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1 June 2020

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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 MAD is followed by a significant improvement in announcement abnormal returns, an improvement which remains even when we control for several firm-specific factors, industry fixed effects, and potential endogeneity issues. 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 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 SRPs are driven by value-

[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.

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 MAD did not have a uniform effect across Member States (Siems and De Cesari, 2012). 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. For instance, Andriosopoulos and Lasfer (2015) find that the EU directive had no significant impact on the market reaction towards share repurchases in France, Germany, and the UK. A possible explanation for this phenomenon is that these major European economies had strong investor protection rules and stringent disclosure requirements even before the MAD enactment (Leuz, 2010). By contrast, Greece is a country characterized by weak investor protection and lower disclosure levels (Persakis and Iatridis, 2016). Therefore, we assume that the MAD effect, if any, should be more pronounced in a country that has the latter institutional features.

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. At the univariate level, our findings point to significant changes in market reaction after the implementation of MAD. Over the [–1, +4] event window, SRP firms realize an average gain of 1.84% in the post-MAD period, while before 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 two 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).

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. 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. In fact, 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. 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

In the literature, various hypotheses have been developed 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

[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; Bonaimé et al., 2014), option exercise in stock option plans (Fenn and Liang, 2001; Kahle, 2002; Bens et al., 2003), and takeover defense (Denis, 1990).

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; Bonaimé 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 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.

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. In fact, 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, 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, the Article 2 of 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

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

2273/2003 of the European Parliament). This regulation was simultaneously adopted with MAD by Member States, and provides a safe harbor for repurchasing stocks. In detail, it specifies the conditions to be met by buyback programs, including the aims of the stock repurchase programs, the repurchase price range, the volume of daily transactions, and disclosure requirements. In Greece, 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 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 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 and interest case to examine.

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.[4] 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.[5] 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 sough in the repurchase ranges from 7.70% to 9.33%. These figures are

[4] 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.
[5] Stocks with fewer than 30 observations during the estimation period are excluded.

comparable to what reported in other relevant studies (Peyer and Vermaelen, 2009; Manconi et al., 2019).

[Insert **Table 1** here]

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 because the maximum duration of the programs was 12 months.[6]

c) If it has been announced at least three years after the previous repurchase program. This condition applies for programs after August 2007 because the maximum duration of the programs was 24 months.[7]

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]

[6] For repurchase announcements in 2000 and 2001, we have examined whether the repurchasing firms had announced any SRPs in the previous 24 months.

[7] Our results remain similar even when we use the same classification of initial programs as before August 2007.

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 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:[8]

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

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.[9]

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.

[8] 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].

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

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 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 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.

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 in other major European economies, such as France, Germany, and the UK, (Andriosopoulos and Lasfer, 2015). In fact, our results indicate that the implementation of an EU directive does not have a uniform effect across Member States, due to the legal differences between those countries (Siems and De Cesari, 2012). Overall, we argue that after the incorporation of 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.

[Insert **Table 3** here]

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: *Leverage*, *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 reasons* 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.[10] Correlation among continuous variables indicates a weak to moderate degree of linear relationship.[11] 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%

[10] Results are similar if we use White (1980) heteroscedasticity robust standard errors.
[11] In absolute values, the highest correlation coefficient is between *Cash* and *Leverage* (–0.39).

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* 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 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, 2019).

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.[12] 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.[13] 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.[14]

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 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]

[12] 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.

[13] Matching is done with replacement. Results are qualitatively similar if we match with no replacement, or if we use more than one matches.

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

6. Robustness checks

In this section, we conduct two robustness checks to ensure 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.

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).

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 that self-selection does not impact our results. Furthermore, our results are very similar to the baseline regressions of 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]

7. Conclusion

In this paper, we investigate the impact of 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. Finally, our results remain robust even when we account for any observed heterogeneity across time periods, sample selection issues, and changes in the dividend policy.

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 MAD in July 2005, 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	−1.083	−0.122	0.887
Tobin's q	548	1.250	1.326	0.152	0.872	8.754
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	0.445	0.497	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. 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