Price Caps and the Performance of IPOs

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Abstract

This paper uses the Athens Stock Exchange as a unique testing ground to examine the effect of regulatory price caps on IPO pricing and initial returns. The Greek stock market offers the opportunity for a new experiment as three substantial changes in regulation were introduced in a short period of eight years (1992-1999). The results indicate significant differences in initial returns. Effective price caps reduce underpricing; in line with the international literature nonetheless, the range of underpricing is also significantly determined by the intensity of demand and hot market conditions. The results are robust after controlling for a number of other variables.

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1. Introduction

Initial Public Offerings (IPOs) constitute one of the most important activities in corporate finance, bringing substantial amounts of new capital to the corporate sector. Underpricing of IPOs has been extensively studied, and findings of high short-term returns from trading have been the rule, according to evidence from around the world. The large variation of IPO underpricing across markets and times has provoked extensive research on the underlying factors. In that context, regulatory interventions in IPO markets have been studied only infrequently. Existing studies of regulatory measures depend on the observation of testable policies and have looked at the design of the initial placement of issues, trading restrictions, disclosure requirements and underwriter obligations. Loughran, Ritter and Rydqvist (1995), (LRR from now on), taking international evidence into account, have advanced the conjecture that regulatory intervention appears to increase underpricing and distort market function[2].

We have uncovered new testing ground for the view on regulation represented by LRR's conjecture in the experience of the Athens Stock Exchange (ASE). This paper is based on a unique set of changes in regulation observed in the 1990s. Price cap regulation in the ASE was initiated in 1992 placing a uniform limit on the daily price variation of all traded shares, including newly listed ones. An extensive 'liberalization' followed, as regulatory authorities gradually relaxed price caps for newly listed shares. More specifically, by 1999, two successive steps had been taken: first, a relaxation of the daily limits to (±99%) for the first three days of trading for new listings was effected in late 1996; second, complete elimination of price caps for the first three days of trading was effected in 1999.

The rationale for limits on daily price variation has been invariably based on a

[2] Loughran et al. (1995) suggest that the movement by most East Asian countries to reduce regulatory interference in the setting of offering prices result in less short-run underpricing in the 1990s than in the 1980s

perception by regulators that rapid price changes are destabilizing and "speculative", and must therefore be slowed down. This was also the rational for imposing rice caps at the Athens Stock Exchange. Price cap policy was not explicitly directed at IPOs. Nevertheless, it is plausible that their imposition had an impact on the strategies of issuers, underwriters and investors in the new-issue market. We undertake to measure and evaluate the impact of the two successive liberalizations on IPO underpricing. Price caps alter the pattern of returns in early trading and force prices to adjust more slowly than they would have otherwise. Loughran's conjecture would indicate that this constraint on the market process is distortive and leads to increased underpricing. We test that conjecture directly.

Different lines of argument have been formulated on the general impact of price caps (or more generally 'circuit breakers'). Most of these focus on whether price caps can affect volatility. One line proposes that caps are inefficient as they suppress rapid price discovery [Fama (1989)]. A contrary line suggests that caps offer opportunities for "cooling down" of investor sentiment and allow for both smoother price adjustment and lower volatility [Choudhry and Nanda (1998)]. An interesting extension of this thinking is that the basic rationale for imposing price caps is the diminution of the potential for market manipulation by market participants who have the means to conduct manipulative schemes, [Kim and Park (2010)]. This rationale can be easily extended to newly listed shares where asymmetries of information are more intense and the potential for manipulation is larger.

We find strong evidence against LRR'sconjecture: Successive liberalizations in ASE price caps for new listing actually increased underpricing. Because this conclusion runs contrary to received thinking, we design our tests carefully to ensure that the finding is robust and does not result from factors such as general changes in market sentiment, in the characteristics of

listed firms, or the process of listing. Our basic explanation is that price caps have mitigated the intensity of investor sentiment in a developing new-issue market.

This study makes several more detailed contributions to the IPO literature. Besides suggesting that price caps play a key role in the pricing of IPOs and on the formation of short - term equilibrium returns, it explores the time (number of days after the listing) needed for the prices to reach their unconstrained level when price caps are binding[3]. It also replicates for the Greek market findings that show a positive relationship between hot market conditions and underpricing in line with evidence offered in Ritter (1984), Derrien and Womack (2003), Ljungvist et al. (2006), Thomadakis et al. (2012) and Boehme and Colak (2012).

Section 2 offers a review of the literature on underpricing and regulatory policies. Section 3 describes the regulatory regime of the Athens Stock Exchange with regard to price caps. Section 4 discusses data, presents control variables and methodology. Section 5 presents empirical findings and section 6 provides the discussion. We test the robustness of our results in Section 7. Section 8 concludes the paper.

2. Empirical studies on regulation and early performance of initial public offerings

The empirical literature on IPOs is extensive and international. The most voluminous branch of that literature concerns short - term performance of newly listed shares. Examples are: Finn and Higham (1988), Lee *et. al.* (1996) and Ritter (2007) for Australia[4]; Tian and Megginson (2007), for China; Derrien and Womack (2003), Loughran et al. (1995) for France; Ljungqvist (1997) and Bessler and Stanzel (2009) for Germany; Hogholm and Rydqvist (1995),

[3] For this reason, the sample of 351 IPO securities is examined in the aggregate as well as in subsamples, for the three sub-periods when different price caps were enforced.

[4] Lee *et. al.* (1996) and Ritter (2007) provide an analysis on the initial underpricing of 1,103 Australian IPOs listed for a period of 30 years. The findings indicate that for the period 1976-2006 the average initial returns have been 19.8%.

Rydqvist (1997), Ritter (2007) for Sweden; Kunz and Aggarwal (1994) for Switzerland, Loughran et al. (1995), Chambers and Dimson (2009), Levis (2011) for United Kingdom, Wu et al. (2007), Friesen and Swift (2009) and Ritter (2009) for USA.

The general content of findings is exemplified by comparative studies such as Loughran, Ritter and Rydqvist (1995) and Gajewski and Gresse (2006). These studies establish that initial IPO underpricing is wide-ranging and suggest that the appearance of positive excess returns in the short run is a generalized phenomenon around the world. However, the size and intensity of underpricing have exhibited great variation across markets and times. Many factors have been examined to account for this inefficiency but also for its variation across space and time. The findings show that these are due to demand and investor sentiment, competitive supply and the incentives of owners, and incentives and competition among underwriters. We draw on these extensive findings to design control variables for our tests of the determinants of underpricing in the ASE.

Regulations, as Leuz and Wysocki (2008) discuss, must function as a low-cost commitment device for preventing market failures. Arguments suggesting as well as casting doubt on the net benefit of capital market regulation are well documented, and the extant empirical evidence largely mixed (see Healy and Palepu, 2001; Mulherin, 2007; Shleifer, 2005; Zingales, 2009). Despite voluminous literature within the broad literature of capital markets regulatory reforms, the studies of regulatory interventions on IPOs are relatively few. This is due mainly to three reasons.

The first is that the emergence of institutional arrangements surrounding new-issue markets evolve in many cases as a matter of contractual agreements among market participants and cannot be directly ascribed to mandatory regulations (an evident exception refers to

mandatory disclosure requirements). Various alternatives to fixed-price auctions, for example, have been 'market–driven innovations' that come from contracting parties. A direct result is that, disclosure requirements aside, arrangements that are exogenously imposed by regulators are far more frequent in emerging than in developed markets. The second reason relates to test designs: the impact of regulatory interventions can be tested only when specific and discrete changes in regulations occur. Thus, where regulations are stable few or no tests can be conducted. On the other hand, the process of liberalization feeds into the ability to conduct credible tests of the effects of regulation. The third reason is that in sophisticated markets regulations and their changes are frequently indirect, seeking to produce results through changes in incentive structures rather than direct constraints on prices, quantities or behaviours. Policies that regulate transparency, encourage competition among participants, or impose capital requirements on intermediaries are examples of this approach frequently found in sophisticated markets. This however does not diminish the need to study direct regulatory constraints, whenever and wherever they occur, since they reflect an important stage in the evolution of markets.

In the context of studying the impact of direct regulations Bancel and Mitto (2009) report that the decision to go public is influenced by listing country institutional and regulatory environment. An early study of trading halts by Pettway and Kaneko (1996) examines IPO underpricing before and after a change in regulation in the Tokyo Stock Exchange. They find that a relaxation of constraints which delayed the commencement of trading of newly listed shares led to less severe underpricing. Chambers and Dimson (2009) report a significant rise in issue discount against the background of regulatory reforms aimed at improving investor protection in the United Kingdom.

Several studies have looked at the liberalization of the market in mainland China over the last decade. Tian (2011) observes that Chinese IPO underpricing is mainly caused by government intervention with IPO pricing regulations and the control of IPO supplies. Cheung et al. (2009) also document the impact of liberalization in China. They note that Chinese IPOs exhibit huge underpricing, which decreases over the period of liberalization and that after adopting a series of regulatory reforms allowing underwriters discretion in the determination of issue price, this 'regulatory underpricing' component vanishes.

In a number of studies that address various aspects of national regulatory requirements across different Asian countries there are additional insights on the implications of institutional constraints for underpricing, such as Chen (1992) for Taiwan, Kao et al. (2009) and Tian (2011) for China, Ekkayokkaya and Pengniti (2012) for Thailand and Chang et al. (2012) for Korea. In the case of Korea, Chang et al. (2012) for example conclude that the high level of underpricing in Korean IPOs is the unintended consequence of regulations designed to promote fairness. Two aspects of the regulations distort the process - an "essential price" formula that severely understates the value of the firm and bid exclusion rules that give investors a strong incentive to cluster their bids so as to avoid being excluded from the offering.

Further, Ekkayokkaya and Pengniti (2012) report significantly drop of IPOs underpricing in Thailand, following the country's major governance reform, indicating less price-protection by investors. They conclude that governance regulation in an economy with fundamentally weak legal institutions works, but its efficacy is limited when insiders retain absolute control.

An early study of the Athens Stock Exchange by Kazantzis and Levis (1995) looked at a different regulatory intervention that was in force from 1987 to December 1990. This was an obligation imposed on the underwriter to offer price support to IPO shares for six months after

listing. They concluded that "…measures to intervene in the pricing process …result in excessive underpricing".

The conclusion of the literature on direct regulatory interventions provides the foundation to LRR's conjecture and increases the challenge in testing whether the conjecture can be extended to other regulatory instruments such as price caps in the IPO aftermarket.

3. Price Limits at the Athens Stock Exchange

3.1 Changing Restrictions on Daily Price Variation

Until June 1992, price fluctuations in the Athens Stock Exchange were unconstrained for all shares, but the Exchange imposed a limit of ± 8% on daily variation in July 1992. The purpose of this regulation was to protect investors and the market from 'speculative attacks'. The context was one of macroeconomic risks, exchange rate pressure and fears that the Greek market might experience a precipitous decline. The price cap imposed both a floor and a ceiling. In subsequent periods when the market started to rise, a healthy supply of IPOs appeared while the limit remained in force.

The regulation applied to all stocks, including newly issued ones from their first day of trading. In particular, within any day a stock price could fluctuate within a range of ±8 percent. When a price reached the limit, it would freeze at that limit and no more trading could take place on the same day, except at (or of course within) the limit range. The stock would start trading again on the next day, its starting price being the limit price of the previous day. If the demand or supply continued to be excessively high (or low) during trading, the stock locked again and further trading of shares transferred to the following day.

Almost four years later, on December 1st, 1996, the regulation was relaxed for newly trading stocks. Specifically, prices of newly listed shares were allowed to fluctuate within a limit

of ±99% for the first three days of trading (from the fourth day on, the limit of ±8% continued to apply).

The regulation changed again on December 1st, 1999 when the stock price of an IPO company was allowed to fluctuate freely during the first three days of trading. The rationale for these successive liberalizaitons was related to the speed of price discovery. The Stock Exchange argued and the regulator (the Capital Market Commission) accepted that newly listed stocks, which were increasingly coming from the second-tier market, needed unrestricted early day trading, in order to achieve rapidly their short – term 'equilibrium'.

In Figure 1 we show a timeline of the changes in Greek regulations.

Please Insert Figure 1 About Here

During the period under examination (1990-2011) 351 IPOs were launched in the Greek market. The discrete changes in regulation of price fluctuation allow us to divide the sample into sub-periods which correspond to the different price cap levels as shown in Figure 1. These are:

(a) January 1, 1990 to 30th June 1992 (no caps).

(b) July 1, 1992 to 30th November 1996 (±8% price caps)

(c) December 1, 1996 to 30th November 1999 (±99% during the first three days of trading).

(d) December 1, 1999 to 31st December 2011 (no caps the first three days of trading).

3.2 The effect of regulatory constraints: simple exposition and hypothesis

Consider the price cap and how returns can compare between the constrained and unconstrained cases:

Letting,

CP(t) be the 'equilibrium' closing price on day t

OP be the offer price

u(t) be the percent underpricing on day t,

it follows that:

$$u(t) = \{CP(t) - OP\}/OP \quad (1)$$

If a price cap is not binding, the unconstrained price will be revealed on the first day and the relevant quantity of underpricing will be u(1). If a price cap is binding over t days the relevant measure of underpricing will be u(t+1). Denoting the expected value of underpricing when no price caps are present by uF(1) and when price caps are in force by uC(t), we wish to compare, ceteris paribus, underpricing in the two different states:

$$uF(1) (> \text{ or } <) uC(t). \quad (2)$$

The direction of the inequality in (2) depends on the effect of the regulatory regime. Equality will imply that the regime is irrelevant. The LRR conjecture implies that:

$$uC(t) > uF(1). \quad (3)$$

The argument in favor of the conjecture states that since newly listed stocks are associated with a high order of uncertainty, an initial trading period without price constraint is desirable as it facilitates more rapid price discovery. This was in fact the rationale used by Greek regulators when in 1996 they liberalized the regime of price caps.

A competing hypothesis would argue that:

$$uF(1) > uC(t). \quad (4)$$

A restriction on daily variation may produce a 'cooling off' effect so that overall underpricing will be moderated. A significant strand of literature on short – term underpricing shows that early trading returns on newly listed shares are excessive and affected by early investor sentiment, [Baker and Wurgler [(2006), (2007)], Campbell et al. (2009)]. Furthermore, some theorists, notably Ljungquist et al. (2006) and Cornelli et al. (2006), have proposed that initial underpricing can be seen as a strategy on the part of issuers and underwriters to appropriate 'hot' investor sentiment, in the short-run. Other studies following behavioral premises suggest that precisely because of the lack of sufficient information, reputation and history, early post – offering prices are not efficient because they are more prone to strong investor sentiment. In fact, Baker and Wurgler (2006) argue that higher information asymmetry intensifies the appearance of investor sentiment. Campbell et al. (2009) offer empirical verification of this assertion for the case of IPO stocks.

If early investor sentiment, whether spontaneous or managed by underwriters, is responsible for underpricing (or some portion thereof), it is plausible that its manifestation will be hampered by limits on price variation. As a result, the attractiveness of underpriced issues to short-term investors will be tempered; In line with arguments presented in Boehme and Colak (2012) the clientele of IPO shares may then shift away from short-term speculators. As the prospect of rapid price increases is reduced, issuers and underwriters will also have reduced incentives to underprice and offering prices will be closer to intrinsic values. It is therefore plausible that daily variation limits reduce underpricing by incentivizing underwriters to price closer to the efficient valuation, and by moderating an investor rush for the new issues by the same token. The argument by Kim and Park (2010) presents an interesting extension to this thinking. They argue that the basic rationale for imposing price caps is the diminution of the

potential for market manipulation by market participants who have the means to conduct manipulative schemes. This rationale has strong implications for newly listed shares where asymmetries of information are more intense, price history does not exist, supply is by definition managed and the potential for manipulation is therefore larger.

The hypothesis we test with Greek IPO data focuses on the direction of inequality (2).

4. Data and Methodology

4.1 The Data on Greek IPOs

This study examines the initial performance of 351 IPOs listed in the Athens Stock Exchange in the Main, Parallel and New boards during the period from January 1990 to December 2011. The sample contains only ordinary common stocks; it excludes the issue of preference stock as well as transfers from the Parallel to the Main market. The study extracts data mainly from IPO prospectuses, but also the daily press, ASE reports (History of ASE, Fact Books, Annual and Monthly Statistical Bulletins) and Annual Reports of the Hellenic Capital Commission. The prospectuses were referenced from the library and website of the ASE and the Capital Market Commission market resource centre.

Prospectuses provide data for each of the issues regarding the offer price, total gross proceeds, age of companies, proportion of shares sold by owners, list of underwriters, and closing date of the offer. Other additional information about the companies comes from databases available at Compustat, Datastream and Thomson Financial Securities Data Corporation, at the public libraries of ASE and the Capital Market Commission, the library of the Bank of Greece, and the database of the Greek Parliament. In a few cases, we approached companies directly.

Please Insert Table 1 About Here

Table 1 provides a categorisation of the IPOs, into the three market boards of Greece (Main, Parallel and New). The highest number of IPOs was launched in 2000 with 53 cases (18 in the Main market and 35 in the Parallel market), followed by 46 IPOs in 1994 (36 in the Main market and 10 in the Parallel market). The lowest number of IPOs registered in 2008 and 2009 (1 IPO in the Main market correspondingly).

4.2 Methodology

We measure the level of initial returns of IPOs listed on the ASE using the conventional method, with the raw initial return (RIR)[5] on the first day of trading calculated as follows:

$$RIR_i = \frac{CP_{i,1} - OP_{i,0}}{OP_{i,0}} \quad (5)$$

As time lag between the closing day of the offer and the first day of trading is significant in the Athens market, the initial return is adjusted for market changes, taking into account movements of the Athens Stock Exchange General Index (ASEGI) between the offer closing date and the end of the first day of trading. During this period, changes in market conditions may cause deviations in measured returns.

Calculations of the market-adjusted initial return are as follows:

$$MAIR_i = \frac{CP_{i,1} - OP_{i,0}}{OP_{i,0}} - \frac{MI_{i,1} - MI_{i,0}}{MI_{i,0}} \quad (6)$$

[5] The raw initial return *RIR* can be considered to be a measure of underpricing, assuming that the normal return under efficiency would be 0 and that the equity risk is equivalent to market risk..

The dependent variable for the tests is the one-day market-adjusted return of the first day of listing, or, in the case of effective price cap, the return over the days until an unconstrained price is first observed.

In the case of periods when price caps were in force, the first day market adjusted return is a curtailed measure of actual return, whenever the cap becomes binding. We use a simple procedure to compute the short term unconstrained return: returns of the second day are added to first day returns if the former are bounded by the daily limit. If second day returns are also bounded, returns of the third day are added. The process goes on until the day when the price is formed without constraint. Thus, if in the case of a new listing when the 8% limit was in force, the first day return was unconstrained, say 7.5 %, it is so recorded. If however the first day return is constrained at 8%, we add on the second day return. If this is unconstrained, say 6.5 %, then a total imputed equilibrium day return of 14.5 % is recorded. If the second day return is also constrained, we add on the return of the third day. If this is unconstrained, say 5.5 % then an imputed return of 21.5 % is recorded. If the third day return is also constrained, we continue to the fourth day return, and so forth.

To compute the unconstrained return, we calculated – for each offering listed in the ASE during the two sub-periods (July 1992-November 1996, and December 1996-November 1999) the return accumulated over the number of consecutive days when the price cap was binding and the first day when it was unbounded. Calculations of raw and adjusted underpricing are as follows:

$$RAU_{i.t} = \frac{EP_{i,t} - OP_{i,0}}{OP_{i,0}} \quad (7) \qquad MAU_{i,t} = \frac{EP_{i,t} - OP_{i,0}}{OP_{i,0}} - \frac{MI_{i,t} - MI_{i,0}}{MI_{i,0}} \quad (8)^{6}$$

[6] Where RAU= Raw underpricing, MAU= Market adjusted underpricing, $OP_{i,0}$=IPO offer price as per prospectus of company 'i', $EP_{i,t}$=Unconstrained price (Closing price of IPO of company 'i' at the end of trading day t), $MI_{i,0}$=ASE

Using these calculations we produce two estimates of the dependent variable. The first is the actual first-day market-adjusted return, irrespective of whether it is constrained or not (MAIR). The second is the unconstrained return (MAU).

In Figure 2, we show the number of IPOs and the movement of the Greek Market Index.

Please Insert Figure 2 About Here

In Figure 3, we show the Raw (RAU) and the Market-adjusted (MAU) returns for IPOs performed in each quarterly period.

Please Insert Figure 3 About Here

The most visible feature in Figure 3 is the great peak in returns during the last two quarters of 1999, a time when the Greek market as a whole achieved all-time highs (6355.04 units in the ASEGI on 17th September 1999). Although market declines set in subsequently during the last quarter of that year, IPO activity and strong underpricing continued. We shall later check for the effect of outliers to be found in these two quarters, on our regression results.

4.3 Descriptive Statistics

Table 2 shows descriptive statistics of raw and market adjusted initial returns. It also shows the average number of days for initial prices to reach an unconstrained level during periods of active price caps.

Specifically, Panel A of Table 2 shows the mean (median) unadjusted and market adjusted first day returns for each of the regulatory sub-periods. The mean unadjusted return at

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General Index at the date of prospectus for company 'i', $MI_{i,t}$=ASE General Index at the close of trading day t for company 'i'.

the end of the first trading day, when no ceiling restriction was present, is 48.50 percent. The market adjusted return in the same period is 48.90 percent. During the period with the cap of ±8 percent, the mean first day unadjusted return is 5.63 percent whereas market adjusted initial return has a mean of 4.94 percent.

Please Insert Table 2 About Here

Finally during the period with a cap of ±99 percent, the mean unadjusted first day return is 70.15 percent and the market adjusted return is 68.98 percent.

A similar pattern of mean returns appears in Panel B where estimates are made of MAU, the unconstrained return. The returns of the period with no caps are of course the same as in panel A and the returns of the periods with caps become higher, as we would expect. What is notable is that whereas average returns of the period with the 8 percent cap are lower than those of the unconstrained period, the returns of the period with the 99 percent cap are much higher than all others. This difference is attributable to the fact that the period with the 99 percent cap includes a 'hot' market incident with the highest returns ever observed in the Greek market. This will of course be taken into account in the regression tests that follow.

During the sub-period where the daily price caps were at ±8 percent, the mean number of successive days required to reach equilibrium was 2.59 (Panel D of Table 2). In other words, the daily price movement of 93 IPOs listed in the ASE during the period of the strict price cap reached their unconstrained level after 2.59 trading days on average. It is worth noting that only 19 out of the 93 IPOs of this period reached an unconstrained price on the first trading day. In other words, in 80 percent of the cases the price cap was binding. In the extreme cases, two IPOs recorded their unconstrained price after 10 and 11 trading days respectively.

In the period when the price cap was set at ±99 percent, the mean number of days required to reach an unconstrained level was 0.67. In other words, on average IPO returns reached their unconstrained level within the first trading day. Thirty (30) out of 67 IPOs during that period however required at least one day to reach an unconstrained level. In extreme cases, the shares in four IPOs rose by 99 percent for three consecutive days. Thus, even the wide constraint of ±99 percent proved to be binding in 45 percent of cases.

4.4 Regulatory Variables

We define two binary dummy variables, one for each of the two periods with price caps on daily variation. Thus, CAP99 represents periods when a daily cap of ±99 percent held for the first three days of trading; CAP8 represents periods with the 8 percent price cap.

The specification of the regulatory dummy variables implies of course that periods with no price caps are considered uniformly as 'unregulated' periods.

4.5 Control Variables

We must consider market conditions, especially as our sample contains alternations of hot and cold periods. Loughran and Ritter ((2002), (2004))[7] report that underpricing increases substantially during a hot market period and then falls in the cold market. Lowry and Schwert (2002), Benveniste *et al.* (2003) and Derrien and Womack (2003) in fact suggest after measuring the relationship of the initial return with the market movements, that companies should choose the cold issue market to go public so that they can gain from higher prices of hot periods.

[7] Loughran and Ritter (2002, 2004) find that underwriters allocate hot IPOs to investors in return for commission business and they receive greater profits from commission business when there is greater underpricing.

The selection of variables that discriminate 'hot periods' is an important issue, as it may be the case that different regulatory regimes coincide with different states of the market. Market conditions may be detected on the basis of a double criterion on a quarterly basis: on one hand, the number of IPOs performed during the quarter and on the other hand, ex-post market returns for the quarter. The use of these two variables is an extended version of the methodology used by Yung et al. (2008) and Boehme and Colak (2012). We use two continuous variables that capture respectively entrepreneur sentiment (on the supply side of IPOs) and investor sentiment (on the demand side of IPOs). The first is NUIPO which represents the ratio of the number of IPOs in each quarter to the quarterly average of IPOs in the whole sample. The second is RET and represents the ratio of each quarter's market return to the overall average quarterly return over the period covered by our sample.

Compared to previously used methodology, this study utilizes two rather than one 'hot market variables' and they are continuous rather than dummy variables. In this manner the tests can capture more accurately market sentiment on both sides of the market. We hypothesize, in line with the extant literature, that underpricing is positively related to both NUIPO and RET.

Test methodology must control for many other factors in order to make effective comparisons between regulatory regimes in a cross-sectional model. We therefore apply a series of additional control variables, inspired from the literature. These control variables are: listing board classification (LBC), age of the firm at the date it goes public (AGE), time lag (TLAG), privatization (PRIV), company size (SIZE), oversubscription (OVER), underwriters' reputation (UR), retained ownership (OWN) and industry type (IND). We also tested for variables of sectoral concentration of IPOs in specific periods. Appendix A summarizes the explanatory variables, briefly giving their definition and measurements:

Listing Board Classification: Following Gajewski and Gresse (2006) we distinguish firms listed in the Main board from those listed in the 'parallel' or 'new' market. The variable takes a value of 1 for the Main Board listings.

Age: Age represents the number of years of operating history of a firm prior to going public and it creates a proxy for ex-ante uncertainty. Following Ritter (1984) and Lee et al. (1996) we use this variable as a proxy for quality of information.

Time Lag: The period between the official date of the prospectus announcement (or offer price date) and the listing date of an IPO, is usually short; however in Greece, this time lag varies between five and seventy days. During the intervening period, changes in market conditions may affect the price performance of the IPOs. (Loughran et al. (1995) and Chowdhry and Sherman (1996)).

Privatization: Privatization is the transfer of ownership from state owned enterprises to private investors through IPOs. Following Perotti and Guney (1993) Jones et. al (1999) and Megginson et al. (2000) we attach a value of 1 to IPOs of privatizing public sector firms.

SIZE: IPO Size is the magnitude of the offering, measured as the product of the offering price and the number of shares being offered. Zarowin (1990) documents that as smaller firms tend, on average, to be more risky, then first day returns are expected to be bearish related to firm size.

Oversubscription: Oversubscription occurs when demand for shares exceeds the supply of shares offered for sale in a fixed price sale. As a result, the underwriters or investment bankers must allocate the shares among investors. Keloharju (1993) and Deloof et al. (2009) report that a higher oversubscription reflects the greater absorption capacity of the market.

Underwriter reputation: The lead underwriter plays an important role in pricing and distributing an IPO, certifying the quality of the issue by their past performance in IPO

underwriting. Beatty and Ritter (1986), Carter and Manaster (1990), Spiess and Pettway (1997), Carter *et al* (1998), Kim and Ritter (1999), Bae et al. (1999) and Ljungqvist and Wilhelm (2002) specify that prestigious underwriters are associated with lower risk offerings and lower initial returns expected from IPOs underwritten by reputable banks. In the Greek case we use the dummy variable with value 1 for all IPOs undertaken by 'major' underwriter banks, as opposed to other smaller banks and syndicates.

Given Ownership: This is the percentage of ownership sold by pre-IPO shareholders. By selling a small percentage of their firm, original owners may signal firm quality (Habib and Ljungqvist (2001)).

Industry classification: IPOs are classified in groups based on their sector. Gajewski and Gresse (2006) use industry as a variable that affects the average initial under pricing. Spiess and Pettway (1995) working on a sample of industrial firms find that initial underpricing is significantly lower[8]. Our dummy variable takes the value 1 for the industrial sectors.

Sectoral concentrations: During the period of study there were three instances in which firms belonging to a single sector performed numerous IPOs within short periods. A large number (25) of construction companies were listed in the Athens Stock Exchange during 1993-1994 while many IT companies (17) were listed during the IT boom of 1999-2001. Further, many media and print companies (11) were listed during 1998-2000. These sectoral clusters of IPO supply could indicate a form of 'sectoral sentiment over and above other measures of supply competition. Thus, we tested three dummy variables (CONS), (IT) and (MED) which take a value of 1 for the

[8] We defined as 'industrial' IPOs those firms which belong to Chemical, , Manufacturing, Metals, Minerals & Shipyards sub-sectors and attached to them a value of one. Non-industrial categories are mainly Conglomerates, Real Estate/Property, Transportation, Tourism and Hotels etc. These take the value of zero.

corresponding IPOs. These variables were never significant so we skip them in the estimations and results which follow.

The main regression model is specified as follows:

$$MAU \text{ or } (MAIR) = a_0 + \gamma_1 LBC + \gamma_2 AGE + \gamma_3 TLAG + \gamma_4 PRIV + \gamma_5 SIZE + \gamma_6 OVER + \gamma_7 UR + \gamma_8 RET + \gamma_9 NUIPO + \gamma_{10} OWN + \gamma_{11} IND + \gamma_{12} CAP8 + \gamma_{13} CAP99 + \varepsilon_i \quad (9).$$

If the regulatory constraints effectively lower underpricing in monotonic fashion, we expect to find that,

$$\gamma 12 < \gamma 13 < 0 \quad (10)$$

5. Empirical Results

In Table 3 we show the result of tests of regression (9) using MAIR as the dependent variable.

The findings on the regulatory dummy variables are as follows: The returns in the period with the 99 percent variation limit do not appear to be significantly different from others, as the relevant dummy variable picks up no significant effect. However, returns observed under the 8 percent cap appear, ceteris paribus, significantly lower than in other periods. These findings are perfectly plausible, since first-day returns under a tight constraint are truncated returns, and thus are lower than in periods with looser constraints or with no constraint at all.

Another observation on the results in Table 3 (columns 1-3) is that among the control variables one comes out consistently significant. This is oversubscription (OVER), which exerts a strong positive influence on first-day returns. This finding is in the expected direction and implies high first day returns under higher demand pressure. Of the remaining control variables, size acquires a significant negative coefficient in two cases, the industry dummy picks up a

marginally significant effect in one regression. The effects of these variables are in the expected direction, so there is no departure from previous evidence.

Please Insert Table 3 About Here

The findings on the variables describing market condition are also remarkable. Relative intensity of IPO supply (NUIPO) shows a positive influence in two regressions. Thus, hot market conditions intensify underpricing in this test.

In Table 4 we test equation (10) with the other variant of the dependent variable which is the unconstrained return. The layout of independent variables is the same as in Table 3. The dependent variable is MAU. In the case of periods with no price caps, MAU is of course identical to MAIR.

The regulatory dummies are the focus of the test. The evidence in Table 4 rejects the null hypothesis. In both regressions where a dummy variable for the period under the tight constraint of ±8 percent is used, it picks up a very significant negative effect. Thus, even when the unconstrained price is used, there are strong differences in underpricing of IPOs conducted under a tight price cap as compared to IPOs conducted with wider or no price caps.

The performance of control variables shown in Table 4 is similar to that found earlier with MAIR, but there are few differences. The single most important determinant of underpricing remains the oversubscription (OVER) variable. The TLAG variable shows a significant positive effect on MAU and the variable of relative quarterly market performance (RET) picks up a positive effect. The dummy variable representing industrial grouping appears with a positive contribution also, but with marginal significance.

Please Insert Table 4 About Here

Unambiguously, the regulatory constraint lowers underpricing. At the same time, the findings of Table 4 do not indicate that the price cap of ±99 percent exerts any influence on underpricing. This is a plausible result since the majority of IPOs performed during the relevant period did not face an active constraint on the first day of trading. Hence, unconstrained returns in the period with the wider cap do not differ significantly from those of the no-cap period.

In Table 5, we test the model of underpricing on subsamples defined by the different regulatory periods. The purpose of these tests is to see whether control variables perform differently in the different sub-periods, where this difference could have been masked by the pooled estimations over the whole sample.

The results are of some interest and support several observations. The first is that oversubscription exercises a strong influence on underpricing across all periods, and represents an unambiguous factor. This is consistent with the notion that there is higher underpricing for IPOs that have a more diverse shareholders base, Gajewski and Gresse (2006). The second observation is that there are no reversals of sign in any variable except one case: the relative number of IPOs per quarter. In the period with the strictest cap, this variable obtains a negative coefficient, whereas in the unregulated period the coefficient is positive. This implies that under a strict cap, IPOs are priced more fairly at times when supply of IPOs is more competitive. Clearly opposite from evidence in the international arena, i.e. Chang et al (2012), Tian (2012), governmental intervention contribute on reducing the level of underpricing. In the absence of price cap, higher IPO frequency implies on the contrary that underpricing is more severe. This reversal could be the result of a shift of power to underwriters (versus the original owners) in the

unregulated period. In fact, during the unregulated interval the variable representing underwriter reputation obtains a surprising positive coefficient. This indicates that reputable underwriters conducted IPOs with heavier underpricing in that period, in order to attract investors in the environment of an already hot market.

Please Insert Table 5 About Here

We have conducted Chow tests to compare coefficients in two subsamples: the period with no price caps and the period with the strictest cap of ±8 percent. These are shown in the last column of Table 5. For three variables (Size, listing board classification and percent of ownership given in the IPO), as well as the variable of relative supply of IPOs (NUIPO), the hypothesis of equality of coefficients in the two sub-periods is rejected.

A more general observation therefore follows: during the period without price caps, several variables that appear to be dormant in other subsamples perform a significant explanatory role. Size, listing board classification, relative market performance, ownership percentage offered are variables that appear significant and their coefficients are in the expected direction. In part, this result is probably due to the fact that in the unregulated period the variation of the dependent variable is much greater across the sample than in the other periods. The coefficient of variation of the dependent variable is 1.768 in the unregulated period but 1.057 and 1.456 respectively in the periods with the ±8 and the ±99 percent limits.

Clearly, someone conducting cross-sectional tests of IPO performance during periods with no price caps would reach different results than if the observations had been drawn from periods with price limits. Hence, institutional detail matters very much and regulatory changes should be carefully accounted for in tests of this type.

6. Robustness Checks

In this section, we address the robustness of the evidence, since it contradicts the spirit of the LRR conjecture.

Robustness checks concentrate on the extremely 'hot' period of the Greek market in order to ensure that the results are not simply driven by hot market conditions, Thomadakis et al. (2012) and changing investors' sentiment. It is possible that the very high returns observed in the latter part of 1999 drive the differences found during the regulated period when no hot market conditions of that magnitude were observed. Thus we repeat the regression by using four different exclusions. In the first case, we exclude both the third and fourth quarters of 1999, when the market showed historically exceptional returns. In the second case, we only exclude the fourth quarter of that year, in which we observe the highest returns. In the third case, we exclude only three individual IPOs which exhibited raw underpricing over 400 percent during that period. In the fourth case, we repeat our tests for only the period 1990-98, excluding both the 'hot period' of 1999 and its aftermath.

In Table 6 the four columns represent the four exclusions. The findings support strongly the robustness of the original test. The period under a strict price cap of ±8 percent continues to capture a significant reduction in underpricing, in all cases In fact when the whole period of 1999 and beyond is excluded, the regulatory dummy for the 99 percent cap also becomes significantly negative, reinforcing our results.

Please Insert Table 6 About Here

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7. Discussion: Does the price cap achieve lower cost to issuers?

A natural question that arises from the findings of our tests is whether the imposition of a price cap leads to improved efficiency in the IPO market. In this paper we find that price intervention restricts initial IPO underpricing and could prove to be a useful tool for regulators or contract designers in primary markets, especially emerging ones.

Several general points can be noted:

First, continuously changing market conditions create different intensities of "investors' sentiment". On certain occasions, markets experience high increases in stock prices ('hot' periods) and inexperienced investors can easily inveigle in uninformed trading. This effectively leads them to risky strategies that may *earn high initial returns but may also cause considerable loss*; it may also imply unwise choices in the medium term. Investor protection is as crucial in the IPO market as in the secondary market and price caps may promote this. Our statement involving the aftermarket trading adds in (Ritter and Welch, 2002; Shleifer and Wolfenzon 2002[9]) pre-listing finding that the issue discount increases in the degree of the risk of value loss facing investors

Second, issuers normally request from underwriters that reduced amounts of "money are left on the table". This is what affects their cost of capital [Dolvin and Jordan (2008)]. Loughran (2002) report $27 billion left on the table in the United States for a period of nine years. In Greek IPOs undertaken during periods of no price cap total "money left on the table" amounted to nearly 2.8 billion Euros. Considering these findings, it is clear that price caps can be applied, perhaps selectively, to reduce the transfer of wealth.

[9] Shleifer and Wolfenzon's (2002) show that where private contract penalties are not sufficient to prevent wealth expropriation/diversion by insiders, an increase in the degree of investor protection limits insider diversion and makes investors more willing to pay higher prices for a firm's equity. In the context of initial public offerings, their model implies that IPO shares should command a higher offer price, i.e., a smaller issue discount, following a successful governance reform aimed at improving investor protection.

Third, it is very clear in our evidence that the application of a price cap did not put off IPO activity. In fact, during the almost four years of the tight regulatory constraint, IPO activity in the Greek stock exchange was sturdy, producing a sample of 93 cases. These represent more than one quarter of all IPO activity over the period 1990-2011. Thus, rather than visibly 'killing' the primary market, the constraint reduced the "money left on the table".

8. Conclusion

We conducted a direct test of the impact of price caps (in the form of daily variation limits) on IPO underpricing. There has been no other such direct test to our knowledge. The Greek market has offered this unique opportunity for testing, as daily variation limits for newly listed shares changed three times in a process of liberalization over seven years.

Our basic finding supports the hypothesis that price caps actually reduce underpricing. This contradicts LRR's conjecture that regulatory intervention increases underpricing. In part, the contradiction must be due to the fact that other research did not have an opportunity to test direct intervention with price caps, nor successive liberalizations within a few years in the same Exchange. Our evidence is very clear since this effect appears strong not only when we compare a period with narrow limits with a period with no limits, but also when we compare periods with limits of different range.

Routine regulatory explanations of price caps focus on the reduction of speculation and the moderation of market volatility. The results we have obtained show an unexpected gain in efficiency in the pricing of newly listed stocks which has not been previously recognized by researchers, nor has been explicitly embedded in regulatory arguments.

Our findings are robust, as we have tested for the possible interference of 'hot market' conditions and a number of other control variables. An important finding is that in regulated and unregulated periods the role of control variables changes. This suggests that empirical tests are sensitive to institutional arrangements and that different regulatory restrictions may lead to validation of different models. This finding has direct implications for research design.

The underlying implications of our findings are that market participants (issuers, underwriters, investors) adjust their behavior to the regulatory environment. A variant of this implication, in line with the spirit of Boehme and Colak (2012), is that the population of participating investors is itself changing not only during hot IPO markets but also during periods when strict regulation is imposed. Clearly this is a matter for further research.

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Appendix A. Variables Definitions

Variable Name in Abbreviation	Variable Definition	Type of Measure	Expected Sign
	Panel A: Measures of Abnormal Returns		
RIR	Measures the returns at the end of the first day of trading.	Continuous	
MAIR	Returns to investors in the end of first day of trading adjusted with the returns of the market. Raw initial returns (RIR) are adjusted for market changes taking into account the Athens Stock Exchange General Index (ASEGI) between the offer price closing date and the end of first day of trading.	Continuous	
RAU	Level of underpricing (unconstrained or fair market price) which considers 2^{nd}, 3^{rd} etc days of trading until the price will reach its unconstrained level	Continuous	
MAU	Calculates the level of underpricing by the time the unconstrained price will occur. Returns are adjusted for the market effect.	Continuous	
	Panel B:IPOs Characteristics		
LBC	Dummy variable: 1 if an IPO is listed in Main Market and '0' if listed in Parallel or New Market.	Discrete	+
AGE	Age of the firm starting from the year of its establishment until the year it goes public.	Continuous	-
Time Lag	Period between IPO announcement (the date of prospectus) and first day of trading.	Continuous	+
PRIV	Companies owed by the State before going public. State sells part of its holdings on those companies in the market.	Discrete	+
SIZE	Market capitalization measured by the log of the total number of outstanding shares after the IPO multiplied by price per share.	Continuous	-
OVER	Oversubscription on the number of shares issued.	Continuous	+
UR	Dummy variable: 1 for reputable underwriters (major banks), 0 otherwise	Discrete	+
OWN	Proportion of given ownership during the going public process.	Continuous	+
IND	Dummy variable: 1 for industrial classified companies, 0 otherwise.	Discrete	-
	Panel C: Market Characteristics		
RET	Quarterly market rate of return divided by overall quarterly average.	Continuous	-
NUIPO	Quarterly number of IPOs divided by the average number of IPOs in all quarters.	Continuous	+
	Panel D: Price Cap Characteristics		
Cap ±8%	Dummy variable: 1 IPOs listed with a price cap limitation of ±8%, otherwise 0 Cap ±8%: IPOs listed in ASE with a price cap limitation of ±8% during Nov. 1993 – Nov. 1996 period..	Discrete	-
Cap ±99%	Dummy variable: 1 IPOs listed with a price cap limitation of ±99%, otherwise 0 Cap ±99%: IPOs listed in ASE during Dec 1996 to Dec. 1999 period.	Discrete	-

Appendix B. Underpricing of Greek IPOs (Quarterly Returns)

The appendix classify the four created periods by price-cap constraints in quarters. Those are from January 1, 1990 and June 30, 1992 (trading without limits), July 1992–November 1996 (cap of ±8%), December 1, 1996 and November 30, 1999 (cap of ±99%) and finally from December 1, 1999 and December 31, 2011 (trading without limits). Quarterly raw and adjusted returns help on better understanding of the regulatory intervention effect.

	Quarter	No of IPOs	Mean of RAU (%)	Mean of MAU (%)
No ceiling	Jan 1990 – Mar 1990	4	129.26	114.34
	Apr 1990 – June 1990	5	147.65	116.14
	July 1990 – Sep 1990	9	94.12	96.89
	Oct 1990 – Dec 1990	10	27.52	30.48
	Jan 1991 – Mar 1991	2	30.44	10.77
	Apr 1991 – June 1991	5	47.18	51.90
	July 1991 – Sep 1991	6	34.35	37.00
	Oct 1991 – Dec 1991	1	-12.39	-14.98
	Jan 1992 – Mar 1992	3	-15.66	-14.29
	Apr 1992 – June 1992	1	9.72	7.39
±8% Cap	July 1992 – Sep 1992	1	-18.86	-31.67
	Oct 1992 – Dec 1992	0	-	-
	Jan 1993 – Mar 1993	0	-	-
	Apr 1993 – June 1993	0	-	-
	July 1993 – Sep 1993	5	17.33	5.94
	Oct 1993 – Dec 1993	5	31.07	17.43
	Jan 1994 – Mar 1994	3	94.39	94.16
	Apr 1994 – June 1994	14	19.94	41.01
	July 1994 – Sep 1994	12	26.00	34.63
	Oct 1994 – Dec 1994	17	22.06	25.29
	Jan 1995 – Mar 1995	3	22.45	24.52
	Apr 1995 – June 1995	5	-2.55	-4.99
	July 1995 – Sep 1995	6	40.65	37.79
	Oct 1995 – Dec 1995	6	36.83	39.71
	Jan 1996 – Mar 1996	7	29.86	28.06
	Apr 1996 – June 1996	4	18.96	22.02
	July 1996 – Sep 1996	5	16.76	15.67
	Oct 1996 – Nov 1996	1	34.16	34.59
±99% Cap	Dec 1996 - Mar 1997	5	5.79	1.70
	Apr 1997 – June 1997	4	17.84	10.83
	July 1997 – Sep 1997	4	51.79	51.83
	Oct 1997 – Dec 1997	2	100.76	108.79
	Jan 1998 – Mar 1998	5	74.68	64.06
	Apr 1998 – June 1998	3	93.21	70.78
	July 1998 – Sep 1998	7	91.56	91.45
	Oct 1998 – Dec 1998	8	51.54	44.06
	Jan 1999 – Mar 1999	7	98.47	85.75
	Apr 1999 – June 1999	9	92.07	89.17
	July 1999 – Sep 1999	8	222.90	202.00
	Oct 1999 – Dec 1999	14	243.50	249.02
	Jan 2000 – Mar 2000	18	136.75	136.98
	Apr 2000 – June 2000	14	27.75	31.07
	July 2000 – Sep 2000	13	8.63	9.06

No ceiling	Oct 2000 – Dec 2000	8	-2.99	-3.45
	Jan 2001 – Mar 2001	3	-0.67	4.58
	Apr 2001 – June 2001	7	69.87	68.26
	July 2001 – Sep 2001	5	-3.11	4.02
	Oct 2001 – Dec 2001	6	42.54	47.21
	Jan 2002 – Mar 2002	8	70.86	72.01
	Apr 2002 – June 2002	4	-2.34	0.59
	July 2002 – Sep 2002	7	13.57	17.56
	Oct 2002 – Dec 2002	3	-11.16	-5.20
	Jan 2003 – Mar 2003	5	-14.59	-15.17
	Apr 2003 – June 2003	2	6.44	5.03
	July 2003 – Sep 2003	6	19.83	7.77
	Oct 2003 – Dec 2003	2	16.26	25.97
	Jan 2004 – Mar 2004	6	-8.19	-3.82
	Apr 2004 – June 2004	4	-2.67	1.45
	July 2004 – Sep 2004	0	-	-
	Oct 2004– Dec 2004	1	-3.72	-7.03

Table 1
Greek IPO sample description

The table presents details of the Greek IPOs by market of listing (main, parallel, new) in every calendar year and on the total annual capital raised by IPOs. There has been no IPO in Athens Stock Exchange after January 1, 2010 as a result of the debt financial crises.

Event Year	IPO firms full sample	Main Market	Parallel Market	New Market	Total Capital Raised '000 Euros
1990	28	23	5	-	108,418
1991	14	11	3	-	124,191
1992	5	5	-	-	26.560
1993	10	10	-	-	60,983
1994	46	36	10	-	263,360
1995	20	10	10	-	70,003
1996	20	7	13	-	336,562
1997	12	3	9	-	50,743
1998	23	10	13	-	924,061
1999	38	15	23	-	1,182,523
2000	53	18	35	-	2,842,882
2001	21	13	6	2	1,497,054
2002	21	8	9	4	99,712
2003	15	1	12	2	121,332
2004	11	4	4	3	87,126
2005	7	3	3	1	81,860
2006	2	2	-	-	725,248
2007	3	3	-	-	500,733
2008	1	1	-	-	23,337
2009	1	1	-	-	10,000
2010	0	-	-	-	-
2011	0	-	-	-	-
Total	**351**	**184**	**155**	**12**	**8,791,468**

Table 2
Distribution of Raw and Market Adjusted Initial Returns

The raw initial return (RIR) measures the returns at the end of the first day of trading whilst the market adjusted initial return (MAIR) adjusts for the general index. The raw initial return is calculated by $RIRi,t=(CP_{i,1}-OP_{i,0})/OP_{i,0}$. The raw initial return (RIR) is adjusted for market changes taking into account the Athens Stock Exchange General Index (ASEGI) between the offer price closing date and the end of first day of trading. This is calculated as $MAIR_{i,t}=[(CP_{i,1}-OP_{i,0})/P_{i,0}-(M_{i,1}-M_{i,0}/M_{i,0})]$. Panel A shows the initial returns in the end of the first day of trading. Panel B shows the level of underpricing (equilibrium or fair market price) which considers 2nd, 3rd etc days of trading until the IPO will reach its equilibrium. The raw underpricing (returns reach their equilibrium price in more than one day of trading in the cases of price cap) is measured as $RUi,t=(EP_{i,t}-OP_{i,0})/OP_{i,0}$. The Market Adjusted Underpricing (MAU) is calculated as $MAU=[(EP_{i,t}-OP_{i,0})/OP_{i,0}-(MI_{i,t}-MI_{i,0}/M_{i,0})]$. Panel C focuses on the daily limit hits of price cap periods. Panel D present the number of days that the prices of IPOs reached their upper price cap during their listing in ASE. Overall the sample as appears in Figure 1 is divided into four periods. These periods are from January 1, 1990 and June 30, 1992 (trading without limits), July 1992–November 1996 (cap of ±8%), December 1, 1996 and November 30, 1999 (cap of ±99%) and finally from December 1, 1999 and December 31, 2011 (trading without limits).

Panel A: Division of the sample into four periods based on regulation changes of the IPOs initial day performance

	Period	No of IPOs	Mean (med) of RIR (%)	Mean (median) of MAIR (%)
No ceiling	Jan 1990 – Dec2011	191	43.74 (12.47)	44.10 (16.23)
	Jan 1990 – Jun 1992	47	56.00 (33.39)	52.15 (36.49)
	Dec 1999 - Dec 2011	144	40.55 (10.32)	41.86 (12.64)
±8% Cap	Jul 1992 - Nov 1996	93	5.63 (8.00)	4.94 (11.72)
±99% Cap	Dec 1996 - Nov 1999	67	70.15 (85.90)	68.98 (70.22)
Overall	Jan 1990 – Dec 2011	351	37.82 (8.00)	36.55 (11.64)

Panel B: Division of the sample into four periods based on regulation of daily variation

	Period	No of IPOs	Mean (medina) of RAU (%)	Mean (median) of MAU (%)
No ceiling	Jan 1990 – Dec2011	191	43.74 (12.47)	44.10 (16.23)
	Jan 1990 – Jun 1992	47	56.00 (33.39)	52.15 (36.49)
	Dec 1999 - Dec 2011	144	40.55 (10.32)	41.86 (12.64)
±8% Cap	Jul 1992 - Nov 1996	93	26.22 (16.84)	29.62 (23.48)
±99% Cap	Dec 1996 - Nov 1999	67	112.88 (84.57)	105.66 (70.80)
Overall	Jan 1990 – Dec 2011	351	52.48 (22.51)	52.15 (24.27)

Panel C: Maximum and Minimum value of IPO initial day performance and Underpricing

	No of IPOs	Max (min) of RAU (%)	Max (min) of MAIR (%)	Max (min) of MAU
No ceiling	191	472.24 (-76.67)	472.34 (-67.35)	472.34 (-67.35)
±8% Cap	93	133.17 (-8.00)	22.25 (-17.30)	120.82 (-17.30)
±99% Cap	67	751.07 (-4.54)	118.73 (-41.84)	748.00 (-41.84)
Overall	351	751.07 (-76.67)	472.34 (-67.35)	748.00 (-41.84)

Panel D: Number of days that the prices of IPOs reached their upper price cap (limit up) during their listing in ASE

	Period with price cap: ±8%	Period with price cap: ±99%
Mean	2.59	0.67
Median	2.00	0.00
Standard Deviation	2.80	0.88
Minimum no of limit ups	0.00	0.00
Maximum no of consecutive 'limit ups'	11	3
Max no of consecutive 'limit downs'	1	0

Table 3

Results of regression analysis of cross sectional variation in MAIR as dependent variable for 351 IPOs listed on ASE over the 1990-2011 period (end of 1st day of trading)

MAIR=[($CP_{i,1}$-$OP_{i,0}$)/$P_{i,0}$-($M_{i,1}$-$M_{i,0}$/$M_{i,0}$)] where MAIR is market adjusted initial returns, LBC, Listing Board Classification which gets the value '1' if listed in 'main market', '0' if listed in 'parallel market' and 'new market', AGE, Ln (1+AGE) the log of the total of one plus the age of the company in years on the listing date, TLAG, Time lag between IPO announcement (the date of prospectus) and first day of trading, PRIV, privatised firms gets the value '1' otherwise '0', Size - market capitalization, i.e. log of the total number of outstanding shares after the IPO multiplied by price per share, OVER, oversubscription for firm i, UR, Underwriters reputation which gets the value '1' for investment or commercial banks charging high fee, with historical large numbers of listings and success of their listings (i.e.measured by low level of underwriters) and '0' for others, RET, is defined as quarterly market rate of return divided by overall quarterly average, NUIPO, is a state of supply variable defined as quarterly activity of IPOs divided by average number of IPOs in each quarter , OWN, proportion of given ownership during the going public process, IND, identify the sector of IPOs. Industrial firms belong to Chemicals, Manufacturing, Metals, Minerals & Shipyards sub-sectors. Non industrial are mainly Conglomerate, Finance, Real Estate/Property, Transportation, Tourism/Hotels etc.The t statistics are based on heteroscedasticity-robust standard errors. *, **, *** indicate the level of significance at 1, 5 and 10 percent respectively.

VARIABLES	(1) MAIR	(2) MAIR	(3) MAIR
Constant	-33.33	63.10*	66.59*
	(0.314)	(0.0844)	(0.0713)
LBC	-3.906	9.307	8.864
	(0.516)	(0.130)	(0.147)
AGE	0.0950	4.140	4.459
	(0.980)	(0.276)	(0.246)
TLAG	-0.267	-0.0996	-0.0217
	(0.209)	(0.601)	(0.913)
PRIV	-10.62	-8.481	-8.059
	(0.400)	(0.475)	(0.501)
SIZE	3.909*	-4.678*	-4.894**
	(0.093)	(0.0563)	(0.0478)
OVER	0.261***	0.220***	0.236***
	(8.78e-08)	(6.86e-06)	(8.31e-06)
UR	-2.958	5.294	11.80*
	(0.656)	(0.404)	(0.0720)
RET	1.048	0.778	1.023
	(0.240)	(0.370)	(0.242)
NUIPO	2.620	10.36**	9.365**
	(0.495)	(0.0105)	(0.0188)
GO	-0.0204	0.461	0.473
	(0.939)	(0.115)	(0.111)
IND	13.30*	10.14	10.23
	(0.0962)	(0.178)	(0.171)
PC8		-50.23***	-56.54***
		(0)	(1.11e-09)
PC99			-16.18
			(0.114)
Observations	351	351	351
Adjusted R-squared	0.290	0.361	0.364

Table 4

Results of multivariate regression analysis of cross sectional variation in MAU as dependent variable for 351 IPOs listed on ASE over the 1990-2011 period (end of 2nd, 3rd…11th day of trading for price cap period)

MAU=[$(EP_{i,t}-OP_{i,0})/OP_{i,0}-(MI_{i,t}-MI_{i,0}/M_{i,0})$] where MAU = Market Adjusted Underpricing, LBC, Listing Board Classification which gets the value '1' if listed in 'main market', '0' if listed in 'parallel market' and 'new market', AGE, Ln (1+AGE) the log of the total of one plus the age of the company in years on the listing date, TLAG, Time lag between IPO announcement (the date of prospectus) and first day of trading, PRIV, privatised firms gets the value '1' otherwise '0', Size - market capitalization, i.e. log of the total number of outstanding shares after the IPO multiplied by price per share, OVER, oversubscription for firm i, UR, Underwriters reputation which gets the value '1' for investment or commercial banks charging high fee, with historical large numbers of listings and success of their listings (i.e.measured by low level of underwriters) and '0' for others, RET, is defined as quarterly market rate of return divided by overall quarterly average, NUIPO, is a state of supply variable defined as quarterly activity of IPOs divided by average number of IPOs in each quarter, OWN, proportion of given ownership during the going public process, IND, identify the sector of IPOs. Industrial are classified those firms which belong in Chemicals, Industrial (pure), Manufacturing, Metals, Minerals & Shipyards sub-sectors. Non industrial are mainly Conglomerate, Finance, Real Estate/Property, Transportation, Tourism/Hotels etc. The t statistics are based on heteroscedasticity-robust standard errors *, **, *** indicate the level of significance at 1, 5 and 10 percent respectively

VARIABLES	(1) MAU	(2) MAU IPOs listed with ±8%	(3) MAU IPOs listed with ±8%, ±99%
Constant	-47.07	10.21	12.59
	(0.440)	(0.870)	(0.840)
LBC	-9.409	-1.560	-1.862
	(0.278)	(0.858)	(0.830)
AGE	-8.015	-5.612	-5.395
	(0.204)	(0.371)	(0.390)
TLAG	0.525	0.624	0.677
	(0.400)	(0.317)	(0.287)
PRIV	-6.399	-5.131	-4.844
	(0.605)	(0.674)	(0.691)
SIZE	4.140	-0.605	-0.752
	(0.272)	(0.878)	(0.849)
OVER	0.444***	0.420***	0.431***
	(1.05e-09)	(1.08e-08)	(2.18e-08)
UR	12.49	17.39**	21.82**
	(0.144)	(0.0457)	(0.0138)
RET	1.792*	1.731*	1.598
	(0.084)	(0.094)	(0.132)
NUIPO	-2.163	2.434	1.756
	(0.629)	(0.606)	(0.710)
GO	0.110	0.396	0.404
	(0.797)	(0.365)	(0.362)
IND	17.67*	15.79	15.86
	(0.098)	(0.142)	(0.138)
PC8		-29.84***	-34.14***
		(0.000328)	(0.000608)
PC99			-11.03
			(0.370)
Observations	351	351	351
Adj. R-squared	0.391	0.401	0.400

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Table 5

Results of multivariate regression analysis of cross sectional variation in MAU as dependent variable for IPOs listed with ±8% ±99% and without ceiling during 1990-2011

MAU=$[(EP_{i,t}-OP_{i,0})/OP_{i,0}-(MI_{i,t}-MI_{i,0}/M_{i,0})]$ where MAU = Market Adjusted Underpricing, LBC, Listing Board Classification which gets the value '1' if listed in 'main market', '0' if listed in 'parallel market' and 'new market', AGE, Ln (1+AGE) the log of the total of one plus the age of the company in years on the listing date, TLAG, Time lag between IPO announcement (the date of prospectus) and first day of trading, PRIV, privatised firms gets the value '1' otherwise '0', Size - market capitalization, i.e. log of the total number of outstanding shares after the IPO multiplied by price per share, OVER, oversubscription for firm i, UR, Underwriters reputation which gets the value '1' for banking underwriters and '0' for others, RET, is defined as quarterly market rate of return divided by overall quarterly average, NUIPO, is a state of supply variable defined as quarterly activity of IPOs divided by average number of IPOs in each quarter, OWN, proportion of given ownership during the going public process, IND, identify the sector of IPOs. Industrial are classified those firms which belong in Chemicals, Industrial (pure), Manufacturing, Metals, Minerals & Shipyards sub-sectors. Non industrial are mainly Conglomerate, Finance, Real Estate/Property, Transportation, Tourism/Hotels etc. The t statistics are based on heteroscedasticity-robust standard errors *, **, *** indicate the level of significance at 1, 5 and 10 percent respectively.

Specifications	(1) MAU for IPOs listed with ±8%	(2) MAU for IPOslisted with ±99%	**(3)** MAU for IPOs without ceiling	**(4)** Comparison of vector coefficients between regressions of ±8% and without ceiling
Constant	32.52	-64.86	180.3***	
LBC	-11.30	28.12	24.63***	F(1, 254) = 3.70
	(0.199)	(0.442)	(0.009)	Prob > F = 0.0554
AGE	4.972	-57.43**	11.16*	F(1, 254) = 0.23
	(0.189)	(0.0283)	(0.080)	Prob > F = 0.6311
TLAG	-0.347	3.049*	0.166	F(1, 254) = 0.73
	(0.122)	(0.0959)	(0.686)	Prob > F = 0.3940
PRIV	-8.983	-31.12	-9.588	F(1, 254) = 0.00
	(0.292)	(0.356)	(0.557)	Prob > F = 0.9510
SIZE	-0.514	4.344	-16.16***	F(1, 254) = 3.26
	(0.872)	(0.705)	(0.0004)	Prob > F = 0.0720
OVER	0.205***	0.527***	0.297***	F(1, 254) = 0.94
	(2.16e-06)	(0.00594)	(5.81e-05)	Prob > F = 0.3331
UR	3.900	-4.648	28.50*	F(1, 254) = 2.57
	(0.465)	(0.835)	(0.083)	Prob > F = 0.1104
RET	-1.483	-1.679	1.407	F(1, 254) = 0.56
	(0.363)	(0.723)	(0.191)	Prob > F = 0.4561
NUIPO	-5.722	65.13	17.72***	F(1, 254) = 8.77
	(0.091)*	(0.206)	(0.006)	Prob > F = 0.0034
OWN	0.256	-1.687	1.624**	F(1, 254) = 2.83
	(0.282)	(0.260)	(0.011)	Prob > F = 0.0936
IND	8.127	26.62	15.98	F(1, 254) = 0.04
	(0.441)	(0.442)	(0.106)	Prob > F = 0.8471
Adj. R^2	0.359	0.469	0.417	
F-statistic	5.58	5.60	13.43	
Observations	93	67	193	

Table 6

Results of multivariate regression analysis considering for market conditions

Results of multivariate regression analysis of cross sectional variation in MAU as dependent variable for IPOs listed on ASE over the 1990-2011 period, (1) (excluding the 'Hot' 3rd and 4th quarter of 1999) (2) (excluding the 'Hot' 4th quarter of 1999) (3) (excluding three major outliers) (4) including IPOs listed between 1990-1998 only. All variables are defined in Appendix A. *, **, *** indicate the level of significance at 1, 5 and 10 percent respectively.

VARIABLES	(1) MAU IPOs listed with ±8%, ±99%	(2) MAU IPOs listed with ±8%, ±99%	(3) MAU IPOs listed with ±8%, ±99%	(4) MAU IPOs listed between 1990-1998
Constant	120.1***	15.32	65.99	162.7**
	(0.004)	(0.818)	(0.104)	(0.0225)
LBC	5.006	-3.175	5.099	0.338
	(0.451)	(0.723)	(0.420)	(0.970)
AGE	5.525	-0.752	3.620	6.005
	(0.153)	(0.880)	(0.380)	(0.233)
TLAG	-0.138	0.807	0.0972	-0.457
	(0.552)	(0.212)	(0.717)	(0.105)
PRIV	-1.726	-6.253	-8.212	-1.500
	(0.889)	(0.607)	(0.502)	(0.966)
SIZE	-7.297***	-1.712	-4.921*	-8.022*
	(0.006)	(0.682)	(0.0712)	(0.0591)
OVER	0.270***	0.308***	0.325***	0.208***
	(0.001)	(0.0001)	(0.0043)	(2.19e-06)
UND	9.309	15.75*	14.30*	2.830
	(0.197)	(0.060)	(0.0595)	(0.685)
RET	1.925*	1.925*	1.293	0.775
	(0.058)	(0.058)	(0.160)	(0.430)
NUIPO	5.325	3.783	4.912	-1.170
	(0.184)	(0.411)	(0.224)	(0.790)
GO	0.0692	0.607	0.692	0.298
	(0.849)	(0.170)	(0.156)	(0.437)
IND	9.709	5.020	11.43	19.50*
	(0.187)	(0.511)	(0.140)	(0.0802)
PC8	-28.44***	-33.91***	-33.46***	-33.22**
	(0.001)	(0.0006)	(0.0006)	(0.0113)
PC99	-15.25	-12.52	-10.36	-27.59**
	(0.156)	(0.261)	(0.346)	(0.0331)
Observations	331	339	346	178
Adjusted R-squared	0.289	0.283	0.383	0.192

Figure 1: Implementation of regulatory price caps on IPOs launched on A.S.E. during 1990-2011 period

The sample is divided into four periods. These periods are from January 1, 1990 and June 30, 1992 (trading without limits), July 1992–November 1996 (cap of ±8%), December 1, 1996 and November 30, 1999 (cap of ±99%) and finally from December 1, 1999 and December 31, 2011 (trading without limits).

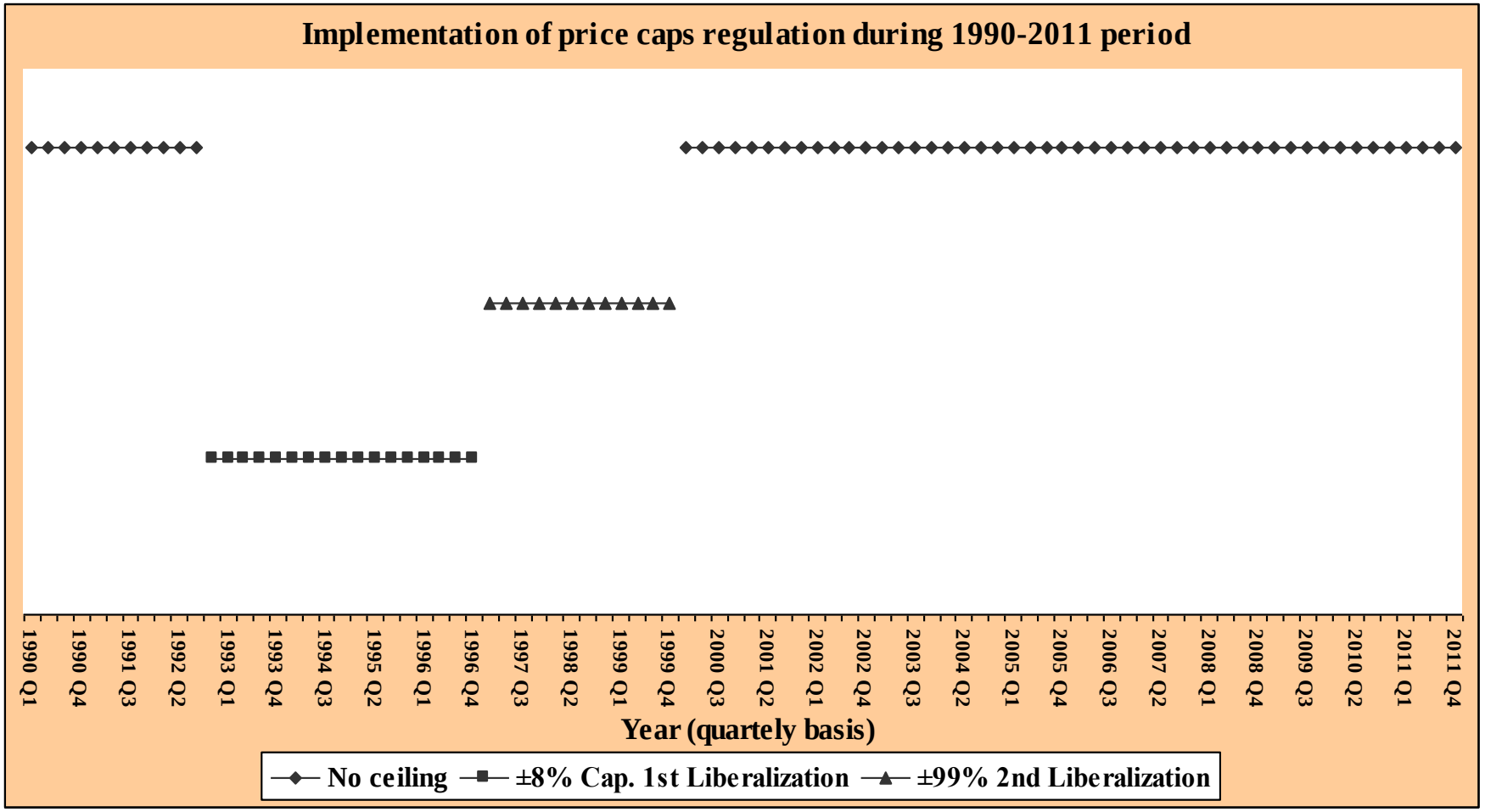

Figure 2: Number of IPOs in ASE and Athens Stock Exchange General Index return on a quarterly basis (1990-2011)

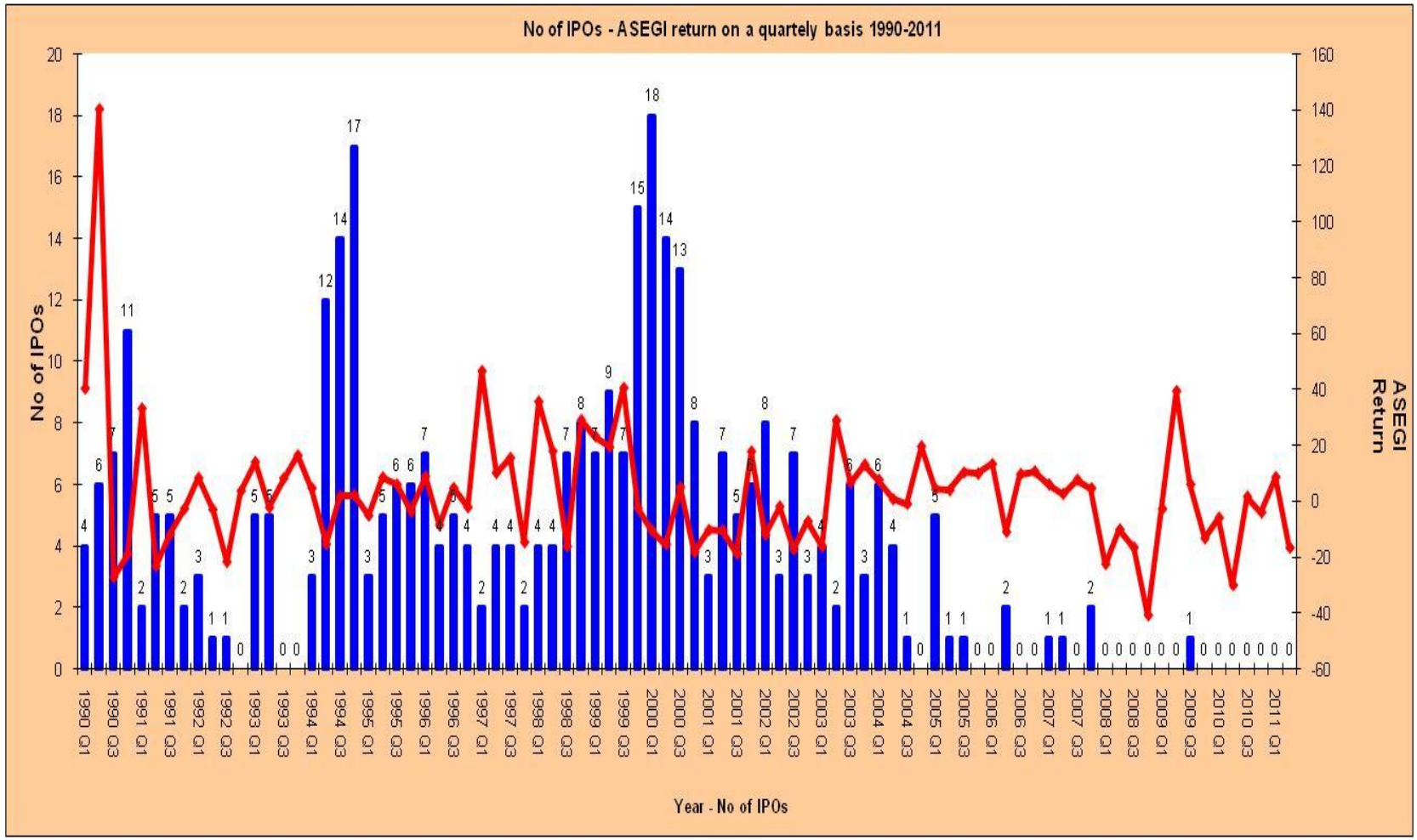

Figure 3: MAU and RAU on a quarterly basis over the period 1990-2011