Long-term Performance of Greek IPOs

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Abstract

We analyze the long-run performance of 254 Greek IPOs that were listed during the period 1994–2002, computing buy-and-hold abnormal returns (BHAR) and cumulative abnormal returns (CAR) over 36 months of secondary market performance. The empirical results differ from international evidence and reveal long-term overperformance that continues for a substantial interval after listing. Measuring these returns in calendar time, we find statistical significance with several of the benchmarks employed. We also find that long-term overperformance is a feature of the mass of IPOs conducted during a pronounced IPO wave. Cross-sectional regressions of long-run performance disclose several significant factors. The study demonstrates that although Greek IPOs overperform the market for a longer period, underperformance eventually emerges, in line with much international evidence. Our interpretation is that the persistence of overperformance over a significant interval is due to excessive supply of issues during the "hot IPO period". Results associated with pricing during the "hot IPO period" indicate positive short- (1-year), medium- (2-year) and negative long-term (3-year) performance.

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1. Introduction

A large volume of research has demonstrated that investors participating in initial public offerings (IPOs) of common stocks earn large positive abnormal returns in the early aftermarket period, as the new shares are usually sold to investors (by newly listed companies and the underwriters) at prices below those prevailing on the first day of trading. This is the "underpricing phenomenon," which is widely accepted as internationally valid. However, if performance is measured over longer intervals, for example after three or five years of listing, IPO returns decrease and turn negative**.**

Early results by Ritter (1991) showed that US IPOs significantly underperformed in the three years following listing. Similar results were reported for IPOs in the United Kingdom, by Levis (1993) and Espenlaub *et al.* (2000), in Australia by Lee *et al.* (1996), in Germany by Ljungqvist (1997) and in France by Chahine (2008). As a general rule, the change from excess positive to negative returns appears to take place within a few months after listing.

In a recent study by Gajewski and Gresse (2006), which involved a sample of 15 European countries, underperformance after a short period is documented. Interestingly, the authors note that Greece and Portugal are exceptions, where overperformance has continued for several years. Thus, medium and long-term underperformance seem to be the rule, but with notable exceptions. Exceptions such as the Greek case warrant deeper analysis. It may be that exceptional market behavior is only apparent as a result of biased measurement. If biased measurement proves to be the case, international evidence will be strengthened. Or, on the contrary, the exception may prove empirically valid. In the latter case, underlying factors must be sought, hopefully enriching the relevant literature. In sum, we believe that the "Greek exception" merits further study, and this is the task we undertake in the present paper.

We conduct a painstaking analysis of short and long-run performance of IPOs in Greece. Our sample consists of 254 IPOs used to compute one-, two- and three-year abnormal returns. We use alternative measures of performance, a number of benchmark models and a sample of matching non-IPO firms for comparison with our IPO sample. We perform time-series tests of excess returns using three different benchmark models both in "event time" and "calendar time"; finally, we conduct a cross-sectional analysis of long-term excess returns using firm and market variables. Through such extensive empirical analysis, we gain confidence that the phenomena we document are robust.

We find that the "Greek exception" is not a figment of biased measurement, but one that persists under a variety of measurements and methodologies. We also find that the exception is not permanent, but valid only for a specific time period. Hence, we turn our attention to possible underlying factors for the exception. We propose that besides classic short-term underpricing explainable by excess post-listing demand, longer-term underpricing is due to a very strong and competitive supply of listings that seek to exploit a window of large prospective profits. In Greece, this window was opened by a combined effect of market boom and the prospect of a unique institutional leap: Greece's joining the Eurozone and a reassignment of its market from the "emerging" group to the group of developed markets.

The remainder of the paper is organized as follows: Section 1 offers background on IPOs and their long-term performance. Section 2 includes a literature review on long-term performance of IPOs. Data and methodology are presented in Section 3. Sections 4 and 5 present empirical findings. Finally, Section 6 offers our conclusion.

2. Background

Scholars have adequately documented the fact that IPOs are underpriced in the short run. Underpricing has been observed around the world in various periods (Ritter and Welch, (2002), Ritter (2003), Loughran *et al.* (1995)), even though its level has changed over time (Loughran and Ritter, (2002)). In the 1980s, average IPO underpricing hovered around 7%. It increased to 15% during the period 1990-1998 and jumped to 65% during the short 1999-2000 period of the Internet bubble (Gajeski and Gresse, 2006). Our study of Greece covers the period 1994-2002.[2] In our data, newly listed firms in the Athens Stock Exchange exhibit a first-day-adjusted return of 38.94% on average. Initial returns of 17.62% have been estimated for IPOs listed during the period 1994-1998, with returns of 70.35% for those listed during 1999-2000. These findings are consistent with international evidence on short-run returns. Using these findings as a basis, we construct and present the long-term performance of Greek IPOs relative to corresponding international evidence.

2.1 Theoretical aspects of the long-term performance of IPOs

The long-run underperformance of IPOs has received considerable attention in the literature in recent years, leading to controversial results and findings that conflict with studies indicating negative, positive or even zero aftermarket performance. For instance, in their studies on the price performance of common stock issues in the US, Ibbotson (1975) and Jenkinson and Ljunqvist (2001) report no departures from market efficiency in the aftermarket. Also, they did not reject the hypothesis that the abnormal returns in the long run are zero. They conclude that IPOs underperform by an average of approximately 1% per month over four years, suggesting a general positive performance reported in the first year, followed by a negative one in the subsequent three years and a generally positive trend in the fifth year.

Derrien and Kecskes (2009) report that sentiment on its own is important to equity issuance and sometimes even has impressive explanatory power. In theory, if companies successfully time their offerings during periods when the cost of equity capital is assumed to be low, they would subsequently manifest low returns for investors. A possible explanation is the ability of firms to identify times at which the market is overvalued, or when investors will overpay for a specific IPO relative to other firms. With this justification, several authors have recently examined the behavior of the IPOs during three or even five years after their listing (Loughran *et al.* (1995)).

However, it would make sense to reflect on the variety of factors correlated to the long-run performance of IPOs. Miller (1977) attributes IPO underperformance to the divergence of investor opinions and short-sale constraints. He implies that in early stock-offering periods, stock prices are generally higher with a greater differentiation of opinions for expected future returns. However, in the long run, prices decrease as the most optimistic investors lower their appraisals. Jenkinson and Ljungvist (2001) add that investors are only periodically over-optimistic about the prospects of firms entering the market. IPOs would benefit if issuers could "time" their flotations to coincide with periods of exuberantly high expectations among investors.

Morris (1996) argues that the heterogeneity of beliefs can support the speculative bubble hypothesis, as well as the overvaluation of the IPOs immediately after their issuance.

[2] Gajeski and Gresse (2006) report that the mean raw return for the 2,104 European IPOs composing their sample is equal to 22.06%. Loughran et al. (2008) report average initial returns of 18% for 15,490 US IPOs. Additionally, they report initial returns of 16.8% for 3,986 UK IPOs, 19.8% for 1,103 Australian IPOs, 15.9% for 1,008 Hong Kong IPOs, 10.7% for 686 French IPOs, 26.9% for 652 German IPOs, 18.2% for 233 Italian IPOs, 10.1% for 181 Dutch IPOs, 20.3% for 214 New Zealand IPOs and only 4.2% for 40 Russian IPOs.

Accordingly, Loughran and Ritter (1995) and Rajan and Servaes (1997) also comment on features related to long-run performance, emphasizing "windows of opportunity" when investors and security analysts tend to be systematically over-optimistic about earnings potential and long-term growth predictions of IPOs. They document that IPOs have better future performance when analysts forecast lower growth prospects.

Others hypothesize that firms manipulate their accounting numbers and financial statements so as to make their offerings much more appealing to the public; therefore, beguiled investors pay a higher than fair price. However, this "window-dressing" technique is not effective in the long run since investors eventually learn the true value of the firm and prices fall, according to Teoh *et al.* (1998).

More recently, Ma and Shen (2003) offered an alternative explanation with regard to the long-run performance of IPOs. They claim that the insights of "prospect theory" can be used and suggest that the underperformance of IPOs is not a puzzle. Their main assumption is that investors have utility functions that overweight low probability events and underweight intermediate and high-probability outcomes as argued by Kahneman and Tversky (1992) & Loughran and Mola (2004). IPOs are more likely to have extremely high returns. Therefore, according to this theory, the low probability outcomes of achieving high returns are valued more than in the standard expected utility setting. So even though average returns in the long run are lower, investors will still invest in IPOs because they will be compensated by the prospect of gaining very high positive returns.

2.2 Long-term Performance of IPOs in Developed Countries

Ritter (1991), in his study of 1,526 US IPOs (issued between 1975-1984), found that they underperformed their market benchmarks by about 34.47% in a three-year period, whereas Aggarwal and Rivoli (1990) reported that the NASDAQ index-adjusted return reached -13.73% at the 250th post-listing day for a sample of 1,598 US IPOs during the period 1977-1987. Similarly, Ritter and Welch (2002) indicated that three-year holding-period returns for an investor buying at the offer price would on average underperform the market significantly. Kooli and Suret (2001) found that investors buying IPOs immediately after listing, who held them for five years, would make a loss of 24.66%. Kooli and Suret attribute this to "hot issues". They based their research on 445 Canadian IPOs from 1991 to 1998.

Moreover, Chahine (2008) also examined the post-issue performance of IPOs issued in France from 1996-1998. He found negative cumulative abnormal returns for the French IPOs of an average level of 9.94%. Lee *et al.* (1996) proved that the 36-month market-adjusted CARs for Australian IPOs were up to -51% from 1976 to 1989, whereas Allen and Patrick (1996) also documented significant aftermarket underperformance of -25.38%.

In the UK, Levis (1993) investigated the long-term performance of a sample of 483 IPOs issued during the period 1980-1988. He reported that British IPOs underperformed the HGSC Index over a three-year period by 8.31%. Similarly, Espenlaub *et al.* (2000) re-examined evidence of the long-run returns in the UK during the period 1985-1995 and found significant negative returns of -8.12% with the same index.

A study of Finnish IPOs by Keloharju (1993) documented a -26.4% long-run-cumulated market-adjusted return for 79 issues that went public between 1984 and 1989. He also confirmed the presence of *winner's curse,* which was first suggested by Rock (1986). However, he claimed that the results reflected a temporary over-optimism of IPO investors that turned into disappointment when they learned more about the IPO firms' prospects. Furthermore, Jakobsen and Sorensen (2001), in their study of 76 Danish IPOs from 1984 to 1992, concluded that the market (Danish Total Stock Index) performed better than the IPO

stocks, and the volatility-adjusted underperformance of the IPOs, when compared to the market, was -30.4% after five years. In an important contrary finding, IPOs in Sweden indicated long-run overperformance. Brounen and Eichholz (2002) found overperformance equal to 18.89% for property IPOs over a period of three years. They attributed this to the fact that the Swedish property market has been undergoing a different phase[3] than other more stable and mature markets.

Stehle *et al.* (2000), in their study on 187 German IPOs listed during the period 1960-1992, concluded that average abnormal buy-and-hold returns were significant at a 5% level, supporting the view that IPOs listed in the main market were performing by 6% less after three years of listing. Bessler and Stanzel (2009) found that IPOs listed in the secondary German market performed worse than the market benchmark. Drobetz *et al*. (2005) found that Swiss IPOs from 1983 to 2000 had average market-adjusted initial returns of 35%, while Drobetz *et al.* (2008) did not find any significant drop in or strong continuous underperformance of Swiss IPO stock prices in the aftermarket, as Swiss IPOs show poor returns only in the very long run after 48 months of trading. These authors attribute long-run underperformance to the fact that IPO firms tend to be small.

Studies have also been conducted in Mediterranean countries including Italy and Spain. Arosio *et al.*(2001) reported significant underperformance levels of -11.53% for 108 Italian IPOs during the period 1985-1997, whereas Alvarez and Gonzalez (2005) found that Spanish IPOs performed at -37.05% after five years of listing. Finally, in their pan-European study, Gajeski and Gresse (2006) found that the long-term abnormal returns were frequently negative, but that they vary over time and across countries. In that study, they used a sample of 2,026 IPOs when measuring one-year performance and 1,846 IPOs when measuring three-year performance. Evidence of underperformance at the one-year term is unclear (the average first-year CAR equals -21.59%, but the average first-year BHAR of -1.52% is not significantly different from zero), and they find a significant three-year underperformance with each measure: -32.61% for BHAR and -87.19% for CAR. However, Greece and Portugal, which exhibit overperformance, were found to be exceptions.

In conclusion, most evidence appears to indicate negative long-run IPO performance in developed markets, but with notable exceptions, such as Greece.

3. Data and Methodology

This study examines long-run performance of Greek IPOs undertaken during the period from 1994 to 2002. The sample includes only listings of common stocks in the Athens Stock Exchange. This paper does not examine preference stocks or transfers from the Parallel to the Main markets.

New listings totaled 254 in the Main, Parallel and New Market segments of the Athens Stock Exchange. As basic sources for the construction of the IPO database, we used the Annual Statistical Bulletins of the Athens Stock Exchange, the Annual Reports of the Hellenic Capital Market Commission and specialized web sites[4]. We computed data on Book-to-Market Value (BMV) and long-term total returns, including both capital gains and dividend payments, from monthly return data collected from DataStream and Bloomberg. The returns on indices, the Athens Stock Exchange General Index (ASEGI) and the Smaller Companies Index are measured as total returns including dividends. Share prices and prices of the General A.S.E. Index are collected during the first three years of trading in the market.

[3] The Swedish property share market went through rough times in the early nineties, leading to relatively low benchmark returns that were easily exceeded by the Swedish aftermarket IPO returns.

[4] For example: www.ase.gr, www.naftemporiki.gr, www.in.gr and www.stockrally.gr.

The cumulative abnormal returns for a holding period of *m* months are measured by the sum of the monthly average abnormal returns from the end of the first month of trading to the close of m^{th} month. Table 1 shows the IPOs launched on the Athens Stock Market during the period 1994-2002. The year 2000 experienced the largest number of listings in the history of the Athens Stock Exchange. We should point out that we classified IPOs on the basis of first day of trading, not on the date of the offer.

Table 1

Number of issues in A.S.E. by year and by market[5]: Time period: 1/1/1994 – 31/12/2002

Year	Number of Issues	Main Market	Parallel Market	New Market	Capital Raised	General Index of ASE (31/12)
1994	46	36	10	-	289,705,180	868.91
1995	20	10	10	-	70,003,910	914.15
1996	20	7	13	-	336,561,660	933.48
1997	12	3	9	-	50,743,500	1479.63
1998	23	10	13	-	924,329,790	2737.53
1999	38	15	23	-	899,420,420	5535.09
2000	53	18	35	-	2,842,882,530	3388.86
2001	21	12	8	1	1,497,054,510	2591.56
2002	21	8	9	4	99,712,290	1748.42
TOTAL	254	120	128	6	7,010,413,790	

Source: Annual Reports of Hellenic Capital Market Commission, Annual & Monthly Statistical Bulletins of A.S.E

3.2 *Methodology*

We employ a methodology similar to Ritter (1991), we employ a structured benchmark portfolio[6] to carefully select periods of IPO performance measurement. There is difference of scholarly opinion as to measurement however and we take this into account as well. Kooli and Suret (2001) argue that one major problem with long-run performance of IPOs is non-standard distribution of their returns. Barber and Lyon (1997) claim that many of the common methods used to calculate the long-run returns are conceptually flawed and lead to biased test statistics. They suggest that cumulative abnormal returns (CARs) are a biased predictor of long-run buy-and-hold abnormal returns, and they favor the use of buy-and-hold abnormal returns (BHARs) in tests designed to detect long-run abnormal returns.

Mitchell and Stafford (2000) and Brav (2000) report that buy-and-hold returns tend to be more sensitive to the problem of cross-sectional dependence among sample firms. Lyon *et al.* (1999) emphasize that the BHARs method is well-accepted among researchers interested in studying whether or not the offerings listed in the stock market earned abnormal returns over a specific period, "measuring precisely the investor experience."

This study uses buy-and-hold returns (BHARs) to evaluate the long-run performance of Greek IPOs. We calculate three-year buy-and-hold returns, assuming that the stocks are held

[5] The annual distribution of the new issues of common stocks in this table is computed according to the first day of trading of a firm in the A.S.E. and not according to the interval of the public offerings.

[6] The returns in Greece are calculated for the initial return period (day 1), defined as the offering date, to the first closing price listed on the ASE and the aftermarket period, defined as the three years after the IPO, exclusive of the initial returns period. The initial return period is defined to be month 0, and the aftermarket period includes the following 36 months, and months are defined as successive 21-trading-day periods relative to the IPO date. Thus, month 1 consists of event days 2-22, month 2 consists of event days 23-43, month 3 consists of event days 44-64, etc.

from their offering period, mainly from first trading day and first trading month after their listing to the three-year anniversary of listing.

We calculate long-run stock exchange returns of IPOs by using the adjusted returns in order to take into consideration market returns and variances. All closing stock prices are adjusted for share capital increases and stock splits that occurred during the three-year period.

The adjusted return for issue *i* is defined as the raw return less the corresponding market return for the same time period used for raw return calculation:

$$\text{Adjusted Return}_{it}\ (ar_{it}) = \text{Raw Return}_{it}\ (r_{it}) - \ \text{Market Return}_{it}\ (r_{mt}) \quad (1)$$

The average adjusted return on a portfolio of *n* stocks for event month *t* is the equally weighted arithmetic average of the adjusted returns.

$$AR_t = \frac{1}{n}\sum_{i=1}^{n} ar_{it} \quad (2)$$

To check the stability of results, we also use cumulative average abnormal returns (CAR), as suggested by Fama (1998) and Ritter (1991). The cumulative adjusted aftermarket performance from event month *q* to event month *s* is the summation of the average adjusted returns.

$$CAR_{q,s} = \sum_{t=q}^{s} AR_t \quad (3)$$

Abnormal returns depend strongly on the benchmark used. Given that the correct benchmark is unknown, it is important to test several model specifications and look at the sensitivity of results. Brav and Gompers (1997), Stehle *et al.* (2000) and Drobetz *et al.* (2005) have shown empirically that when controlling for effects such as size or book-to-market, the long-term underperformance of IPOs decreases, or even disappears.

To calculate the abnormal return a_i, the first benchmark we use is the standard Capital Asset Pricing Model. The second is a multi-index model using the market index as one factor and the difference between the Smaller Companies Index and the market index as the measure of smaller companies' differential performances (Dimson and Marsh, 1996 and Espenlaub *et al.*, 2000). The third benchmark is another multi-index model where the factors are those specified by Carhart (1997), who extends the Fama and French model for momentum phenomena.

Model 1: CAPM

$$R_{it} - R_{ft} = a_{it} + \beta_i (R_{mt} - R_{ft}) + e_{it} \quad (4)$$

where R_{it} is the monthly return for each security, R_{mt} is the return on the Greek market in event month *t* as measured by the return on the Athens Stock Exchange General Index (ASEGI), R_{ft} is the treasury bill (T-bill) return in event month *t*, and β_i is the CAPM beta of company *i*.

Model 2: Value-weighted multi-index model using the Smaller Companies Index (SCI)

$$(R_{pt} - R_{ft}) = a_p + \beta_p (R_{mt} - R_{ft}) + \gamma_p (R_{sc} - R_{mt}) + e_{pt} \quad (5)$$

where R_{sc} is the return on the Smaller Companies Index (SCI) in the event month *t*. The SCI is a value-weighted index of the bottom 80% of market capitalization of the companies quoted on the Athens Stock Exchange.

Jegadeesh *et al. (*1993) and Carhart (1997) have shown momentum in stock returns to be a significant factor in explaining performance. This is a factor in the Fama-French model, expressed as *UMD*, defined as the equally weighted average return of the top 30 percent of firms with the highest returns minus the equally weighted average of bottom 30 percent firms with the lowest returns for the preceding month.

Model 3: Carhart (1997) momentum extension model (FF4F)

$$(R_{pt} - R_{ft}) = a_p + \beta_p (R_{mt} - R_{ft}) + \gamma_p SMB_t + \delta_p HML_t + \varepsilon_p UMD_t + e_{pt} \quad (6)$$

where R_{pt} is the calendar-time portfolio return, R_{ft} is the return of 1-month Treasury Bill, (R_{mt}-R_{ft}) is the return on the value-weighted portfolio, SMB_t is the difference in returns of value-weighted portfolios of small and big firms during month *t*, HML_t is the return differential of value-weighted portfolios of high and low book-to-market firms in a month, and UMD_t is the difference between returns of portfolios of high-and-low momentum stocks.

Underperformance implies that the intercepts in times-series regressions of equation (4-6) should be statistically significant and less than zero. To test the null hypothesis that the mean buy-and-hold abnormal return is equal (different) to zero for the sample of IPO firms, we employ a conventional t-statistic:

$$t = \frac{AR_T}{\sigma(AR_T)/\sqrt{n}} \quad (7)$$

In addition to "event-time" analysis, we also perform calendar-time analysis to check the influence of specific periods of very intense IPO activity on the results.

The next step involves the estimation of multivariate regressions in order to check for determinants of cross-sectional variation of long-run performance. Previous studies have identified a number of possible determinants. We chose six factors for tests. Table 2 summarizes the explanatory variables, briefly giving their definition and measurements.

Table 2

Summary of Explanatory Variables

LBC is a market classification variable Greek IPOs are classified among three markets. We insert the value "1" if an IPO is listed in Main Market and "0" if listed in Parallel or New Market - PRIV takes the value "0" for. companies partially or fully owned by the state before going public (privatized firms),value "1" for fully private companies - Size, the logarithm of the total market capitalisation of an IPO - UR, Underwriters reputation: "1" for reputable underwriters – five older banking institutions – and "0" for lesser-known investment firms, - HDV, is the Hot Period e that takes the value "1" for IPOs listed in the hot period - OC, represents the proportion of retained ownership by the pre-IPO shareholders.

Variable Name in Abbreviation	Variable Definition	Type of Measure	Expected Sign
LBC	Listing Board Classification (main or parallel market)	Discrete	+
PRIV	Corporate Condition of the company	Discrete	+

SIZE	Size of the IPO firms, calculated as the number of shares, multiplied by the offer price	Continuous	+
UR	Underwriters' Reputation	Discrete	+
HDV	Hot Period Dummy Variable	Discrete	-
OC	Ownership Concentration	Continuous	+

The choice of variables for the cross-sectional analysis is based on findings of previous research. Two continuous variables serve as proxies for firm-specific conditions (size and ownership concentration). The binary variable on underwriter reputation[7] is a possible proxy for quality. These variables are more specifically discussed in Section 5. We must note here that the binary variables that represent market conditions show sufficient discriminating power on a univariate basis within our sample. Thus, for example, Main market buy-and-hold returns (120 IPOs) over one, two, and three years respectively average 27.66%, 5.15% and -21.39%. Parallel market returns (124 IPOs) returns are correspondingly 52.70%, 28.79%, and -3.56%. Finally, New Market returns (6 IPOs) show 77.01%, -0.92%, and -89.17%.

The influence of public versus private ownership on the level of IPO returns is estimated by our variable PRIV. International evidence (Hingorani *et al.* (1997), Megginson and Netter (2001), Jones *et al*. (1999) and Keloharju *et al.* (2008)) suggests that firms under private ownership experience higher average initial and lower long-run returns compared to state-owned firms. It is noted that in our sample, the number of private firms is much larger than the public sector companies. In particular, of 254 IPOs, only 14 are state-owned companies. The initial excess return is 37.52% for private IPOs and 20.66% for state-owned IPOs. The long-run buy-and-hold abnormal returns range from 46.67% (six months) to -16.16% (three years) for the private IPOs and from 37.25% (six months) to -3.50% (three years) for the state-owned newly listed enterprises on the A.S.E. Thus, it appears that prima facie Greek results resemble the international evidence.

The window of opportunity for an IPO is related to market conditions. Several authors have examined this issue. (Lowry (2003), Gajeski and Gresse (2006), Derrien and Kecskés (2007) Bancel and Mittoo (2009)). Table 1 shows clear evidence of a "hot period" in the Greek market during the period 1998-2000 and an unprecedented amount of capital raised through IPOs. Furthermore, short-term IPO returns during this same period increased greatly, as we already mentioned in Section 2.

4. Aftermarket performance

4.1. *Basic findings for the buy-and-hold and cumulative abnormal returns of IPOs.*

In Table 3, we show the average BHARs of IPOs undertaken during the period 1994-2002. Panel A shows the adjusted returns,[8] which are calculated based on the listing price of new issues and the closing price of the ASEGI on the last day of the public offering period. The second panel reports the BHARs that are calculated, based on closing price at the end of the first day of trading and the closing price of ASEGI on the same date. The third panel reports adjusted returns based on the closing price at the end of the first month of trading and the corresponding closing price on the ASEGI. In Figure 1, we show a diagram of the evolution of BHARs over 36 months after listing.

[7] The variable of underwriter reputation (UR) refers to the distinction between the five older, larger and more experienced Greek banking institutions and other underwriter investment firms. It is used as a proxy of high quality of scrutiny at the time of issue. It takes the value of 1 for the banks and 0 otherwise.

[8] The adjusted returns have been calculated as the raw returns minus returns of the General Index of the A.S.E. for the same time period used for raw returns calculation.

The initial excess return received by investors was substantial and reached the level of almost 40 percent (38.94 percent). Moreover, the one-year mean-adjusted return calculated on the basis of listing price, the first-day closing price, and the first-month closing price reached 40.82%, 15.71% and 4.11%, respectively. The two-year returns were 13.49, 8.09 and -12.42. Finally, the corresponding three-year returns were -15.35%, -31.43% and -37.56%. These results reveal that new issues in the Greek stock market offer investors substantial

Table 3

Buy-And-Hold Adjusted Returns[9] for IPOs from the Athens Stock Exchange
Time Period 1994-2002

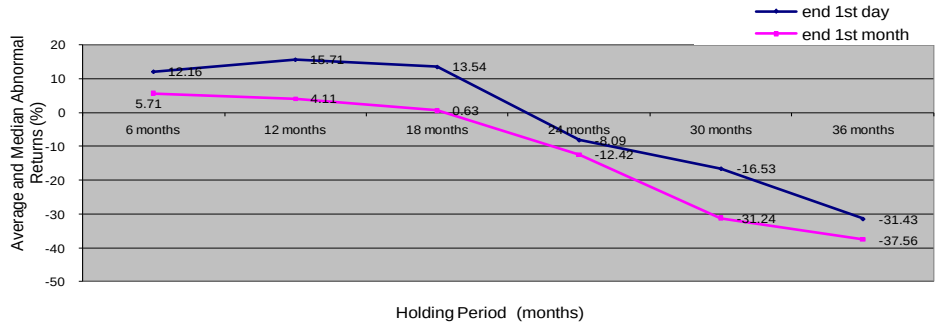
Buy-And-Hold Adjusted Returns are defined as the raw returns less the corresponding market returns: returns of the General Index of the A.S.E. (value-weighted index) for the same time period used for raw returns calculation. IPO-adjusted returns taken in a three-year period (from beginning of first day of trading until 36 months after going public) are based on IPO prices of offer price period, end of first trading day and end of first trading month. The differences in the number of firms in each panel are due to not having the data for the period of analysis to estimate three- and five-year returns. Total returns include both capital gains and dividends.

Return of	Mean Return (%)	Standard Deviation (%)	Number of observations	Median (%)	Minimum Return (%)	Maximum Return (%)
Panel A: Excess or Adjusted Buy-And-Hold Returns based on the listing price						
1st day	38.94***	61.21	253	14.14	-41.84	397.41
6 months	45.18***	70.34	252	26.75	-74.94	252.47
12 months	40.82***	82.73	247	18.03	-108.60	298.11
18 months	28.51***	83.29	241	8.79	-245.60	298.33
24 months	13.49***	13.49	240	3.66	-266.96	247.14
30 months	-2.00*	88.82	237	-4.29	-246.93	286.93
36 months	-15.35**	101.34	232	-11.49	-395.22	275.82
Return of	Mean Return (%)	Standard Deviation (%)	Number of observations	Median (%)	Minimum Return (%)	Maximum Return (%)
Panel B: Excess or Adjusted Buy and Hold Returns based on the first day closing price						
6 months	12.16***	47.78	254	-0.58	-73.80	147.98
12 months	15.71***	68.82	247	0.289	-107.47	249.53
18 months	13.54**	82.01	241	-9.36	-241.24	282.61
24 months	8.09**	63.30	240	-3.20	-262.22	208.38
30 months	-16.53***	84.98	237	-17.94	-286.76	294.43
36 months	-31.43**	97.45	231	-20.73	-437.01	249.82
Return of	Mean Return (%)	Standard Deviation (%)	Number of observations	Median (%)	Minimum Return (%)	Maximum Return (%)
Panel C: Excess or Adjusted Buy and Hold Returns based on the first month closing price						
6 months	5.71**	42.47	254	-4.97	-59.17	186.07
12 months	4.11**	55.39	246	-6.67	-96.62	262.58
18 months	0.63**	71.25	242	-14.75	-203.8	364.81

[9] The IPO price changes that give the adjusted returns include dividends.

24 months	-12.42**	66.63	239	-18.08	-223.27	285.75
30 months	-31.24**	73.73	237	-24.15	-230.69	267.70
36 months	-37.56***	83.76	232	-22.69	-256.72	251.72

*Significance level at 10%, ** Significance level at 5%, ***Significance level at 1%,



The figure arises the excessive returns (Adjusted IPO returns=Raw IPO returns – market returns) of Greek IPOs on a three-year period based on their market prices of first trading day and month. The y-axis in the figure is the Average Abnormal Returns while the x-axis is the holding period

Fig. 1 Adjusted Returns of IPOs on the A.S.E. (First day closing day and month basis)

long-run adjusted returns for about two years after listing. This positive IPO performance for about two years distinguishes the Greek market from other cases where the positive returns wane at the end of the first three months or, at most, within one year after listing[10].

The figure shows the excess returns (Adjusted IPO returns=Raw IPO returns – market returns) of Greek IPOs during a three-year period based on their market prices at the end of first trading day and month. The y-axis in the figure represents the Average Abnormal Returns while the x-axis represents the holding period.

Table 4 reports monthly average and cumulative abnormal returns, commencing on the first day of listing. The equally weighted CAR in month 36 is -16.18%; thus, an equal investment in each of these IPOs would have resulted in a loss of approximately 1/6 the value of the initial portfolio over a three-year period. Notably, the cumulative average-adjusted returns remain positive for 22 months after listing. This is comparable to the findings of Table 3 based on BHARs. Thus, our results are stable and do not depend on choice-of-return calculation.

The sample size in Table 4 decreases from 254 IPOs to only 231 in the three-year period; fourteen firms have available price observations for less than 36 months, five experienced a successful takeover and four liquidated with no cash returns to shareholders.

[10] In other words, we find evidence that investors who participated in the Greek IPO market during the period 1994-2002, and who bought stocks at the listing price/at the closing first-day price/at the closing day of the first-month and held them for a three-year period, obtained long-term negative returns even on the basis of listing price, because the listing prices of IPOs were slightly higher than their equilibrium prices formed at the 750th day of trading. We should note that the range of the above IPO returns is wide, fluctuating from -395.22% to 275.82% (adjusted returns based on listing price) from -437.01% to 249.82% (adjusted returns based on first-day closing price) and from -256.72% to 251.72% (adjusted returns based on first-month closing price). We must point out that results of Table 3 were extracted from a sample that exempted a few outliers. Specifically, in several cases returns over three years raised form 540 to 4480 percent. We thought their exclusion prudent so that we would be sure that persistent overpricing is not driven by a few very large returns.

4.2. *The findings using alternative benchmark models and matching samples*

Ritter (1991) offers an early argument that CARs and BHARs can be used to answer different questions regarding long-term performance of IPOs. Barber and Lyon (1997) favor the use of buy-and-hold abnormal returns over cumulative abnormal returns on conceptual grounds.

Table 4

Abnormal returns for initial Public Offerings in 1994-2002

Post-listing average-adjusted returns (AR_t) with associated *t* statistics and cumulative average returns (CAR_t) for the 36 months (where month one represents the market index-adjusted return from the last sale price on the day of listing to the end of that calendar month) after going public, excluding the initial return. Our final sample constitutes 254 Greek initial public offers of ordinary equity made between January 1994 and December 2002, calculated on the basis of an equal euro investment in each issue.

Month	No of firms trading	AR_t (%)	*t-stat*	CAR_t (%)
1	254	2.513	3.002	2.513
2	254	0.233	0.279	2.746
3	254	0.964	1.036	3.710
4	254	0.486	0.490	4.197
5	254	-0.184	-0.279	4.012
6	254	-0.769	-0.876	3.243
7	254	0.504	0.522	3.747
8	253	-0.298	-0.326	3.449
9	253	0.051	0.072	3.500
10	250	0.281	-0.331	3.781
11	248	1.002	1.189	4.783
12	247	0.611	0.065	5.395
13	245	0.213	0.227	5.609
14	244	-1.002	-1.029	4.606
15	244	-0.122	0.134	4.483
16	243	-0.587	-0.616	3.895
17	243	-0.920	-0.970	2.975
18	241	-0.069	-0.075	2.905
19	241	0.489	0.521	3.395
20	241	-0.649	-0.737	2.745
21	241	-1.503	-1.424	1.241
22	241	-0.723	-0.847	0.517
23	240	-1.046	-1.104	-0.528
24	240	-1.402	-1.491	-1.931
25	240	-0.798	-0.829	-2.725
26	239	-2.117	-2.457	-4.847
27	238	-1.550	-1.611	-6.397
28	237	-0.933	-1.028	-7.331
29	237	-1.543	-1.754	-8.874
30	237	-0.798	-0.940	-9.673
31	236	-1.507	-1.604	-11.181

32	236	-1.385	-1.601	-12.566
33	234	-1.412	-1.561	-13.978
34	233	0.104	0.111	-13.874
35	233	-0.963	-1.046	-14.838
36	231	-1.339	-1.499	-16.177

In Table 5, we evaluate the empirical specification and power of test statistics based on both CAR and BHAR at one-, two-, and three-year horizons. We measure abnormal returns following the IPO using the three models specified in Section 3.2. We have also selected matching non-IPO firms[11] of similar size and sector. These tests examine the sensitivity of results to alternative benchmark specifications. They will also establish a direct comparison within each benchmark model between IPO- and non-IPO-matching samples. In Table 5, we estimate the difference of abnormal returns between IPO- and non-IPO-matching firms.

The results of Table 5 confirm our basic findings. Estimates of excess returns in the table are made on the basis of closing prices one month after trading is initiated and thus embody the positive impact in the short term after-market. We derive three important conclusions from these findings. The first tells us that the results are not particularly sensitive to benchmark specification. The second conclusion is that what we found using the simple adjustment model continues to hold true as we move to more sophisticated benchmarks: Greek IPOs maintain a positive abnormal return on average for 18 months after listing. After the 18-month interval, adjusted returns turn increasingly negative up to the 36th month.

Table 5

Buy-and-Hold Abnormal Returns (BHARs) and Cumulative Abnormal Returns (CARs)

The table presents 12, 18, 24, 30 and 36 months, Buy-and-Hold Abnormal Returns (BHAR) and Cumulative Abnormal Returns (CARs) calculated from the end of the first month of trading. Abnormal returns are calculated using CAPM, SC and the Fama and French (FF) four-factor model. The intercept α_i is interpreted as the mean monthly abnormal return of the portfolio. Statistical significance is calculated by using the time-series standard deviation of the mean monthly abnormal returns. a, b and c indicate significance at the 1%, 5% and 10% levels, respectively.

	Buy and Hold Abnormal Return (BHAR)					Cumulative Abnormal Returns (CARs)				
	12 months	18 month	24 months	30 months	36 months	12 months	18 months	24 months	30 months	36 months
CAPM	1.335[c]	0.972 [c]	-0.374[c]	-1.025 [b]	-1.617[b]	0.672[b]	0.082[a]	-0.785[b]	-1.337[b]	-1.851[c]
	254	253	253	253	253	253	253	251	251	250
IPOs - Matching	0.944[c]	0.217 [c]	-0.659[c]	-1.238 [c]	-1.752[c]	0.513[a]	-0.138	-0.943[c]	-1.648[b]	-2.053[c]
	254	253	253	251	251	253	253	253	251	251
SC	1.095[c]	0.394 [b]	-0.418[b]	-1.183 [b]	-1.653[c]	0.742[c]	-0.217[c]	-0.544[c]	-1.043[c]	-1.354[c]
	254	254	254	252	252	252	253	252	250	250
IPOs - Matching	0.817[b]	0.268 [a]	-0.583[b]	-1.311[b]	-1.972[c]	0.124	0.043	-0.078	-0.113	-0.136
	254	253	252	251	251	254	253	253	252	252

[11] In order to select matching firms for the 254 IPOs during the period 1994-2002, the following procedure was employed. Among firms listed in the Athens Stock Exchange, their market values were computed annually on December 31st. These firms were ranked by market value. If a matching firm in the same industry was not available, then a firm in another industry was chosen, with preference given to firms in relative industries (i.e. chemicals, mining, oil and gas). For companies going public in 1995, the market value of a listed firm at the end of 1994 was used. For firms going public in 2000, the market value of a listed firm at the end of 1999 was used. This procedure resulted in 245 matching firms, as nine of them were used in more than one case. Special care was taken to avoid "survivorship bias." This was accomplished by choosing a matching firm regardless of whether it was later delisted. Few matching firms were delisted at a time earlier than the 3-year anniversary date. In those few cases, the matching firm was replaced using the same procedure. The matching company's returns were aligned over exactly the same horizon as the IPO.

FF4F	1.103[c]	0.462[c]	-0.543[c]	-1.307[b]	-1.821[c]	0.714[c]	0.146[b]	-0.752[c]	-1.418[c]	-1.924[c]
	253	253	252	251	250	249	249	249	249	249
IPOs - Matching	0.898[c]	0.271[c]	-0.508[c]	-1.525[c]	-2.023[c]	0.159	0.032	-0.292	-0.762[a]	-1.126
	254	253	252	252	252	254	254	254	254	254

Thirdly, we conclude that a comparison of IPO and non-IPO firms generally confirms that either positive or negative excess returns associated with IPO firms represent a significant departure from the return behavior of matching firms. Thus, IPO performance is clearly distinct from non-IPO performance. This conclusion, however, is much more strongly founded on estimations of BHARs than CARs. In the case of CARs (the right side of Table 5), differences between IPO and non-IPO firms are statistically significant only in the case of CAPM estimation, but not in the other cases. This could result from the selection of matching firms on the basis of both sector and size. Controlling for size effect in the benchmark model possibly weakens the differential between the two samples. However, as this is not true in the case of BHARs, our findings appear to retain their validity.

4.3 A Calendar-Time Approach

One possible criticism of this type of finding appears in the work of Espenlaub *et al.* (2000). They suggest that a comparatively short period of severe underperformance of IPOs might affect the overall picture. In our case, for example, the statistical significance of the abnormal returns in Table 5 will be emphasized in the presence of cross-correlation, as the t-tests assume independent observations. However, observations may actually not be independent, as IPOs are clustered within short calendar intervals. In our case, the time distribution of IPOs is wide, but the amount of capital sought and raised was indeed clustered in a sub-period of our observations, as indicated in Table 1. To control for this possibility of bias, we re-estimate return regressions based on a calendar-time approach[12]. We can test the simplest aspect of the "window of opportunity" hypothesis with this approach.

The window of opportunity for an IPO may be determined by market conditions. Lowry (2003)[13] suggests that in a bullish market, the number of IPOs tends to increase because the placement of stocks is easier, the risk of failure of an IPO is lower and securities are priced higher. These factors soften the cost of initial underpricing. Schultz (2003) calls this hypothesis "pseudo market-timing" and demonstrates that long-term underperformance is linked to IPO clustering. International evidence shows weaker long-term returns for firms that go bankrupt. In his work he supposes that periods of "hot markets" attract "good" firms as well as "bad" firms, the latter being offered to the market by less scrupulous intermediaries. In Europe, Derrien and Kecskés (2007) attempt to fill this gap by providing empirical evidence of market timing for AIM IPOs in the UK, and only Gajeski and Gresse (2006) have formally tested the market timing hypothesis.

In each period, we cumulate returns of IPOs that occurred in the previous 12, 24, or 36 months of observation. We introduce a binary variable (ZETA) that we associate with observations of returns for IPOs introduced during the "hot IPO period" 1998-2000. During

[12] Calendar portfolios are value-weighted. Fama and French (1993, 1996) document that three-factor models have systematic problems in explaining the average returns on categories of small stocks. Loughran and Ritter (2000) confirm that multi-factor regressions fail in detecting abnormal returns that are present, especially when the target population composes small stocks like typical IPOs. Value-weighting is used to avoid giving more weight to small stocks.

[13] Lowry (2003) indicates that firms' demands for capital and investor sentiment are important determinants of IPO volume, in both statistical and economic terms. Adverse selection costs are also statistically significant, but their economic effect appears small.

that period, both the market and the supply of IPOs crested in a large wave, as seen in Table 1. In these tests, we again use the three benchmark models specified above. The intercept of the regressions captures the excess returns. The coefficient of the binary variable ZETA will show the modification of the intercept for returns of IPOs introduced during the "hot period." Our hypothesis is that the coefficient of ZETA in the following equations will be positive and significant.

Model 4: Extension of CAPM for 'Hot' Market Conditions

$$R_{it} - R_{ft} = a_{it} + \beta_i (R_{mt} - R_{ft}) + z_{it} HOT + e_{it} \tag{8}$$

Model 5: Smaller Companies Index (SCI) extended for 'Hot' Market Conditions

$$(R_{pt} - R_{ft}) = a_p + \beta_p (R_{mt} - R_{ft}) + \gamma_p (R_{sc} - R_{mt}) + z_p HOT + e_{pt} \tag{9}$$

Model 6: Carhart (1997) momentum extended for 'Hot' Market Conditions

$$(R_{pt} - R_{ft}) = a_p + \beta_p (R_{mt} - R_{ft}) + \gamma_p SMB_t + \delta_p HML_t + \varepsilon_p UMD_t + z_p HOT + e_{pt} \tag{10}$$

Our hypothesis here is based on the theoretical expectation that the "Greek exception" of positive returns is not a general phenomenon, but rather was rooted in the wave of 1998-2000, which combined two features: the years 1998-99 experienced a very pronounced market boom. In the year 2000, the market boom abated; however, a big institutional event was looming: perceptions of Greece's joining the Eurozone in 2001 solidified. These perceptions did not only create expectations of a macro-economic nature. They included the implication that, as a major part of exchange risk would be eliminated from Greek shares and as market regulation would converge to European standards, the Greek market would graduate from the status of "emerging" to the status of "developed market." These expectations were in fact realized. The combination of market conditions and broad institutional change could indeed be the foundation of the "Greek exception." Owners of firms had reason to believe that the shares they would float would gain a permanent value component from the transition to a Eurozone "developed market" status. This belief actually contributed to oversupply of primary listings.

In Table 6, we show results for each of our benchmark models[14]. The results are quite revealing, as they show significant differences both among periods and among benchmarks. If we look across the panels at the CAPM estimations, we see a uniform result. The intercepts are negative and significant everywhere, but the coefficients of the "hot period dummy" throughout are positive, significant and much larger than the intercepts. The implication of this finding is that IPOs were more strongly underpriced during the "hot period," relative to the other periods in our sample observations.

The two more sophisticated models reveal a more complex pattern of finding. Results change as we move from short- to longer-term excess returns. The 12-month return estimation shows neither intercepts nor dummy coefficients that are significantly different from zero. Thus, they seem to imply that IPO yearly returns neither over- nor underperform.

[14] Mimicking portfolios indicate the proportion of mean return attributable to four elementary strategies: high versus low beta stocks, large versus small market capitalization stocks, value versus growth stocks, and one-year return momentum versus contrarian stocks (Carhart (1999)).

The 18-, 24- and 30-month estimations yield a mixed picture. Intercepts are significantly negative in both the SCI and FF4F models, implying that Greek IPO returns have behaved in line with the international evidence. However, the "hot period dummy" coefficient is strongly positive. This implies that IPOs associated with the "hot period" overperformed, whereas

Table 6

Calendar-time regression for alternative benchmark models

Time-series models are the Capital Asset Pricing Model, a multi-index model using the excess return on the SCI, and the Carhart (1997) extension of Fama and French (1993) model. Figures in brackets are the *t* statistics. The regressions in each case are estimated using monthly observations, with the dependent variable being either the return on a 12-, 18-, 24-, 30- or the 36-month portfolio of IPOs minus the risk-free rate and the independent variables being the benchmark factors. Beta is the sensitivity of the excess returns on the company to the excess return in the market (ASEGI); Gamma is the sensitivity of the excess returns on the company to the "small firms premium", which is taken as $(R_{sc}-R_{mt})$ for SCI model, and as SML for FF4F; Delta is the sensitivity to the HML factor in the FF4F models; Epsilon is the sensitivity to the momentum factor in the FF4F model and Zeta is the dummy variable for the "hot IPO period" 1998-2000. In the case of the FF4F model, the dependent variable $(R_{pt}-R_{ft})$ is the excess return on an equally weighted (τ=12, 18, 24, 30 or 36 months) portfolio of IPOs that were issued up to month t; Alpha is the intercept term.[15]

Panel A: 12-month portfolio			
	CAPM	SC	FF4F
Alpha	-0.00851	-0.00302	-0.00247
t-stat	(-2.509)	(-0.900)	(-0.755)
Beta	0.569	0.394	0.395
t-stat	(11.058)	(6.233)	(6.098)
Gamma		0.366	0.368
T-stat		(4.787)	(3.012)
Delta			-0.044
t-stat			(-0.344)
Epsilon			-0.010
t-stat			(-0.161)
Zeta	0.136	-0.048	-0.001
t-stat	(2.647)	(-0.140)	(-0.023)
Adj R^2	0.338	0.394	0.394
Panel B: 18-month portfolio			
	CAPM	SC	FF4F
Alpha	-0.0203	-0.0152	-0.0133
t-stat	(-5.876)	(-4.428)	(-4.081)
Beta	0.636	0.534	0.483
t-stat	(12.734)	(8.791)	(7.253)
Gamma		0.192	0.061
T-stat		(2.891)	(0.350)
Delta			0.127
t-stat			(0.673)

[15] We performed tests for alternative benchmarks such as the size control portfolio (SD) and Fama and French three-factor models (FF3F) as dependent variables. The results have been similar to those reported for SC and FF4F

Epsilon			0.095
t-stat			(1.477)
Zeta	0.283	0.173	0.130
t-stat	(5.662)	(2.789)	(1.921)
Adj R^2	0.401	0.425	0.433
Panel C: 24-month portfolio			
	CAPM	SC	FF4F
Alpha	-0.0263	-0.0211	-0.0173
t-stat	(-7.876)	(-6.453)	(-4.972)
Beta	0.669	0.564	0.453
t-stat	(13.488)	(9.777)	(6.230)
Gamma		0.202	0.057
T-stat		(3.352)	(0.309)
Delta			0.132
t-stat			(0.678)
Epsilon			0.163
t-stat			(2.286)
Zeta	0.327	0.218	0.149
t-stat	(6.606)	(3.736)	(2.300)
Adj R^2	0.433	0.457	0.472
Panel D: 30-month portfolio			
	CAPM	SC	FF4F
Alpha	-0.0302	-0.0236	-0.0181
t-stat	(-8.722)	(-7.075)	(-5.252)
Beta	0.760	0.629	0.486
t-stat	(14.413)	(10.787)	(6.319)
Gamma		0.251	0.276
T-stat		(4.549)	(1.394)
Delta			-0.108
t-stat			(-0.517)
Epsilon			0.229
t-stat			(3.210)
Zeta	0.351	0.204	0.153
t-stat	(6.667)	(3.400)	(2.243)
Adj R^2	0.454	0.496	0.517
Panel E: 36-month portfolio			
	CAPM	SC	FF4F
Alpha	-0.0154	-0.00524	-0.0003
t-stat	(-4.471)	(-1.412)	(0.020)
Beta	0.631	0.344	0.133
t-stat	(9.973)	(4.843)	(1.619)
Gamma		0.438	0.554
T-stat		(6.951)	(2.677)
Delta			-0.284
t-stat			(-1.306)

Epsilon			0.395
t-stat			(5.320)
Zeta	0.172	-0.137	-0.132
t-stat	(2.727)	(-1.870)	(-1.861)
Adj R^2	0.307	0.420	0.480

those that occurred in other periods underperformed. Finally, the 36-month estimation yields both intercepts and dummy variable coefficients that are negative and significant. Hence, when we measure excess returns over a long enough interval (36 months in this case), all IPOs appear to underperform. These findings are quite interesting. They offer an elaboration of findings in previous sections: in the short and medium term, IPO returns appear positive. These positive returns are bunched in the "hot IPO period." In the long run, IPO performance aligns with international experience and transforms to clear underperformance.

The two more sophisticated models reveal a more complex pattern of finding. Results change as we move from short- to longer-term excess returns. The 12-month return estimation shows neither intercepts nor dummy coefficients that are significantly different from zero. Thus, they seem to imply that IPO yearly returns neither over- nor underperform. The 18-, 24- and 30-month estimations yield a mixed picture. Intercepts are significantly negative in both the SCI and FF4F models, implying that Greek IPO returns have behaved in line with the international evidence. However, the "hot period dummy" coefficient is strongly positive. This implies that IPOs associated with the "hot period" overperformed, whereas those that occurred in other periods underperformed. Finally, the 36-month estimation yields both intercepts and dummy variable coefficients that are negative and significant. Hence, when we measure excess returns over a long enough interval (36 months in this case), all IPOs appear to underperform. These findings are quite interesting. They offer an elaboration of findings in previous sections: in the short and medium term, IPO returns appear positive. These positive returns are bunched in the "hot IPO period." In the long run, IPO performance aligns with international experience and transforms to clear underperformance.

5. Cross-sectional Regression Results

We finally hypothesize that long-run IPO performance is a function of the condition and quality of firms and markets when firms decide to go public. We use a number of characteristics (listing board classification, privatization of public sector firms, size, ownership concentration, underwriters' reputations, and hot IPO period). These have been used elsewhere as proxies for quality and reputation of the firms and for market quality and condition. We estimate a series of multiple-regression models, using buy-and-hold abnormal returns (BHAR) and residuals from the FF4F model as dependent variables for three years after going public. The regression model is:

$$\text{(BHAR) or (FF4F Residuals)} = a + \beta_1 (LBC) + \beta_2(PRIV) + \beta_3 Log(SIZE) + \beta_4 (UR) + \beta_5 (HDV) + \beta_6 (OC) + \varepsilon_i \quad (11)$$

Our first variable, LBC, is expected to proxy for higher firm reputation for those IPOs that can attain the listing on the main market. Consistent with Ljungqvist *et al*. (2003), who reported that IPOs traded in the primary market yield higher returns in the long run, we expect this to exert a positive influence on returns.

IPO size (SIZE) is measured by the logarithm of market capitalization of the offering. In previous studies, Keloharju (1993) and Goergen et al. (2007) have shown better long-term performance for large IPOs, and we expect that size will be associated with better long-term performance.

The privatization variable (PRIV) is binary and distinguishes between public sector firms and private firms being listed.[16] Our expectation is that public sector firms are more highly scrutinized at the time of listing and therefore will present higher long-term performance (Perotti and Guney (1993), Perotti (1995), Megginson *et al.* (2000))**.** International evidence (Hingorani *et al.* (1997), Megginson and Netter (2001), Jones *et al*. (1999) and Keloharju *et al.* (2008)) suggests that firms under private ownership experience higher average initial and lower long-run returns compared to state-owned firms. It is noted that in our sample, the number of private firms is much larger than the public sector companies. In particular, of 254 IPOs, only 14 are IPOs performed by state-owned companies. The initial excess return is 37.52% for private IPOs and 20.66% for state-owned IPOs. The long-run buy-and-hold abnormal returns range from 46.67% (six months) to -16.16% (three years) for the private IPOs and from 37.25% (six months) to -3.50% (three years) for the state-owned newly listed enterprises. Thus, it appears that prima facie Greek results resemble the international evidence.

The percentage of ownership retained by original shareholders at the time of issue (OC) is another firm-specific variable that we use. Our hypothesis is that higher retention will proxy for lower uncertainty about the quality of the firm and will therefore be associated with better long-run performance. Indeed, empirical findings from IPOs in other markets have supported this hypothesis (Goergen *et al.* (2007) for example).

Jenkinson and Jones (2009) report strong competition between banks for lead underwriter, but having committed to a particular bank, the power of the issuer is greatly reduced. The variable of underwriter reputation (UR), which distinguishes the five banking institutions as lead underwriters, is used as a proxy of high quality of scrutiny at the time of issue. Thus, in line with other studies, (Ljungqvist and Wilhelm (2002), Chemmanur and Paeglis (2005), Doukas and Gonenc (2005)[17], Johnson and Westberg (2009)), we hypothesize that this variable will positively affect long-run returns.

Finally, we use a dummy variable for "hot" periods. The window of opportunity for an IPO is related to market conditions. Several authors have examined this issue. (Lowry (2003), Gajeski and Gresse (2006), Derrien and Kecskés (2007), Bancel and Mittoo (2009)). Table 1 shows clear evidence of a "hot period" in the Greek market during the period 1998-2000 and an unprecedented amount of capital raised through IPOs. The short-term IPO returns during this same period increased greatly, as we already mentioned in Section 2. The hot periods are those years when the Greek market showed high positive performance and when IPOs crowded the waiting line for listing. We expect that IPO overpricing in "hot" periods will be associated with negative long-term returns in line with the findings in the calendar-time estimations in the previous section and with international evidence {(See Loughran and Ritter (1995) as well as Helwege and Liang (2004)}.[18]

In the estimation of the cross-sectional regression, we use two sets of returns for each case. BHARs and FF4F CARs are computed on two alternative bases: on closing prices after the first day of trading or after the first month of trading. In Table 7, regressions (1, 2) show the results using BHARs as dependent variables and regressions (3, 4) show the CARs extracted from the FF4F model. Because the dependent variable on the BHAR long-term

[16] Roosenbloom and Schramade (2005) document that the large (non-pecuniary) private benefits of control in France may motivate owner-managers to retain control after the IPO.

[17] Doukas and Gonenc (2005) investigate the potential effects of the reputation of investment banking and venture capital on the long-term performance of initial public offerings (IPOs) simultaneously. They indicate that the reputation of investment bankers matters only in the absence of venture capital.

[18] Jenkinson and Ljunqvist (2001) and Helwege and Liang (2004) report that 'hot issue' periods for IPOs offered extraordinary returns to investors, but the ones seen on IPOs in 1999 and the first half of 2000 (periods that our study covers) are quite unprecedented. Exceptional price movements, upwards and downwards, often result in the spotlight being turned on market intermediaries.

returns is skewed, the residuals are also highly non-normal; bootstrapped p-values are reported.[19]

Table 7

Results of multiple regressions using three-year BHARs and FF4F-CARs

Multivariate regression analysis of cross-sectional variation in long-run market index-adjusted (excess) returns – BHAR (over columns 1 and 2) and CARs for the Fama and French (FF) four-factor model $R_{pt}-R_{ft}=\alpha_i+\beta_i(R_{mt}-R_{ft})+\gamma_i SMB_t+\delta_i HML_t+\varepsilon_i UMD_t+\varepsilon_{pt}$ (over columns 3 and 4) subsequent to listing for 254 Greek initial public offers of ordinary equity made between January 1994 and December 2002, calculated on the basis of an investment in each issue purchased at the closing price of the first day or first month, for a holding period of three years for various explanatory variables, with related t-statistics in parentheses. ER3Y1D - Adjusted returns from first-day price to three years after going public, ER3Y1M - Adjusted returns from first-month price to three years after going public, Size - The logarithm of the total market capitalisation of an IPO, OC - proportion of retained ownership by the initial shareholders, PRIV - Companies partially or fully owned by the Greek state before going public, get the value "1" and fully private companies get the value "0", UR – Underwriters' reputation: "1" for reputable underwriters – five older and more experienced in underwriting tasks banking institutions – and "0" for non reputable, HDV - IPOs listed in the Hot Period (1998-2000) get the value "1" and IPOs listed at other times get the value "0" , LBC - Greek IPOs are classified among three markets. We insert the value "1" if an IPO is listed in Main Market, and "0" if listed in the Parallel or New Markets *** Significance at the one per cent level. **Significance at the five per cent level *Significance at the ten per cent level; t-statistics are robust for heteroskedasticity using the Newey-West HAC Standard Errors and Covariance process.

Specifications	(1) ER3Y1D	(2) ER3Y1M	(3) ER3Y1D	(4) ER3Y1M
	BHAR		FF4F-CAR	
Constant	-87.547	-121.700	-4.439	-1.147
SIZE	-0.063	-0.035	0.091	0.041
	(-0.805)	(-0.449)	(1.206)	(0.490)
OC	0.102	0.231	0.109	-0.039
	(1.452)	(3.319)***	(1.631)	(-0.533)
PRIV	0.012	-0.017	0.095	0.026
	(0.013)	(-0.263)	(1.473)	(0.372)
UR	-0.059	-0.067	0.023	-0.132
	(-0.836)	(-0.948)	(0.336)	(-1.741)*
HDV	-0.136	-0.144	-0.323	0.014
	(-1.715)*	(-1.843)*	(-4.260)***	(0.161)
LBC	0.148	0.065	0.139	0.154
	(1.943)*	(0.855)	(1.921)*	(0.056)

[19] Barber and Lyon (1997) document that positive skewness leads to negatively biased t-statistics. To conduct significance tests for initial returns, we apply the skewness-adjusted t-statistic. Lyon, Barber, and Tsai (1999) argue that only the bootstrapped application of this skewness-adjusted test statistic yields well-specified test statistics. We follow their approach and report the adjusted t-statistics on the basis of the distribution of bootstrapped resamples. The hypothesis is that the number of observed positive initial returns equals the number of negative returns. Bootstrapping procedure as described by Noreen (1989) creates a coefficient vector under the null hypothesis of no relation by randomly reordering the 254 dependent variable observations and running an OLS regression. This is repeated many times creating a distribution of least square coefficient vectors. The bootstrapped p-values are calculated by finding the location of the original coefficient vector in the ranked empirical distribution, variable by variable. The bootstrapped p-values that are reported are similar to the ordinary least squares values

Adj. R^2	0.062	0.079	0.108	0.041
No. of IPOs	254	254	254	254
F-statistic	2.561	3.353	4.873	1.522

When using BHARs as the dependent variables, the listing board classification exerts a positive influence over a three-year long-term period and so does owners' concentration. These two variables appear with a positive and significant coefficient in two different regressions. The "hot period variable" throughout the three-year term shows a negative influence. When we use FF4F CARs as a dependent variable (1, 2) listing board classification comes out positive again, and the "hot period variable" comes out as insignificant in one regression. Underwriter reputation obtains a negative coefficient in one of the FF4F regressions.

Our general conclusion is that these regressions although not very strong, offer some evidence of the determinants of long-term returns. Listing board classification and owner concentration appear to exert positive influence. These two variables reflect higher firm quality, and apparently they boost long-term performance.

Underwriter reputation appears as a negative determinant in one regression out of four. This is the regression in which FF4F CARs are calculated on the basis of the closing price after the first month of trading. CARs calculated on the basis of closing price after the first day of trading do not show this effect. Hence the finding suggests the possibility that reputable underwriters fostered high aftermarket prices in the short run (i.e. in the first month of trading), producing more pronounced subsequent negative returns.

Finally, the negative influence of the "hot period dummy" is as expected, and the findings are perfectly consistent with what we found in Table 6.

6. Conclusion

In this paper, we have established four basic findings. First, short-term overperformance of Greek IPOs is undisputed and in line with international evidence. Second, overperformance continues for a much longer period than in other markets, extending to between 18 and 24 months after listing. This has given rise to evidence that the Greek case is an exception, as rates of return are different than those found for other markets (Gajeski and Gresse (2006)). In fact, our third finding shows that eventually this "Greek exception" is restored, as we find that in three-year returns, Greek IPOs underperform the market, as most international studies confirm.

We have tested the stability of our results using alternative estimates of excess returns, alternative benchmark models (CAPM, Small Cap, Fama-French-Carhart models), alternative constructions of time series (event-time versus calendar-time) and comparisons with a non-IPO sample of matching firms. Such extensive testing has not been performed before on Greek data. We are satisfied that our results have passed the test of stability, and that our main findings do not depend on the alternative benchmarks and variable specifications.

Cross-sectional analysis points to up to three factors that affect long-term performance. Listing on the main market and the retention of a higher percentage of original owner concentration appear as positive influences, proxying for higher firm quality. Our measure of underwriter reputation indicates a negative influence on performance in one of our models. Although the result is sensitive to the benchmark model used, it casts doubt on the role of "reputable underwriters" (i.e. large banks) in Greece as certifiers of firm quality. Rather, they

may have engendered a much hotter short-term aftermarket, setting the scene for later underperformance.

Perhaps the most meaningful is our fourth finding. This relates to pricing during the "hot IPO period." This period is associated with positive short (1-year) and medium (2-year) performance, but with negative long-term (3-year) performance. Since an unprecedented amount of capital was sought and raised by IPOs in Greece during the 'hot period', it is seen that the features of these IPOs played a critical role in our results, as shown by our calendar-time regressions. In our opinion, during hot periods, there are not only tendencies of short-term overpricing due to investor sentiment, but also strong countering tendencies of underpricing due to strong issuer competition, as an "IPO wave" developed. We believe that this occurred in Greece because a strong market boom appeared along with major institutional change: the entry of Greece into the Eurozone, regulatory modernization and the transition of the Greek market to "developed market" status. These conditions heightened the rush to IPOs during the period 1998-2000 and created a long waiting line for listing. In that context, strong issuer competition was quite evident and has contributed to the findings of our study, and to the appearance of a "Greek exception."

On a more general level, this study of the "Greek exception" clearly shows that even where there are longer-lasting positive excess returns after IPOs, eventually negative returns emerge. This conclusion strengthens the recognition that IPO pricing is not efficient in the long term, despite appearances of impressive short- or even medium-term gains, as in the case of Greece.

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