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"Is There a Non-linear Relationship of Market Value with Cash and Ownership?"

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Abstract

The paper provides new evidence on the way that both the cash and ownership influence firms' market value in the Athens Stock Exchange (ASE) within the Eurozone (2000-2015). Based on corporate governance theory and critical analysis we use the dynamic panel data econometrics, in order to get consistent estimations of the impact of firms' cash and ownership upon either the return on equity or the Tobin's Q ratio. It is confirmed the dominance of the ownership pattern on these determinants of firms' value. Actually, we have found an inverse-U-shape value-ownership relationship, while practically, there's no-effect of cash on business efficiency. Unlike the previous studies, the findings support not only the interest alignment hypothesis, or the ownership could be a substitute for weak legal and institutional environment, but also the expropriation of outright majority ownership (large shareholder) against the minority one. In addition, the constantly changing optimal level of cash due to the unstable economic environment is a possible explanation of the insignificant cash variable. The estimated 40% of the equity as optimal level of ownership concentration maximizing market value of firms in the ASE could be useful for candidate investors.

Keywords: Corporate governance; Cash management; Corporate ownership concentration; Agency theory; Eurozone crisis; Tradeoff theory.
JEL Classification: C58, G32, G34.

1. Introduction

The structure of the ownership is accepted as one of the main drivers of firms' agency costs, in the corporate governance literature (Jensen and Meckling, 1976). Based on well founded theoretical arguments, the non-linear effect of ownership on market value of firms is also widely documented, primarily for industrialized countries, such as the U.S.A., U.K, Germany, Japan or Spain (Miguel, et al., 2004). In ownership concentration literature the agency theory prevails, yet with its opposite hypotheses (hypo.). The "alignment hypo." considers that high managerial ownership and good internal governance are positive factors on firm valuation, because, when managers align their interests with shareholders, agency

costs fall, raising firm's ability for external finance and decreasing the need of cash accumulation (Jensen and Murphy, 1990). Nevertheless, the "retrenchment hypo." predicts that the higher ownership gives more power to managers who can resist on willing of shareholders (Ozkan and Ozkan, 2004; Berle and Means, 1933). Emphasizing no systematic relation between ownership structure and firm value other studies find non-monotonic relationship (Morck *et al.*, 1988) or even inverse function, that is, profit-maximizing interests of shareholders may cause ownership concentration (Demsetz and Villalonga, 2001). Thus, arguments from agency or trade-off theories, such as the ownership like the substitute of weak institutional environment, the monitoring of managers by the shareholders, or the alignment-of-interests (positively related to firms' value), while the entrenchment or even the expropriation effects (negatively related to firms' value), have also been empirically confirmed, underpinning that there is an optimum level of ownership concentration that maximizes firms' value.

In addition, the liquidity management of firms receives increasing attention in the finance literature because not only the corporations hold significant amounts of cash[1] in their balance sheets (Dittmar and Marth-Smith, 2007), but also market imperfections justify it (Stiglitz, 1974). The literature assumes that managers, either follow a partial adjustment mechanism to reach a target cash level theoretically existed, or seek to improve marginal value of cash for shareholders, depended on different circumstances of business environment, e.g., firm-specific and time-varying information asymmetry or investment opportunities or quality of management or institutional conditions related to investors' protection or corporate financial management (Drobetz *et al.*, 2010; Pinkowitz and Williamson, 2007; Dittmar and Martin-Smith, 2007; Pinkowitz *et al.*, 2006; Faulkender and Wang, 2006). So, given that corporate cash holdings have benefits and costs for the firm, it is theoretically and empirically confirmed, that there should be an optimum cash level at which the market value of firm is maximized (Martinez-Sola et al., 2013). For instance, firms would maintain liquidity to meet unexpected contingencies or reduce cash flow uncertainty (precautionary motives), or face their current expenses (transactional motives) or even fund investment opportunities at lower cost than external financing and thus, make rise shareholders' value (agency motive). In contrast, cash holdings have opportunity costs, e.g., they give significant control rights to managers (discretion) resulting in the basic agency problem of opposing interests between managers (control) and shareholders (finance) (Shleifer and Vishny, 1997; Jensen, 1986). Thus, the inflection point of a firm's market value function versus corporate cash holdings should be there where the marginal costs of cash just offset the marginal benefits.

Moreover, as relevant theory predicts, widely-owned firms have lower cash holdings because managers can easily access the capital market (convergence of interests hypo.), while the opposite is also true for firms with concentrated ownership which could have complex agency and information asymmetry problems (entrenchment's effect hypo.). The expropriation effects (managerial or controlling shareholders') could be found, given the institutional framework, in firms with less ownership concentration, that is, shareholders' less supervisory, which is reflected in the reduction of their market value, since the managers or controlling owners have more discretion in liquidity management policies for their own

[1] In accordance to Martinez-Sola, et al. (2013), the respective figures for the paper's sample firms are: first, the cash ratio [=cash/total assets, see section 3 for variables' definitions) was on average 5% during the pre-crisis period (2000-'09) and 4% during the crisis one (2010-'15), but from another perspective, second, the aggregate cash held by sample's firms represents approximately 13% of the average Greek's gross domestic product (GDP) during the pre-crisis period, while 9% during the crisis period, resulting in to be almost 30% more than USA's or UK's amounts. So, it is justified the adoption of the view that cash holdings represent a significant amount in this study, too.

interests (Ameer, 2012; Ozkan and Ozkan, 2004). Consequently, this trade-off, suggests that there could be an optimum level of both cash and ownership which maximizes firm's value.

This paper explores the relationship between efficiency and cash holdings as well as ownership concentration of Greek non-financial listed firms in the Athens Stock Exchange (ASE), during 2000-2015. Based on non-linear effects of cash and ownership on efficiency and examining their implications depended on the sampled sub-periods before or after 2010, when the outbreak of the crisis, of the Greek public debt or in general that one of the Economic and Monetary Union of the European Union (EMU or Eurozone) (Gibson et al., 2014).

The motivation of using efficiency functions of both cash and ownership comes not only from the financial trade-off or agency cost theory but mainly from the lack of relevant studies for the Eurozone in the literature, as well as, the hypothesis "the radical macro-economic changes done in Greece during its course on the Eurozone, 2000-2015, should be reflected to the business micro-economic level, too". This productive (as opposed to inductive) route resulted in, firstly, the liquidity abundant and cheap until the global financial crisis of 2008 (GFC-2008) while scarce then, and secondly in the inevitably twin crisis of the Greek public debt and the banking one, ended up to huge reallocation of resources (firms' ownership included, too), since 2010 (Provopoulos, 2014; De Grauwe, 2011). The huge capital inflows[2] to the country, from its accession into the EMU up to the burst of the crisis (2000-2009), invested mainly in the ASE (and government's bonds[3] as well), widely spread the ownership of the Greek listed firms, while the leveraged economic growth has challenged higher business returns and accompanied with respective liquidity. The opposite picture[4] has been observed during the crisis-period 2010-2015 (that is, actual depression one[5]). The market discipline hypothesis (Lane, 1993) did not really work, because both the market

[2] *Net inflows* (transactions in portfolio investments + financial derivatives) have reached on average (with standard deviation) 12.8 (4.9) billion Euros per year, during the euphoria period 2000-2009, while, turned into net outflows of 19.9 (41.8) billion Euros, during the crisis 2010-2015. Source: Bank of Greece, Bulletin of Conjectural Indicators, various issues. Available at https://www.bankofgreece.gr/Pages/en/Publications/AllItems.aspx?List_ID=7E6B3766-BD04-4A45-AF1B-C033A426BD8B&Year=2016 .

[3] Greek 10-year bond *Yields* were on average (with stdev.) 4.7% (0.7%) during the euphoria period 2000-2009, while they climbed up 12.4% (6.0%) during the crisis 2010-2015. Source: Bank of Greece, Greek government securities. Available at http://www.bankofgreece.gr/Pages/en/Statistics/rates_markets/titloieldimosiou/titloieldimosiou.aspx?Year=2000

[4] *Overdrafts* offered by the Greek banking system to non-financial domestic corporations were on average (with standard deviation) 23.6 (5.6) billion Euros per year, during the euphoria period 2000-2009, while declined to 18.1 (7.6) billion Euros, over the crisis 2010-2015. Source: Bank of Greece, Bank deposits and loan interest rates. Available at https://www.bankofgreece.gr/Pages/en/Statistics/rates_markets/deposits.aspx . *Credit expansion to private sector* (Cumulative Change during period) offered from Monetary Financial Institutions (MFIs) were on average (with standard deviation) 26.9 (10.3) billion Euros, during 2004-2009, while precipitated (actually to "contraction") to (minus) -6.3 (3.7) billion Euros, during the crisis 2010-2015. Source: Bank of Greece, Bulletin of Conjectural Indicators, various issues. Available at https://www.bankofgreece.gr/Pages/en/Publications/AllItems.aspx?List_ID=7E6B3766-BD04-4A45-AF1B-C033A426BD8B&Year=2016 . Finally a crucial indicator that synthesizes the healthy prospects of all markets of the country, *Non Performing Loans* ratio (yearly) in the Greek banking system by the domestic private sector, was on average (with standard deviation) 6.7% (2.2%) during 2000-2009, while multiplied to 25.0% (11.2%) during the crisis 2010-2015. Source: World Bank. Available at https://data.worldbank.org/indicator/FB.AST.NPER.ZS?locations=GR .

[5] *Real GDP grew* on average (with standard deviation) 5.9% (3.1%) per year, during the euphoria period 2000-2009, while reduced by -4.3% (2.7%), respectively, during the crisis 2010-2015. Source: Hellenic Statistical Authority, National Accounts, various issues. Available at http://www.statistics.gr/en/statistics/-/publication/SEL15/-

interests punishment put country's solvency at risk and the responsiveness of EU-Greek governing has made the sovereign debt unsustainable[6] (IMF, 2017; IMF, 2010), aggravating the great decease that was supposed to cure (Rommerskirchen, 2015). However, methodologically, this paper considers macro-economic effects on the efficiency of Greek listed firms, as a subset of control variables (country-specific) complementary with the other (firm-specific) which is usually used by the literature.

The contribution of this paper to the literature is that it discusses and provides evidence on both "cash and ownership" factors of the market value of non-financial listed firms for Greece in the special case of the Eurozone during the period 2000-2015. It is believed that is the first time to have been explored.

Thus, the article underpins and explores a research hypothesis (see the following section 3) concerning the inverse-U-shape function of the market value of firms (as measured by Return on Equity –*ROE*- or Tobin's Q ratio –*Q*-) and cash holdings as well as ownership concentration, in the studying sample. That is, based on theoretical arguments and logical associations we have estimated empirical models of firms' value specified as concave functions of the cash holdings and ownership concentration. Following the relevant literature we control for firm and country-specific variables. The results are mixed and interesting. It is confirmed that the sample data is consistent with a concave function of *ROE* of the major shareholder ownership, during all the sample periods, but more strongly over the crisis one (2010-'15). The same inverse-U-shaped function of *Q* this time, of the major shareholder has statistically been confirmed significant, during the whole sample period 2000-'15. In contrast, we cannot accept the second part of the research hypothesis on the concave function of the market value of firms (regardless the measure used, ROE or Q) of the cash holdings. Practically, we have found no-relationship between market value of the sample firms and their cash**,** indicating the dominance of the ownership concentration in the unstable economic environment of Greece within EMU. The firm and country-specific control variables have also been proved significant. We have argued that the foundation of the research question on the trade-off and agency cost financial theories could help in understanding the dynamic adjustment of the sample firms on the strongly structural changes of the macroeconomic environment in the Eurozone, during the period 2000-'15.

The paper is structured as follows: in the next section it is briefly reviewed relevant literature. In section 3 it is derived the research hypothesis, the data and methodology chosen, as well as, the empirical models to be used so as to test econometrically the question. Section 4 reports and discusses the results, while main concluding remarks and implications of the study conclude the article.

2. Relevant Literature Review

In an efficient or perfect market of the textbook there is no need of liquidity management because the external finance is always available at equilibrium market prices. That is, the

[6] *"Public debt has reached 179 percent* (of GDP) *at end-2015, and is unsustainable.*" *IMF, Press Release No. 17/38*, February 6, 2017, p. 3. Available at http://www.imf.org/en/Publications/CR/Issues/2017/02/07/Greece-2017-Article-IV-Consultation-Press-Release-Staff-Report-and-Statement-by-the-44630. At the end-2009, before the implementation of fiscal adjustment programs by Troika (IMF, EC, ECB)-Greek governing (under memorandums of understanding –MoU-), the Public Debt/GDP ratio was 127% as it is reported by *IMF country (Greece) report No. 10/372*, December 17, 2010, p. 59. Available at http://www.imf.org/en/Publications/CR/Issues/2016/12/31/Greece-Second-Review-Under-the-Stand-By-Arrangement-Staff-Report-Press-Release-on-the-24520.

capital allocation in cash or equivalent assets would not affect firm's market valuation (Opler *et al.*, 2001; Stiglitz, 1974).

In reality however, market imperfections imply that financial management balances costs and benefits of holding cash, that is, it matters for shareholders' wealth. Transactional and precautionary motives for hoarding cash from the firms are among the benefits well known from Keynes early as 1936. The transactional motif arises from the operation expenses to cover company's turnover or enable firms to make diversifying acquisitions, while the precautionary one may result by undertaking valuable projects when they arise, or avoid distress costs when the firms face adverse cash flow shocks, or even exploit hedging opportunities within less developed financial markets. Nevertheless, cash holdings imply not only an opportunity cost but in addition, it can be caused by the agency motive, because free cash flows give managers discretionary power over shareholders' interests (Jensen, 1986). Likewise, higher cash holdings may have a cost-of-curry, i.e., the difference between debit interest to finance an additional unit of currency and return on hoarding cash, or avoid external financing that could result in the additional cost associated to the lack of monitoring firms from the markets (Dittmar *et al.*, 2003; Jensen and Meckling, 1976).

Depending on firm-specific characteristics, information asymmetry between demand and supply of external funds often results in adverse selection of capital allocation, which would imply underinvestment because it may pass up a project of positive net present value (NPV), as corporations do not desire to issue under valuated securities. On the other hand, higher cash holdings, reducing external funding dependence, would offer to managers more "degrees of freedom" in order to overtake value-enhanced investments which could refuse it, otherwise. The latter is also invoked by the free cash flow theory (Faulkender and Wang, 2006; Dosoung and Sangsoo, 1997; Jensen, 1986; Myers, 1977). So, the literature predicts a positive relationship between financial constraint firms and cash, often due to higher transaction cost in external financing investment opportunities, which add value to the firm by the market (Denis and Sibilikov, 2011; Faulkender and Wang, 2006; Ferreira and Vilela, 2004). Moreover, it is argued that the marginal return of expenditures funded by cash holdings of financial constrained firms is greater than those of unconstrained ones (Luo, 2011). Also, the size and age of firms are found to drive negatively their cash holdings, in order to smooth intertemporal R&D expenses (Brown and Petersen, 2011). In addition, R&D intensive companies is possible to hold more cash than those of capital intensive ones, due to their more risky cash flows and less cash substitutes they have such as inventories or requirements (Bates et al., 2009). In total, the literature claims as major factors for firms' cash holdings their investment opportunities positively, while their access to developed financial system negatively, given the macro-economic and financial stability of the country (Ferreira and Vilela, 2004; Ozkan and Ozkan, 2004; Opler, Pinkowitz, Stulz and Williamson, 1999). Thus, trade-off between benefits and costs of cash holdings may cause an optimum level such as the model of Kim *et al.* (1998) predicts and finally the relationship "market value of firms and their cash holdings" to be non-linear, in fact concave or "inverse U shape", which is also in line with agency theory's literature, where cash accumulation is not uniformly beneficial (Nguyen et al., 2016; Sola, Teruel and Solano, 2013; DeAngelo and DeAngelo, 2007; Luo and Hachiya, 2005; Lee et al., 2004; Myers and Majluf, 1984).

Among few studies on the relationship of both cash and ownership concentration Ameer (2012) reports linear functions on Australian listed firms' performance, positive on cash and negative on ownership. But when he distinguishes between widely and closely held firms, he reveals positive and negative, respectively, relation between cash and market value of his sampled firms.

The relationship between firm economic performance and ownership structure is also a topic of great interest in the literature, either in strategic management (Demsetz and Villalonga, 2001; Li and Simerly, 1998; Bethel and Liebeskind, 1993; Oswald and Jahera, 1991) or corporate governance (Shleifer and Vishny, 1986) or agency theory (Thomsen and Pedersen, 2000; La Porta, Lopez-de-Silanes, and Shleifer, 1999; Hill and Snell, 1989; Fama and Jensen, 1983; Amihud and Lev, 1981; Jensen and Meckling, 1976). Generally, the literature predicts a positive or concave function of firms' market value on ownership concentration. However, there is also a research stream which suggests the inverse function as true, i.e., that ownership structure may be influenced by firm's efficiency, and not vice versa (Chang, 2003; Demsetz and Lehn, 1985; Demsetz, 1983).

Thus, in the logic of agency cost literature, financial and reputational benefits of managers in product or market diversification and fast corporate growth by non-related mergers and acquisitions, which provide them with risk reduction, preference of expenses or empire building, are facilitated by widely-held firm's ownership. Equivalently, lower ownership concentration provides lower control of management which could not follow owners' interest in maximizing firm's market value. That is, large shareholders may act as "controlling mechanism" by monitoring managers and preventing "free riding". So, their control is negatively related to diversification strategy since it opposes to large shareholders' wealth maximization. Therefore, the literature focuses on the structure and concentration of the firm's ownership as a driver of its market value (Castillo & Wakefield, 2006; McConnell & Servaes, 1990; Demsetz & Lehn, 1985). The identity of the shareholder, such as insiders - managerial or institutional or even family or special nationality ownership could affect positively or negatively and more accurately in a second or even third order functional form the value of a corporation (Chen et al., 2004; Pedersen & Thomsen, 1997; McConnell & Servaes, 1990; Morck, Shleifer, & Vishny, 1988). The alignment of interest hypothesis (Jensen and Meckling, 1976) or the signaling model (Leland and Pyle, 1977) of the theory (e.g., Stulz, 1988), predicts that higher managerial ownership implies lower agency cost, resulting in, ceteris paribus, higher market value of the firm, with possibly existence of a concave functional form. In the opposite, the literature also argues in favor of a negative relation of firm value-managerial ownership, because, when the managers own large stake of the equity, then negative entrenchment effects, due to this separation, could be significant, amplifying the agency cost that ends up to lower valuation of the firm from the market (Fama and Jensen, 1983; Demsetz, 1983).

A strand of the literature has studied this relationship focusing on the family ownership (e.g. Arosa, Iturralde and Maseda, 2010; Anderson and Reeb, 2003) and regardless of the measure expressing the market value of the firm, EBITDA, ROE, ROA or Tobin's Q ratio, they confirm an inverted-U-shaped function, with inflection points ranging between 30% and 49% of the equity owned by the family or even their first generation. Correspondingly, when the relevant strand of the literature has concentrated on the insiders' ownership, large shareholding or institutional ownership then the studies confirm even cubic function with turning points at 5% or 16% (max.) and 25% or 42% (min.) of the equity owned to the managers or at least concave ones whose inflection points range between 38% and 49% (Short and Keasey, 1999; Morck, Shleifer andVishny, 1988; McConnell and Servaes, 1990).

The analysis consistent with the upward part of the concave function "firm's market value-ownership concentration" has an upper limit, economically understandable, when managers become entrenched and start expropriating minority shareholders' wealth. Thus, the literature has suggested another kind of the agency problem, consistent especially with European markets, the conflict "controlling owners vs. minority shareholders" instead of the traditional "ownership vs. management".

Moreover, Shleifer and Vishny (1997) show the important role played by large shareholders when become controlling owners who prefer to generate and extract private benefits that are not shared by minority shareholders (expropriation effects' hypo.). Thus, large shareholders could have incentives to increase cash holdings they control in consuming private benefits at the expense of minority shareholders. This, in turn, indicates that firms with ownership concentration are more likely to accumulate more cash than widely-held firms (positive relation ownership-cash). However, to the extent that monitoring or alignment-of-interests hypotheses hold, the cost of external financing would be lower for firms with ownership concentration, implying less need to hold higher levels of cash. This ends up in a negative relation ownership-cash (Ozkan and Ozkan, 2004). Consequently, the pre-described trade-off, suggests that there could be an optimum level of both cash and ownership which maximizes firm's value.

Despite this long debate, there is no empirical evidence on the effects of both cash holdings and ownership concentration on firms' market value in Europe and especially in country-members of the EMU under an ongoing sovereign debt crisis. This paper aims to fill this gap. Alimehmeti and Paletta (2012) investigated the relationship "return on assets (ROA) - ownership concentration" for listed firms in Italy before Eurozone crisis (2006-'09). This work in conjunction with those of Ameer's (2012) and Martinez-Sola's et al. (2013) are the more relevant for the present study.

3. Research Hypothesis, Data and Methodology

Following financial theory and having in mind the historical route of Greece in the "sui generis" EMU (Eichengreen, 2008) it is logical to hypothesize that firms' ownership concentration should prevail in understanding their market value. It is well known that large share holding plays an active role in corporate governance (Shleifer and Vishny, 1986), while the weak legal protection of investors in the country[7], could explain the need of large shareholders scheme in ownership of local firms. So, the state's weak legal and institutional environment that requires large shareholders also causes *unstable* economic conditions that the firms ought to face. The latter are consistent with the always *changing* optimal level in their cash holdings (Opler, Pinkowitz, Stulz and Williamson, 1999). The mentioned theoretical arguments seem to be critical in our study.

Since widely-held firms create free-riding problems it is expected a *positive* relationship between firms' market value and ownership. The basic agency problem of monitoring managers (who control the firm) from shareholders (who finance it), is mitigated by ownership concentration at low levels. So, as the latter increases, large shareholders are expected to have sufficient incentives and power (their representatives or relatives often serve as directors and officers) to discipline managers, thereby reducing managerial malfeasance and shirking. This gradual alignment-of-interests could increase firm value by decreasing monitoring costs and probably increasing output (Shleifer and Vishny, 1997). Nevertheless, ownership concentration may cause falling share prices, especially in thin markets as it is the case of the ASE, because controlling owners can redistribute wealth from minority shareholders, whose interests need not coincide (Miguel et al., 2013). In other words, large shareholders as they are getting controlling owners could extract private benefits at the expense of minority shareholders or facilitate potentially inefficient activities (e.g.,

[7] In 2012 in compliance with the so called PSI (private sector involvement) in the restructuring of Greek bonds agreed by European-Greek governance, the minority of Greek holders have been suffered a haircut of about 50% (see Zettelmeyer et al., 2013).

maximizing market share or technological leadership). This conflict of interests due to ownership concentration at high levels ends up in decreasing firm's value, that is, it could even be seen *negative* relation between market value of firm and ownership concentration at high levels (La Porta et al., 1999). These two competing hypotheses indicate that is appropriate to consider non-linear (concave) relation between ownership concentration and firm efficiency.

As regards cash holdings DeAngelo and DeAngelo (2007) indicate that they entail both agency costs and confer flexibility benefits, hence, a trade-off could determine the optimum cash level maximizing the market value of firms. Transaction and precautionary motives are expected to predominate at low levels of cash holdings, suggesting *positive* relation with firm's value. Although, as free cash flow theory predicts, at high levels of cash, agency costs could arise because managers have more power (discretion) with large amount of funds, resulting in *negative* relationship with market value of firm (Miguel et al., 2013).

Moreover, to the extent that monitoring or alignment-of-interests hypotheses hold as ownership concentration increases, it is already mentioned that since agency costs fall and external financing is feasible at low price, there is no need of accumulating cash (i.e., negative relation ownership-cash, agency motive), while firm's value it is expected to increase (Ozkan and Ozkan, 2004). However, consistent with the expropriation effects' hypothesis, Shleifer and Vishny (1997) show the important role played by large shareholders, and how they could have good incentives to increase cash holdings (i.e., positive relation ownership-cash, extract private benefits, transactional and investment opportunities motives), while the price of the firm shares decreases as the proportion of their shares rises. Thus, this trade-off, suggests that there could be an optimum level of both cash and ownership which maximizes firm's value.

In this paper is expected, based on the aforementioned theoretical arguments and the special business and macro-economic context of Greece within the Eurozone over the sampled period 2000-2015 that both functions (*ROE*, *Q*) should be concave upon dominant ownership concentration and associated cash holdings. Thus, economically supported the research hypothesis (RH), which should empirically be tested, is:

RH: The market value of firms increases with both cash and ownership concentration at low levels and decreases with both cash and ownership concentration at high levels.

To test this RH we regress *ROE* or *Q* upon ownership concentration (i.e., the largest owner's share of the equity) and cash holdings and their squares as well, so as to explicitly be able to test both positive and negative effects of both factors. At the same time it allows us to optimally determine the inflection point value-ownership (V-OWN1) and value-cash (V-CASH) relations. Following the literature we control for the profits, size, age, investments, leverage, and the interaction terms of ownership concentration with dividends or leverage (firm-specific control variables), as well as for the real gross domestic product (GDP) growth, non-performing loans and inflation rate (country-specific control variables). The definition of all variables is given in the following.

To validate logically the RH we have founded it on the aforementioned trade-off and agency cost literature's predictions which could explain the dynamic adjustment of the firms, on strongly structural changes of the macroeconomic environment in the Eurozone, during the sample period 2000-'15. This is effortlessly distinguished firstly, in the pre-crisis period

2000-'09, just after the GFC-2008 and before the outbreak of the Eurozone debt crisis-2010, and secondly, in the Greek economic depression one 2010-'15 (during the crisis).

Thus, it is logical to hypothesize that during the pre-crisis period 2000-'09, of the abundant and cheap liquidity, offered from the banking system and allowed by the ECB, there should be an optimal level for both the major shareholder's ownership (OWN1) and cash holdings (CASH), which maximizes the market value of firms (V, as measure by ROE or Tobin's Q ratio here). That is, we consider as concave (inverse-U-shape) the both functions, V-OWN1 and V-CASH. The upward part of the functions could be prevailed, firstly for the V-OWN1, by the fact that the ownership substitutes the weak legal and institutional environment of the country, and secondly for the V-CASH, by the investment opportunities and the overheating of the economy. Subsequently, the downward part of them could plausibly be attributable, first for V-OWN1, to the mature conditions of widely held ownership (especially after the investments made for the Olympic Games of Athens-2004) justifying the redemption of capital gains, and therefore, the gradual ownership concentration, consistent with expropriation effects, and second for V-CASH, to be prevailed by the V-OWN1 declining relation associated with the analogous V-CASH pattern.

As regards the depression period (2010-'15), with so many businesses closing or changing their capital structure, and in general with the great reallocation of resources, it is logical to hypothesize that the ownership structure should prevail the *changing* optimal level of cash (Opler, Pinkowitz, Stulz and Williamson, 1999) in market value of firms, because their existence depends on their bailout of the major shareholder(s). So, it is possible in that non-credit macroeconomic environment (*almost closed banks since 2010 while in fact they have been closing since mid-2015*) the V-CASH relation even not to appear as significant at all. During those turbulent times, the upward part of the concave V-OWN1 relation could be explained from the logic of the alignment of interests' hypothesis. This, in its turn, it must be complemented by the reforms due to applied memoranda by Troika-Greek governance, that is, the ownership acts as a substitute of the changing legal or institutional structure of the economy, which causes a really *unstable* economic environment that firms ought to face. Its downward part could be prevailed once again, by the expropriation effects. The V-CASH relation, if there is one[8] during the crisis period, could logically depend on the concave V-OWN1 one, as well as, on the substitute of CASH, such as the firms' inventories or requirements, or even the sales.

The data of the sample have been drawn from Thomson Reuters/Eikon database and refer to basic balance sheets and income statements items. As commonly in the literature this study uses a panel dataset of non-financial listed firms in the ASE, during 2000-2015. Of the full sample of 217 firms with 3,025 firm-year observations, they are excluded these ones with fewer observations than five consecutive years including both sub-periods. The sample resulted to contain 183 companies representing 1,524 firm-year observations of the unbalanced Greek panel dataset, 2000-2015.

Two proxy variables have been used to measure the dependent variable of market valuation of firms, that of the return on equity (*ROE* = Net Income used to calculate basic earnings/ Total Shareholder's Equity) and the Tobin's Q ratio (*Q* = Market Capitalization / Total Asset Value). The key independent variables are the cash holdings [*CASH* = Cash & Short Term Investments / Net Assets (= Assets - Cash & Short Term Investments)] and ownership concentration (*OWN1* = the percentage of shares held by the major shareholder, as a proxy to

[8] It is remarkable that the median value of cash over the crisis period (2010-'15) has been dived to 16% (584,000 €) of the respective figure (3,620,000 €) during the pre-crisis one (2000-'09) [see, Table 1, panels B and C).

Ownership Concentration on Common Shares Outstanding). The square values of both the key independent variables, i.e., *CASHsq* (= $CASH^2$) and *OWN1sq* (= $OWN1^2$) serve to test the likely of non-linear relationships. The positive or negative part of the expected concave function of *ROE* or *Q* on *CASH* and *OWN5* should be below their optimal levels.

In the empirical models are also included control variables usually referred to the literature, like: 1) the profits [*profit* = (operating EBIT or pretax income) / (total assets)], 2) the firm size (based on assets or sales) in levels or growth rate [*size* = ln(Net Assets) and $sizegr = size_t - size_{t-1}$ or *size1* = ln(Sales) and $size1gr = size1_t - size1_{t-1}$], 3) the capital expenditures [*capex* = (additions to fixed assets) / (total assets)], 4) the leverage [*leverage* = (Total Debt) / (Total Assets)], 5) the dividends [*DIVID1* = Common Dividends (Cash) / Total Assets], 6) the age of the firm [*AGE* = number of years by 2015 since the organization founding year]. It is also possible to include interaction terms, like: 1) this one of the major owner who enjoys the company's dividends [*own1divid1* = (*own1* x *divid1*)], 2) the other of the major owner who undergoes the burden of the firm's leverage [*own1leverage* = (*own1* x *leverage*)]. They are also included country-specific variables, here reflecting the Eurozone crisis, such as 1) the bank non-performing loans to total gross loans (*npl* : macro-data from the World Bank)[9], 2) the real gross domestic product (GDP) growth [*gdpgr* = real GDP growth rate, macro-data][10], 3) the inflation rate [*infl* = growth rate of the harmonized index of consumer prices, macro-data][11], and finally 4) a linear time trend dummy variable [*time* = 1 if year=2000, 2 if year=2001, 3 if year=2002, …, 16 if year=2015].

Table 1 presents descriptive statistics for the study's variables distinguishing between the whole sample period 2000-2015 and two sub-periods, i.e., the pre-crisis times 2000-2009 and during the Eurozone crisis 2010-2015. The heterogeneity of the dataset results effortlessly from high dispersion, skewness and kurtosis for almost all variables.

Given extremely negative skewness and high kurtosis for *ROE* in either sub-periods, low positive mean (median) value of 2.9% (5.2%) during pre-crisis period 2000-2009 has been proved unsound over the crisis one 2010-2015, when it has been reversed to strongly negative - 35.8% (-4.1%). So totally for the full sample period 2000-2015 has been turned to negative about - 11% on average while slightly positive 2.8% for the median value.

Nevertheless, the comparison of the aggregate firms' frequency distributions for the Tobin's *Q* ratio before (2000-2009) and during the crisis (2010-2015) reveals the depth and the extent of the impact of the crisis on the depreciation of their assets, or the redistribution of production capabilities of the Greek economy or even the likely expropriation of minority's ownership from large shareholders. Throughout the whole sample period listed firms remain too much undervalued with a *Q* mean (median) value of 57% (32%) within a framework of high volatility and extreme skewness and kurtosis coefficients, supporting to use the median as the appropriate trend measure. Although it is much more apparent the gradually trend to approximate from distance normality through the first sample sub-period to the second one, the average (median) value of the stocks of listed firms' in the ASE have fallen to 76% (50%) of the replacement cost of their assets before the crisis (2000-2009), while they have collapsed to 28% (16%), during the crisis (2010-2015).

Table 2 shows the correlation matrix. Among the independent variables it is not observed high pairwise correlations supporting the possibility of not having multicollinearity problems.

[9] Source: World Bank, https://data.worldbank.org/indicator/FB.AST.NPER.ZS?locations=GR .
[10] Source: Hellenic Statistical Authority, http://www.statistics.gr/en/statistics/-/publication/SEL15/-
[11] Source: Hellenic Statistical Authority, http://www.statistics.gr/en/statistics/-/publication/DKT90/-

Table 1 Descriptive statistics

Panel A. Pooled data 2000-2015

variable	N	min	max	sd	mean	p50	skewness	kurtosis
roe	2850	-18.037	4.0822	0.97	-0.1099	0.0281	-11.02	160.08
tobinq1	2937	0.0006	12.3210	0.77	0.5699	0.3222	4.82	45.04
cash	1983	0.00	1.43E+09	7.68E+07	2.11E+07	1.60E+06	8.70	113.90
cashratio	1983	0	0.647142	0.075727	0.044084	0.013746	3.037478	14.20557
own1	1971	0.0001	0.9727	0.20	0.1514	0.0554	1.75	5.66
age	2296	9.0	105.0	17.05	36.27	34.00	1.61	6.60
capex	3034	0.0000	0.9278	0.06	0.0343	0.0144	5.59	61.32
sizegr	2817	-1.4050	3.5426	0.23	0.0260	0.0008	3.14	42.27
leverage	3022	0.0000	5.0950	0.28	0.3408	0.3194	4.27	52.21
size1gr	2817	-4.5420	3.6633	0.35	0.0063	0.0229	-0.51	35.42
profit	3027	-9.3080	0.8325	0.20	0.0108	0.0202	-34.35	1615.35
divid1	3034	0.0000	11.4293	0.21	0.0143	0.0000	53.23	2896.26
gdpgr	2817	-0.0852	0.0934	0.06	0.0149	0.0308	-0.18	1.70
infl	3034	-0.0140	0.0470	0.02	0.0234	0.0305	-0.89	2.40
npl	3034	0.0460	0.3660	0.11	0.1357	0.0700	1.12	2.63

Panel B. Pooled data for the pre-crisis period 2000-2009

variable	N	min	max	sd	mean	p50	skewness	kurtosis
roe	1825	-11.2003	3.0577	0.4094	0.0297	0.0522	-13.07	326.18
tobinq1	1779	0.0162	12.3210	0.8908	0.7560	0.5025	4.47	37.65
cash	1011	0.0000	1.43E+09	7.89E+07	2.40E+07	3.62E+06	9.03	125.35
cashratio	1011	0	0.533086	0.078065	0.049855	0.020573	2.84406	12.27903
own1	1080	0.0001	0.8858	0.1251	0.0588	0.0159	3.95	20.39
age	1390	9	105	16.9139	36.9777	34.0000	1.63	6.68
capex	1846	0.0000	0.4808	0.0586	0.0384	0.0176	2.96	14.59
sizegr	1640	-1.4050	3.5426	0.2493	0.0797	0.0545	3.60	44.20
leverage	1834	0.0000	1.4886	0.1857	0.2890	0.2935	0.50	4.64
size1gr	1640	-4.5420	3.5531	0.3339	0.0637	0.0671	-0.15	43.09
profit	1841	-9.3080	0.7427	0.2362	0.0348	0.0349	-33.57	1330.95
divid1	1846	0.0000	11.4293	0.2681	0.0205	0.0045	41.81	1778.80
gdpgr	1640	-0.0014	0.0934	0.0300	0.0573	0.0688	-0.69	2.29
infl	1846	0.0130	0.0420	0.0078	0.0320	0.0330	-1.31	4.33
npl	1846	0.0460	0.1230	0.0197	0.0657	0.0630	1.80	6.15

Panel C. Pooled data during the crisis period 2010-2015

variable	N	min	max	sd	mean	p50	skewness	kurtosis
roe	1025	-18.037	4.0822	1.49	-0.3583	-0.0413	-7.49	71.51
tobinq1	1158	0.0006	4.4697	0.40	0.2840	0.1588	4.20	28.78
cash	972	0.00	1.23E+09	7.43E+07	1.81E+07	5.84E+05	8.29	98.18
cashratio	972	0	0.647142	0.072771	0.038081	0.006430	3.299072	16.94853
own1	891	0.0006	0.9727	0.22	0.2636	0.2074	1.05	3.57
age	906	9.0000	105.0000	17.21	35.19	32.00	1.59	6.54
capex	1188	0.0000	0.9278	0.06	0.0280	0.0116	9.55	131.93
sizegr	1177	-1.4025	1.8710	0.18	-0.0488	-0.0441	1.57	35.70
leverage	1188	0.0000	5.0950	0.36	0.4207	0.3730	4.23	40.61
size1gr	1177	-4.0575	3.6633	0.36	-0.0736	-0.0279	-0.84	31.66
profit	1186	-0.8762	0.8325	0.11	-0.0265	-0.0108	-0.96	13.74
divid1	1188	0.0000	0.4402	0.02	0.0046	0.0000	11.15	169.65
gdpgr	1177	-0.0852	-0.0201	0.02	-0.0441	-0.0360	-0.65	1.83
infl	1188	-0.0140	0.0470	0.02	0.0099	0.0100	0.48	1.64
npl	1188	0.0910	0.3660	0.10	0.2444	0.2320	-0.30	1.50

Notes: cashratio=cash/total assets.

Table 2 Pairwise Correlations for the pooled data 2000-2015

	roe	tobinq1	cash	own1	age	capex	sizegr
roe	1						
tobinq1	0.1432*	1					
cash	0.0782*	0.1470*	1				
own1	-0.0943*	-0.1871*	0.0195	1			
age	0.0099	-0.1312*	0.0930*	0.0314	1		
capex	-0.0845*	0.014	0.0560*	-0.0737*	-0.0784*	1	
sizegr	0.1622*	0.1611*	0.0852*	-0.1743*	-0.0477*	0.1802*	1
leverage	-0.1765*	-0.2897*	-0.0635*	0.1711*	0.1297*	-0.0660*	-0.1821*
size1gr	0.1783*	0.1332*	0.0508*	-0.0754*	-0.0424	0.1070*	0.5544*
profit	0.1757*	0.2014*	0.2319*	-0.0616*	-0.0111	0.0228	0.1342*
divid1	0.0167	0.0687*	0.2631*	-0.0524*	-0.0244	-0.0062	0.0492*
gdpgr	0.1876*	0.3046*	0.0337	-0.3784*	0.0669*	0.0687*	0.2975*
infl	0.1102*	0.1757*	0.034	-0.6171*	0.035	0.0707*	0.1926*
npl	-0.1503*	-0.2041*	-0.0329	0.6423*	-0.035	-0.1064*	-0.2301*
	leverage	size1gr	profit	divid1	gdpgr	infl	npl
leverage	1						
size1gr	-0.1042*	1					
profit	-0.1576*	0.1469*	1				
divid1	-0.0479*	0.0530*	0.0364*	1			
gdpgr	-0.1888*	0.2451*	0.1359*	0.1291*	1		
infl	-0.2160*	0.1092*	0.0942*	0.0218	0.4567*	1	
npl	0.2364*	-0.1246*	-0.1131*	-0.0221	-0.6165*	-0.9042*	1

For the described dependent variables (*ROE* or *Q*), they are used two models to test empirically if the data are consistent with the above addressed question as it is identified by the relevant research hypothesis. Thus, in the following equation (1) the dependent variable, the market value in firm (*i*) at time (*t*), y_{it} , takes the form of *ROE* in model 1, while that of *Q* in model 2 (Wintoki, Linck and Netter, 2009).

$$y_{it} = \alpha + \sum_{s} k_s y_{it-s} + \beta \boldsymbol{X}_{it} + \gamma \boldsymbol{Z}_{it} + v_{it}, \;\; s = 1, \dots, p \tag{1}$$

$$v_{it} = \eta_i + \varepsilon_{it} \text{ , } E(\eta_i) = E(\varepsilon_{it}) = E(\eta_i \varepsilon_{it}) = 0 \text{ , } E\left(\varepsilon_{it}\varepsilon_{js}\right) = 0, \forall\, i, t, s \neq j$$

Where $\boldsymbol{X}$ is a vector of strictly exogenous variables (i.e., those ones not depended on either current or past $\boldsymbol{v}_{\mathrm{it}}$); $\boldsymbol{Z}$ is a vector of predetermined independent (which may include the lag of y) and endogenous ones, that all may be correlated with the $\boldsymbol{\eta}_{\mathrm{i}}$ (predetermined variables are potentially correlated with past errors, while the endogenous with both past and present errors); $\boldsymbol{v}_{\mathrm{it}}$ are the observation-specific errors; $\boldsymbol{\varepsilon}_{\mathrm{it}}$ is a random error term; $\boldsymbol{\beta}$ is the vector of parameters of interest are to be estimated.

It could reasonably be argued that ASE, even after 2002 when the Euro has been launched in Greece, did not manage to get away from a "Thin Market" having high price and volume volatility while low liquidity, on the grounds that the economy attracted in total, nearly zero foreign direct and indirect investments that period. In particular, the relevant ratio to GDP was on average 6.5% net inflows, during 2000-2009, while -12% net outflows over the crisis period 2010-2015[12]. Thus, it is logical to assume that listed firms in the ASE, throughout the sample period, were considering as first priority, among their goals, to maximize the wealth of the shareholders so as to be able to finance cheap their operations. Hence, because of the nature of the ASE, market value of the listed firms of this sample should be caused by cash and ownership structure included in vector $\boldsymbol{X}$, as well as, other control variables included in vector $\boldsymbol{Z}$ as defined above.

Thus, it makes sense to assume that generalized method of moments (GMM) estimators (Holtz-Eakin, Newey, Rosen, 1988; Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998) will efficiently face the endogeneity possibly present in our dataset. We refer to three sources of econometric endogeneity which can be addressed by dynamic GMM estimators. These sources, in terms of orthogonality may arise in equation (1) in the forms as: First, the "simultaneity", if $\mathrm{E}(\varepsilon_{\mathrm{it}}|\mathrm{X}_{\mathrm{it}}, \mathrm{Z}_{\mathrm{it}}) \neq 0$; Second, the "unobservable heterogeneity" if $\mathrm{E}(\eta_{\mathrm{i}}|\mathrm{X}_{\mathrm{it}}, \mathrm{Z}_{\mathrm{it}}) \neq 0$; Third, the "dynamic heterogeneity" if past values of the dependent variable (y_{it-s}) affect current values of cash and ownership variables included in ($\boldsymbol{X}_{it}$). The estimation procedure consists of two essential steps. First, estimating the dynamic equation (1) in first-differenced form (diff.GMM), and second, conducting to the following system GMM estimator (sys.GMM):

[12] *Direct plus Indirect foreign investments as a ratio of GDP*, had a peak value 9.7% in 2009 and on average (stdev.) 6.5% (1.8%) during the period 2000-2009, while, they plunged to – 12.0% (20.3%), over the crisis period 2010-2015. The latter obviously contains the outlier of – 51.8% of GDP in 2012 of huge outflows, in compliance with so called PSI (private sector involvement) (see Zettelmeyer et al., 2013). Source: Bank of Greece (http://www.bankofgreece.gr/Pages/en/Statistics/externalsector/balance/default.aspx), for the Greek Balance of Payments data, while, Hellenic Statistical Authority (http://www.statistics.gr/en/statistics/-/publication/SEM91/-) for the GDP (at current prices and million Euros) from National Accounts Statements.

$$\begin{bmatrix} y_{it} \\ \Delta y_{it} \end{bmatrix} = \alpha + k \begin{bmatrix} y_{it-p} \\ \Delta y_{it-p} \end{bmatrix} + \beta \begin{bmatrix} \boldsymbol{X}_{it} \\ \Delta \boldsymbol{X}_{it} \end{bmatrix} + \gamma \begin{bmatrix} \boldsymbol{Z}_{it} \\ \Delta \boldsymbol{Z}_{it} \end{bmatrix} + \varepsilon_{it}, \;\; p > 0 \qquad (2)$$

With the sys.GMM we achieve to control the aforementioned sources of econometric endogeneity, while we obtain efficient estimations under some orthogonality conditions (see Arellano and Bover, 1995; Blundell and Bond, 1998).

We use the STATA v.14.2 software so as to estimate sys.GMM (equation 2) of our sample.

4. Estimations and Discussion

Table 3 (or 4 respectively) presents the results of the estimation of model 1 using as proxy of the market value of the firms the *ROE* (or *Q* respectively) variable. The slightly decreasing linear function of *ROE* on *CASH* is confirmed (at 5% level of statistical significance) for the full sample period (2000-2015) and the pre-crisis sub-period (2000-2009), displaying us to reject the respective half part of the research hypothesis (*RH*) of non-linearity of this function. This means that the increases in cash holdings slightly decrease, by a steady very small pace, the profits of the listed firms in the ASE, by generating with the money that shareholders have invested in. It is remarkable what is reported on table 5 on statistically insignificant estimations of the cash for the Tobin's Q ratio function, possibly reflecting that cash holdings do not drive at all investment decisions in this sample or the investors may not pay any attention to the cash of the firms when they decide for their replacement cost. The latter evidence may be understood by the euphoria that was prevailing the first decade of the EMU's common markets existence where all figures had just an upward tendency. Given the outbreak of the global financial crisis in 2008 (GFC-2008), and the resulting credit scarcity (Calomiris and Haber, 2014), the firms should recall the opportunity cost for money demand (companies' cash holdings), especially over the Eurozone crisis and the Greek economic *depression* period 2010-2015. In contrast, our estimations show slightly decreasing linear relationship of expected *ROE* on cash, particularly during the pre-crisis period 2000-'09, while no-relation of Tobin's Q on cash holdings for all the sample period. However practically, this Greek dataset's estimations indicate no-relationship between cash and business efficiency (as it is measured by *ROE* or *Q*) for non financial listed firms in the ASE, during 2000-'15.

We can understand the evidence of slightly decreasing linear relationship or even the practically no-relation of expected *ROE* on cash, through firstly, the unstable economic conditions due to constantly required adjustments towards the compliance with sui generis EMU, secondly, the expansionary monetary policy of the ECB implemented in the pre-crisis period of the Eurozone during 2000-'10. That policy has burdened the Greek economy with cheap loans making easy the finance of the firms' operating cycle (generally non-competitive in EU level) with high leverage. Thus, it isn't surprise that the latter variable has been confirmed strongly statistical significant the pre-crisis sub-period. Just the opposite was the case during the crisis-period (2010-'15). Then, due to the liquidity crisis initially and the public debt one afterwards, the contagion of the private sector (due to the depression of the country aggravated by austerity policies), has blocked normal financing of Greek business from the already powerless banks (due to the slump of government bonds' prices they have had on their assets). Thus, it is really unexpected our finding of the insignificant cash holdings on efficiency during the Greek depression period (2010-'15). A plausible explanation could be that the market valuation of firms (the *ROE* here), in "normal times" (2000-'10) given the possibility of financial leverage (the relative variable *leverage*, only during the pre-crisis period has been proved statistically significant), is based on the growth

of their assets (*sizegr*, strongly significant this period) transformable in profits (*profit*, has also been found significant this period). However, in "extra-distress times" (2010-'15) with credit scarcity[13], it seems to be assessed as first priority to survive on business at all costs (no reason to invest… perhaps that's why *capex* had strongly negative influence on *ROE*), i.e., it is urgent the growth of sales (confirmed positive and strongly significant the *size1gr* variable, during this crisis-period). The latter could offer the minimum cash to finance the firms' operating cycle. Therefore, it seems that during Greek economic depression period (2010-'15) the sales assessed by the market as substitute of cash in firms' efficiency (table 3).

As regards the expected (*RH*) concave function (inverse-U-shape) of the market (ASE) value (*ROE*) of Greek firms on the ownership of the major shareholder (*OWN1*), it is strongly confirmed as statistically significant during the sample period. What our data tell us through these estimations, is that the expected *ROE* increases as the share of the major shareholder increases up to (maximum) about 39% of the equity, and then it decreases despite this ownership concentration continues, during the sample period 2000-'15 (or up to about 30% in the pre-crisis sub-period 2000-'09, and 42% during the crisis 2010-'15). However, *RH* on non-linearity is accepted only for the whole sample period, in the case of the relationship *Q-OWN1,* which has also proved statistically significant in inverse-U-shape, confirming the respective half part of the research hypothesis. The maximum point of inflection of the expected *Q* value is now about 37% of the equity owned to the major shareholder. In other words, the expected replacement cost of the sample company's assets or value is maximized when the ownership concentration of the major shareholder gets to about the 37% of the equity, while after this peak they decrease. The above mentioned, could be understood based on descriptive statistics (see Table 1) for the "replacement cost" variable *Q* which collapsed in terms of the median value at about 16% in the crisis period (2010-'15), from 50% respectively during the pre-crisis one (2000-'09). The latter fact should be considered in combination with respective trend statistics of *OWN1,* where the major investor has many times multiplied its companies' ownership, i.e., from about 6% on average (or 1.6% in median terms) in the 2000-2009 period, jumped to about 26% (21%) respectively in crisis period 2010-2015. In addition, major shareholder's type has changed between two subsequent periods, expressing qualitative changes too, in ownership concentration procedure; in the study's sample, their descending classification, on average became Government Agency 45% (55%), (Private Equity, 45%), Holding Company 41% (34%), Corporation 29% (30%) and Individual Investor 22% (26%) during 2000-2009 (2010-2015) periods, respectively.

It is remarkable to mention the interaction terms expected effects of the major owner with, first the dividends paid, positively affecting Tobin's Q ratio during the pre-crisis period and the whole sample too, while, second the firms' leverage, statistically significant with negative influence on business efficiency. In addition, it seems that the market rewards with increasing capitalization (rising *Q*) the firms that pay dividends. The latter could be confirmed by the relative finding on *divid1* variable proved positive and strongly statistically significant only during the crisis period (2010-'15).

So, one understands that the inverse-U-shape function of *ROE or Q* on *OWN1* (Tables 4 or 5) as an indication of verification that ownership acts mainly as a substitute to weak legal and institutional environment in their upward slope, while in the downward turn prevail the "expropriation effects" that have happened for stocks in the ASE which throughout the 16 years sample period were undervalued (trend statistics, $Q<1$). That is, the alignment-of-

[13] Or even no-access to credit after mid-2015 with the "capital controls" imposed by the ECB which is supposed to be there for the re-establishment of the financial stability of the market.

interests hypothesis and the ownership concentration as a substitute of the unstable environment, as well as, the new kind of agency cost theory that one of which the controlling owners expropriate value from the minority, seems to be consistent with the fit of our data to model *ROE* or Tobin's *Q* ratio of equation 1.

The overall macroeconomic environment seems to be decisive on firms efficiency regardless the measure we use to proxy it, *ROE* or Tobin's *Q* ratio. In all cases the growth of the real GDP is positive and strongly significant during the pre-crisis period (2000-'09), while in contrast, the non-performing loans weigh negatively during the crisis period (2010-'15) and the whole sample one (2000-'15). The latter pattern of negative effects, but this time only on Tobin's *Q* ratio we have found in the case of inflation rates, reflecting that the sample firms are facing possibly elastic demand.

To sum, one of the main empirical evidence obtained of this paper is that the ownership concentration (i.e., the largest owner's share of the equity) has a non-linear (concave) effect on Greek firms' market value supporting the hypotheses not only the ownership as a substitute of weak legal and institutional (see unstable) environment, or the alignment-of-interests but also the expropriation effects of the majority against the minority shareholders. This finding is consistent with the respective of Miguel et al. (2013) for the Spanish firms, during 1990-'99, as regards the inverse-U-shape market value of firms vis-à-vis ownership concentration. However, they estimated as optimal level of ownership the 87% of the equity (versus 40% of our study on Greek firms, during 2000-'15) which maximizes Spanish firms' value – as a clear consequence of the more efficient monitoring provided by ownership concentrated shareholding- and that beyond this breakpoint firm value is negatively affected by ownership concentration – since at this very high levels the expropriation of minority shareholders is feasible.

Differences in corporate governance among countries could really help in understanding these discrepancies of inflection points of firms' value functions, as it is very well and relatively with this study documented by Miguel et al. (2013).

The second main empirical evidence obtained of this paper is that cash holdings have no effect on Greek firms' market value of the sample. We offer possible explanations for this which rely first, on the dominance of the ownership factor over firms' cash holdings. This argument is consistent with the second one, that is, the unstable economic conditions probably due to constantly required adjustments towards the compliance with sui generis EMU the sample period 2000-'15. The latter could probably explain the respective constantly changing optimal level of firms' cash, ending up to the non-existence of a clear trend. This, in turn, could make cash holdings statistically insignificant variable.

Table 3. One step system GMM estimation results (ROE dep.var.)

VARIABLES	(1) ROE full sample 2000-'15	(2) ROE before EZ-crisis 2000-'09	(3) ROE during EZ-crisis 2010-'15
L.roe	0.0573	0.539**	0.0550
	(0.802)	(2.261)	(1.270)
cash	-9.04e-09**	-1.82e-09**	3.80e-09
	(-2.279)	(-2.268)	(0.530)
cashsq	0**	0**	0
	(2.111)	(2.057)	(0.446)
own1	6.799**	1.726**	14.72**
	(2.104)	(2.002)	(2.334)
own1sq	-8.749**	-2.802**	-17.60**
	(-2.033)	(-2.110)	(-2.348)
profit	4.414**	0.908*	
	(2.415)	(1.718)	
sizegr	0.580***	0.143***	
	(3.258)	(2.916)	
size1gr			1.747***
			(4.399)
capex			-5.968***
			(-3.938)
leverage		-0.753***	
		(-2.721)	
npl	-2.163*		-3.961**
	(-1.970)		(-2.230)
gdpgr	-1.658	1.821***	
	(-1.150)	(2.777)	
time	-0.0225	0.00927	-0.0655
	(-1.057)	(1.062)	(-1.448)
Observations (obs)	1,350	694	660
Number of groups	193	107	188
Avg_obs per group	6.995	6.486	3.511
No. of instruments	43	36	26
AR(2) stat. *p*-val.	0.833	0.272	0.616
Sargan stat. *p*-val.	0	0.000640	0
Hansen stat. *p*-val.	0.205	0.299	0.328

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: AR(2) stat. p-val. = p-value of Arellano-Bond test statistic for AR(2) in first differences; Sargan stat. p-val. = p-value of Sargan test of over identified restrictions (Not robust, but not weakened by many instruments); Hansen stat. p-val. = p-value of Hansen test of over identified restrictions (Robust, but weakened by many instruments). For the definitions of variables see section 3.

Table 4. One step system GMM estimation results (Tobin's Q-ratio dep.var.)

VARIABLES	(4) Q-ratio full sample 2000-'15	(5) Q-ratio before EZ-crisis 2000-'09	(6) Q-ratio during EZ-crisis 2010-'15
L.tobinq1	1.357***	0.940***	0.286***
	(12.69)	(6.591)	(4.194)
L2.tobinq1	-0.244***	-0.224***	
	(-3.367)	(-3.178)	
cash	6.78e-10	-3.49e-10	-4.37e-10
	(0.513)	(-0.342)	(-0.717)
cashsq	-0	-0	0
	(-0.596)	(-0.605)	(0.769)
own1	2.612**	0.830	-0.487
	(2.143)	(0.788)	(-0.798)
own1sq	-3.501**	-1.651	0.576
	(-2.223)	(-0.897)	(0.799)
divid1	-4.152***	1.511	3.468***
	(-2.684)	(1.023)	(2.931)
own1divid1	9.842**	16.28***	
	(2.142)	(3.551)	
age	0.00165*	-0.000931	-0.00281**
	(1.853)	(-1.099)	(-2.560)
own1leverage			-0.172*
			(-1.815)
npl	-1.261***		-0.395*
	(-3.193)		(-1.862)
gdpgr		5.627***	
		(4.176)	
infl	-5.990***	-11.47***	
	(-4.074)	(-2.782)	
time	-0.000638	0.0312***	0.0349***
	(-0.0627)	(3.785)	(3.913)
Observations (obs)	855	370	582
Number of groups	140	68	152
Avg_obs per group	6.107	5.441	3.829
No. of instruments	43	27	35
AR(2) stat. *p*-val.	0.460	0.622	0.200
Sargan stat. *p*-val.	1.79e-08	0.251	0
Hansen stat. *p*-val.	0.158	0.301	0.429

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: see notes of previous table 3.

5. Concluding Remarks

The paper explores the relationship between market value of non-financial listed firms in the Athens Stock Exchange (ASE) and cash holdings as well as ownership concentration, during the 2000-'15 period. The motivation of using non-linear efficiency functions of both cash and ownership comes mainly from the lack of relevant studies for the Eurozone in the literature. To test the underpinned research hypothesis (RH) we have used dynamic system GMM estimators in order to face with probable endogeneity problems.

The study provides the following major insights. Firstly, between cash and ownership determinants the major shareholder's ownership (OWN1) proved to be dominant in the sample. The results obtained confirm that there is an optimal level ownership concentration around 40% of the equity for the largest shareholder which maximizes the value of Greek firms, regardless the measure used (*ROE, Q*), during the whole sample period (2000-'15). These findings are consistent with those of Miguel et al. (2013) for the Spanish firms 1990-'99 (EMU member country of the south too, but large economy) and in contrast with other studies for USA, UK, Germany and Japan which found linear the relationship. Secondly, our dataset has been proved not to be consistent with the hypothesized second determinant of business efficiency, the cash holdings (CASH), resulting in accepted only the half of the RH. The dominance of the ownership factor over the cash holding one, and the constantly changing optimal level of firms' cash, which due to unstable economic environment of the country are the explanations we have offered for this evidence. Thirdly, the firm and country-specific control variables were found statistically significant, too, in understanding the market value of the sample companies. This could confirm not only the critical role of sample firms' both internal and external environment, but also the total of our motivation. Fourthly, the findings support trade-off and agency theories' predictions in understanding the dynamic adjustment of the Greek firms, on strongly structural changes of the macroeconomic environment in the Eurozone during the period 2000-'15. We should underline that in this study the large shareholder's (OWN1) role in substituting the weak legal and institutional environment combined with the alignment-of-interests' hypotheses seems likely to explain the ownership concentration at low levels, while the expropriation effects at high ones.

The paper provides practical implications for candidate investors who should take into account the estimated around 40% of the equity optimal level of ownership concentration (i.e., the largest owner's share of the equity) which maximizes market value of non-financial listed firms in the ASE, during 2000-'15.

Policy implications are concerned not only the investors who have to search for the optimal level of ownership but also the EU-Greek policy makers in the perspective to integrate open capital markets in the European EMU, as the ECB Governor's M.Draghi's commitment in the 26-7-2012 "…*Within our mandate, the ECB is ready to do whatever it takes to preserve the Euro. And believe me, it will be enough. ...*" (Draghi, 2012).

Further research needs to be done so as to understand the nonlinearities of both cash and ownership on business efficiency. Thus, some future research proposals could aim first, to reveal the major shareholder identity (for instance, managerial or institutional or family ownership), second, to verify the findings of this paper for a larger dataset distinguishing between South West Euro Area Periphery (SWEAP, Aizenman, et al., 2013) and the Core of European EMU members, third, to look for these nonlinearities within the industry level, taking into account for the total of the proposals the endogeneity econometric problem.

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