official List of the Athens Stock Exchange became available on the Exchange's website.
[7] Stocks with fewer than 30 observations during the estimation period are excluded.

3.2. Summary statistics

Table 2 provides the summary statistics of our sample. All variables are defined in the Appendix. We use the U-index as a measure of undervaluation in the spirit of Peyer and Vermaelen (2009). This index is computed as the sum of ranks of the following three categories:

a) Size: the largest firms (as measured by the market value of equity) receive a rank of 1, while the smallest firms receive a rank of 5.

b) Book-to-market: the firms with the lowest book-to-market receive a rank of 1, whereas the firms with the highest book-to-market receive a rank of 5.

c) 6-month prior raw returns: the firms with the highest prior raw returns receive a rank of 1, while the firms with the lowest prior raw returns receive a rank of 5.

The U-index of our sampled firms has a mean value of 9. The higher the score, the more likely is that the firm is undervalued. *Tobin's q* and *Cash* are included in the analysis to examine whether firms with low investment opportunities and excess free cash flow experience a higher market reaction when they announce a SRP program (Lie, 2000; Grullon and Michaely, 2004). *Leverage, Dividend payout ratio*, and *Percentage sought* are control variables, frequently used in relevant studies (Dittmar, 2000; Grullon and Michaely, 2002; Kang et al., 2011; Manconi et al., 2019).

From our entire sample of 548 programs, 242 (44.16%) are classified as initial and the remaining are classified as subsequent. To classify a program as initial, we make sure either that it is the first for the company in the study period or that it is announced at least one year after the expiration of the previous program. More precisely, a program is classified as initial in the following cases:

a) If it is the first program of the company during the period under study.

b) If it has been announced at least two years after the previous repurchase program. This condition applies for programs before August 2007, when the maximum allowable duration of the programs was 12 months.[8]

c) If it has been announced at least three years after the previous repurchase program. This condition applies for programs after August 2007, when the maximum allowable duration of the programs was 24 months.[9]

We also report the main reasons for authorizing SRPs, as stated by the companies on the announcement date. We classify the company-stated reasons in three categories. First, companies announce that supporting the stock price if it is perceived as undervalued is the reason for announcing an SRP in 211 cases (38.50%). Second, the reason is not explicitly mentioned in 299 cases (54.60%), and the company simply announces that it will carry out stock repurchases according to existing law. Third, in 38 cases (6.90%), the programs are announced with a variety of reasons for authorization such as cancelling shares to reduce the company share capital, selling shares back in the open market, distributing shares to employees, or a mixture of these reasons (e.g., a fraction of the shares is cancelled, and the rest is distributed to employees).

[Insert **Table 2** here]

4. Event study results

4.1. The stock market reaction around the announcement date

We use the standard event study methodology to estimate the cumulative abnormal return (CAR) around the SRP announcement dates. The event day (day "0") is the day the board of directors

[8] For repurchase announcements in 2000 and 2001, we have examined whether the repurchasing firms had announced any SRPs in the previous 24 months.
[9] Our results remain similar even when we use the same classification of initial programs as before August 2007.

announces its intention to buy back shares, by calling a shareholders' meeting to vote on the stock repurchase program (Leledakis et al., 2009). We estimate CARs over four event windows [−20, −2], [−1, +1], [−1, + 4], and [+2, +20] using the market adjusted return model:[10]

$$AR_{i,t} = R_{i,t} - R_{m,t}$$

where $R_{i,t}$ is the return for stock i on day t and $R_{m,t}$ is the return on the Athens Stock Exchange General Index on day t. Finally, we examine the statistical significance using the Patell Z-test.[11]

Panel A of Table 3 reports the results for our entire sample of 548 repurchase programs. At a first glance, the results for the two short-term event windows are similar to those reported in prior studies which focus on other European countries such as France (Lee et al., 2010), Germany (Lee et al., 2010; Andriosopoulos and Lasfer, 2015), Spain (González and González, 2004), or the UK (Rau and Vermaelen, 2002; Oswald and Young, 2004; Crawford and Wang, 2012). More precisely, mean CARs during the event window [−1, +1] are 0.44% and statistically significant at the 5% level, and 0.85% and statistically significant at the 1% level during the event window [−1, +4]. Interestingly, these results are in contrast with Manconi et al. (2019), who find positive but insignificant CARs for a sample of 27 repurchase announcements occurred in Greece from 1998 to 2010.

However, results for the longer event windows deviate from the existing literature in European markets. In fact, Andriosopoulos and Lasfer (2015) find that both pre-announcement date and post-announcement date CARs are indistinguishable from zero. By using the same event windows, we find that before the announcement, our sampled firms experience negative abnormal

[10] Similar results were obtained when we used the market model, the mean-adjusted return model, and the market model with the Scholes-Williams beta estimation method. The estimation period ranges from 200 to 21 days before the announcement date [–200, –21].

[11] For robustness, we also use the standardized cross-sectional test and the generalized sign test. The results are qualitatively the same.

returns, while after the announcement, abnormal returns are even larger in magnitude compared to what reported in the short-term windows. More specifically, mean CARs over the [−20, −2] window are in the order of −1.09% and statistically significant at the 1% level, while mean CARs over the [+2, +20] window are 2.02% and statistically significant also at the 1% level.

4.2. The MAD effect on announcement abnormal returns

To address our main research question, we examine whether the MAD enactment affects the way investors react to announcements of repurchase programs. Panel B of Table 3 segments the sample based on whether the SRP announcement has been announced before or after the implementation of the MAD in Greece (July, 2005).

The results of this analysis produce some interesting insights, since they indicate a significant difference in market reaction between the two sub-periods. In the pre-MAD era, firms realize negative abnormal returns (–2.21%) and statistically significant at the 1% level in the pre-announcement window, while abnormal returns for the remaining three windows are indistinguishable from zero. By contrast, in the post-MAD period, stock prices do not decrease in the pre-announcement period, while CARs for windows both around and after the announcement are positive and statistically significant. For instance, mean CARs over the [−1, +4] event window are 1.84% and statistically significant at the 1% level, and the difference between the two sub-periods is 1.79% and statistically significant at the 5% level. In the [+2, +20] event window, this difference reaches 3.53% and is statistically significant at the 1% level. Notably, in all event windows, mean differences are positive and statistically significant at the 5% level, or better. Taken altogether, the results of the univariate analysis suggest that the investors' reaction towards share repurchase announcements is substantially different between the two periods. In the pre-MAD era, repurchasing firms realize negative abnormal returns before the announcement of the

SRP. Despite this negative run-up, investors do not react to the announcement of the SRPs, probably questioning the motives behind such announcements. By contrast, after the MAD's enactment, repurchasing firms do not experience a negative run-up before the announcements of the SRPs, and they realize positive abnormal returns during and after the announcement. This finding may suggest that the adoption of the safe harbor enabled firms to send their quality signal to the market regarding their motives behind the announcement of an SRP.

[Insert **Table 3** here]

Our findings are important for a variety of reasons. First, we provide supportive evidence of our conjecture that the MAD enactment introduced a safe harbor for stock repurchases in Greece. Second, this documented positive MAD effect on announcement abnormal returns is in contrast with evidence reported for France, Germany, and the UK, (Andriosopoulos and Lasfer, 2015). In fact, our results indicate that the implementation of the MAD had a different impact in Greece compared to other major European economies, due to the differences in the pre-MAD national laws. Overall, we argue that after the incorporation of the MAD in the Greek law, investors evaluate more favorably a stock repurchase program because the new framework makes it less likely that a program will be used for market manipulation.

5. Further empirical analysis

5.1. Regression analysis

The results of the univariate analysis indicate that abnormal returns are significantly higher when firms announce their intention to repurchase their shares after the MAD enactment. In this section, we conduct ordinary least squares (OLS) regression analysis to examine the persistency of this positive MAD effect on CARs, and the possible determinants of this pattern in abnormal returns.

Furthermore, we examine two theories regarding the real motives behind the announcement of a share repurchase program: (1) the signaling undervaluation hypothesis, and (2) the free cash flow hypothesis.

In our regressions, the dependent variable is the announcement CAR around the [–1, +4] event window. *MAD* is a dummy variable that equals 1 if the SRP announcement took place after the MAD enactment. In line with Peyer and Vermaelen (2009), we use the *U-index* to test the undervaluation hypothesis. To test the free cash flow hypothesis, we follow Grullon and Michaely (2004). More precisely, we include in our regression *Cash* and an interaction variable that takes the value of *Cash* if the firm's Tobin's q ratio is less than 1, and 0 otherwise. In practice, this interaction term tests whether firms with lower investment opportunities and excess cash reserves are able to mitigate agency costs associated with the possible overinvestment of their free cash flows (Easterbrook, 1984; Jensen, 1986).

We account for any firm-specific characteristics that may impact our results by including the following control variables: *Leverag*e, *Dividend payout*, and *Percentage sought*. We also use the dummy variable *Initial* to examine whether initial SRP programs produce higher announcement CARs. Further, we include two dummies (*Stated undervaluation* and *Not-stated*) to control for the company-stated reasons for announcing a SRP (leaving *Other reason*s as the residual category). Finally, in all our regression models, we include industry fixed effects.

To ensure that our results are not affected by the presence of outliers, we winsorize all continuous variables at the 1st and 99th percentiles (Cheng et al., 2015). We report standard errors clustered at the firm level.[12] Correlation among continuous variables indicates a weak to moderate

[12] Results are similar if we use White (1980) heteroscedasticity robust standard errors.

degree of linear relationship.[13] In all our models, the highest variance inflation factor (VIF) is 6.37, suggesting that multicollinearity is not an issue in our empirical setting.

Table 4 present the results of our OLS regressions. Models 1 to 5 report results for the entire sample. In model 1, *MAD* bears a positive and statistically significant coefficient at the 5% level. The magnitude of its coefficient suggests that SRPs announced after the MAD enactment experience 1.5% higher announcement CARs, on average. In model 2, *U-index* has a positive and statistically significant coefficient at the 5% level. This finding indicates that undervalued firms experience larger announcement CARs, when they decide to announce a share repurchase program (Manconi et al, 2019). In model 3, we regress CARs against *Tobin's q*, *Cash*, and the interaction variable *Low Tobin's q* × *Cash*. All variables are insignificant at conventional levels, which suggests that the free cash flow hypothesis is not supported in our entire sample. Model 4 includes all the aforementioned variables. Again, both *MAD* and *U-index* are positive and statistically significant at the 5% level, or better, while the remaining variables are insignificant. Finally, in model 5, we add all our control variables. We observe that *MAD* and *U-index* are positive and statistically significant at the 1% level, while all the other variables bear insignificant coefficients.

Models 6 to 9 report results for the post-MAD subsample. In essence, we rerun the regressions 2 to 5 without the inclusion of *MAD*. In models 6, 8, and 9, *U-index* has a positive and statistically significant coefficient at the 5% level. By contrast, *Low Tobin's q* × *Cash* is insignificant in models 7, 8, and 9. These results suggest that after the MAD enactment, the signaling undervaluation hypothesis is the prevailing explanation for the documented improvement in announcement abnormal returns. From the remaining variables, *Cash* bears a negative and statistically significant coefficient at the 5% level in both models 7 and 8, and *Initial*

[13] In absolute values, the highest correlation coefficient is between *Cash* and *Leverage* (–0.39).

is positive and statistical significant at the 1% level in model 9. Both findings are consistent with Andriosopoulos and Lasfer (2015). It appears that after the MAD, investors prefer the excess cash reserves to be retained rather than returned to shareholders via share repurchases and anticipate initial programs to have more information content. Lastly, the positive and statistically significant coefficient of *Tobin's q* in models 8 and 9 is in contrast with the predictions of the free cash flow hypothesis. In terms of explanatory power, our adjusted R^2 is low, since it ranges from 0.3% to 5.9%. However, such results are typically observed in relevant studies (Kang et al., 2011).

[Insert **Table 4** here]

The conclusion of our regression analysis is twofold. First, the adoption of the MAD has a positive effect on announcement CARs, because it introduced a safe harbor for stock repurchases. Second, undervaluation seems to be the main driver behind this improvement. In untabulated results, we have also conducted regressions for the pre-MAD period and we found no significant results. We attribute this lack of significance to the fact that before the introduction of the safe harbor, investors were skeptical about the motives behind the announcement of share repurchases.

5.2. Propensity score matching analysis

So far, we have documented that the MAD enactment has a positive effect on announcement CARs. However, it is likely that this positive effect does not necessarily relate to the legislation itself, but it is influenced by differences in observable characteristics between the two sub-periods. For instance, if more undervalued firms announced SRPs in the post-MAD period, then, it is likely that this improvement in announcement CARs is not attributed to the MAD enactment. Although our multivariate regressions help addressing this issue, the OLS estimates may be biased if the observable characteristics have a poor distributional overlap between the two-periods (Heckman et al., 1998). Therefore, to ensure the consistency of our results, we also use the propensity score

matching (PSM) approach. This approach is commonly-used in recent studies that examine the impact of regulatory changes on corporate events (Dahya et al., 2019; Leledakis and Pyrgiotakis, 2021).

The steps of our PSM approach are the following. First, we run two probit models, where the dependent variable equals 1 for SRPs announced after the MAD enactment, and 0 otherwise. In the first model we only include *U-index*, *Tobin's q*, and *Cash* as independent variables, and in the second model we add all our control variables.[14] In both models, we include industry fixed effects. Second, we estimate the propensity scores, and we use them to match the post-MAD observations with pre-MAD observations, according to the one-to-one nearest neighbor matching approach.[15] Third, we compute the average treatment effect on the treated (ATT), which in our case is the difference in announcement CARs between post-MAD observations and their matched pre-MAD counterparts.[16]

Panel A of Table 5 present the results of the two probit models. Taken together, the results indicate that firms announcing SRPs post-MAD have less investment opportunities, higher leverage, and seek a higher fraction of shares to repurchase. In addition, they tend to state undervaluation as the reason for repurchasing their shares less often. Finally, initial programs are less frequent events after the MAD enactment.

Panel B of Table 5 reports the ATTs. In both cases, ATTs are positive and statistically significant at the 1% level, and the magnitude of the difference is comparable to what reported in Table 3. This finding indicates that firms announcing SRPs post-MAD significantly outperform

[14] Low Tobin's q × Cash is not included in the analysis, because it worsens the quality of matching between the two groups. The exclusion of this variable ensures that all mean differences in covariates between post-MAD and pre-MAD matches are insignificant.

[15] Matching is done with replacement (yielded 143 matches in model 1 and 109 matches in model 2). Results are qualitatively similar if we match with no replacement, or if we use more than one matches.

[16] We report ATTs on the announcement CARs over the [–1, +4] event window. Results are similar if we use the other three windows.

their pre-MAD matches. Therefore, we conclude that our documented positive MAD effect on announcement CARs remains, even if we control for any observable heterogeneity issues.

[Insert **Table 5** here]

6. Robustness checks

In this section, we conduct a series of robustness checks to verify the validity of our results. First, we examine whether our regression results could be biased due to the presence of untreated endogeneity in the data collection process. Second, we investigate whether changes in the dividend policy may have an impact on the way market participants react to announcements of a SRP. Third, we employ a difference-in-differences regression analysis, to examine whether there is a specific group of SRPs which is more influenced by the MAD's enactment. Finally, we re-run our baseline models to control for the impact of the financial crisis, the inclusion of financial firms in our sample, and the enactment of subsequent EU directives in the post-MAD period.

6.1. Controlling for selection bias

An important econometric issue in corporate finance studies is the problem of potential endogeneity caused by self-selection. In our empirical setting, self-selection bias may occur because firms that announce share repurchases programs may not be randomly selected from the population of firms. This practically means that there might be innate differences between firms that announce share repurchases and firms that do not. In this case, our regression analysis could produce unreliable estimates. To account for this possibility, we use the Heckman's (1979) two-stage approach, as in Liang (2016), and Moin et al. (2020).

To proceed with this analysis, we first have to identify all those firms that have not announced a share repurchase program (non-SRP firms hereafter). To do so, we collect data for

all firms listed on the Athens Stock Exchange during our examination period. For each calendar year, a firm is classified as non-SRP firm if it has not announced an SRP in that year. This procedure leaves us with a sample of 2,683 observations (548 SRP observations and 2,135 non-SRP observations).[17]

The first-stage selection equation is a probit model, where the dependent variable equals 1 if a firms has announced an SRP, and 0 otherwise. We use a number of independent variables, frequently used in the relevant literature, including: *Size*, *Book-to-market*, *Cash*, *Leverage*, and *Dividend payout*. We do not include the *U-index* in our first stage equations, because it is not feasible to calculate past returns for non-SRP firms, as there is no specific event date for these firms. To capture time varying trends, we include year fixed effects, along with industry fixed effects. From this stage, we construct the *Inverse Mills ratio*, and we use it in the second-stage regressions to control for self-selection. In the second-stage regressions, the dependent variable is the announcement CAR around the [–1, +4] event window. To be consistent with our analysis so far, we run our two-stage procedure two times, one for the whole sample, and one for the post-MAD subsample.

Models 1 and 3 of Table 6 report the results of the first-stage regressions. Our findings indicate that there are some firm-specific characteristics associated with the firms' decision to announce a share repurchase program (Andriosopoulos and Hoque, 2013). In fact, SRP firms are larger compared to their non-SRP counterparts, they hold more cash and they distribute a lower dividend as a percent of their total assets. What is important however is the results of the second-stage regressions. Models 2 and 4 of Table 6 replicate the baseline regressions of Table 4, with the addition of the *Inverse Mills ratio*. In both models, *Inverse Mills ratio* is not significant, suggesting

[17] To identify the non-SRP firms, we exclude all firms from the initial sample of 615 SRPs.

that self-selection does not impact our results. Furthermore, for the relevant variables, our results are similar to the ones reported in Table 4. Therefore, we conclude that our OLS regressions provide reliable estimates.

[Insert **Table 6** here]

6.2. Changes in the dividend policy

There is a plethora of studies in the payout policy literature that examine the choice between dividend distribution and share repurchases (Howe et al., 1992; Lie and Lie, 1999; Jagannathan et al., 2000; Guay and Harford, 2000; Allen et al., 2000; Lee and Rui, 2007; Von Eije and Megginson, 2008). According to the substitution hypothesis outlined by Grullon and Michaelly (2002), firms gradually substitute repurchases for dividends, as SRPs have some advantages over dividend distributions. In fact, in the recent years, the number of firms that choose to distribute cash via share repurchase increases relative to dividend payments (Moin et al., 2020).

In terms of market reaction, the substitution hypothesis predicts that there is a relationship between changes in the dividend policy, share repurchases and announcement abnormal returns. More precisely, Grullon and Michaelly (2002) find that the market reaction around the announcement of dividend decreases is significantly less negative for SRP firms than for non-SRP firms, a finding which indicates that share repurchases and dividends are close substitutes. In our paper, we examine this relationship in the inverse order. In fact, we investigate whether any prior changes in the dividend policy (either increase or decrease of the dividend) have an impact on the way investors react to announcements of share repurchases. For instance, if dividends are substituted by share repurchases, then, any decrease in the dividend may suggest that the firm will spend more money on a share repurchase program. In that event, the dividend change may influence abnormal returns around the announcement of the SRP.

To address this issue, we examine whether our sampled firms have announced a change in the dividend over the one year prior to the SRP announcement. Following this criterion, we classify out sample in three categories: (1) dividend increase and share repurchase (130 observations), (2) dividend decrease and share repurchase (119 observations), and (3) no dividend change and share repurchase (299 observations).

To investigate the impact of dividend changes on announcement abnormal returns, we rerun the baseline regressions of Table 4, using two dummy variables: (1) *Dividend increase*, and (2) *Dividend decrease*, leaving *No dividend change* as the residual category. Table 7 presents the results of this analysis. In models 1 and 3, we only use those two dummy variables, along with industry fixed effects. Both variables are insignificant, which suggests that changes in the dividend policy does not impact CARs around the SRP announcement. Moreover, when we add all our explanatory variables (models 2 and 4), both variables remain insignificant, while our results are quite similar with the ones reported in Table 4. In sum, these findings indicate that our inferences about share repurchases are robust to any changes in the dividend policy.

[Insert **Table 7** here]

6.3. Difference-in-differences regressions

So far, we have provided robust evidence that the market reaction for SRP announcement is significantly higher after the implementation of the MAD. We attribute this finding to the fact that the adoption of the MAD provisions creates a more transparent environment for investors, where good quality firms are able to send a more credible sign to the market regarding their motives behind SRPs.

In an open market share repurchase, firms voluntarily disclose information to the market. Firms that release more accurate information send a more credible sign to the market, and as such,

they enjoy higher abnormal returns when they announce a SRP (Bonaime, 2012). Furthermore, this signaling role of share repurchase announcements is stronger in initial programs rather than subsequent programs, as the former programs carry more information content compared to the latter (Andropsopoulos and Lasfer, 2015).

Considering all the aforementioned statements, we may assume that the signaling role of initial programs should be more pronounced in the post-MAD era. In other words, if the MAD provisions enable firms to send a more credible sign to the market, and if initial repurchases carry a higher information content, then, it is likely that the positive MAD effect should be stronger in initial programs. To empirically test our conjecture, we use the difference-in-differences (DiD) approach.

The DiD method is frequently-used to study the effect of regulatory changes on a specific group of observations that are more likely to be affected by a new regulation (Lechner, 2011). This group is commonly referred to as the "treatment group". In our case, the treatment group is the initial programs, and the control group (the unaffected group) is the subsequent programs. To conduct the analysis, we re-run the baseline regressions of Table 4 (for the whole sample), using the interaction term *MAD×Initial*. The coefficient of this interaction term is the DiD estimator. According to our predictions, we expect it to be positive and statistically significant.

Table 8 present the results of this analysis. In line with our expectations, the DiD estimator is positive and statistically significant at the 1% level in all models. The magnitude of its coefficient ranges for 0.038 (models 1 and 2) to 0.041 (models 4 and 5). Collectively, these results suggest that initial programs earn significantly higher announcement abnormal returns after the MAD's enactment, even after we control for several other possible determinants of abnormal

returns. Furthermore, the improvement in shareholder wealth for such programs is in the range of 3.8% to 4.1%.

[Insert **Table 8** here]

Any inferences from the DiD approach could be biased if we do not test the parallel trends assumption. This assumption suggests that any difference between the two groups (treatment and control) can only be attributed to the regulatory change, if those two groups were following parallel trends before the enactment of the regulation. To test this assumption, we follow the approach of Leledakis and Pyrgiotakis (2021), and we re-run the DiD regression for the pre-MAD period. In this empirical setting, we construct several hypothetical post-MAD periods, and we expect the DiD estimator to be indistinguishable from zero.

Panel A of Table 9 presents the results for this analysis. We construct 3 different hypothetical post-MAD periods: (1) from 2002 until June 2005, (2) from 2003 until June 2005, and (3) from 2004 until June 2005. In all models, the DiD estimator is zero, which suggests that abnormal returns for initial programs do not increase -or decrease- after each hypothetical post-MAD period, compared to subsequent programs.[18] Further, panel B reports the distribution of observations for each DiD regression. In each case, we have a sufficient number of observations both for the treatment and control groups, as well as for the 3 hypothetical pre-and post-MAD periods. Taken altogether, it is reasonable to assume that abnormal returns of initial and subsequent programs were following a parallel trend prior to the MAD's enactment.

[Insert **Table 9** here]

[18] We have also compared abnormal returns between initial and subsequent programs at the univariate level. We have done the comparisons for all the hypothetical sub-periods as well as the actual pre-MAD period. In all cases, mean differences across the two subsamples were insignificant.

6.4. Further robustness check

In this section, we conduct three additional robustness checks to further ensure the stability of our results. First, we exclude the crisis years from our sample. Second, we exclude financial firms from our sample. Third, we test whether an EU-Directive, which was enacted in the post-MAD period, "Markets in Financial Instruments" (MiFID) has any impact on our results. The aim of this subsequent directive was similar to the scope of the MAD, as it includes provisions for market manipulation and rules for harmonizing the trading legislation across Member States.

To account for any crisis effect on our results, we exclude the years 2009 and 2010 from our sample. We do so, in accordance with Claessens et al., (2010), who argue that by the first quarter of 2009, all European economies had entered into recession. Models 1 and 2 of Table 10 report the results of this analysis. Evidently, the financial crisis does not drive our results, as our findings are similar to those reported in Table 4. Similarly, when we exclude financial firms from our sample (models 3 and 4), our results remain unchanged. Finally, we test whether the MiFID's enactment has any impact on the announcement abnormal returns of SRPs, as in Anolick et al. (2021). In both models 5 and 6, *MiFID* has an insignificant coefficient. One possible interpretation for this latter finding is that the MAD had already strengthened the market manipulation regulation in Greece, and as a result, the MiFID has a less structural impact on the domestic law environment.

[Insert **Table 10** here]

7. Conclusion

In this paper, we investigate the impact of the MAD on share repurchases in Greece. We differentiate from previous literature because we assume that this European legislation does not have a uniform effect across Member States. To support our conjecture, we use a comprehensive

hand-collected sample of 548 SRP announcements over the period 2000-2010. This datasets represents the whole SRP population for the Greek market in the aforementioned period, after removing programs with incomplete or missing data.

The results of the univariate analysis indicate that SRP announcements create shareholder value. However, this value creation is only evident in the post-MAD period. In fact, the enactment of the legislation marks a significant improvement in abnormal returns, in all examined event windows. Markedly, this positive MAD effect on announcement CARs remains in our regression analysis, where we control for several factors that are likely to influence the market reaction towards share repurchases. One important insight from our regression analysis is that undervaluation seems to be the prevailing motive for repurchasing shares. Our regression results remain robust even when we account for any observed heterogeneity across time periods, sample selection issues, and changes in the dividend policy. Notably, we find that the documented positive MAD effect is significantly higher in initial share repurchase programs, as they contain more information compared to subsequent programs. Finally, our results hold if we exclude the financial crisis or the financial firms from our sample, and when we account for subsequent EU directives.

Overall, our results indicate that the impact of an EU directive across countries depends on the relationship between the directive itself, and pre-existing national laws. In Greece, where investor protection laws are not that strong as in other larger European economies, the implementation of the safe harbor on share repurchases sends a more credible signal to the investors regarding the intentions of firms to repurchase their shares. Therefore, these findings highlight the need to examine the effectiveness of EU directives on separate countries, rather than the Union as a whole.

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Appendix: Variable definitions

Variables	Definition
MAD	A dummy variable that equals 1 if the SRP announcement was after the implementation of the MAD in July 2005, and 0 otherwise.
MiFID	A dummy variable that equals 1 if the SRP announcement was after the implementation of the MiFID in November 2007, and 0 otherwise.
U-index	A proxy for undervaluation, which is based on ranks obtained by three variables: size, book-to-market, and 6-month prior raw returns.
ln(Size)	The natural logarithm of the company market value of equity at the year-end prior to the SRP announcement.
Book-to-market	The ratio of the book value of equity to the market value of equity at the year-end prior to the SRP announcement.
6-month prior raw returns	The cumulative raw stock return over the six months preceding the repurchase announcement [−145, −21].
Tobin's q	The firm's Tobin's q at the year-end prior to the SRP announcement.
Low Tobin's q	A dummy variable that equals 1 if the firm's Tobin's q is less than 1, and 0 otherwise.
Cash	The ratio of cash equivalent to total assets at the year-end prior to the SRP announcement.
Leverage	The ratio of total debt to total assets at the year-end prior to the SRP announcement.
Dividend payout ratio	The ratio of cash dividend to total assets at the year-end prior to the SRP announcement.
Percentage sought (%)	The maximum shares for repurchase in the program as a percent of total shares outstanding.
Initial	A dummy variable that equals 1 if the program has been classified as initial, and 0 otherwise.
Stated undervaluation	A dummy variable that equals 1 if the company mentions undervaluation as the reason for announcing a share repurchase, and 0 otherwise.
Not-stated	A dummy variable that equals 1 if the company does not state any reason for announcing a share repurchase, and 0 otherwise.
Other reasons	A dummy variable that equals 1 if the company mentions a specific reason for announcing a share repurchase, different from undervaluation, and 0 otherwise.

Table 1

Distribution of repurchase announcements by calendar year

This table reports statistics for a sample of 548 announcements of intention to repurchase shares over the period 2000-2010. Fraction of sample (%) represents annual repurchase announcements as a percentage of the full sample. Percentage sought (%) denotes the mean ratio of number of shares announced for repurchase to the number of shares outstanding.

Year	N	Fraction of sample (%)	Percentage sought (%)
2000	22	4.02	9.33
2001	66	12.04	8.77
2002	50	9.12	8.37
2003	57	10.40	7.70
2004	56	10.22	7.86
2005	57	10.40	8.05
2006	51	9.31	8.74
2007	53	9.67	8.81
2008	69	12.59	9.10
2009	31	5.66	8.95
2010	36	6.57	8.76
2000-2010	548	100.00	8.59

Table 2
Summary statistics

This table reports summary statistics for a sample of 548 announcements of intention to repurchase shares over the period 2000-2010. All variables are defined in the Appendix.

	N	Mean	Std.dev.	Min	Median	Max
MAD	548	0.445	0.497	0.000	0.000	1.000
U-index	548	9.000	2.758	3.000	9.000	15.000
ln(Size)	548	4.673	1.736	1.502	4.365	9.320
Book-to-market	548	1.105	1.938	0.057	0.651	16.667
6-month prior raw returns	548	−0.117	0.370	−0.961	−0.122	0.887
Tobin's q	548	1.250	1.326	0.152	0.872	8.754
Low Tobin's q	548	0.604	0.490	0.000	1.000	1.000
Cash	548	0.140	0.212	0.003	0.066	0.997
Leverage	548	0.254	0.173	0.000	0.262	0.684
Dividend payout ratio	548	0.014	0.024	0.000	0.005	0.134
Percentage sought (%)	548	8.527	2.502	1.000	10.000	10.000
Initial	548	0.442	0.497	0.000	0.000	1.000
Stated undervaluation	548	0.385	0.487	0.000	0.000	1.000
Not stated	548	0.546	0.498	0.000	1.000	1.000
Other reasons	548	0.069	0.254	0.000	0.000	1.000

Table 3

CARs around share repurchase announcements

The table shows the mean CAR for a sample of 548 announcements of intention to repurchase shares over the period 2000-2010. Panel A reports the results for the full sample. Panel B partitions the sample according to the MAD enactment (July, 2005). CARs are calculated using the marked adjusted return model. The Patell Z-test for the significance of mean CARs is shown in parentheses. Significance for the difference between mean CARs is based on the t-test assuming unequal variances (in brackets). The symbols **, and *** denote statistical significance at the 5% and 1% levels, respectively, using a 2-tail test.

			Windows			
Panel A: Full sample		N	(−20, −2)	(−1, +1)	(−1, +4)	(+2, +20)
Mean CAR		548	−1.09%***	0.44%**	0.85%***	2.02%***
			(−2.92)	(2.05)	(2.63)	(5.09)
Panel B: MAD enactment						
Mean CAR	Pre-MAD	304	−2.21%***	−0.02%	0.05%	0.45%
			(−4.17)	(−0.20)	(−0.29)	(1.18)
Mean CAR	Post-MAD	244	0.31%	1.02%***	1.84%***	3.98%***
			(0.29)	(3.29)	(4.26)	(6.30)
Difference	Post-MAD−Pre-MAD		2.52**	1.04%**	1.79%**	3.53%***
			[2.29]	[1.97]	[2.56]	[3.43]

Table 4

Regression analysis

The table shows OLS regression results for a sample of 548 announcements of intention to repurchase shares over the period 2000-2010. The dependent variable is CAR [−1, +4]. CARs are estimated using the market adjusted return model. Models 1-5 report regression results for the entire sample of firms, while models 6-9 report regression results for the subsample of the post-MAD period. All independent variables are defined in the Appendix. All continuous variables are winsorized at 1% and 99% level. Standard errors are clustered at the firm level. The *t*-statistics are reported in parentheses. The symbols **, and *** denote statistical significance at the 0.05 and 0.01 levels, respectively, using a 2-tail test.

	Full sample					Post-MAD			
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	–0.014	–0.034***	–0.008	–0.053***	–0.060**	–0.040**	–0.007	–0.054**	–0.100***
	(–1.46)	(–2.61)	(–0.79)	(–3.26)	(–2.58)	(–2.21)	(–0.59)	(–2.59)	(–2.75)
MAD	0.015**			0.016**	0.018***				
	(2.28)			(2.53)	(2.71)				
U-index		0.003**		0.004***	0.004***	0.004**		0.005**	0.005**
		(2.40)		(2.60)	(2.64)	(2.01)		(2.21)	(2.29)
Tobin's q			0.000	0.004	0.003		0.004	0.011**	0.010**
			(0.18)	(1.37)	(0.95)		(0.81)	(2.35)	(2.07)
Cash			–0.014	–0.009	–0.017		–0.068**	–0.063**	–0.053
			(–0.61)	(–0.43)	(–0.73)		(–2.01)	(–2.20)	(–1.58)
Low Tobin's q × Cash			0.014	–0.005	–0.003		0.047	0.024	0.027
			(0.63)	(–0.24)	(–0.12)		(1.34)	(0.77)	(0.77)
Leverage					–0.014				–0.001
					(–0.71)				(–0.04)
Dividend payout					0.104				–0.044
					(0.83)				(–0.21)
Percentage sought					–0.000				0.000
					(–0.20)				(0.14)
Initial					0.009				0.032***
					(1.29)				(2.84)
Stated undervaluation					0.009				0.029
					(0.72)				(1.59)
Not-stated					0.009				0.029
					(0.69)				(1.56)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	548	548	548	548	548	244	244	244	244
Adjusted R^2	0.012	0.014	0.003	0.020	0.015	0.039	0.017	0.038	0.059

Table 5
CARs based on propensity score matching

This table illustrates CARs based on propensity scores estimated from a probit model. The sample consists of 548 announcements of intention to repurchase shares over the period 2000-2010. In both models, the dependent variable is a dummy variable that equals 1 for announcements occurring after the MAD's enactment, and 0 otherwise. Heteroscedasticity-robust t-statistics are reported in parentheses. All independent variables are defined in the Appendix. Matching is done with replacement (yielded 143 matches in model 1 and 109 matches in model 2). Panel B reports the average treatment effect on the treated (ATT). We report propensity score matching (PSM) results using the closest-neighbor approach. Standard errors for the ATTs are the heteroscedasticity-consistent standard errors outlined in Abadie and Imbens (2006). The symbols *, **, and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels, respectively, using a 2-tail test.

Panel A: Probit models		
Variables	(1)	(2)
Constant	0.486	0.056
	(1.48)	(0.12)
U-index	–0.034	–0.024
	(–1.41)	(–0.97)
Tobin's q	–0.324***	–0.295***
	(–3.49)	(–3.52)
Cash	0.376	0.070
	(1.28)	(0.21)
Leverage		1.275***
		(3.46)
Dividend payout		5.532*
		(1.90)
Percentage sought		0.060**
		(2.37)
Initial		–0.255**
		(–2.04)
Stated undervaluation		–1.048***
		(–4.24)
Not-stated		–0.325
		(–1.39)
Industry FE	Yes	Yes
N	548	548
Pseudo R^2	0.054	0.146
Panel B: ATTs	(1)	(2)
Post-MAD	1.84%***	1.84%***
Matched Pre-MAD	–0.15%	–0.05%
Difference	1.99%***	1.89%***

Table 6
Controlling for selection bias

This table illustrates the results of the Heckman (1979) two-step procedure to control for sample selection bias. The sample consists of 2,683 firm-year observations over the period 2000-2010. From this sample, 548 observations involve firms that announced a share repurchase program, and the remaining observations involve firms that did not announce a share repurchase program in the same calendar year. Model 1 and 3 report the results of the probit models (first-stage selection equation). The dependent variable in models 1 and 3 is a dummy variable which equals 1 if the firm had announced a SRP program in a giver year, and 0 otherwise. Models 2 and 4 report the results of the cross sectional regressions, where the dependent variable is the CARs over the [–1, +4] window and the Inverse Mills ratio accounts for the nonzero mean of error terms (second-stage selection equation). Models 1 and 2 refer to the whole sample and models 3 and 4 refer to the post-MAD subsample. All continuous variables are winsorized at 1% and 99% level. All independent variables are defined in the Appendix. Standard errors are clustered at the firm level. The *t*-statistics are reported in parentheses. The symbols *, **, and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels, respectively, using a 2-tail test.

	Full sample		Post-MAD	
Variables	(1)	(2)	(3)	(4)
Constant	–2.869***	–0.051	–3.699***	–0.107*
	(–13.43)	(–1.43)	(–11.96)	(–1.91)
MAD		0.019***		
		(2.83)		
U-index		0.004**		0.005**
		(2.40)		(2.00)
ln(Size)	0.174***		0.190***	
	(8.78)		(7.25)	
Book-to-market	0.054		0.110**	
	(1.54)		(2.52)	
Tobin's q		0.002		0.006
		(0.85)		(1.07)
Cash	0.798***		1.045***	
	(4.76)		(4.06)	
Low Tobin's q × Cash		–0.018		–0.014
		(–1.19)		(–0.55)
Leverage	0.155	–0.012	0.193	0.005
	(0.90)	(–0.58)	(0.77)	(0.16)
Dividend payout	–5.059***	0.094	–3.995*	–0.097
	(–3.44)	(0.70)	(–1.89)	(–0.43)
Percentage sought		–0.000		0.000
		(–0.30)		(0.08)
Initial		0.010		0.033***
		(1.35)		(2.87)
Stated undervaluation		0.010		0.029
		(0.79)		(1.45)
Not-stated		0.010		0.028
		(0.74)		(1.48)
Inverse Mills ratio		–0.008		0.006
		(–0.38)		(0.21)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	No	Yes	No
N	2,683	548	1,506	244
Pseudo R^2/ Adjusted R^2	0.141	0.014	0.169	0.056

Table 7
Dividend change

The table shows OLS regression results for a sample of 548 announcements of intention to repurchase shares over the period 2000-2010. The dependent variable is CAR [−1, +4]. CARs are estimated using the market adjusted return model. Models 1 and 2 report regression results for the entire sample of firms, while models 3 and 4 report regression results for the subsample of the post-MAD period. All independent variables are defined in the Appendix. All continuous variables are winsorized at 1% and 99% level. Standard errors are clustered at the firm level. The *t*-statistics are reported in parentheses. The symbols **, and *** denote statistical significance at the 0.05 and 0.01 levels, respectively, using a 2-tail test.

	Full sample		Post-MAD	
Variables	(1)	(2)	(3)	(4)
Constant	–0.005	–0.057**	–0.005	–0.105***
	(–0.61)	(–2.30)	(–0.41)	(–2.69)
Dividend increase	–0.007	–0.002	–0.002	0.008
	(–1.01)	(–0.27)	(–0.16)	(0.59)
Dividend decrease	–0.004	–0.004	–0.004	0.006
	(–0.48)	(–0.39)	(–0.26)	(0.39)
MAD		0.018***		
		(2.70)		
U-index		0.004**		0.005**
		(2.45)		(2.32)
Tobin's q		0.003		0.011**
		(0.85)		(2.10)
Cash		–0.019		–0.053
		(–0.83)		(–1.51)
Low Tobin's q × Cash		–0.001		0.027
		(–0.03)		(0.79)
Leverage		–0.014		–0.002
		(–0.69)		(–0.06)
Dividend payout		0.118		–0.065
		(0.92)		(–0.30)
Percentage sought		–0.000		0.000
		(–0.22)		(0.17)
Initial		0.009		0.033***
		(1.25)		(2.85)
Stated undervaluation		0.009		0.028
		(0.70)		(1.51)
Not-stated		0.009		0.028
		(0.66)		(1.51)
Industry FE	Yes	Yes	Yes	Yes
N	548	548	244	244
Adjusted R^2	0.003	0.012	0.014	0.052

Table 8
Difference-in-differences

The table shows difference-in-differences (DiD) regression results for a sample of 548 announcements of intention to repurchase shares over the period 2000-2010. The dependent variable is CAR [−1, +4]. CARs are estimated using the market adjusted return model. The interaction term MAD×Initial is the DiD estimator. All independent variables are defined in the Appendix. All continuous variables are winsorized at 1% and 99% level. Standard errors are clustered at the firm level. The *t*-statistics are reported in parentheses. The symbols **, and *** denote statistical significance at the 0.05 and 0.01 levels, respectively, using a 2-tail test.

Variables	(1)	(2)	(3)	(4)	(5)
Constant	–0.012	–0.038***	–0.014	–0.051***	–0.056**
	(–1.21)	(–2.82)	(–1.30)	(–3.18)	(–2.41)
MAD	0.001	–0.000	0.001	0.000	0.001
	(0.09)	(–0.01)	(0.07)	(0.06)	(0.17)
Initial	–0.005	–0.005	–0.006	–0.009	–0.009
	(–0.59)	(–0.60)	(–0.74)	(–1.03)	(–1.02)
MAD×Initial	0.038***	0.038***	0.039***	0.041***	0.041***
	(2.87)	(2.92)	(2.94)	(3.09)	(3.07)
U-index		0.003**		0.004***	0.004***
		(2.41)		(2.65)	(2.81)
Tobin's q			0.002	0.005	0.004
			(0.65)	(1.46)	(1.28)
Cash			–0.012	–0.007	–0.016
			(–0.55)	(–0.35)	(–0.68)
Low Tobin's q × Cash			0.017	–0.001	0.002
			(0.76)	(–0.03)	(0.07)
Leverage					–0.012
					(–0.60)
Dividend payout					0.100
					(0.81)
Percentage sought					–0.000
					(–0.20)
Stated undervaluation					0.010
					(0.80)
Not-stated					0.010
					(0.79)
Industry FE	Yes	Yes	Yes	Yes	Yes
N	548	548	548	548	548
Adjusted R^2	0.028	0.038	0.024	0.037	0.031

Table 9

Testing parallel trends assumption

This table reports the tests of the DiD parallel trends assumption. Panel repeats the difference-in-differences (DiD) regression of Table 8 (model 5) for hypothetical treatment periods. All regressions refer to the pre-MAD period. In model 1, the hypothetical treatment period is from 2002 until the MAD's enactment. In model 2, the hypothetical treatment period is from 2003 until the MAD's enactment. In model 3, the hypothetical treatment period is from 2004 until the MAD's enactment. The dependent variable is CAR [−1, +4]. CARs are estimated using the market adjusted return model. All independent variables are defined in the Appendix. All continuous variables are winsorized at 1% and 99% level. Standard errors are clustered at the firm level. The *t*-statistics are reported in parentheses. The symbols **, and *** denote statistical significance at the 0.05 and 0.01 levels, respectively, using a 2-tail test. Panel B reports the distribution of observations. Pre-MAD represents the number of observations before each hypothetical treatment period, and post-MAD represents the number of observations after each hypothetical treatment period. Treated and control denote the number of hypothetical treated and control observations.

Panel A: DiD regressions	MAD>=2002	MAD>=2003	MAD>=2004
Variables	(1)	(2)	(3)
Constant	–0.029	–0.027	–0.024
	(–0.99)	(–0.93)	(–0.87)
MAD	0.013	0.012	0.009
	(1.22)	(1.19)	(0.90)
Initial	0.003	–0.000	0.000
	(0.25)	(–0.03)	(0.04)
MAD×Initial	–0.015	–0.014	–0.028
	(–0.86)	(–0.79)	(–1.51)
Control variables	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
N	304	304	304
Adjusted R^2	0.001	0.001	0.002
Panel B: Distribution of observations			
Pre-MAD	88	138	195
Post-MAD	216	166	109
Treated group	155	155	155
Control group	149	149	149

Table 10

Further robustness tests

This table reports the results of some additional robustness tests. In columns 1 and 2 we re-run the models 4 and 5 of Table 4, by excluding the years of the financial crisis (years 2009 and 2010). In columns 3 and 4 we re-run the models 4 and 5 of Table 4, by excluding all firms of the financial services sector. In columns 5 and 6 we re-run the models 8 and 9 of Table 4, by including the dummy variable MiFID (Markets in Financial Instruments), which takes the value of 1 if the SRP is announced after November, 2007, and 0 otherwise. All independent variables are defined in the Appendix. All continuous variables are winsorized at 1% and 99% level. Standard errors are clustered at the firm level. The *t*-statistics are reported in parentheses. The symbols *, **, and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels, respectively, using a 2-tail test.

	Excluding crisis		Excluding financial		MiFID	
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Constant	–0.056***	–0.055**	–0.049***	–0.052**	–0.054**	–0.101***
	(–3.34)	(–2.25)	(–2.64)	(–2.01)	(–2.56)	(–2.80)
MAD	0.018***	0.019***	0.018**	0.019**		
	(2.65)	(2.72)	(2.42)	(2.38)		
MiFID					0.004	0.016
					(0.43)	(1.45)
U-index	0.004**	0.004**	0.003*	0.003*	0.005*	0.004*
	(2.52)	(2.53)	(1.80)	(1.66)	(1.95)	(1.80)
Tobin's q	0.004	0.002	0.005	0.004	0.011**	0.010*
	(1.24)	(0.70)	(1.41)	(1.04)	(2.33)	(1.92)
Cash	–0.005	–0.019	–0.022	–0.037	–0.064**	–0.052
	(–0.25)	(–0.82)	(–0.71)	(–1.14)	(–2.17)	(–1.44)
Low Tobin's q × Cash	–0.002	0.005	0.050	0.054	0.025	0.026
	(–0.07)	(0.23)	(0.93)	(1.02)	(0.78)	(0.70)
Leverage		–0.011		–0.014		–0.008
		(–0.53)		(–0.68)		(–0.28)
Dividend payout		0.191		0.052		–0.058
		(1.47)		(0.34)		(–0.27)
Percentage sought		–0.000		–0.000		0.000
		(–0.15)		(–0.01)		(0.23)
Initial		0.009		0.008		0.033***
		(1.12)		(0.99)		(2.88)
Stated undervaluation		0.000		0.005		0.039**
		(0.00)		(0.35)		(2.07)
Not-stated		–0.001		0.007		0.028
		(–0.09)		(0.47)		(1.51)
N	481	481	465	465	244	244
Adjusted R^2	0.019	0.014	0.030	0.022	0.035	0.060