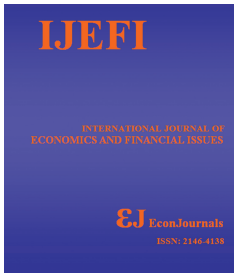

International Journal of Economics and Financial Issues

ISSN: 2146-4138

available at http: www.econjournals.com

International Journal of Economics and Financial Issues, 2019, 9(2), 241-250.

Insider Trading Patterns in Periods of Financial Crisis: A Study of the Technological Sector of Athens Stock Exchange Market

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Received: 02 January 2019 **Accepted:** 05 March 2019 **DOI:** https://doi.org/10.32479/ijefi.7635

ABSTRACT

In this paper, we investigate the insider trading patterns of the Greek Stock Exchange Market before and after the outburst of the Greek Financial Crisis. Using the event study methodology, we examine and compare the relationship between insider trading and corporate governance structures, for 14 firms of the Greek Technology sector listed in ATHEX for the periods 2007-2010 and 2010-2013. Our results suggest that there are structural differences in the patterns of insider trading and the relationship that it has with the corporate governance and the ownership structure of the firms for the two time periods examined differences that should be attributed to the financial crisis. Although ownership structure does not seem to have an important effect on stock returns, separation of ownership and control, and the board of directors had a significant effect during the period of the financial crisis.

Keywords: Insider Trading, Corporate Governance, Ownership Structure, Financial Crisis, Greece
JEL Classifications: G11, G34

1. INTRODUCTION

Insider trading has been a significant issue of discussion for both academics and practitioners since it affects the efficient and transparent operation of the markets (Leland, 1992; Firdmuc et al., 2006). Top executives, members of the board of Directors, and blockholders of the firms, and employees in critical positions of the firm are characterised as insiders, as they all have privileged access to information regarding the financial status of the firm, and the operation of the firm, that the rest of the shareholders are not able to know. This kind of privileged information can be used, to achieve higher (abnormal) returns from transactions on stocks of a listed firm (Seyhun, 1986; Ravina and Sapienza, 2010), at the expense of the other shareholders, in a way that literature characterizes as unethical (Moore, 1990) and damaging shareholder value and wealth (Hu and Noe, 2001).

It has long been recognized that insiders are able to use trading patterns that are based on private information to gain profits by their transactions (Hirshleifer et al., 1994; Bainbridge, 1999; Biggerstaff et al., 2015; Antoniadis et al., 2015). Gregory et al. (2006) also identified insider trading patterns that may provide higher returns.

A way of dealing with this issue is the application of regulation concerning the disclosure of these transactions and the adoption and application of Corporate Governance rules and mechanisms as it is suggested by relevant literature (Shleifer and Vishny, 1997). Corporate governance is even more important in periods of financial crisis as literature suggested for them and has found in the case of Asian Financial crisis in the late 1990s' (Johnson et al., 2000; Lemmon and Lins, 2003).

The same should be examined also for Greece. The country faces an unprecedented financial crisis (Gibson et al., 2012), that started in 2010 and continues up to this day. The Greek capital markets were also influenced by this adverse economic environment and the companies in the Athens Stock exchange market has suffered

the consequences. Considering the fact that most companies are run by their owners like founders and family (Kapopoulos and Lazaretou, 2007; Nerantzidis and Filos, 2014), that had a profound impact on the way that insiders performed transactions in the stock market.

Notwithstanding the importance of insider trading in smaller markets, and especially the ones facing a financial crisis, little research has been done in this direction. The majority of the studies in this topic concern countries that are categorized in the Anglo-Saxon corporate governance system and more specifically the US and the UK (Leledakis et al., 2010; Antoniadis et al., 2015; 2017), with some exceptions concerning Germany (Dickgiesser and Kaserer, 2009) and recently Asia (Hsu and Wen, 2015; He and Rui, 2016).

In this paper, we examine the differences in the relationship of insider trading, with specific corporate governance mechanisms, as these are identified by relevant literature, between two different periods of time before and after the Greek Financial crisis. The effect that ownership structure, separation of ownership and control, members of the board of directors, has on abnormal returns is examined and the existence of structural differences between the two time periods is surveyed. In order to do that we examine a number of 636 announcements of insider trading for the 14 technology sector firms listed in Athens Stock Exchange Market (ATHEX), that operate in software, hardware, and telecommunications) firms, during the period 2007-2010 and 2010-2013, respectively.

The contribution of our research to the literature of insider trading and corporate governance is multifaceted. First of all our work extends further the research that has been performed on the subject for Greece (Lekkas, 1998; Leledakis et al., 2010; Maditinos et al., 2007) by examining the relationship of insider trading with corporate governance. Second, our survey focuses in an important sector for modern economies, and with a comparative analysis with similar studies, can provide useful insight on the existence of different insider trading patterns of behavior in different sectors. And finally, the period examined encompasses a transitional period of time for the Greek economy and stock market with the outburst of the financial crisis of 2010, providing evidence on the behavior of insiders when their firms face financial pressure from the external – macroeconomic environment.

The remainder of the paper is structured as follows. Section 2 gives a brief presentation of the sector in the period we are examining. Section 3 reviews the literature concerning insider trading and its relationship ownership structure and corporate governance along with the legal framework of insider trading announcement in ATHEX. Section 4 discusses shortly the event study methodology used in the paper, the characteristics of the sample of firms included, and the estimated econometric model. In Section 5 the empirical results of the econometric analysis are presented and discussed. Finally, Section 6 concludes the paper and offers suggestions for further research.

2. THE GREEK TECHNOLOGY SECTOR DURING THE FINANCIAL CRISIS

The technology sector is probably the most important sector for most developed economies. In Greece however, the technology sector has not grown to its full potential and was severely battered by the financial crisis, as almost every sector of the Greek economy. The technology sector of the Athens Stock Exchange market includes firms that operate in hardware, software, consumers electronics, internet services and equipment, and telecommunications equipment. In Table 1 the 14 firms examined in our paper are listed.

The firms of the sector followed the general bearish trend of the general index of the Athens Stock Exchange (ASE), and as a result, firms have lost up to 80% of their value, in average, during the period 2007-2013 as can be seen in Figure 1. The same trend was observed in the transactions volume. The overall crisis had its toll also to the number of the listed firms in the market. In 2007, 24 technology firms were listed in the (ASE), while in 2013 there are 20 firms, out of which 5 are under supervision status and 2 of them were under deletion. The fundamental financial data of the firms also deteriorated.

In Figure 2, the turnover of the firms shows a decline of 14,56% for the period 2009-2013, reflecting the declining demand caused by the financial crisis. The same is true for the total assets of the firms (Figure 3), that also decline by 31,09%, during the period of the financial crisis, as firms were obliged to sell assets or postpone investments that would increase the value of their assets.

3. INSIDER TRADING PATTERNS AND FACTORS AFFECTING IT

Insider trading is a phenomenon that is rooted in the practice of stock markets since their origin. Kudijs (2015) reported the ways that private information had been used by insiders in the London and Amsterdam stock exchange market in the 18th century, finding considerable analogies with today's practices. Today practices, of course, are more complicated and sophisticated and are widely influenced by the media and the high speed that news is disseminated (Dai et al., 2016). Although insider trading is usually seen by investors, as an unethical course of action undertaken by the managers of the firm, that is supposed to be illegal, it also encompasses a legitimate side if performed within the provisions

Table 1: List of technology (hardware and software) firms listed in the Athens stock exchange market included in the study

ALTEC SA	PROFILE
BYTE COMPUTER	QUEST HOLDINGS
FORTHNET SA	ALFA GRISIN
HELLAS ONLINE SA	INTRALOT SA
INTPAKOM HOLDINGS	AVENIR LEISURE and ENTERTAINMENT SA
LOGISMOS SA	CENTRIC HOLDINGS SA
M.L.S. SA	INFORM P. LYKOS SA

Figure 1: Technology sector index

Figure 2: Turnover of the listed firms of the sector (in thousands euros)

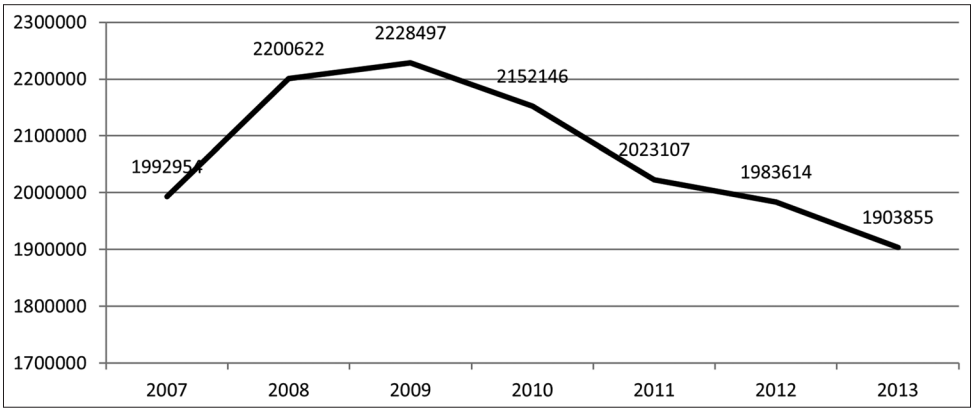
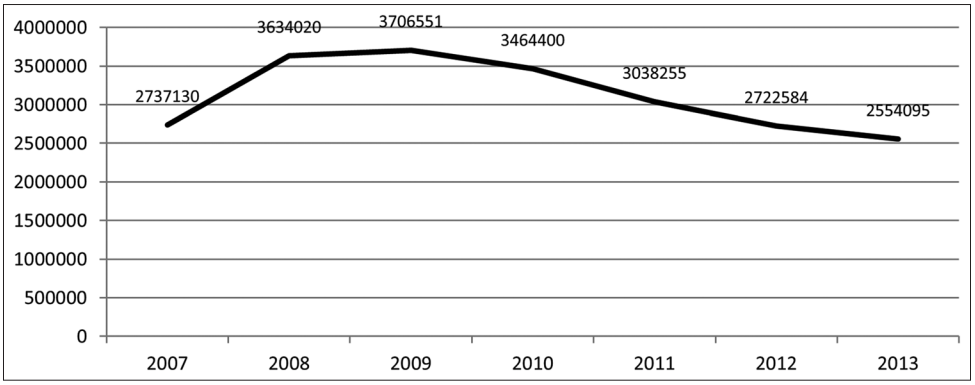


Figure 3: Total assets of the listed firms of the sector (in thousands euros)



of the law governing the operation of firms as well, especially when they are accompanied with media coverage as they can provide valuable information to investors and the markets (Rogers et al., 2016). Insider trading violations include leaking crucial information to third party investors, securities trading by the person in possession of such kind of information, and securities trading by those who came in possession of such information in a fraudulent way.

Leland (1992) summarised the positive and negative aspects of insider trading. The arguments in favor of insider trading are that if properly communicated it provides the market and the investors with information by insider transactions, that will result to a better valuation of assets and therefore decreasing risks associated with the investment in this asset leading to increased levels of investments n the market. On the other hand, however outside investors may be discouraged to invest in a market they believe is unfair, resulting in reduced liquidity and increased volatility (Du and Wei, 2004). Accounting scandals may also lead to higher levels of insider trading as insiders try to sell stocks at higher prices, before the restating of the statements of their firms (Agrawal and Cooper, 2015).

According to Hamill et al. (2002) insiders perform these transactions for two main reasons: (a) For liquidity reasons, or (b) because they are in possession of crucial non-disclosed information. Insider trading has been an important issue that had to be regulated (Leland, 1992), and European Union legislation has published numerous proposals and directives in this direction that had to be incorporated in the national laws of the member

states (Langenbucher, 2004). That also happened in Greece where insider trading regulation was introduced after 1989, integrating of European Union legislation that required all its members to implement the European Community Insider Trading Directive (89 592 EEC of November 13, 1989), in the Greek national law. Until then, however, Lekkas (1998) has described the market operation in terms of insider trading, as inadequate and "dark", where insider trading was not just a common practice but the status quo for the majority of the listed firms in ATHEX. Significant progress has been achieved however since that period of time. In a recent survey on the status of the Corporate Governance framework in Greece as it was documented by Nerantzidis and Filos (2014), through the incorporation of relevant European Directives in the Greek National Law, resulting to an increase in transparency, disclosure, and protection of the rights of small investors (outsiders).

For the period before and during the financial crisis, that we are investigating examined in the present paper, Law 3340/2005 regulated the issues of insider trading[1]. Every company listed in ATHEX according to this law must declare the list of employees/persons, under contract or otherwise, who have access to insider information, and make that list available to the Hellenic Capital Market Commission (HCMC). These persons may be members of the administrative, management or supervisory body of that entity; or senior executive who are not members of the bodies referred, but have systematic access to inside information related directly or indirectly to that entity and also authority to take managerial decisions affecting the future developments and business prospects of that entity. Disclosure requirements specify that insiders must inform their company and the relevant authority of the transaction the day after its execution. In turn, the relevant authority informs the public as soon as possible and no later than two calendar day following receipt of the information. The above-mentioned obligation applies also to persons closely associated with persons discharging managerial responsibilities and also covers all shareholders who are in possession of more than 5% of the voting rights of the company.

Insider trading has always been closely associated with the existence of a sound corporate governance framework within the company, that would protect outsiders from any unethical or damage bearing action of insiders (Firdmuc et al., 2006; Betzer and Theissen, 2009). Goergen and Renneboog (2006), defined corporate governance as "*the combination of mechanisms which ensure that the management (agents) runs the firm for the benefit of one or several stakeholders (principals).*" Cziraki et al. (2014) also provide two more explanations, through which good corporate governance impacts insider trading: Increased shareholder awareness and increased monitoring by blockholders.

Corporate Governance is also important in periods of financial crisis. Johnson et al. (2000) outlined the importance of good corporate governance as a way of dealing with a financial crisis, examining the Asian Financial crisis of the late 1990s, finding that countries and companies with better corporate governance were harmed less by the crisis. The same conclusions are drawn by Bailey et al. (2006), specifically, that better corporate governance provides an institutional framework that improves significantly the accuracy and transparency of disclosed information to shareholders including the ones concerning insider trading. This is also true for Greece as Georgantopoulos and Filos (2017), found examining the relationship of the board of directors as a corporate governance mechanism and performance of Greek Banks during the period of the financial crisis.

One of the most important corporate governance mechanism is ownership structure (Elvin and Hamid, 2016; Mirchandani and Gupta, 2018) and most specifically the existence of blockholders as an increase in the percentage of shares shareholders own, should increase their motivation for better and more active monitoring of the insiders (Agrawal and Knoeber, 1996; Shleifer and Vishny, 1997). Fidrmuc et al. (2006) in a similar fashion presented the concept of blockholder as a mechanism for monitoring insider trading. As large shareholders have a greater stake in the company they have stronger incentives, and larger voting power to effectively monitor and control insiders' actions. That is also more evident when the blockholder is also the CEO of the firm (Adams et al., 2005), or when the CEO is performing a transaction (Jeng et al., 2003) or a member of the Board of Directors, and in this case the effect on abnormal returns should be positive (Gregory et al., 2009).

Insider trading has not been researched in such an extent for the Greek Stock Market. Thalassinos et al. (2012) have found evidence of agency problem as the impact of announcement of insider trading, is less severe in firms with more concentrated ownership structure. Their results also demonstrated that the effect of insider trading is on stock returns is also affected by the position the insider holds within the firm. Antoniadis et al. (2017) studying technology sector firms of the Greek Stock market found that insider trading by CEOs and members of the Boards of Directors has a significant effect on stock returns in the long run. Their results also indicated that ownership structure and high levels of ownership concentration and control have a negative/positive effect in abnormal stock returns of the firms only in long periods of time after the announcement of purchases/sales.

In the following section, we use the above-mentioned findings of literature review, to formulate a model that could explain the relationship of insider trading and corporate governance patterns and the effect they have on stock returns, focusing in technology sector firms of the Greek Stock Exchange market.

4. METHODOLOGY

The sample used consists of the announcements concerning purchase and selling of shares from insiders of 14 technology firms (computer software and hardware) of the ATHEX during the period 2007-2013. The announcements and the corporate

1 The current framework for insider trading notifications obligation is in line with the Article 18 of the Regulation (EU) No. 596/2014 of 16 April 2014, and the Commission Implementing Regulation (EU) 2016/347 of 10 March 2016, entered in force in July 3, 2016.

governance and financial data were provided by the official web page of the ATHEX (www.helex.gr), and the investor relations section of the sites of the websites of the 14 firms. Data for the stock prices and the market index was acquired by Bloomberg database. A total number of 636 events were identified, 359 before the crisis outburst, and 277 after the crisis, after excluding non-statistical important events and outliers. The date that we use in order to define the beginning of the financial crisis is the week 14-21st of January of 2010, as in this week the spreads of Greek Sovereign bonds have risen above 300 basis points, and Credit Rating Agencies like Fitch started examining the possibility of downgrading the credit rating of the Greek Economy.

The effect of the announcement and the identification of insider trading patterns, in stock returns, is calculated by the use of the event study methodology used (Brown and Warner, 1985). Event studies that examine the effect of specific events in the stock prices reactions before and after the event can provide significant insight on the existence of agency problem and agency cost (Shleifer and Vishny, 1997).

The rationale of this methodology is based in the efficient market hypothesis (Fama, 1970), where investors take under consideration any available information that would influence the returns of securities in an abnormal way compared to the one predicted by the CAPM model.

The first step of this method is to estimate the Abnormal Returns based on the estimation of a CAPM model for a period of time (*estimation window*), before the announcement (event) took place, and then sum these abnormal returns for designated periods of time around the time the event (transaction) occurred (Campbell et al., 1997. p. 149-168). The sum will provide us with the Cumulative Abnormal Return that we are going to use as a dependent variable in regression (1).

Table 2: List of variables used

Variable	Definition
CAR (t_1, t_2)	Cumulative abnormal returns for the period (t_1, t_2)
CEO	=1 if the insider is the CEO, and 0 if otherwise
Member	=1 if the insider is a member of the BoD, and 0 if other
NONE_EXEC	=1 if the insider is a nonexecutive member of the BoD, 0 if other
TRANSACT	Transaction volume divided by the mean capitalization value of the equity during the period t=−180 to t=−21
CEO_OWN	=1 if the insider is the CEO holds the largest block of shares in the firm, and 0 if otherwise
OWN	The percentage of share held by the largest blockholder
CR5	The percentage of shares held by the largest 5 shareholders
LNCAP	The logarithm of the average market value of equity during the period t=−180 to t=−21
LNMBV	The logarithm of the average market-to-book value during the period t=−180 to t=−21
LNTABV	The logarithm of the ratio of total assets to book value

$$CAR_{i,(t_1,t_2)} = \begin{aligned} & a + \beta_1 CEO_i + \beta_2 MEMBER_i + \beta_3 NONE\_EXEC_i + \\ & \beta_4 TRANSACT_i + \beta_5 CEO\_OWN_i + \\ & \beta_6 OWN_i + \beta_7 CR5_i + \beta_8 LNCAP_i + \\ & \beta_9 LNMBV_i + \beta_{10} LNTABV_i + u_i \end{aligned} \quad (1)$$

In our case, the estimation window used for $CAR_i(t_1,t_2)$ was 160 days, from 180 days before the announcement of the transaction (event) took place, until 21 days before the event, as suggested by the literature (Brown and Warner, 1985; Campbell et al., 1997). The independent variables used in the model are explained in Table 2.

Those variables are in line with the relevant literature. Gregory et al. (2009) and Dickgiesser and Kaserer (2009) suggest that the effect of an insider's position, in the Board of Director, on abnormal returns should be positive. In order to incorporate to our model the market financial characteristics of the firms of the sample, 3 control variables are introduced, namely the capitalization of the firm *LNCAP*, the value of the firm *LNMBV,* and the financial leverage of the firm measured by *LNTABV* (Dickgiesser and Kaserer, 2009).

Model (1) is estimated for two periods of time. The first covers the period before the crisis (2007-2010) and the second the period of time after the beginning of the crisis (2010-2013). To test for the existence of structural differences in the insider trading patterns we perform a Chow test (Brooks, 2008. p. 180-181), therefore model (1) is estimated again for the whole time period this time (2007-2013). The section that follows presents the empirical results of the above-described regression.

5. EMPIRICAL RESULTS

In Table 3 the descriptive summary statistics for the cross-sectional regression sample consisting of a total of 636 observations are presented, broken down during the two time periods, before and after the crisis. Panel A reports transactions for the period 2007 until 2010, including 359 transactions and Panel B the transactions for the time periods for 2010 to 2013 (277 observations). Panel C offers the descriptive statistics for the total sample (636 transactions).

A comparison of the results in the 3 panels of Table 3 provides a first insight into the changes that occurred in the insider trading and corporate governance due to the financial crisis. CEOs performed more transactions in the period after the crisis compared to before, while being a member of the Board of Directors, and none executive members of the Board seemed to be less active. Another notable difference concerns the volume of the transaction of insider trading (*TRANSACT*), that also rises in the period after the crisis has occurred.

The most interesting and notable change, however, concerns the ownership structure of the firms. The mean value of the percentage

Table 3: Descriptive statistics of the independent variables

Panel A. Transactions before crisis (observations 1-359)					
Variable	**Mean±SD**	**Skewness**	**Kurtosis**	**Jarque-Bera**	**Observ.**
CEO	0.6128±0.4878	−0.4632	1.2146	60.5219	359
Member	0.9304±0.2549	−3.3815	12.4349	2015.7220	359
NONE_EXEC	0.1393±0.3467	2.0837	5.3418	341.8179	359
TRANSACT	0.0012±0.0049	13.0608	203.2740	610180.4000	359
CEO_OWN	0.6936±0.4616	−0.8399	1.7054	67.2765	359
OWN	0.3764±0.1917	0.3973	2.0153	23.9467	359
CR5	0.5431±0.1365	−0.1554	1.6860	27.2720	359
LNCAP	18.1348±2.0067	0.5250	1.8579	36.0005	359
LNMBV	−0.6304±1.0770	−0.9928	4.3117	84.7163	359
LNTABV	0.6657±0.3455	1.4364	10.6889	1007.7820	359
Panel B. Transactions after crisis (observations 360−636)					
	Mean±SD	**Skewness**	**Kurtosis**	**Jarque−Bera**	**Observ.**
CEO	0.6354±0.4822	−0.5625	1.3164	47.3224	277
Member	0.9097±0.2871	−2.8599	9.1792	818.2974	277
NONE_EXEC	0.1300±0.3369	2.2009	5.8438	316.9643	277
TRANSACT	0.0014±0.0037	6.7213	66.1576	48123.9700	277
CEO_OWN	0.7112±0.4540	−0.9320	1.8686	54.8743	277
OWN	0.4807±0.1825	−0.6970	1.9465	35.2336	277
CR5	0.6226±0.0911	−1.6702	7.2112	333.4705	277
LNCAP	17.1618±0.8916	1.1177	4.9457	101.3651	277
LNMBV	−0.0953±0.7216	0.7997	2.4335	33.2287	277
LNTABV	0.5878±0.4627	1.5702	4.4138	136.8999	277
Panel C. Pooled sample (observations 1-636)					
	Mean±SD	**Skewness**	**Kurtosis**	**Jarque-Bera**	**Observ.**
CEO	0.6226±0.4851	−0.5060	1.2561	107.7375	636
Member	0.9214±0.2694	−3.1313	10.8053	2653.8260	636
NONE_EXEC	0.1352±0.3422	2.1335	5.5517	655.0293	636
TRANSACT	0.7013±0.4581	−0.8794	1.7734	121.8500	636
CEO_OWN	0.0013±0.0044	11.8207	189.1294	932881.3000	636
OWN	0.4219±0.1946	−0.0669	1.6139	51.3869	636
CR5	0.5777±0.1252	−0.6941	2.4412	59.3365	636
LNCAP	17.7110±1.6879	1.0448	3.0499	115.7693	636
LNMBV	−0.3973±0.9751	−0.8801	5.2054	210.9967	636
LNTABV	0.6318±0.4023	1.4663	6.4023	534.6430	636

SD: Standard deviation

of shares held by the largest blockholder (*OWN*) has risen from 37.64% before the crisis to 48.07% after the crisis. The same of course is true for the percentage of shares held by the 5 biggest shareholders, that has risen from 54.31% to 62.26% respectively. The rise of concentration of the ownership structure of the firms of the sample and the fact that most of the blockholders (who were in most cases also the CEOs of the companies) were purchasing shares in order to provide support for the price of the shares, or in order to gain more power in their companies taking advantage the significantly lower prices of the shares. The decrease of the capitalization of the firms of the sample (*LNCAP*) for the period before the announcement of the transaction in the period after 2010, of course, would be not a surprise considering the overall situation of the market.

In tables 4 and 5, the results of the regression estimation for equation (1) for transactions before and after the crisis are presented respectively. As a general observation, we must note that the model seems to have better explanatory power for CARs in long periods of time after the announcement (0, +10), (0+20). All 12 estimated regressions are statistical important since the F value exceeds the critical value, and no multicollinearity issues were detected.

Before the crisis, transactions performed by the CEOs have a positive but not statistically significant effect in the returns of the stock only in the long term periods after the announcement of the transaction. On the other hand, however, transactions performed by the members of the board have a statistically significant negative effect for the long term periods after the event. The same finding holds for high levels of ownership concentration do not have a statistically significant effect on stock returns in the short run periods before and after the announcements but have a negative and significant effect in the long run periods after the transaction (0,+10 and +20). Separation of ownership and control, and non executive members of the board, do not have a statistically significant effect in all cases. The volume of the transaction had also a negative effect for the same periods of time after the event before the crisis. Another important finding is that control variables have an effect on the cumulative abnormal returns.

For the period after the crisis however insider trading patterns seem to change (Table 5). Transactions performed by CEOs have a positive effect on CAR (0, +10) and CAR (0, +20), while for purchases and sales conducted by the members of the board the effect is negative only for the periods of time after the announcement of the transaction, drawing attention in the role

Table 4: Regression results for the period 2007-2010

Variable	CAR (−2,0)	CAR (−1,0)	CAR (0,+1)	CAR (0,+2)	CAR (0,+10)	CAR (0,+20)
Constant	−0.028	0.051	0.149***	0.227***	0.702***	0.827***
	(−0.378)	(0.912)	(2.775)	(3.400)	(6.670)	(5.369)
CEO	0.001	0.002	0.001	0.004	0.010	0.024
	(0.130)	(0.275)	(0.116)	(0.377)	(0.643)	(1.063)
Member	0.019	0.017*	0.008	0.004	−0.037**	−0.071***
	(1.522)	(1.810)	(0.921)	(0.318)	(−2.096)	(−2.765)
NONE_EXEC	0.009	0.009	0.010	0.008	0.003	0.009
	(0.854)	(1.024)	(1.252)	(0.789)	(0.216)	(0.396)
TRANSACT	0.010	−0.003	−0.008	−0.013	−0.058***	−0.058**
	(0.795)	(−0.319)	(−0.809)	(−1.145)	(−3.163)	(−2.166)
CEO_OWN	0.136	0.129	−0.127	0.254	−0.918	−2.845**
	(0.248)	(0.309)	(−0.318)	(0.515)	(−1.178)	(−2.496)
OWN	0.029	0.022	−0.011	−0.019	−0.090***	−0.030
	(1.398)	(1.399)	(−0.745)	(−1.011)	(−3.067)	(−0.697
CR5	−0.003	−0.011	−0.025	−0.035	−0.142***	−0.141**
	(−0.114)	(−0.591)	(−1.380)	(−1.550)	(−4.038)	(−2.729)
LNCAP	−0.002	−0.005**	−0.008***	−0.012***	−0.029***	−0.038***
	(−0.689)	(−2.150)	(−3.619)	(−4.281)	(−6.400)	(−5.819)
LNMBV	−0.011***	−0.009***	−0.012***	−0.018***	−0.021***	−0.039***
	(−3.091)	(−3.228)	(−4.671)	(−5.573)	(−4.184)	(−5.294)
LNTABV	0.037***	0.029***	0.008	0.013	−0.028*	0.024
	(3.532)	(3.644)	(1.003)	(1.383)	(−1.867)	(1.098)
R^2	7.10%	8.97%	9.04%	11.57%	14.68%	16.89%
Adjusted R^2	4.43%	6.36%	6.43%	9.02%	12.23%	14.50%
N	359	359	359	359	359	359
BPG	2.206	1.767	2.173	2.207	1.931	5.710
Max VIF	5.707	5.707	5.707	5.707	5.707	5.707
Avg VIF	2.706	2.706	2.706	2.706	2.706	2.706
F-statistic	2.660	3.431	3.460	4.551	5.987	7.074

Values in brackets are t statistics. *, **, ***denotes statistical significance of 10%, 5% and 1% respectively

Table 5: Regression results for the period 2010-2013

Variable	CAR (−2,0)	CAR (−1,0)	CAR (0,+1)	CAR (0,+2)	CAR (0,+10)	CAR (0,+20)
Constant	−0.079	−0.081	−0.050	−0.024	−0.066	−0.293
	(−0.937)	(−1.236)	(−0.768)	(−0.280)	(−0.404)	(−1.650)
CEO	0.010	0.000	0.008	0.006	0.053**	0.060**
	(0.894)	(0.016)	(0.931)	(0.585)	(2.485)	(2.556)
Member	−0.013	−0.004	−0.014	−0.021*	−0.057**	−0.048*
	(−1.078)	(−0.433)	(−1.514)	(−1.681)	(−2.416)	(−1.835)
NONE_EXEC	−0.001	0.001	0.004	−0.001	0.008	−0.020
	(−0.105)	(0.094)	(0.441)	(−0.113)	(0.358)	(−0.782)
TRANSACT	0.012	0.013*	0.005	0.004	−0.006	0.005
	(1.187)	(1.661)	(0.683)	(0.406)	(−0.310)	(0.254)
CEO_OWN	1.697**	1.280**	0.727	2.626***	5.099***	5.191***
	(2.240)	(2.194)	(1.246)	(3.488)	(3.504)	(3.261)
OWN	0.027	0.030**	0.014	0.004	−0.019	0.006
	(1.486)	(2.082)	(0.952)	(0.209)	(−0.542)	(0.143)
CR5	−−0.021	0.013	0.015	0.037	−0.040	−0.016
	(−0.627)	(0.520)	(0.585)	(1.1320	(−0.638)	(−0.226)
LNCAP	0.004	0.003	0.002	0.000	0.007	0.018*
	(0.841)	(0.772)	(0.643)	(0.103)	(0.818)	(1.854)
LNMBV	0.004	0.003	0.006*	0.003	0.017	0.034***
	(0.926)	(0.933)	(1.815)	(0.651)	(1.970)**	(3.507)
LNTABV	0.018**	0.008	−0.003	−0.005	−0.013	−0.003
	(2.306)	(1.336)	(−0.473)	(−0.696)	(−0.900)	(−0.214)
R^2	6.52%	7.04%	4.16%	7.12%	10.22%	13.28%
Adjusted R^2	3.00%	3.54%	0.55%	3.63%	6.84%	10.02%
N	277	277	277	277	277	277
BPG	11.603	12.684	14.357	11.877	6.546	6.797
Max VIF	3.520	3.520	3.520	3.520	3.520	3.520
Avg VIF	2.107	2.107	2.107	2.107	2.107	2.107
F- statistic	1.855	2.014	1.154	2.038	3.028	4.075

Values in brackets are t statistics. *, **, ***denotes statistical significance of 10%, 5% and 1% respectively

Table 6: Regression results for the period 2007-2013

Variable	CAR (−2,0)	CAR (−1,0)	CAR (0,+1)	CAR (0,+2)	CAR (0,+10)	CAR (0,+20)
Constant	−0.038	−0.015	0.063	0.111**	0.320***	0.326***
	(−0.829)	(−0.434)	(1.831)	(2.546)	(4.162)	(3.234)
CEO	0.004	0.002	0.002	0.004	0.025**	0.034**
	(0.561)	(0.293)	(0.417)	(0.506)	(2.032)	(2.095)
Member	0.009	0.010	0.003	−0.001	−0.030**	−0.034*
	(0.992)	(1.580)	(0.474)	(−0.151)	(−2.057)	(−1.811)
NONE_EXEC	0.006	0.007	0.008	0.005	0.013	0.013
	(0.846)	(1.171)	(1.413)	(0.704)	(1.023)	(0.792)
TRANSACT	0.009	0.007	−0.001	−0.003	−0.022*	−0.018
	(1.255)	(1.312)	(−0.155)	(−0.470)	(−1.855)	(−1.139)
CEO_OWN	0.556	0.479	0.181	1.021**	1.239*	0.179
	(1.276)	(1.427)	(0.551)	(2.466)	(1.706)	(0.188)
OWN	0.031**	0.027***	0.006	−0.002	−0.026	0.023
	(2.416)	(2.714)	(0.572)	(−0.151)	(−1.197)	(0.817)
CR5	−0.011	−0.008	−0.016	−0.017	−0.116***	−0.120***
	(−0.607)	(−0.581)	(−1.172)	(−0.943)	(−3.734)	(−2.950)
LNCAP	0.000	−0.001	−0.004**	−0.006***	−0.012***	−0.015***
	(−0.109)	(−0.748)	(−2.404)	(−3.177)	(−3.467)	(−3.212)
LNMBV	−0.006**	−0.006***	−0.007***	−0.012***	−0.009**	−0.015***
	(−2.412)	(−2.863)	(−3.378)	(−4.685)	(−2.122)	(−2.661)
LNTABV	0.025***	0.018***	0.002	0.004	−0.019*	0.006
	(3.988)	(3.688)	(0.409)	(0.723)	(−1.834)	(0.410)
R^2	4.16%	4.84%	2.77%	4.82%	5.56%	4.98%
Adjusted R^2	2.62%	3.32%	1.21%	3.29%	4.05%	3.46%
N	636	636	636	636	636	636
BPG	6.161	5.051	8.728	8.777	6.954	11.247
Max VIF	3.520	3.520	3.520	3.520	3.520	3.520
Avg VIF	2.363	2.363	2.363	2.363	2.363	2.363
Chow test	1.669	2.087	2.690	3.093	4.379	7.020
F- statistic	2.711	3.178	1.778	3.163	3.681	3.278

Values in brackets are t statistics. *, **, ***denotes statistical significance of 10%, 5% and 1% respectively. The breakpoint for the Chow test is observation 359

of the Board of Directors and its members as a mechanism of corporate governance.

This difference in the way that insider trading affects stock returns, after the outburst of the crisis, is also depicted in the variable concerning the separation of ownership and control (*CEO_OWN*), that has a positive and statistically significant effect in all periods of time examined before and after the transaction, whereas before the financial crisis ha only negative effect in the (0, +20) period of time. Ownership structure during the financial crisis does not have an effect in stock returns and insider trading for the firms of our sample after 2010, as most of the financial control variables.

In Table 6 the results of the regression for the whole time period and the Chow test values are presented. As mentioned in a previous section of the paper the breakpoint for performing the Chow test was 14/1/2010 (observation 359). The calculated values of the Chow test, reported in Table 6 show that there are significant structural differences in the insider trading patterns and the corporate governance of firms before and after the financial crisis especially after the announcement of the conducted transaction.

6. CONCLUSIONS

In this paper, we have examined the change in patterns of the relationship between insider trading and, the position the insider holds in the firms and the ownership structure that the Greek financial crisis caused. The focus of this study was for the firms of the Greek technology sector in ATHEX, for the period of time between 2007 and 2013, a period that is characterized by seismic changes in the Greek economy and stock market.

Our results have found statistically significant differences in the way that insider trading affects stock returns for the period before and after the crisis. Insider trading by CEOs became more important in the years of the financial crisis, and the ownership structure of the firm became more concentrated. Investors could possibly achieve higher returns by following transactions performed by the CEOs but not by other members of the board. Also it is important to note that the effect is stronger when the CEO is also the biggest shareholder, providing an agency theory perspective in monitoring the actions of the CEO. Ownership structure on the other hand became a less important mechanism of corporate governance during the financial crisis. On the other hand, the importance of the board of directors grew because of the financial crisis, as transactions made by members had a negative effect on stock returns.

The findings of this paper are also in line with the ones provided by the literature, such as the ones of Dickgiesser and Kaserer (2009) as there is evidence that the insiders performing the transaction affect abnormal stock returns, but not in a clear and homogenous manner. Especially for transactions performed by members of the board, our results are different from the ones provided by Gregory et al. (2009). For our case, this relationship varies according to the period of time examined (before or after the crisis) and is

definitely limited only to long term periods after the transaction occurred (10 or 20 days after the announcement). It is also important to highlight the role and importance of the Board of Directors during a period of financial crisis as it is also suggested by literature (Georgantopoulos and Filos, 2017), as a corporate governance mechanism, but also as a source of information for investors and traders. Concerns should also be raised on issues of information leaks, and on the development of mechanisms and procedures within the board that would promote transparency and accountability.

Although these results provide an insight on the way that the financial crisis has affected insider trading, there are limitations and issues that should be taken under consideration. The most important limitation of our study is that we have not discriminated the transactions performed by the insiders to sales and purchases of stocks due to the small size of the sales sample in the period 2010-2013. Expanding the research sample to other sectors and industries individually or as a whole, would help address methodological and econometric problems, and provide insight, on the ways that the financial crisis has affected insider trading both in different sectors of the Greek stock market but also in other countries that faced a similar situation.

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