

# The Cross-Section of European IPO Returns

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## ABSTRACT

We apply a sector-based approach to companies going public in the six largest Continental European markets and Sweden during a period characterized by dramatic change. For a sample of 973 IPOs during 1988 and 1998, there is considerable underpricing which is time-varying and related to company characteristics. Much of the large “amounts of money left on the table” is due to privatization issues. For the sample as a whole, IPOs did not underperform in the long-run. Over shorter measurement horizons, we find overperformance. IPO performance is sensitive to market condition at the time of going public and IPO issuing characteristic. The favourable performance for the sample as a whole is driven by New Economy IPOs accounting for 28 percent of the sample. The pervasiveness of the outperformance of New Economy IPOs sheds light on the drivers behind the dramatic shift in industry composition of European IPOs in favor of New Economy IPOs during the “Internet Bubble”.

THE ACADEMIC LITERATURE on Initial Public Offerings (IPOs) has grown rapidly over the past decade. Much of this literature has focused on documenting and explaining empirical patterns associated with the phenomena surrounding IPOs: underpricing, “hot issue” markets, and long-run underperformance. The patterns and models that try to explain them are mostly from an American perspective whereas the European marketplace has received considerably less attention.

In this study, we seek to close this gap by extending the international evidence on IPOs to include 973 companies which went public on the six largest Continental European markets and Sweden between 1988 and 1998. The extension of empirical IPO work to a pan-European scale responds to a number of fundamental developments during the past decade which have shaped European stock markets.

First, throughout the 1990s, the European IPO market has developed as one of the cornerstones of the worldwide IPO market. This has been fostered either by privatization programs introducing “equity culture” to the Continental European marketplace, by initially highly successful stock exchange segments catering to companies in high-growth industries, or by the convergence of listing requirements, reporting rules and pricing mechanisms across Europe. Within this setting, European

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IPO activity has overtaken US IPO activity. During the late 1990s, more companies went public and more funds were raised by companies on the European market segments than in the US.<sup>1</sup> Second, European integration has been at work for some time now, and the changes brought about by the introduction of the European single currency and the adoption of a common monetary policy have resulted in a dramatic change in portfolio allocation decisions. As the barriers to cross-border investing have declined, it has become increasingly important for issuers and investors alike to evaluate the European market from the perspective of a full set of available opportunities across countries. One of those consequences has been the rise of pan-European sector analysis at the expense of individual country analysis. Third, by taking a pan-European perspective, we are able to investigate the performance patterns of a large enough sample of IPOs over a period that stretches beyond the rising markets of the late 1990s. This allows us to shed more light on the generality of the empirical patterns and theoretical foundations associated with IPOs. Finally, to the degree that a broad industry mix characterizes our sample of European IPOs, this analysis may also provide an interesting perspective of the performance of US IPOs in the post-bubble period.<sup>2</sup>

Some issues are of particular interest. Our first objective is to study the underpricing phenomenon for European IPOs. Here, we are interested in whether initial returns are time-varying and related to company characteristics. We are also interested in studying the relation between short-run and long-run IPO returns because institutional arrangements in the IPO aftermarket that are unrelated to fundamentals seem to affect the IPO price dynamics. These institutional arrangements include short-selling restrictions (Geczy, Musto and Reed (2002)), the “quiet period” (Bradley, Jordan and Ritter (2002)), aftermarket stabilization through price support (Aggarwal (2002)) and the expiration of the “lock-up” period (Bradley, Jordan, Roten, and Yi, (2001)). Recent studies show that IPO underperformance is a time-varying phenomenon (Gompers and Lerner (2001)) or disappears in sub-sample analysis (Brav and Gompers (1997)). We study how European IPO returns relate to this evidence. Finally, the sample period has also been characterized by unprecedented changes in global economies caused by the increasing role of technology, the effects of which are still subject to intense debate (Gordon (2001)). This has had a dramatic impact on the composition of equity indices in general, and the nature of companies seeking an IPO in particular. We are interested in finding out whether the performance patterns of European IPOs mirror this change.

In this respect we make a number of interesting observations that appear robust across various methodological choices:

- (1) For the sample of 973 European IPOs offered between 1988 and 1998, we find considerable underpricing which is time-varying and related to proxies of uncertainty, such as age or sector. There is a large discrepancy between the mean and median amount of “money left on the table” which is due to the impact of large privatizations.
- (2) For the sample as a whole we do not find long-run underperformance. This is consistent with Gompers and Lerner’s (2001) conjecture that long-run IPO underperformance is a time-varying phenomenon. Over the short-run, there is significant absolute and relative overperformance. This result supports the

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<sup>1</sup> Jenkinson and Ljungqvist (2001) provide a comprehensive coverage of the theory, empirical evidence, international patterns and institutional practices.

<sup>2</sup> Ritter (2002) reports a median age of 14 years for US IPOs in 2002, the oldest for any year between 1980 and 2002, much higher than the median age of seven years reported over the whole 23-year period. This is similar to the median age of 17 years for our sample of European IPOs between 1988 and 1998.

growing literature that addresses the effect of institutional practices on the IPO return dynamics (Duffie, Gârleanu and Pedersen (2002)).

- (3) IPOs offered in “hot” markets, during which the general market is generally rising and which have the highest initial return, are associated with the best absolute and relative IPO performance. IPOs offered in “cold” markets, where underpricing is lower and stock markets are either stable or falling, experience poorer absolute and relative aftermarket performance. For the sample as a whole, this does not necessarily indicate that European IPOs issued in “hot” markets were aggressively priced in order to take advantage of “windows of opportunity”.
- (4) The study emphasizes the significant difference in IPO performance of sub-groups of IPOs (Brav and Gompers (1997)). There is strong evidence to support the fact that aftermarket performance is positively related to underpricing and negatively related to the size of the public float. Moreover, the relatively favourable aftermarket performance throughout the sample period is driven by New Economy IPOs, which account for 28 percent of the sample on average. This can help to explain the dramatic shift in industry composition of IPOs towards New Economy IPOs during the “Internet Bubble” of 1999 and 2000.

The rest of this paper is organized as follows: Section I discusses the empirical anomalies associated with IPOs and surveys some of the main theories that try to explain them. The data, sample and methodology are described in Section II. In Section III, we turn to the examination of initial and aftermarket performance. Here, we also study aftermarket performance when categorized according to issuing characteristics and present regression results. Section IV concludes the chapter and discusses the significance of our findings in order to help to explain recent events.

## I. Patterns in IPOs

### A. Initial Pricing

One observed pattern in IPOs concerns the existence of abnormal initial returns, whereby the first market price is on average significantly higher than the offering price. This adjustment is usually interpreted as evidence of IPO underpricing. Over the years, a large body of literature has documented the underpricing phenomenon (Logue (1973), Ibbotson (1975), Ritter (1984), Ibbotson, Sindelar and Ritter (1988)). In a recent study, Ritter and Welch (2002) find an average first-day return of 18.8 percent when looking at 6,240 US IPOs issued between 1980 and 2001. The underpricing phenomenon has also been documented internationally (Loughran and Ritter (1995)).

A number of papers reviewing the theoretical literature classify the theories of underpricing based on whether the information between issuer, underwriter and different groups of investors is assumed to be symmetric or not. The underwriter plays a particularly crucial role. It performs three main functions: underwriting, advising and distribution. Owing to the potentially conflicting incentives offered by these functions, underwriters may face a trade-off between the costs and benefits of underpricing. On the one hand, for instance, underpricing may lower both the risk that the issue fails as well as the efforts in marketing. On the other hand, since underwriting fees are typically proportional to gross floatation proceeds, and thus negatively related to the degree of underpricing, investment banks should have an incentive to minimize underpricing.

Because of the important role of an investment bank in practice, we divide the theories related to underpricing into two sections on the premise that explanations related to the underpricing phenomenon assume a more passive or active role of the underwriter.<sup>3</sup> It must be noted that many of the underpricing theories are not mutually exclusive.

### *A.1. Theories assuming a passive role of the underwriter*

#### *Winner's Curse*

One model, in which underwriters act primarily as passive agents for the issuing firm, has been developed by Rock (1986). His winner's curse hypothesis explains the underpricing phenomenon in terms of information asymmetry among the different groups of investors, the issuing firm and the underwriter. The information asymmetry arises because an issuer faces an unknown demand for its shares from two types of investors. The first group consists of outside or informed investors who have better knowledge about the prospective cash flow than does the issuing firm and its underwriter for which it incurred a cost. These informed investors will only submit purchase orders if the offering price is less than the true value of the IPO. The second type, uninformed investors, lack special knowledge about firm value. They may participate in the market even though they did not purchase information. Consequently, informed investors will bid for more shares of the more successful firms, which will leave the uninformed investors with a disproportionate amount of the less successful IPOs. In addition, since the allocation is not made on a pro rata basis and over subscription and rationing can occur, the bias against uninformed investors can be even larger if the underwriters favor the informed investors. This information asymmetry may lead to Akerlof's (1970) 'lemons problem', where the uninformed investor ends up primarily with the less successful issues. Underpricing the issue results in compensating uninformed investors for the bias in the allocation mechanism. The model generates a number of empirical predictions. For example, underpricing will be directly proportionate to the ex-ante uncertainty surrounding the issue.

The empirical literature is supportive of the model's predictions in countries where underwriters play a relatively passive role in bringing new issues to market. Koh and Walter (1989), using information on rationing, find that an uninformed strategy in Singapore just about broke even. Keloharju (1993) also finds evidence of a winner's curse in Finland. Ritter (1984) verifies some predictions and finds a monotonous link between underpricing and empirical proxies for uncertainty, such as sales and the daily aftermarket standard deviation of stock returns for the first month in aftermarket trading.

#### *Information Cascades*

In the information cascades or "herding" hypothesis, developed by Welch (1992), it is assumed that, in aggregate, investors hold perfectly accurate information about the issuing firm. However, information concerning the value of the shares is highly uncertain for investors. Furthermore, it is assumed that it takes investment bankers time to approach interested investors because of their limited distribution channels. The hypothesis draws from the notion that potential investors base their investment decisions not only on their own information about the issue, but also on whether or not other investors, who were approached earlier, are purchasing. Thus, subsequent

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<sup>3</sup> The recent literature on IPO underpricing focuses on the institutional aspects of underpricing and the role of the underwriter. In particular, the theory and evidence concerning the allocation of shares has stimulated a large number of papers. See Ritter and Welch (2002) for a literature survey.

investors will view the actions of previous investors as an indication of what information they hold privately. Thus, they will imitate the purchasing decisions of their predecessors. Consequently, an issuer may want to underprice an offering to induce the first few potential investors to buy and induce a cascade in which all subsequent investors want to buy irrespective of their own information. When combining the cascades hypothesis within a setting of a pricing process in which the underwriter dynamically adjusts the IPO price, positively sloped demand curves can result.<sup>4</sup>

Empirical support for the cascades hypothesis is mixed. Barry and Jennings (1992) reject the cascades model in favor of the dynamic information acquisition argument, while in a recent work, Amihud, Hauser and Kirsh (2002) test the theory on a sample of 284 IPOs in the Tel Aviv Stock Exchange between 1989 and 1993 and find evidence consistent with herding. More specifically, they found that investors either subscribed overwhelmingly to new issues, which resulted in very small allocations, or largely abstained from subscribing so that the issue was undersubscribed and subscribers received full allocations, with very few cases in-between.

### *Signaling*

Another line of theoretical literature reverses Rock's assumption regarding informational asymmetry and assumes that the issuer is better informed than investors. Here, underpricing is a means for high quality firms to distinguish themselves from low quality issuers. These studies are motivated by Ibbotson's (1975) conjecture that the issuer may want to "leave a good taste in investors' mouths." In the signaling models, banks are simply assumed to be passive distributors of shares to the general public.

In Allen and Faulhaber (1989), bad managers, who are more likely to run bad firms, are deterred from mimicking good managers who underprice, because subsequent cash flows partially reveal the firm's type. Consequently, their model implies that firms that underprice more are likelier to have higher dividends, and that the market reacts more favourably to dividend announcements by firms that underprice more. In Welch's (1989) model, risk-neutral entrepreneurs sell a fraction of their firm in an unseasoned offering and the remainder in a subsequent seasoned offering. Low-quality firms that mimic high quality firms must pay an exogenously specified operation cost, which the high-quality firms do not incur. In some cases, this cost may be insufficient to deter mimicking, and underpricing becomes the additional wedge that deters low-quality firms in the separating equilibrium. In Grinblatt and Hwang (1989), a firm employs two signals to convey the mean and variance of its future cash flow: the degree of underpricing and the fraction of shares held by insiders. To overcome the asymmetric information problem, the issuer signals the true value of the firm by offering shares at a discount and by retaining some of the shares. In the model's separating equilibrium, a firm's intrinsic value is positively related to underpricing. This model is a generalization of Leland and Pyle's (1977) signaling hypothesis which suggests that, by retaining a significant ownership stake in the firm, entrepreneurs can signal project quality as false representation can be costly. The hypothesis therefore predicts relatively superior performance of IPO firms with high entrepreneurial ownership.

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<sup>4</sup> Similar dynamics can be applied when a cut in the offer price may actually scare away potential investors. See Financial Times (June 26, 2002) for the dynamics leading to the postponement and eventual cancellation of the IPO of Prada SpA, and CBS Marketwatch.com (July 2, 2002), describing the circumstances surrounding the IPO of CIT Group Inc., an insurance company and Tyco International Inc. spin-off, which offered shares at \$23 against an expected range of \$25 to \$29 and closed at \$22 after the first day of trading in an adverse company and market environment.

The empirical support for the signaling models of underpricing is mixed. Michaely and Shaw (1994) find no support for signaling. They find no evidence of either a higher propensity to pay dividends for IPOs that were more underpriced or of a higher propensity to return to the market for a seasoned equity offering. The insider holding variable has no significant power to explain initial returns and there is no evidence to suggest that insider holdings provide a credible signal of firm quality that reduces uncertainty and, therefore, initial underpricing. Neither the initial-day return nor the fraction held by insiders seems to explain the value of the firm two years after going public. Jegadeesh, Weinstein and Welch (1993) find that returns after the first day are just as effective in inducing future issuing activity as the first-day returns are. While providing evidence suggesting a positive relation between managerial ownership retention and post-IPO operating performance, Jain and Kini (1994) find no support that firms that underprice more produce superior operating performance after the IPO.

### *Legal Liability*

A further line of research does not rely on asymmetric information that is resolved on the first day of trading. Ibbotson (1975) and Tinic (1988) have suggested that the issuing firm may underprice to reduce the legal liability arising from any false or inadequate information in the prospectuses.

Drake and Vetsuypens (1992), however, call such a conclusion into question. By examining a sample of 93 US firms from 1969 to 1990 that are sued after their IPO, they find that the average initial return for the sample firms is approximately the same as that for a control group of IPOs of similar size. They also present evidence that litigation typically results from some unfavourable company-specific news in the aftermarket and not from IPO overpricing on the first trading day. Keloharju (1993) argues that, given the paucity of legal liabilities associated with the process of going public in Finland, it is unlikely that potential legal liability has much to do with the observed initial returns.<sup>5</sup>

## *A.2. Theories assuming an active role of the underwriter*

### *Underwriter Reputation*

While their focus was on signaling firm quality through underpricing, Allen and Faulhaber (1989) and Welch (1989) had already noted that signaling could also be accomplished through the choice of underwriter.

Carter and Manaster (1990) uncovered that high-quality underwriters are typically associated with less underpricing. Findings in Beatty and Welch (1996) and Cooney, Singh, Carter and Dark (2001) document, however, that the relationship between underwriter reputation and underpricing has changed over time, casting doubt on the theory. Loughran and Ritter (2001) report that unlike the 1980s, IPOs that are managed by high-prestige underwriters during the internet boom in the late 1990s are associated with more underpricing than IPOs managed by less prestigious underwriters.

### *Underwriter Price support*

Ruud (1993) challenges the conventional view that positive average initial IPO returns result from deliberate underpricing. By investigating the distribution of initial

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<sup>5</sup> Chalmers, Dann and Harford (2002) analyze a sample of 72 US IPOs between 1992 and 1996 and investigate the amount and cost of D&O liability insurance. They find a significant negative relation between the three-year post-IPO stock price performance and the insurance coverage purchased in conjunction with the IPO.

returns of 469 IPOs in 1982 and 1983, she shows that positive mean initial returns result from a partially censored left (negative) tail. She argues that underwriter price support or stabilization can account for this censoring of the distribution of initial returns because in the US regulatory framework, the practice is not considered manipulative as long as it is disclosed in the offering prospectus. The theory predicts that a large percentage of stocks should experience positive initial and short-run abnormal aftermarket returns. More specifically, because underwriters remove price support over time, prices of fully priced or just-underpriced IPOs are more likely to fall than to rise over the short-term.<sup>6</sup>

Miller and Reilly (1987) examine the returns and spread behaviour of IPOs over the first five days of trading and find that the relation of the spread and its determinants differs between overpriced and underpriced issues only on the first trading day. For a sample of 1,523 NASDAQ IPOs issued between 1982 and 1987, Hanley, Kumar and Seguin (1993) find evidence suggesting that stabilization significantly affects quoted spreads. Moreover, significant negative returns are documented after the termination of stabilization.

#### *Dynamic Information Acquisition*

The dynamic information acquisition argument - also referred to as bookbuilding theory or information-gathering theory (Beneviste and Spindt (1989), Beneviste and Wilhelm (1990) and Spatt and Srivastava (1991)) - studies the process whereby the offer price is set and its effect on underpricing. The assumed pricing mechanism is the bookbuilding process, whereby, after setting a preliminary offer price range, the underwriter and issuer solicit "indications of interest" from prospective investors during the "road show", where the company is marketed to selected, typically institutional investors. Through bookbuilding, investment banks extract information about the true value from investors.<sup>7</sup> The investors natural inclination to bid lower during the marketing phase entails a trade-off: while it increases the potential profit from selling the IPO in the immediate aftermarket, assuming shares have been allocated at the offering price, it also jeopardizes the probability and size of their allocations. In order to induce investors to reveal that they want to purchase shares at a high price, the investment banker must offer them a combination of underpricing and share allocations in return.

There is strong empirical support for the bookbuilding theory of underpricing. Hanley (1993) documents that the relation of the final offer price to the range of anticipated offer prices disclosed in the preliminary prospectus, is a good predictor of initial returns. Having documented evidence for the partial adjustment phenomenon for a sample of 1,430 US IPOs from January through September 1987, she finds that issuers that have final offer prices exceeding the limits of the offer range have greater underpricing than all other IPOs, and are also more likely to increase the number of shares issued. The final offer price only "partially adjusts" to new information. Using a unique dataset from 39 international equity issues that used bookbuilding between 1995 and 1997, Cornelli and Goldreich (2001) find that the investment banker awards more shares to bidders who provide information in their bids or to those who bid regularly.

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<sup>6</sup> Aggarwal (2000) provides a detailed account of the mechanics of stabilization in the aftermarket.

<sup>7</sup> In a more general context, Jenkinson, Ljungqvist, and Wilhelm (2000) use a dataset of 2,051 IPOs in 61 non-US markets during the period 1992-1999 and find that bookbuilding - while costing around twice as much as the fixed costs offering - leads to substantially less underpricing.

### *Investment Banker's Monopsony Power*

Baron (1982) offers an agency-based explanation for underpricing. His theory assumes that the value of a new issue is affected by market demand and by the investment banker's selling effort. In the model, the investment banker is better informed about market demand than the issuer, but his distribution effort is unobservable. To address this moral hazard, the optimal contract sets the issue's offering price below its "true value", defined as the equilibrium offering price when the investment banker expends his best effort.

Some empirical evidence of self-underwritten IPOs refutes this theory. Muscarella and Vetsuypens (1989) find that when underwriters themselves go public, their shares are just as underpriced, even though there is no monitoring problem.

Loughran and Ritter (2002) argue that agency problems between underwriters and issuing firms, largely latent in the 1980s, have become increasingly important and are partly responsible for the high initial returns of Internet stocks during the late 1990s. They postulate that higher valuations have resulted in issuers being more complacent about "leaving money on the table". In this context, they apply Prospect Theory, developed by Kahneman and Tversky (1979), to the IPO market. Here, individuals often violate Bayes' Rule and rational choice theories when making decisions under uncertainty in experimental settings. Loughran and Ritter (2002) predict that in most situations issuers will sum the wealth loss from underpricing with the larger wealth gain on the retained shares from a price jump, producing a net increase in wealth for pre-issue shareholders. They empirically show that most of the money left on the table comes from a minority of IPOs. In the cross-section, the IPOs that were underpriced most were those where the offer price was revised upwards from what had been anticipated at the time of filing the initial price range. This observation is consistent with the dynamic information acquisition theory of Beneviste and Spindt (1989) and the empirical documentation of the partial adjustment phenomenon by Hanley (1993). It is also in line with Habib and Ljungqvist (2001) who argue that the opportunity cost of underpricing is less if the relative float is small. The complacency about underpricing, combined with the desire of underwriters to leave money on the table so as to receive indirect compensation from buy-side clients that were favoured in IPO allocations, resulted in even greater underpricing during the boom in Internet stocks during the late 1990s.<sup>8</sup>

This conjecture is similar to Shiller's (1990) "Impresario" hypothesis of underpricing, whereby underwriters choose a lower offering price because they know that the cumulative profit of underpricing (through less transparent forms of revenue streams such as brokerage commissions) will be higher than maximizing revenue for the single event (compensation in the form of the gross underwriter spread).<sup>9</sup>

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<sup>8</sup> For a related article see, Wall Street Journal Europe (Mai 05, 2002): eToys Sues Goldman Sachs Over Management of Its IPO. "...The relatively low price set for the IPO, the suit alleges, robbed eToys of hundreds of millions of dollars of cash that could have helped the company to stave off bankruptcy. The shares nearly quadrupled in the price on their first day of trading. The suit charged Goldman induced some investors to agree to give the firm a portion of the profits they later made on eToys shares in exchange for getting IPO stock allocation ..."

<sup>9</sup> On January 22, 2002, Credit Suisse First Boston (CSFB), an investment bank, agreed to settle a \$100 million with the Securities and Exchange Commission (SEC), the US regulatory agency, based on the following allegations: "... From at least April 1999 through June 2000, CSFB employees allocated shares of IPOs to over 100 customers who were willing to funnel between 33 and 65 percent of their IPO profits to CSFB. The profits were channeled to CSFB in the form of excessive brokerage commissions generated by the customers in unrelated securities trades that the customers effected solely to satisfy CSFB's demands for a share of the IPO profits..." (Source: SEC Litigation Release No. 17327). Ritter and Welch



## *B. Cycles in IPO activity*

Another anomaly associated with IPOs is the “hot issue” phenomenon, whereby the observed issuing activity exhibits significant, recurrent, and to some extent predictable variations over time. Ibbotson and Jaffe (1975) were among the first to identify significant autocorrelation in both the monthly number of IPOs and the monthly average underpricing of IPOs. Ritter (1984) studies initial returns for US IPOs between 1960 and 1982 and finds highly significant autocorrelation in monthly average initial returns and in monthly IPO volume. He also observes that periods of high volume tend to follow periods of high average initial returns. In the cross-section of the data, he identifies a 15-month period during which the average initial return was 48.4 percent, as contrasted with an average initial return of 16.3 percent for the rest of the period. This “hot” IPO market is also concentrated in a certain class of industries and a certain group of underwriters. In a recent study, Lowry and Schwert (2002) find an autocorrelation coefficient of monthly average first-day returns of 0.60 between 1960 and 1997, which increased during the Internet boom in the late 1990s. They confirm a significant positive relation between initial returns and future IPO volume and note that, “increased numbers of companies go public after observing that IPOs are being underpriced by the greatest amount.” They associate the cycles in initial returns with the investment bankers’ learning process. Because the registration periods of many IPOs overlap, the information that underwriters learn during one firm’s registration period will contribute to the first-day returns of many IPOs.

The prospect theory explanation of the partial adjustment phenomenon addresses the phenomenon of “hot issue” markets in a similar fashion (Loughran and Ritter (2001)). It predicts that all IPOs that are in the “road show” stage of going public when there is an overall market rally, will have higher expected underpricing because offer prices are not raised as much as they could be. Because of the length of the bookbuilding period, which can take from four weeks to four months, the first day returns of these IPOs will be correlated.

Shiller’s (1990) “Impresario” hypothesis can also explain the positive autocorrelation in IPO activity and initial returns reported in the literature. “Hot” markets appear when underwriters exploit a segment sought to be ripe for a “fad”. Even though many investors may be unwilling to follow a “fad”, they may find it profitable to follow positive feedback investment strategies (Rajan and Servaes (1993)). Acting this way, they may actually have caused the positive autocorrelation themselves. In the more general setting of “fads” described by Aggarwal and Rivoli (1990), “fads” occur in “hot issue” periods when investors are especially overoptimistic about the growth potential of the firms that go public, induced by the “Impresario”, the investment bank taking the company public. Firms time their IPOs in precisely these periods in order to take advantage of “windows of opportunity”. It follows that “hot” markets for IPOs should be concentrated in certain industry classes, dominated by specific underwriters and that IPO activity should come from those companies for which issuing equity is always the least favoured choice of financing. Moreover, companies with the largest initial returns should have the lowest subsequent aftermarket returns.

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(2002) calculate that the practice of funneling back IPO profits through excessive trading may have accounted for up to 250 million shares per trading day during 1999 to 2000.

### *C. Return Dynamics in Aftermarket Trading*

Most of the literature on aftermarket performance concentrates on how IPO shares perform over three- to five years. Over those time horizons, IPO shares seem, on average, to perform poorly when measured against various benchmarks. Ritter (1991) finds that every dollar invested in a portfolio of IPOs purchased at the closing market price on the end of the first day of trading results in a terminal wealth of \$1.3447 over three years, while every dollar in the matching firm results in \$1.6168, a ratio of only 0.841 during the same period. He performs the study for a total sample of 1,526 US IPOs of common stock in 1975-84. The international evidence also supports the notion of poor long-run performance. Álvarez and Gonzáles (2001), Espenlaub, Gregory and Tonks (1998), Giudici and Paleari (1999), Leleux and Muzyka (1998) or Schuster (1996) all highlight low market-adjusted long-run returns for various European IPO markets. Jain and Kini (1994) extend this evidence to show that long-run performance is also accompanied by poor financial accounting performance post-IPO relative to pre-IPO performance. However, because there has been a sustained effort to extend empirical evidence on IPO performance beyond the past two decades, it has become apparent that the results on long-run performance are sensitive to the time-period chosen. In a large out-of-sample test, Gompers and Lerner (2001) study the five-year aftermarket performance of a sample of 3,661 US IPOs from 1935 to 1972 and find that the long-run performance of IPOs depends considerably on the method used for calculating returns and performance. The authors conclude, "...While the results do not rule out the possibility of more broad-based sentiment-driven mispricing, they provide little support of a distinct IPO effect."

Another facet that has attracted much academic interest addresses the relation between short- and long-run IPO returns. One of the first to document the dynamics in aftermarket trading was Stoll and Curley (1970). They found that investors in new small issues floated under Regulation A in 1957, 1959, and 1963, experienced lower long-run rates of return than if they had invested in a portfolio of large stocks represented by the Standard & Poor's 425 Industrial Average. However, short-run price appreciation of the 643 companies in the sample was considerably greater than the appreciation of large-cap stocks. Considerable short-run overperformance is also reported in Ritter (1991) and Schuster (1996).

It is difficult to explain these price dynamics in the IPO aftermarket within a semi-rational setting. Miller (1977) proposes a theory that is consistent with the empirical findings. Assuming the presence of short-selling constraints and heterogeneous investors' expectations, he argues that the prices of new issues are set not by the appraisal of the typical investor, but by the small minority who think highly enough of the investment merits of the new issue to include it in their portfolio. This "divergence of opinion" about a new issue is greatest when the stock is issued, either because the company has not yet started operations, or because there is uncertainty about the success of new products or the profitability of a major business expansion.

As a result, short-sale constraints lead to upward biases in stock prices, as pessimistic investors are restricted from short-selling. Over time, as the variance of opinion decreases and the company acquires a history of earnings, the marginal investor's valuation will converge towards the mean valuation and IPOs will start to underperform. Duffie, Gârleanu and Pedersen (2002) present a dynamic model of the determination of prices, lending fees and short interest that is consistent with this theory. They show that, if lendable securities are difficult to locate, then the price of the security is initially elevated and expected to decline over time. This decline increases in

the degree of heterogeneity of beliefs of investors about the future value of the security. Harrison and Kreps (1978), Morris (1996) and Scheinkman and Xiong (2002) show that short-selling constraints can lead to prices higher than the valuations of all investors. Empirically, Gecy, Musto and Reed (2001) find an extra cost to shorting hotter IPOs.

A number of other institutional arrangements in the short-run aftermarket, unrelated to fundamentals, have an effect on prices. For example, some recent studies examine the expiration of IPO lockup agreements. Lockup agreements are a feature of US and IPOs in international markets and prohibit insider sales before a pre-specified date, usually 180 calendar days after the IPO. Since insiders often own a majority of the firm, the potential for an increase in the supply of tradable shares following lockup expiration could have a significant effect on the value of the stock. Bradley, Jordan, Roten, and Yi (2001), Brav and Gompers (2002) and Field and Hanka (2001) document significant negative abnormal returns of approximately two percent around lockup expiration. Moreover, Bradley, Jordan and Ritter (2002) investigate the performance of IPOs around the expiration of the “quiet period” – typically the first 25 calendar days in aftermarket trading when a company is still “in registration” and subject to a number of regulatory restrictions that prohibit certain activities, such as analyst coverage.

Using a sample of 1,611 firms going public over the period 1996 to 2000, they find that firms, for which coverage is initiated, experience a significantly positive abnormal return of 4.1 percent in a five-day period surrounding the end of the “quiet period”. This compares to an insignificant 0.1 percent for firms that do not have coverage initiated. Most of these abnormal returns experienced by firms with coverage occur in the days before the quiet period expires.

Furthermore, Aggarwal (2000) pays attention to the stabilization activities of underwriters in the aftermarket and their influence on prices by studying a sample of 137 US IPOs going public during May and July 1997. She finds that direct intervention or “pure” stabilization, in which an identified stabilizing bid is posted, is never done, and that aftermarket short-covering, which has the same result as pure stabilization, but has no disclosure requirements, is the principal form of stabilization. Stabilization by short-covering can occur because the underwriter initially sells shares in excess of the original amount offered, which is then covered by exercising the overallocation option and/or by short covering in the aftermarket during 30 calendar days after the offering. She also finds that stabilization seems to have a permanent rather than a temporary effect on prices, a similar observation made by Schultz and Zaman (1994).

Several behavioural explanations have also been advanced for the empirical findings. Teoh, Welch and Wong (1998) relate the analysis of IPO performance to earnings management and find that investors do not fully take into consideration that financial accounts of companies going public are managed before the IPO, and therefore base their valuation on a naïve extrapolation of the past. They use discretionary current accruals as a proxy for earnings management and show that companies, which boost their earnings most in the IPO year, also have the worst long-run performance. Ritter (1991), Lerner (1994), Loughran and Ritter (1995, 2001) or Baker and Wurgler (2000) discuss another set of behavioural explanations for poor long-run performance. They suggest that stock prices periodically diverge from fundamental values, and that managers and investment bankers take advantage of overpricing by selling stock to overly optimistic investors. This is in line with De Bondt and Thaler’s (1985) conjecture that, at least for low-capitalization stocks, there is a negative relation between past and subsequent abnormal returns on individual securities using holding periods of one year or more which they interpret as evidence of market overreaction.

## II. Data, Sample and Methodology

### A. Data

In order to be included in the sample, the relevant companies pursuing an IPO had to meet the following criteria: (1) the company's main headquarter is registered in Germany, France, Italy, The Netherlands, Spain, Sweden or Switzerland with the obligation to publish consolidated and/or parent company accounts, (2) the company is listed on one of the three tiers of the main stock exchange in the respective country: the Official Market, the Official Parallel Market or the New Market, and meets the relevant listing requirements, (3) each share is given an offer price of 5.00 units of national currency or more, (4) gross proceeds, measured in terms of end-1998 purchasing power, of the equivalent of Euro (€) 2.0 million or more, and (5) the offering being unseasoned and involved common and/or preferred stock.<sup>10</sup> While the sample includes Privatizations (13), spin-offs and equity-carve outs (26), we have excluded foreign listings, Real Estate Investment Trusts (REITs), investment trust and certificates, demutualizations and companies that transferred from one market segment to another.<sup>11</sup>

The data was hand-collected individually from each of the respective country. It is unique in its entirety as it spans over a relatively long period of time covering at least one market cycle of IPO activity in the seven largest European countries ranked in terms of market capitalization, excluding the UK, and is not commercially available.<sup>12</sup> The data collection process involved a two-stage process:

First, in order to insure a most complete sample, we identified the IPOs by collecting information from the individual stock exchanges, national publications in the respective country or other sources such as regulatory agencies, central banks, commercial providers and, if necessary, by directly contacting the issuing company. This step included the search for full name of the offering company, nationality, IPO date and place of the offering, total number of shares issued, public float adjusted for overallocation options exercised, issue price, sector and year of foundation. We did not collect data for issuing activity in the secondary market.<sup>13</sup> For Germany, information provided by the Frankfurt Stock Exchange and the various yearly issues of the *Saling Aktienführer* were primary data sources of company data.<sup>14</sup> Data on French issuers and issuing characteristics was obtained from the annual lists published by Euronext France and *Sociétés cotées*, 1996 and 1999 edition, Cofisem. Italian IPO data came from *Indici e Dati*, 1992 and 1999 edition, Mediobanca and from the Italian Stock Exchange. Euronext Netherlands and *Effectengids*, 2000 edition, Kluwer, were the primary source for data on Dutch IPOs. Spanish IPO company data was obtained from the Madrid Official Stock Exchange Bulletins and from CNMV, the Spanish regulating agency. Swedish data is from annual reports of the OM Stockholm Exchanges and from Six AB.

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<sup>10</sup> The large number of IPOs issuing dual-class shares is a relatively unique feature of the Swedish IPO market. For Germany, for example, only seven companies issued dual-class shares during the sample period 1988 to 1998.

<sup>11</sup> For empirical evidence relating to privatizations or equity carve-outs, see D'Souza and Megginson (1999) or Vijh (1999).

<sup>12</sup> Capitaldata, a division of Euromoney PLC, is a commercial provider of IPO information. For the period 1988 to 1998, their IPO database includes around 550 companies, almost half of our database. This commercially available data includes only limited cross-sectional IPO characteristics.

<sup>13</sup> A large number of empirical studies link seasoned issuing activity with IPO performance. For European markets see, for example, Espenlaub and Tonks (1998) or Stehle, Erhardt and Przyborowsky (1998).

<sup>14</sup> We want to thank Hoppenstedt Finanzinformationen GmbH, for allowing access to their archives.

The Swiss Stock Exchange and Swiss Central Bank were sources of the data for the sample of Swiss IPOs.<sup>15</sup>

Second, we collected daily closing stock prices from the national stock market operators, academic institutions and, if necessary, commercial services. Sources of the German stock price data included the University of Karlsruhe Stock Price Database, the Frankfurt Stock Exchange and daily issues of the *Frankfurter Allgemeine Zeitung*. French, Italian and Spanish Stock Price data was made available by Euronext Paris and the Italian and Madrid Stock Exchange, respectively. Data on Swedish stock returns was obtained from Six AB. Dutch and Swiss stock price data was collected from Datastream. We used Dow Jones for the time-series data for the four size-based benchmark indices. Macroeconomic data such as Exchange rates and GDP deflators was collected from Datastream. Stock prices are adjusted for dividends, stock splits or rights offerings and were calibrated to a European trading day calendar and converted into Euro (€). Share prices represent closing prices and care was taken that quotations represented actual trades. For our sector analysis, we use the Dow Jones STOXX global sector classification standard.<sup>16</sup>

The resulting IPO sample is comprised of 973 companies that conducted an IPO of common and/or preferred stock between 1988 and 1998 on one of the three main market segments of the main national stock exchange operators in Germany (219 companies), France (323), Italy (77), The Netherlands (75), Spain (88), Sweden (148) and Switzerland (43).<sup>17</sup> Based on our original stock exchange records, this represents at least 90 percent of IPO activity in Continental Europe between 1988 and 1998, measured in terms of number of IPOs and aggregate gross proceeds. The sample does not suffer from survivorship bias. Only seven companies were delisted before their third-year anniversary. In this section, we look at IPOs issued over the period 1988 to 1998 using stock returns through February 23, 2001. This implies a declining sample size of 686 companies when measuring returns over three years and 381 companies when measuring returns over a five-year window.<sup>18</sup>

## *B. Sample*

In Table I, we provide some summary statistics for our sample.<sup>19</sup> While presenting evidence for the sample as a whole, we also divide IPOs based on whether they were

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<sup>15</sup> Prof. Alfred Mettler kindly supplied fundamental data on Swiss IPOs issued between 1988 and 1990.

<sup>16</sup> The Dow Jones STOXX global industry classification standard is displayed in the Appendix, Table AI.

<sup>17</sup> The market segments are (Number of IPOs in brackets): Germany (Deutsche Börse AG: Amtlicher Handel (80), Geregelter Markt (89), Neuer Markt (50)); France (SBF-Paris Bourse SA\*: Premier Marché (21), Second Marché (231), Nouveau Marché (71)); Italy (Borsa Italiana SpA: Borsa Valori (70) Mercato Ristretto (7)); The Netherlands (Amsterdam Exchanges NV\*: Officiële Markt, (56) Officiële Parallel Markt (8)); Spain (Bolsa de Madrid SA: Primer Mercado (56), Segundo Mercado (32)); Sweden (OM Stockholm Exchanges AB: A-list (15), OTC-list (52), O-list (81)); and Switzerland (SWX Swiss Exchange AG: SWX Hauptsegment, (35) SWX Nebensegment (8)). \*Merged to Euronext SA.

<sup>18</sup> While not reported separately here, we also calculate results with constant sample sizes of 686 and 381 IPOs, respectively. The results confirm that changes in measurement periods and sample sizes do not change the qualitative nature of the findings presented here.

<sup>19</sup> The sample differs from US studies in some important respects. Our sample period does not overlap with Ritter (1991) who looks at IPOs from 1971 to 1988. Neither does it completely overlap with Brav and Gompers (1997) who study 3,407 nonventure-backed and 934 venture-backed US IPOs between 1975 and 1992. Moreover, while Ritter (1991) and Brav and Gompers (1997) focus on reporting long-run returns over three and five years, we present evidence on the dynamics of short- and long-run performance over a variety of dimensions.

**Table I**  
**Market Conditions and Sample Characteristics**

The sample is comprised of 973 European IPOs. Average Age is defined as the year of going public minus the year of foundation, with firms founded before 1901 assumed to be founded in 1901. New Economy firms (as a percentage of total number of issues) belong to market sectors 5,13,16 and 17 representing Technology, Media, Telecommunication and Healthcare, respectively, in the attached Dow Jones STOXX global sector classification standard. Public Float is the percentage of equity offered. Initial Return is defined as the percentage difference between the final offer price and the first-day closing price. Market measures stock market momentum using the value-weighted Dow Jones STOXX broad-market index, excluding the UK. Size is the total number of shares issued times the final offer price and is expressed in constant end-1998 prices using monthly national consumer price indices. Issuing Volume is defined as the total number of shares issued multiplied by the final offer price and expressed in constant end-1998 prices. For the measurement of inflation-adjusted size and issuing volume, amounts in national currency were converted using the appropriate € exchange rate at the IPO date. The monthly distribution of European IPOs is as follows: Month of January (25 IPOs), February (30), March (59), April (65), May (95), June (184), July (131), August (25), September (57), October (107), November (98) and December (97).

IPO Market	Duration	Months	Number	Offerings	Age	Average		Public	Initial Returns		Market	Size		Issuing Volume	
						Years <sup>20</sup>	Years		Percent	Mean		Median	Percent	Change	Percent
Cold Market	Jan-88 - Aug-88	8	41	8	26	27	36	7.08	4.00	18.66	78.45	2,425.1	59.15	24.74	
Cold Market	Apr-90 - Sep-93	42	127	40	40	10	31	6.13	1.70	8.52	108.97	12,078.6	95.11	35.29	
Cold Market	May-94 - Mar-96	23	148	34	34	20	35	8.25	3.80	12.57	85.56	26,700.0	180.41	26.82	
All Cold Markets		73	316	35	35	17	34	7.25	2.65		90.32	41,203.7	130.39	30.14	
Hot Market	Sep-88 - Mar-90	19	130	35	35	18	31	17.66	10.00	41.94	105.57	12,708.2	97.76	27.09	
Hot Market	Oct-93 - Apr-94	7	31	30	30	35	31	24.49	20.90	13.12	73.28	6,505.8	209.86	22.44	
Hot Market	Apr-96 - Dec-98	33	496	21	21	37	34	21.64	9.00	92.46	60.32	63,219.0	127.46	16.52	
All Hot Markets		59	657	24	24	33	33	20.98	9.52		66.24	82,433.0	125.47	18.33	
All 973 issues	Jan-88 - Dec-98	132	973	28	28	28	33	16.52	7.14	347.97	73.93	123,636.8	127.07	22.02	

<sup>20</sup> The median age for the sample of European IPOs is 17 years.

issued in “hot” or “cold” markets. Because of big fluctuations in the level of the stock market and IPO activity throughout the sample period, this potentially enables us to draw more inferences about the robustness of the patterns associated with IPOs.

The most frequently used definition of “hot” IPO markets is based on “volume”. Loughran and Ritter (1995), for example, describe the 1980s as “hot” because most of that decade had much higher issuance volume than the 1970s. Helwege and Liang (2001) define “hot” and “cold” months according to volume of issuance, based on a three-month centred moving average of the number of IPOs for each month in the sample. Similar to Ritter (1984) and Ibbotson and Jaffe (1975), we define “hot” IPO markets based on the level of underpricing.<sup>21</sup> We also include a proxy for the general level of the stock market into the analysis. Initially, we define those months with higher average monthly underpricing compared to median underpricing for the total sample as “hot” IPO months; we consider those months during which the mean is lower than the median as “cold” IPO months. We apply the same procedure to our proxy for market returns. Months during which the market return exceeds the median for the monthly series of 132 months (January 1988 – December 1998), are defined as “hot” market months. Likewise, months during which the market return is less than the median are considered “cold” months. Finally, we match “hot” (“cold”) IPO months with “hot” (“cold”) market months to identify “hot” and “cold” IPO markets. During 118 months, (89 percent of the entire period), a “hot” (“cold”) IPO month corresponds to a “hot” (“cold”) market month. During 14 months, a “hot” (“cold”) IPO month does not correspond to a “hot” (“cold”) market months. We attribute part of this to seasonalities in the underwriting industry. The overall pattern confirms our earlier conjecture about the close link between the level of the stock market and underpricing.

Of the 132 months, we identify 73 months as “cold” markets and 59 months as “hot” markets and mark three individual “hot” and “cold” market periods. In more than half of the 132 issuing months, the general market was either stable or falling. For example, the longest “cold” market period occurred between April 1990 and September 1993. During this period, only 127 IPOs went public, averaging 6.13 percent initial return. This period was characterized by subdued economic conditions in Continental Europe following the German Unification. During the 42-month period, the Dow Jones STOXX broad-market index recorded a rise of 8.52 percent. Conversely, during the 33-month “hot” market period between April 1996 and December 1998, 496 IPOs went public with an average initial return of 21.64 percent. During this period, the general level of the market rose by 92.46 percent. Interestingly, the Asian and Russian Financial Crises in the autumn of 1998 did not have an impact on European IPO activity.

Between 1988 and 1998, 973 European companies raised a total of €123.6 billion on the stock market. Ritter (2001) reports that during the same period, 3,872 IPOs raised a total of \$237.9 billion in the US. The average issuing volume of European IPOs of €127.1 million, however, is higher than the one reported for the US (\$61.4 million). Some large offerings such as privatizations (13) and equity carveouts (26) account for part of the difference. For example, privatizations raised a total of €44.4 billion with a median issuing volume of €2.6 billion. On average, European companies going public have sold 33 percent of their company to the public (henceforth “public float”), which remained stable throughout the sample period. This observation is within the close range of 30 percent and 36 percent reported by Ritter (2001) for US IPOs issued between 1992 and 1998. Moreover, the average European IPO was 28 years old at the

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<sup>21</sup> Because of the presence of some very large IPOs, defining “hot” and “cold” markets by volume does potentially lead to misleading results.

time of going public. While the average age of European IPOs has declined throughout the sample period, it is still high compared to companies going public in the US. Ritter (1991), for example, finds an average age of six years. As shown in the Appendix, Table AI, European IPOs are clearly widespread among the various industries. This is different to Helwege and Liang (2001) who study 2,072 US IPOs between 1982 and 1993 and point out that US IPOs during this period are drawn largely from the same set of high-technology industries.

Table I shows that the sample composition is clustered in certain industries: in “cold” markets, the percentage of New Economy companies of total IPO activity is almost half of what is observed for IPOs issued under “hot” markets. Moreover, the average size of European IPOs in “cold” markets is €90.3 million compared to €66.2 million in “hot” markets. This reinforces the fact that IPO activity in “cold” markets, during which the stock market is generally more stable or declining, is associated with larger and more mature IPOs in Old Economy industries. Table I also demonstrates the changing composition of IPO issuers. It indicates that during the 1990s, New Economy sectors have gradually taken a bigger share of the total IPO market. During this time IPO age, size and median issuing volume has also declined considerably. This highlights the fact that money, previously flowing into mature industries with lower growth prospects, had started to flow into young, technology-oriented companies focusing on growth.

### *C. Methodology*

While the estimation of initial returns is less problematic, there are several factors that must be taken into account when estimating abnormal returns over longer time horizons. Barber and Lyon (1997) and Kothari and Warner (1997) both highlight the problems associated with calculating long-run abnormal returns using either a reference portfolio or an asset pricing model.

Barber and Lyon (1997) demonstrate that many of the commonly used matching procedures are poorly specified and abnormal return estimates can be systematically nonzero. They also show that seemingly minor changes in experimental features can have a major impact on the results. These include the benchmark for measuring abnormal returns, cumulating procedures or the populations from which securities are drawn.<sup>22</sup> In this context, they isolate one parametric procedure that may be well-specified, specifically to calculate abnormal returns as the buy-and-hold returns on a sample firm less the buy-and-hold return on a control firm with similar size and book-to-market characteristics.<sup>23</sup> The authors also suggest a rebalancing bias that arises because the compounded returns of a reference portfolio, such as an equally weighted market index, are usually calculated assuming periodic rebalancing, whereas the returns of sample firms are compounded without rebalancing. Furthermore, they also point out that a new listing bias arises when an IPO firm, which is known to perform badly following an IPO, is added to an index which will cause the index to underperform.

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<sup>22</sup> In context of European Markets, Dimson and Marsh (1986), report the importance of controlling for the size effect in the United Kingdom. Moreover, Brav and Gompers (1997) find that most institutional investors will not be significantly hurt by investing in IPOs because they usually do not buy the small issues that underperform most.

<sup>23</sup> For the European market, this is difficult because of the relative infancy of many of the stock markets in the study, with few comparable quoted firms and benchmarks available over a long period of time. The use of the Eurostoxx value-weighted size indices as benchmarks may also induce biases that result from the fact that these market indices are value-weighted.



Kothari and Warner (1997) also show that long-horizon tests are misspecified. They find that parametric long-horizon tests will often indicate abnormal performance when none is present and suggest that bootstrap procedures might be a promising way to minimize test statistic misspecification. Moreover, they suggest a survivorship bias, which occurs when the de-listed firms are simply removed and the index is rebalanced. This bias tends to cause the index to outperform a portfolio that includes delisted firms.

It must be noted that the inferences drawn by these authors can themselves be sensitive to experimental design. Both Barber and Lyon (1997) and Kothari and Warner (1997), for example, focus on measuring portfolio long-horizon performance in event time, rather than calendar time. As Fama (1998) points out, event time results may be misleading about the pervasiveness of performance because any verification of an observed puzzle may only reflect investor sentiment. Moreover, as noted in Shleifer and Summers (1990), many trading strategies are based on pseudo-signals, noise, and popular models are correlated, leading to aggregate demand shifts. Consequently, to the degree that the design of the empirical experiment has an impact on the confidence of the reliability of inferences from long-horizon studies, the interpretation of the results on the performance of European IPOs requires caution.

For the evaluation of aftermarket IPO returns, our approach is similar to the empirical methodology in Ritter (1991). Consequently, we show results using BHARs, when reporting long-term abnormal performance of IPOs. This procedure assumes no monthly portfolio rebalancing.<sup>24</sup>

However, we extend the performance analysis across several dimensions for the European market. Because we are interested in the dynamics of aftermarket performance, we report aftermarket returns over various holding periods. Furthermore, we also determine how the aftermarket performance of European IPOs issued in “hot” and “cold” markets differs. Finally, we are also interested in whether issuing characteristics are related to these performance dynamics and time-varying market conditions. We calculate equally-weighted raw- and benchmark-adjusted returns over 1, 3, 12, 36 and 60 months, whereas one month is defined as a consecutive 21-day-trading interval after the close of the first day of trading. In order to eliminate the effect of national holidays, stock prices for the national countries were first calibrated to a European trading day calendar. Returns were then calculated whenever at least one of the seven markets covered in this study was trading. If the IPO was delisted before the end of the measurement period, we computed the return until the delisting date. Aftermarket returns are compared with four alternative size-based benchmarks, all of which are value-weighted: (1) The Dow Jones STOXX broad-market index, excluding UK, which captures the free-float adjusted market capitalization of around 95 percent of the market capitalization of the countries in our sample, includes 404 European companies and is similar in terms of industry composition to the IPO sample, (2) the Dow Jones STOXX large-cap index, excluding UK companies, (3) the Dow Jones STOXX mid-cap index, excluding UK companies, and (4) the Dow Jones STOXX

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<sup>24</sup> We have also calculated performance using Cumulative Average Returns (CARs). While not shown separately in this section, we report the results in the Appendix, Table AIII and Figure AI, respectively. The results on monthly portfolio rebalancing confirm that the use of BHRs biases the long-run performance upwards, a finding consistent with the literature (see, for example, Ritter (1991) or Teoh, Welch and Wong (1998)).

**Table II**  
**Initial Returns of European IPOs**

Descriptive statistics for the initial return performance of European IPOs (1988-1998) under alternative market conditions and categorized according to age, sector, size, public float (%), and average daily standard deviation (S.D.) for the first 21 days of trading (unadjusted). The initial return is the difference from the final offering price to the first-day closing price. For example, for the youngest age group in “hot” markets, the initial return is  $0.2496 \times 100 = 24.96$  percent. Based on 132 monthly observations, the first-order autocorrelation coefficient is i) for number of offerings:  $0.597^a$  (0.086), ii) for average monthly initial returns:  $0.300^a$  (0.086). In the cross-section of observations, we find a first-order autocorrelation coefficient for initial returns of 0.180 for Old Economy Stocks versus 0.481 for New Economy stocks. The first-order autocorrelation is higher for the number of offerings: 0.238 for Old Economy Stocks and 0.639 for New Economy stocks. All coefficients are highly significant at conventional levels. Because of the influence of few large privatization offerings, we do not find significant autocorrelation in issuing volume; Standard Errors (S.E.) in parenthesis.

Category	Year	Market Condition			Number of Issues		
	1988-1998	Hot	Cold	Hot-Cold	All	Hot	Cold
Age < 14	0.2068 <sup>a</sup> (0.0186)	0.2496 <sup>a</sup> (0.0239)	0.0766 <sup>a</sup> (0.0126)	0.1731 <sup>a</sup>	420	316	104
15 ≤ Age < 36	0.1654 <sup>a</sup> (0.0156)	0.1990 <sup>a</sup> (0.0204)	0.0893 <sup>a</sup> (0.0194)	0.1096 <sup>a</sup>	297	206	91
Age ≥ 37	0.0969 <sup>a</sup> (0.0130)	0.1333 <sup>a</sup> (0.0165)	0.0562 <sup>a</sup> (0.0199)	0.0770 <sup>a</sup>	256	135	121
New Economy	0.2718 <sup>a</sup> (0.0259)	0.3126 <sup>a</sup> (0.0313)	0.1048 <sup>a</sup> (0.0198)	0.2078 <sup>a</sup>	270	217	53
Old Economy	0.1243 <sup>a</sup> (0.0092)	0.1592 <sup>a</sup> (0.0127)	0.0659 <sup>a</sup> (0.0117)	0.0932 <sup>a</sup>	703	440	263
Small firms	0.1847 <sup>a</sup> (0.0176)	0.2129 <sup>a</sup> (0.0221)	0.1089 <sup>a</sup> (0.0249)	0.1040 <sup>a</sup>	361	263	98
Medium firms	0.1729 <sup>a</sup> (0.0161)	0.2259 <sup>a</sup> (0.0223)	0.0619 <sup>a</sup> (0.0124)	0.1639 <sup>a</sup>	421	285	136
Large firms	0.1114 <sup>a</sup> (0.0153)	0.1604 <sup>a</sup> (0.0231)	0.0463 <sup>a</sup> (0.0158)	0.1141 <sup>a</sup>	191	109	82
Public Float < 20	0.1413 <sup>a</sup> (0.0121)	0.1743 <sup>a</sup> (0.0166)	0.0794 <sup>a</sup> (0.0134)	0.0950 <sup>a</sup>	273	178	95
20 ≤ Public Float < 30	0.2143 <sup>a</sup> (0.0229)	0.2619 <sup>a</sup> (0.0277)	0.0880 <sup>a</sup> (0.0359)	0.1740 <sup>a</sup>	241	175	66
30 ≤ Public Float < 50	0.1795 <sup>a</sup> (0.0225)	0.2399 <sup>a</sup> (0.0322)	0.0580 <sup>a</sup> (0.0132)	0.1819 <sup>a</sup>	283	189	94
Public Float ≥ 50	0.1122 <sup>a</sup> (0.0199)	0.1360 <sup>a</sup> (0.0278)	0.0672 <sup>a</sup> (0.0225)	0.0688 <sup>a</sup>	176	115	61
0.0000 ≤ S.D. < 0.0124	0.0542 <sup>a</sup> (0.0054)	0.0810 <sup>a</sup> (0.0104)	0.0352 <sup>a</sup> (0.0051)	0.0458 <sup>a</sup>	245	102	143
0.0125 ≤ S.D. < 0.0196	0.0969 <sup>a</sup> (0.0108)	0.1288 <sup>a</sup> (0.0158)	0.0485 <sup>a</sup> (0.0109)	0.0803 <sup>a</sup>	244	147	97
0.0197 ≤ S.D. < 0.0314	0.1333 <sup>a</sup> (0.0119)	0.1403 <sup>a</sup> (0.0134)	0.1032 <sup>a</sup> (0.0258)	0.0370	243	197	46
0.0315 ≤ S.D. < ∞	0.3794 <sup>a</sup> (0.0329)	0.3935 <sup>a</sup> (0.0357)	0.2804 <sup>a</sup> (0.0828)	0.1131	241	211	30
All IPOs (Mean)	0.1652 <sup>a</sup> (0.0100)	0.2098 <sup>a</sup> (0.0137)	0.0725 <sup>a</sup> (0.0103)	0.1374 <sup>a</sup>	973	657	316
All IPOs (Median)	0.0714	0.0952	0.0265	0.0687	973	657	316

<sup>a,b,c</sup> denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively, based on a simple t-test.

small-cap index, excluding UK companies. These indices have a history dating back to the start of the sample period in January 1988.<sup>25</sup>

For this section, we also report wealth relatives (WR) by taking the ratio of one plus the IPO return divided by one plus the chosen benchmark return. A wealth relative less than one indicates that the IPO underperforms the chosen benchmark. Similarly, a wealth relative greater than one indicates that the IPO outperforms the chosen benchmark.<sup>26</sup>

### III. Performance Analysis of European Initial Public Offerings

#### A. Initial Returns

In Table II, we present evidence concerning the underpricing phenomenon. The average initial return for the 973 European firms that went public between 1988 and 1998 is 16.52 percent. The median is positive 7.14 percent where only 86 of the 973 offerings (8.84 percent) had negative unadjusted initial returns. 129 IPOs (13.26 percent) did not change from the offering price, supporting the conjecture that positive mean initial returns result from a partially censored left tail, which itself stems from stabilization activities by underwriters (Ruud (1993) or Aggarwal (2000)). The findings are generally consistent with US evidence. For a sample of 6,249 US IPOs between 1980 and 2001, Ritter and Welch (2002) find average underpricing to be 18.8 percent, ranging from 5.4 percent to 22.3 percent during our sample period.

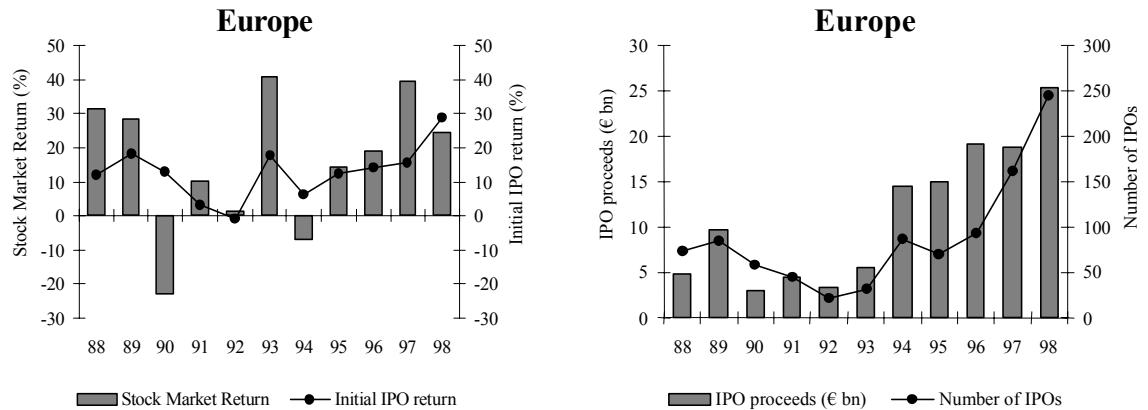
In Figure 1, we graph IPO activity and stock market returns for the sample of European IPOs. The first-order autocorrelation coefficient for the time series of 132 monthly observations of average initial returns between January 1988 and December 1998 is 0.300. The autocorrelation is higher when looking at the monthly number of offerings, with a first-order autocorrelation coefficient of 0.597 during the period between 1988 and 1998. Both coefficients are highly significant at conventional levels. Figure 1 also underlines that initial returns and issuing activity in Europe are sensitive to the general state of the stock market.

Table II shows the substantial variability in average underpricing when categorizing the sample according to the issuing characteristics. The model uses age, market sector and the standard deviation of aftermarket stock prices as measures of uncertainty, producing results that confirm the monotonic relationship between risk and initial returns, as postulated in the winner's curse explanation of underpricing. For the period 1988-1998, high-risk companies (younger firms) average substantially higher initial returns than low-risk companies (older firms). Initial returns are 10.99 percent higher for the youngest age group as compared to the oldest age group in the sample. Differences increase to 14.75 percent when comparing underpricing of New versus Old Economy IPOs. Using the daily standard deviation of unadjusted aftermarket returns for the first month of trading, an ex-post measure of uncertainty, we confirm our observations. Moreover, not only do the higher-risk categories display higher initial returns, they also show greater variability in initial returns as indicated by the Standard Errors. The relationship between other issuing characteristics and initial returns,

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<sup>25</sup> The chosen benchmarks also form the basis of derivative products and exchange-traded funds (ETFs).

<sup>26</sup> We do not adjust for betas. A broad literature argues that differences in betas are too small to have significant effects on the conclusions (Ibbotson (1975), Clarkson and Thomson (1990) or Chan and Lakonishok (1992) for the US market, and Keloharju (1993) or Leleux (1996) for European Markets).



**Figure 1. Stock Market Returns and IPO activity.** IPO proceeds are measured in 1998 purchasing power defined as the number of shares offered to the public times the final offering price. Initial Return is defined as the change from the IPO price to the closing price at the end of the first day of trading. The annual stock market return is defined as the annual change in the value-weighted Dow Jones STOXX broad-market index, excluding the UK.

however, is less clear. Size and public float do not appear to be strongly related to the level of underpricing. Evidence from Table II also shows that the quantitative relationship between company characteristics and average initial returns are not the same for IPO issued in “hot” or “cold” markets. We find average underpricing of 20.98 percent in “hot” markets versus 7.25 percent in “cold” markets, a difference of 13.74 percent. Much of this difference is attributable to underpricing among New Economy IPOs. This observation is similar to Ritter (1984) who relates the “hot issue” market of 1980-1981 to IPOs in the natural resources sector. For each issuing characteristic, we also find that average initial returns are significantly higher in “hot” as opposed to “cold” markets. This difference is most pronounced in the category of New Economy IPOs, where the difference amounts to 20.78 percent. The findings confirm the effect of clustering by industry in “hot” markets.

It is important to put the magnitude of initial returns into perspective. Loughran and Ritter (2002) report that from 1990 to 1998, companies going public in the US left a total of \$27.6 billion on the table, calculated by multiplying the first-day price gain by the number of shares sold. Investment bankers collected fees of €13 billion during this period. They found that most of the money left on the table came from a minority of IPOs whose offering price had been revised upwards in the filing range, a finding consistent with the partial adjustment phenomenon (Hanley (1993)). Although the average amount left on the table is \$9.1 million, the median is only \$2.3 million. Loughran and Ritter (2002) attribute the willingness to leave such large amounts on the table to Prospect Theory, whereby, in most situations, issuers will sum-up the wealth loss from underpricing with the larger wealth gain obtained from the retained shares. They also argue that leaving money on the table is an indirect form of underwriter compensation. For the sample of European IPOs, we find similar tendencies. The total amount of money left on the table during the period 1990-1998 amounted to €10.9 billion with underwriters collecting fees upwards of €6 billion. We also find that most IPOs left relatively little money on the table. The average amount left on the table amounted to €13.4 million while the median was only €1.1 million. However, government privatizations had a strong effect on the results. When excluding privatiza-

**Table III**  
**Aftermarket Performance of European IPOs**

The sample contains 973 European IPOs between 1988 and 1998. Aftermarket returns are measured as equally-weighted buy-and-hold returns, whereas one month is defined as a consecutive 21-day trading interval from the first closing price, using European trading days, assuming a declining sample size. The value-weighted Dow Jones STOXX size indices (Broad-Market, Large-Caps, Mid-Caps and Small-Caps), excluding UK, were used as a proxy for the market benchmark. The wealth relative is the ratio of one plus the average aftermarket period buy-and-hold IPO return, divided by one plus the average aftermarket period benchmark buy-and-hold return. For example, for the month 36 adjustment of IPO returns for the movement in the broad- market benchmark,  $(1 + 0.6791)/(1+0.5947) = 1.05$ ; Standard Errors (S.E.) in parentheses.

*Panel A: Mean Aftermarket Performance of IPOs: All Market Conditions*

Aftermarket	IPO and Benchmark Returns								
	IPO Return	Broad-Market	Wealth Relative	Large-Caps	Wealth Relative	Mid-Caps	Wealth Relative	Small-Caps	Wealth Relative
Month 1 (N=973)	0.0312 <sup>a</sup> (0.0068)	0.0178 <sup>a</sup> (0.0016)	1.01 <sup>b</sup> (0.0066)	0.0206 <sup>a</sup> (0.0017)	1.01 (0.0066)	0.0104 <sup>a</sup> (0.0015)	1.02 <sup>a</sup> (0.0066)	0.0016 (0.0016)	1.03 <sup>a</sup> (0.0066)
Month 3 (N=972)	0.0591 <sup>a</sup> (0.0111)	0.0276 <sup>a</sup> (0.0035)	1.03 <sup>a</sup> (0.0104)	0.0339 <sup>a</sup> (0.0035)	1.02 <sup>b</sup> (0.0105)	0.0102 <sup>a</sup> (0.0036)	1.05 <sup>a</sup> (0.0105)	-0.0101 <sup>a</sup> (0.0039)	1.07 <sup>a</sup> (0.0105)
Month 12 (N=970)	0.2779 <sup>a</sup> (0.0582)	0.1550 <sup>a</sup> (0.0057)	1.11 <sup>b</sup> (0.0575)	0.1791 <sup>a</sup> (0.0057)	1.08 <sup>c</sup> (0.0575)	0.0910 <sup>a</sup> (0.0058)	1.17 <sup>a</sup> (0.0575)	0.0173 <sup>a</sup> (0.0061)	1.26 <sup>a</sup> (0.0578)
Month 36 (N=686)	0.6791 <sup>a</sup> (0.1746)	0.5947 <sup>a</sup> (0.0172)	1.05 (0.1729)	0.7037 <sup>a</sup> (0.0184)	0.99 (0.1729)	0.3462 <sup>a</sup> (0.0120)	1.25 <sup>c</sup> (0.1733)	0.0951 <sup>a</sup> (0.0091)	1.53 <sup>a</sup> (0.1735)
Month 60 (N=381)	0.5974 <sup>a</sup> (0.1245)	0.6179 <sup>a</sup> (0.0351)	0.99 (0.1204)	1.1974 <sup>a</sup> (0.0426)	0.73 <sup>a</sup> (0.1177)	0.5313 <sup>a</sup> (0.0228)	1.04 (0.1193)	0.0933 <sup>a</sup> (0.0151)	1.46 <sup>a</sup> (0.1209)

*Panel B: Mean Aftermarket Performance of IPOs: Hot Markets*

Aftermarket	IPO and Benchmark Returns								
	IPO Return	Broad-Market	Wealth Relative	Large-Caps	Wealth Relative	Mid-Caps	Wealth Relative	Small-Caps	Wealth Relative
Month 1 (N=657)	0.0442 <sup>a</sup> (0.0094)	0.0232 <sup>a</sup> (0.0021)	1.02 <sup>b</sup> (0.0093)	0.0264 <sup>a</sup> (0.0022)	1.02 <sup>c</sup> (0.0093)	0.0131 <sup>a</sup> (0.0020)	1.03 <sup>a</sup> (0.0092)	0.0039 <sup>c</sup> (0.0020)	1.04 <sup>a</sup> (0.0092)
Month 3 (N=656)	0.0829 <sup>a</sup> (0.0156)	0.0371 <sup>a</sup> (0.0047)	1.04 <sup>a</sup> (0.0147)	0.0436 <sup>a</sup> (0.0047)	1.04 <sup>a</sup> (0.0147)	0.0145 <sup>a</sup> (0.0048)	1.07 <sup>a</sup> (0.0147)	-0.0066 (0.0052)	1.09 <sup>a</sup> (0.0148)
Month 12 (N=655)	0.3439 <sup>a</sup> (0.0845)	0.1825 <sup>a</sup> (0.0075)	1.14 <sup>c</sup> (0.0837)	0.2068 <sup>a</sup> (0.0076)	1.11 (0.0837)	0.1022 <sup>a</sup> (0.0075)	1.22 <sup>a</sup> (0.0836)	0.0292 <sup>a</sup> (0.0078)	1.31 <sup>a</sup> (0.0839)
Month 36 (N=389)	0.8568 <sup>a</sup> (0.3014)	0.6120 <sup>a</sup> (0.0239)	1.15 (0.2997)	0.7244 <sup>a</sup> (0.0255)	1.08 (0.2997)	0.3146 <sup>a</sup> (0.0151)	1.41 <sup>c</sup> (0.3001)	0.0775 <sup>a</sup> (0.0124)	1.72 <sup>a</sup> (0.3002)
Month 60 (N=119)	0.2795 <sup>b</sup> (0.1231)	0.1264 <sup>a</sup> (0.0310)	1.14 (0.1228)	0.6066 <sup>a</sup> (0.0343)	0.80 <sup>a</sup> (0.1229)	0.2257 <sup>a</sup> (0.0194)	1.04 (0.1212)	-0.0903 <sup>a</sup> (0.0100)	1.41 <sup>a</sup> (0.1222)

*Panel C: Mean Aftermarket Performance of IPOs: Cold Markets*

Aftermarket	IPO and Benchmark Returns								
	IPO Return	Broad-Market	Wealth Relative	Large-Caps	Wealth Relative	Mid-Caps	Wealth Relative	Small-Caps	Wealth Relative
Month 1 (N=316)	0.0041 (0.0069)	0.0066 <sup>a</sup> (0.0022)	1.00 (0.0068)	0.0087 <sup>a</sup> (0.0022)	1.00 (0.0068)	0.0048 <sup>b</sup> (0.0023)	1.00 (0.0068)	-0.0033 (0.0024)	1.01 (0.0069)
Month 3 (N=316)	0.0097 (0.0103)	0.0077 <sup>c</sup> (0.0043)	1.00 (0.0098)	0.0137 <sup>a</sup> (0.0042)	1.00 (0.0098)	0.0014 (0.0045)	1.01 (0.0098)	-0.0175 <sup>a</sup> (0.0051)	1.03 <sup>a</sup> (0.0100)
Month 12 (N=315)	0.1406 <sup>a</sup> (0.0352)	0.0978 <sup>a</sup> (0.0074)	1.04 (0.0333)	0.1215 <sup>a</sup> (0.0067)	1.02 (0.0334)	0.0679 <sup>a</sup> (0.0085)	1.07 <sup>b</sup> (0.0333)	-0.0076 (0.0097)	1.15 <sup>a</sup> (0.0338)
Month 36 (N=297)	0.4465 <sup>a</sup> (0.0810)	0.5719 <sup>a</sup> (0.0243)	0.92 <sup>c</sup> (0.0734)	0.6766 <sup>a</sup> (0.0262)	0.86 <sup>a</sup> (0.0733)	0.3875 <sup>a</sup> (0.0191)	1.04 (0.0742)	0.1182 <sup>a</sup> (0.0133)	1.29 <sup>a</sup> (0.0764)
Month 60 (N=262)	0.7418 <sup>a</sup> (0.1716)	0.8412 <sup>a</sup> (0.0425)	0.95 (0.1658)	1.4657 <sup>a</sup> (0.0522)	0.71 <sup>a</sup> (0.1614)	0.6701 <sup>a</sup> (0.0281)	1.04 (0.1646)	0.1766 <sup>a</sup> (0.0194)	1.48 <sup>a</sup> (0.1669)

<sup>a,b,c</sup> denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively, based on a simple t-test.

tions, which accounted for €5.2 billion of money left on the table, the average amount of money left on the table fell to €7.2 million.<sup>27</sup> As Perotti and Guney (1993), Perotti (1995), Shafik (1996), and Jones, Megginson, Nash, and Netter (1999) all point out, governments and their investment bankers have become extremely adept at manipulating the offer price and allocations terms of IPOs in order to achieve multiple, often competing, political and economic objectives. During the 1990s, European governments kick-started a European equity culture by allocating discounted shares from formerly state-owned monopolies to retail investors.

### *B. Aftermarket Returns*

In Table III, we report the buy-and-hold performance for European IPOs issued between 1988 and 1998 over different holding periods starting from the close of the first day of trading. In Panel A, we report the benchmark-adjusted equally-weighted aftermarket performance for different holding periods, independent of the market condition at the IPO date. The results indicate that the sample of European IPOs outperformed all the benchmarks up to the first year of aftermarket trading. Over 12 months, for example, the IPOs earned 27.79 percent, on average, while the broad market index earned 15.50 percent, a wealth relative of 1.11. However, the broad-market and large-cap market-adjusted wealth relatives fall substantially when measuring the aftermarket performance over longer periods. Over three years, for example, IPOs returned 67.91 percent on average while the broad market returned 59.47 percent, a ratio of 1.05. Panel A also shows that IPO performance is sensitive to the benchmark employed. Across all measurement horizons, IPOs perform better relative to small-caps than relative to large-caps. In Panels B and C of Table III, we present results calculated according to the market condition at the time of the IPO. We find that the favourable aftermarket IPO performance is mainly driven by outperformance of IPOs issued in “hot” markets. IPOs issued in “cold” markets underperform in the long-run. For example, investing in the average sample of IPOs in “cold” markets would have left the investor with only €0.92 relative to each Euro invested in the broad-market index after three years, while rendering €1.15 if invested during a “hot” market period.

While not reported separately, the long-run performance picture changes dramatically when looking at the median IPO. A strategy of investing in the median IPO at the end of the first day of trading and holding over a three-year period, would have left the investor with only €0.67 relative to each Euro invested in the broad-market index. This underlines the skewness of the return distribution with only 28 percent of the issuers reporting positive broad-market-adjusted returns, and some extreme winners dominating the mean return picture. In the Appendix, Table AII, we have also calculated value-weighted results for the aftermarket performance of European IPOs. Brav and Gompers (1997) find that value-weighting significantly reduces performance differences. For the sample of European IPOs, however, value-weighting does not significantly change the results from equally-weighting. Indeed, the three-year broad-market-adjusted wealth relative is 1.06 compared to 1.05 for the equally-weighted sample of European IPOs. The wealth relatives fall to 0.73 (equally-weighted) and 0.74 (value-weighted) when measured over five years, respectively.

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<sup>27</sup> While raising €27.5 billion, four privatizations (Deutsche Telecom AG, France Telecom SA, TNT Poest Group NV and Swisscom AG) accounted for €4.0 billion of money left on the table. From 1996 onwards, each of these companies were brought to the market by using the bookbuilding procedure and recorded significant average underpricing (14.02 percent).

## *C. Cross-Sectional Results*

### *C.1. Performance Categorized by Initial Returns*

In order to shed more light on the dynamics of European IPO performance, this section distinguishes firms by issuing characteristic and provides time-series evidence of performance. For each issuing characteristic, we divide the sample into sub-samples and use dummy variables to distinguish each subsample. The resulting regression coefficients measure the difference in average market-adjusted returns across subsamples, calculated for each measurement horizon and market condition. In the rest of this chapter, we will focus on reporting the results adjusted for movements in the value-weighted Dow Jones STOXX broad-market index, excluding the UK.

In Table IV, firms are segmented by the initial return of the IPO. The results are categorized according to four initial return categories and across three dimensions: IPOs issued in all market conditions, “hot” markets, and “cold” markets. Panel A reveals that there is a tendency for companies that have the highest initial returns to have the best aftermarket performance across all measurement horizons. Companies that have the lowest initial returns also exhibit the worst aftermarket performance. The result extends to all measurement horizons and is most significant in the short-run. Over 36 months, for example, the difference between the market-adjusted aftermarket performance between highest and lowest initial returns category is 65.52 percent.

In Panels B and C, we are able to disentangle this observation by looking at IPOs issued in “hot” and “cold” markets separately. For IPOs issued in “cold” markets, we find that the positive relationship between initial returns and broad-market-adjusted aftermarket performance is more consistent and more significant, albeit less in magnitude, compared to that for “hot” markets. The underperformance of IPOs is most pervasive in the category of IPOs with zero or negative initial returns. In this category, IPOs issued in “hot” markets underperformed the market by 51.21 percent, while IPOs in “cold” markets underperformed by 14.68 percent over three years.

The findings reveal a number of interesting patterns related to the literature. When considering the short-run dynamics, the result indicates a clearly significant relation between underpricing and performance under the three market conditions studied. Underpricing indeed seems to induce sentiment-driven short-run positive feedback strategies (Rajan and Servaes (1993)). The significantly negative returns of IPOs with least underpricing are also indicative of the effect of the cessation of stabilization activities of underwriters in the immediate aftermarket (Hanley, Kumar and Seguin (1992), Ruud (1993)). Moreover, the results for long-run performance contrast with Ritter’s (1991) findings which reveal a tendency for firms with high initial returns to have the worst aftermarket performance. This, according to the author, mildly supports DeBondt and Thalers (1985) “overreaction hypothesis” as an explanation for the poor long-run performance of US IPOs. The results are also not consistent with Shiller’s (1990) “Impresario” hypothesis, which predicts a negative relation between initial returns and aftermarket performance, in particular for IPOs issued in “hot” markets. As well, our findings do not correspond to the desire of issuers to avoid future lawsuits by underpricing (Tinic (1988)). The results, however, do support the various signaling theories of underpricing (Allen and Faulhaber (1989) or Grinblatt and Hwang (1989)). Here, underpricing separates low-quality firms from high-quality firms, since only high quality firms are expected to recoup the initial loss of underpricing once their true value is revealed.

**Table IV**  
**Aftermarket Performance Categorized by Initial Return**

$$R_i = \alpha + \beta_1 D_{1i} + \beta_2 D_{2i} + \beta_3 D_{3i} + \varepsilon_i$$

The model is estimated for each of the return measurement horizons (1, 3, 12, 36 and 60 months) and for different market conditions (All Market Conditions, Hot Markets and Cold Markets).  $R_i$  is the broad-market-adjusted return.  $D_{1i}$ ,  $D_{2i}$ , and  $D_{3i}$  are (0,1) dummy variables taking the value of 1 if the IPO falls into the specified initial return category and 0 otherwise. The initial return is the percentage difference from the final offering price to the first-day closing price and divided into four categories: IPOs with initial returns of not more than 0%, IPOs with more than 0% but less than 7% initial returns, IPOs with at least 7% but less than 20% initial returns and IPOs with more than 20% initial returns; Standard Errors (S.E.) in parentheses.

Aftermarket	$R_i$	$\alpha$	S.E.	$\hat{\beta}_1$	S.E.	$\hat{\beta}_2$	S.E.	$\hat{\beta}_3$	S.E.	Total	Number of Issues			
											D=0	D=1	D=2	D=3
Month 1	0.0134 <sup>b</sup>	-0.0226	(0.0138)	-0.0180	(0.0184)	0.0678 <sup>a</sup>	(0.0188)	0.0963 <sup>a</sup>	(0.0190)	973	215	270	250	238
Month 3	0.0315 <sup>a</sup>	-0.0424	(0.0219)	0.0217	(0.0293)	0.1227 <sup>a</sup>	(0.0298)	0.1483 <sup>a</sup>	(0.0301)	972	214	270	250	238
Month 12	0.1229 <sup>b</sup>	-0.0436	(0.1225)	0.1826	(0.1643)	0.2671	(0.1669)	0.1923	(0.1688)	970	214	268	250	238
Month 36	0.0845	-0.3006	(0.3676)	0.6181	(0.4882)	0.2319	(0.4961)	0.6552	(0.5216)	686	152	199	185	150
Month 60	-0.0205	-0.1792	(0.2375)	-0.0035	(0.3140)	-0.1228	(0.3341)	1.1742 <sup>a</sup>	(0.3779)	381	95	127	97	62

*Panel A: Aftermarket Performance of IPOs Categorized by Initial Return: All Market Conditions*

Aftermarket	$R_i$	$\alpha$	S.E.	$\hat{\beta}_1$	S.E.	$\hat{\beta}_2$	S.E.	$\hat{\beta}_3$	S.E.	Total	Number of Issues			
											D=0	D=1	D=2	D=3
Month 1	0.0210 <sup>b</sup>	-0.0146	(0.0209)	-0.0407	(0.0282)	0.0650 <sup>b</sup>	(0.0272)	0.0876 <sup>a</sup>	(0.0265)	657	123	151	178	205
Month 3	0.0458 <sup>a</sup>	-0.0367	(0.0337)	0.0153	(0.0453)	0.1275 <sup>a</sup>	(0.0437)	0.1419 <sup>a</sup>	(0.0426)	656	122	151	178	205
Month 12	0.1614 <sup>c</sup>	-0.0705	(0.1939)	0.3656	(0.2611)	0.3311	(0.2517)	0.1859	(0.2449)	655	122	150	178	205
Month 36	0.2448	-0.5121	(0.7391)	1.5288	(0.9714)	0.5059	(0.9166)	0.8449	(0.9179)	389	64	88	119	118
Month 60	0.1531	0.1761	(0.2912)	0.0266	(0.4028)	-0.3238	(0.3597)	0.2747	(0.3684)	119	21	23	40	35

*Panel B: Aftermarket Performance of IPOs Categorized by Initial Return: Hot Markets*

Aftermarket	$R_i$	$\alpha$	S.E.	$\hat{\beta}_1$	S.E.	$\hat{\beta}_2$	S.E.	$\hat{\beta}_3$	S.E.	Total	Number of Issues			
											D=0	D=1	D=2	D=3
Month 1	-0.0025	-0.0333 <sup>a</sup>	(0.0120)	0.0112	(0.0160)	0.0657 <sup>a</sup>	(0.0182)	0.1111 <sup>a</sup>	(0.0234)	316	92	119	72	33
Month 3	0.0020	-0.0499 <sup>a</sup>	(0.0173)	0.0300	(0.0230)	0.1043 <sup>a</sup>	(0.0261)	0.1604 <sup>a</sup>	(0.0336)	316	92	119	72	33
Month 12	0.0427	-0.0080	(0.0604)	-0.0515	(0.0806)	0.1397	(0.0912)	0.3652 <sup>a</sup>	(0.1176)	315	92	118	72	33
Month 36	-0.1254 <sup>c</sup>	-0.1468	(0.1339)	-0.0900	(0.1792)	-0.0346	(0.2045)	0.5819 <sup>b</sup>	(0.2592)	297	88	111	66	32
Month 60	-0.0994	-0.2800	(0.3055)	0.0121	(0.3997)	-0.1302	(0.4632)	1.9807 <sup>a</sup>	(0.5909)	262	74	104	57	27

*Panel C: Aftermarket Performance of IPOs Categorized by Initial Return: Cold Markets*

<sup>a,b,c</sup> denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively, based on a simple t-test.



**Table V**  
**Aftermarket Performance Categorized by Age**

$$R_i = \alpha + \beta_1 D_{1i} + \beta_2 D_{2i} + \varepsilon_i$$

The model is estimated for each of the return measurement horizons (1, 3, 12, 36 and 60 months) and for different market conditions (All Market Conditions, Hot Markets and Cold Markets).  $R_i$  is the broad-market-adjusted return.  $D_{1i}$  and  $D_{2i}$  are (0,1) dummy variables taking the value of 1 if the IPO falls into the specified age category and 0 otherwise. Age is defined as the year of going public minus the year of foundation, with firms founded before 1901 assumed to be founded in 1901. Observations of company age are divided into three categories: IPOs with age between 0-14 years (young firms), 15-36 years (medium-young firms) and IPOs older than 37 years (old firms); Standard Errors (S.E.) in parentheses.

*Panel A: Aftermarket Performance of IPOs Categorized by Initial Return: All Market Conditions*

Aftermarket	$R_i$	$\alpha$	S.E.	$\hat{\beta}_1$	S.E.	$\hat{\beta}_2$	S.E.	Number of Issues			
								Total	D=0	D=1	D=2
Month 1	0.0134 <sup>b</sup>	0.0370 <sup>a</sup>	(0.0100)	-0.0244	(0.0156)	-0.0613 <sup>a</sup>	(0.0163)	973	420	297	256
Month 3	0.0315 <sup>a</sup>	0.0800 <sup>a</sup>	(0.0158)	-0.0646 <sup>c</sup>	(0.0245)	-0.1091 <sup>a</sup>	(0.0256)	972	419	297	256
Month 12	0.1229 <sup>b</sup>	0.3120 <sup>a</sup>	(0.0872)	-0.2935 <sup>b</sup>	(0.1354)	-0.3790 <sup>a</sup>	(0.1420)	970	419	297	254
Month 36	0.0845	0.5794 <sup>b</sup>	(0.2792)	-0.7318 <sup>c</sup>	(0.4186)	-0.8684 <sup>b</sup>	(0.4164)	686	262	210	214
Month 60	-0.0205	0.0404	(0.2110)	0.1410	(0.3100)	-0.2554	(0.2852)	381	124	107	150

*Panel B: Aftermarket Performance of IPOs Categorized by Initial Return: Hot Markets*

Aftermarket	$R_i$	$\alpha$	S.E.	$\hat{\beta}_1$	S.E.	$\hat{\beta}_2$	S.E.	Number of Issues			
								Total	D=0	D=1	D=2
Month 1	0.0210 <sup>b</sup>	0.0494 <sup>a</sup>	(0.0132)	-0.0388 <sup>c</sup>	(0.0211)	-0.0789 <sup>a</sup>	(0.0242)	657	316	206	135
Month 3	0.0458 <sup>a</sup>	0.1060 <sup>a</sup>	(0.0210)	-0.1007 <sup>a</sup>	(0.0334)	-0.1387 <sup>a</sup>	(0.0383)	656	315	206	135
Month 12	0.1614 <sup>c</sup>	0.3992 <sup>a</sup>	(0.1201)	-0.4396 <sup>b</sup>	(0.1910)	-0.4867 <sup>b</sup>	(0.2199)	655	315	206	134
Month 36	0.2448	1.1135 <sup>b</sup>	(0.4635)	-1.4614 <sup>b</sup>	(0.6995)	-1.5079 <sup>b</sup>	(0.7443)	389	161	126	102
Month 60	0.1531	0.2806	(0.2312)	-0.1643	(0.3224)	-0.1889	(0.3009)	119	34	36	49

*Panel C: Aftermarket Performance of IPOs Categorized by Initial Return: Cold Markets*

Aftermarket	$R_i$	$\alpha$	S.E.	$\hat{\beta}_1$	S.E.	$\hat{\beta}_2$	S.E.	Number of Issues			
								Total	D=0	D=1	D=2
Month 1	-0.0025	-0.0008	(0.0118)	0.0178	(0.0173)	-0.0178	(0.0161)	316	104	91	121
Month 3	0.0020	0.0014	(0.0169)	0.0372	(0.0247)	-0.0264	(0.0230)	316	104	91	121
Month 12	0.0427	0.0478	(0.0576)	0.1038	(0.0844)	-0.0919	(0.0788)	315	104	91	120
Month 36	-0.1254 <sup>c</sup>	-0.2720 <sup>b</sup>	(0.1251)	0.4129 <sup>b</sup>	(0.1857)	0.0791	(0.1726)	297	101	84	112
Month 60	-0.0994	-0.0503	(0.2830)	0.2647	(0.4261)	-0.3134	(0.3891)	262	90	71	101

<sup>a,b,c</sup> denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively, based on a simple t-test.

### *C.2. Performance Categorized by Age*

In Table V, we segment firms according to their age at the time of going public. Ritter (1991) finds poor long-run performance with younger US IPOs and interprets this as being consistent with investor overoptimism and “fads”.

For the sample of European IPOs, we find that young IPOs fare substantially better than old IPOs. The pattern consistently extends across all measurement horizons. The magnitude of the market-adjusted return difference is economically significant and accounts for 86.84 percent of return performance, when comparing the youngest with the oldest age group over 36 months. In the short-run, the patterns confirm the large performance differences in favor of the youngest IPO firms. For example, the 419 firms in the youngest age category outperform the market by 31.20 percent over one year. In this case, the difference with their oldest counterparts accounts for 37.90 percent. Results in Panels B and C of Table V indicate that the relationship between age and aftermarket returns is not the same for IPOs issued during “hot” and “cold” markets. In “hot” markets, the youngest IPOs have overperformed old firms by 150.79 percent over three years, with similarly positive dynamics over shorter measurement horizons. However, there is no clear indication that could postulate a link between age and aftermarket returns for IPO issued in “cold” markets. Here, the youngest firms underperform the market as well as old firms over three years.

The results for the European IPO market suggest that riskier issues require higher initial returns and that age is a proxy for risk. This also suggests that the role of age differs for “hot” and “cold” markets and that age is a good proxy for investor sentiment, particularly for IPOs in “hot” markets. This is consistent with Helwege and Liang (2001) who find that “... investors are much more (perhaps overly) optimistic in hot markets, as hot market firms may be able to go public at a more favourable price and certainly raise more money in their offering.”

### *C.3. Performance Categorized by Size*

In Table VI, firms are segmented by market capitalization (size) into three size categories. As shown in Table II, small offerings have slightly higher initial returns. Table VI discloses that smaller offerings tend to have the best long-run performance. For example, the smallest IPOs with a market capitalization below €100 million at the first day of trading outperform the largest IPO firms by 57.86 percent over three years. This is similar for IPOs issued in “hot” and “cold” markets. As shown in Panels A, B, and C, the smallest IPOs outperform their larger peers for 27 of the 30 measurement horizons.

Table VI also reveals a tendency for the smallest offerings in the immediate aftermarket to outperform the market and larger offerings. As seen earlier, our sample of small European IPOs is clustered in “hot” markets, indicated by the relatively small median size of companies going public (€66.2 million). Because small offerings typically have a small public float, they are particularly susceptible to institutional frictions prevailing in the immediate IPO aftermarket and to investor sentiment. Conversely, Ritter (1991) finds a tendency for smaller offerings, which also have the highest initial returns, to have the worst aftermarket performance. In his sample, all size-categories display poor long-run performance. Our results are consistent with our earlier observation that, in contrast to Brav and Gompers (1997), value-weighting does not change the results on aftermarket performance. Owing to their weak statistical power, however, results regarding the role of size in the European market need to be treated with caution.

**Table VI**  
**Aftermarket Performance Categorized by Size**

$$R_i = \alpha + \beta_1 D_{1i} + \beta_2 D_{2i} + \varepsilon_i$$

The model is estimated for each of the return measurement horizons (1, 3, 12, 36 and 60 months) and for different market conditions (All Market Conditions, Hot Markets and Cold Markets).  $R_i$  is the broad-market-adjusted return.  $D_{1i}$  and  $D_{2i}$  are (0,1) dummy variables taking the value of 1 if the IPO falls into the specified size category and 0 otherwise. Size/Market Capitalization in €m is the number of shares issued times the final offer price and is expressed in constant end-1998 prices. Observations for size are divided into three categories: Firms with a first day market capitalization less than €100m (small firms), between €100 and €500m (medium firms) and exceeding €500m (large firms); Standard Errors (S.E.) in parentheses

*Panel A: Aftermarket Performance of IPOs Categorized by Initial Return: All Market Conditions*

Aftermarket	$R_i$	$\alpha$	S.E.	$\hat{\beta}_1$	S.E.	$\hat{\beta}_2$	S.E.	Number of Issues			
								D=0	D=1	D=2	D=3
Month 1	0.0134 <sup>b</sup>	0.0321 <sup>a</sup>	(0.0109)	-0.0274 <sup>c</sup>	(0.0148)	-0.0346 <sup>c</sup>	(0.0185)	973	361	421	191
Month 3	0.0315 <sup>a</sup>	0.0375 <sup>b</sup>	(0.0171)	-0.0036	(0.0234)	-0.0223	(0.0291)	972	361	420	191
Month 12	0.1229 <sup>b</sup>	0.1973 <sup>b</sup>	(0.0944)	-0.1644	(0.1288)	-0.0175	(0.1604)	970	360	419	191
Month 36	0.0845	0.4670	(0.2910)	-0.5975	(0.3942)	-0.5786	(0.4667)	686	242	290	154
Month 60	-0.0205	0.2566	(0.2135)	-0.6038 <sup>b</sup>	(0.2813)	-0.0731	(0.3184)	381	120	163	98

*Panel B: Aftermarket Performance of IPOs Categorized by Initial Return: Hot Markets*

Aftermarket	$R_i$	$\alpha$	S.E.	$\hat{\beta}_1$	S.E.	$\hat{\beta}_2$	S.E.	Number of Issues			
								D=0	D=1	D=2	D=3
Month 1	0.0210 <sup>b</sup>	0.0372 <sup>b</sup>	(0.0146)	-0.0208	(0.0203)	-0.0427	(0.0270)	657	263	285	109
Month 3	0.0458 <sup>a</sup>	0.0420 <sup>c</sup>	(0.0232)	0.0181	(0.0323)	-0.0245	(0.0429)	656	263	284	109
Month 12	0.1614 <sup>c</sup>	0.2216 <sup>c</sup>	(0.1321)	-0.1660	(0.1835)	0.0690	(0.2440)	655	263	283	109
Month 36	0.2448	0.6823	(0.4847)	-0.6444	(0.6715)	-0.8436	(0.8268)	389	149	162	78
Month 60	0.1531	0.4713 <sup>b</sup>	(0.2162)	-0.4704 <sup>c</sup>	(0.2844)	-0.4622	(0.3286)	119	38	52	29

*Panel C: Aftermarket Performance of IPOs Categorized by Initial Return: Cold Markets*

Aftermarket	$R_i$	$\alpha$	S.E.	$\hat{\beta}_1$	S.E.	$\hat{\beta}_2$	S.E.	Number of Issues			
								D=0	D=1	D=2	D=3
Month 1	-0.0025	0.0184	(0.0121)	-0.0383 <sup>b</sup>	(0.0159)	-0.0168	(0.0180)	316	98	136	82
Month 3	0.0020	0.0252	(0.0174)	-0.0461 <sup>b</sup>	(0.0229)	-0.0133	(0.0258)	316	98	136	82
Month 12	0.0427	0.1313 <sup>b</sup>	(0.0599)	-0.1456 <sup>c</sup>	(0.0784)	-0.0987	(0.0885)	315	97	136	82
Month 36	-0.1254 <sup>c</sup>	0.1220	(0.1299)	-0.4658 <sup>a</sup>	(0.1707)	-0.1825	(0.1937)	297	93	128	76
Month 60	-0.0994	0.1571	(0.2950)	-0.6674 <sup>c</sup>	(0.3889)	0.0996	(0.4363)	262	82	111	69

<sup>a,b,c</sup> denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively, based on a simple t-test.

**Table VII**  
**Aftermarket Performance Categorized by Public Float**

$$R_i = \alpha + \beta_1 D_{1i} + \beta_2 D_{2i} + \beta_3 D_{3i} + \varepsilon_i$$

The model is estimated for each of the return measurement horizons (1, 3, 12, 36 and 60 months) and for different market conditions (All Market Conditions, Hot Markets and Cold Markets).  $R_i$  is the broad-market-adjusted return.  $D_{1i}$ ,  $D_{2i}$ , and  $D_{3i}$  are (0,1) dummy variables taking the value of 1 if the IPO falls into the specified category of public float and 0 otherwise. Public Float is defined as the percentage of equity offered to the public at the IPO date. Observations on the public float are divided into four categories: Firms with less than 20% of public float, with at least 20% but less than 30% of public float, with at least 30% but less than 50% of public float, and at least 50% of public float; Standard Errors (S.E.) in parentheses.

*Panel A: Aftermarket Performance of IPOs Categorized by Initial Return: All Market Conditions*

Aftermarket	$R_i$	$\alpha$	S.E.	$\hat{\beta}_1$	S.E.	$\hat{\beta}_2$	S.E.	$\hat{\beta}_3$	S.E.	Number of Issues				
										Total	D=0	D=1	D=2	D=3
Month 1	0.0134 <sup>b</sup>	0.0625 <sup>a</sup>	(0.0124)	-0.0416 <sup>b</sup>	(0.0181)	-0.0845 <sup>a</sup>	(0.0173)	-0.0788 <sup>a</sup>	(0.0197)	973	273	241	283	176
Month 3	0.0315 <sup>a</sup>	0.0850 <sup>a</sup>	(0.0195)	-0.0292	(0.0285)	-0.0931 <sup>a</sup>	(0.0274)	-0.1066 <sup>a</sup>	(0.0313)	972	273	241	283	175
Month 12	0.1229 <sup>b</sup>	0.1774	(0.1083)	0.1012	(0.1584)	-0.1118	(0.1520)	-0.2609	(0.1734)	970	273	240	282	175
Month 36	0.0845	0.2513	(0.3158)	-0.2374	(0.4744)	0.0321	(0.4566)	-0.6423	(0.5114)	686	206	164	189	127
Month 60	-0.0205	0.2162	(0.2095)	-0.2859	(0.3195)	-0.3244	(0.3215)	-0.4907	(0.3556)	381	126	95	93	67

*Panel B: Aftermarket Performance of IPOs Categorized by Initial Return: Hot Markets*

Aftermarket	$R_i$	$\alpha$	S.E.	$\hat{\beta}_1$	S.E.	$\hat{\beta}_2$	S.E.	$\hat{\beta}_3$	S.E.	Number of Issues				
										Total	D=0	D=1	D=2	D=3
Month 1	0.0210 <sup>b</sup>	0.0828 <sup>a</sup>	(0.0175)	-0.0485 <sup>c</sup>	(0.0249)	-0.1043 <sup>a</sup>	(0.0244)	-0.1076 <sup>a</sup>	(0.0279)	657	178	175	189	115
Month 3	0.0458 <sup>a</sup>	0.1175 <sup>a</sup>	(0.0279)	-0.0315	(0.0396)	-0.1249 <sup>a</sup>	(0.0389)	-0.1570 <sup>a</sup>	(0.0447)	656	178	175	189	114
Month 12	0.1614 <sup>c</sup>	0.1956	(0.1604)	0.1698	(0.2279)	-0.1121	(0.2239)	-0.2726	(0.2568)	655	178	175	188	114
Month 36	0.2448	0.3654	(0.5624)	-0.2107	(0.8127)	0.2581	(0.8086)	-0.7261	(0.8965)	389	111	102	104	72
Month 60	0.1531	0.0872	(0.2165)	0.1776	(0.3042)	-0.1006	(0.3605)	0.1641	(0.3852)	119	39	40	22	18

*Panel C: Aftermarket Performance of IPOs Categorized by Initial Return: Cold Markets*

Aftermarket	$R_i$	$\alpha$	S.E.	$\hat{\beta}_1$	S.E.	$\hat{\beta}_2$	S.E.	$\hat{\beta}_3$	S.E.	Number of Issues				
										Total	D=0	D=1	D=2	D=3
Month 1	-0.0025	0.0246 <sup>b</sup>	(0.0123)	-0.0389 <sup>b</sup>	(0.0192)	-0.0475 <sup>a</sup>	(0.0174)	-0.0249	(0.0196)	316	95	66	94	61
Month 3	0.0020	0.0243	(0.0178)	-0.0482 <sup>c</sup>	(0.0278)	-0.0335	(0.0252)	-0.0121	(0.0284)	316	95	66	94	61
Month 12	0.0427	0.1432 <sup>b</sup>	(0.0604)	-0.0984	(0.0947)	-0.1135	(0.0856)	-0.2390 <sup>b</sup>	(0.0965)	315	95	65	94	61
Month 36	-0.1254 <sup>c</sup>	0.1180	(0.1289)	-0.3357	(0.2051)	-0.2506	(0.1876)	-0.5486 <sup>a</sup>	(0.2129)	297	95	62	85	55
Month 60	-0.0994	0.2740	(0.2878)	-0.5870	(0.4624)	-0.4115	(0.4293)	-0.7416	(0.4795)	262	87	55	71	49

<sup>a,b,c</sup> denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively, based on a simple t-test.

#### *C.4. Performance Categorized by Public Float*

Table VII segments the firms by the size of the public float. Here, we divide the sample into four groups. Based on the results from Table II, public float does not appear to be strongly related to the level of underpricing.

Three interpretations of Table VII are possible: First, there appears to be a linear relation between public float and market-adjusted aftermarket performance. These performance dynamics are pervasive. Companies issuing least, fare the best. Companies issuing most, fare the worst. For example, after three months of trading, the difference in the broad-market-adjusted return between companies with the smallest and the largest public float is 10.66 percent. This difference increases to 64.23 percent after three years in the aftermarket. The performance patterns are manifested particularly in firms that bring at least 50 percent of their company to the market. Second, the relation between public float and IPO return dynamics is relatively insensitive to the market condition at the IPO date. For instance, companies with the largest public float underperform companies with the lowest public float by 72.61 percent over three years when issued during “hot” markets, and by 54.86 percent during “cold” markets. Third, public float is significantly related to IPO performance in the immediate aftermarket. This effect appears to be stronger under “hot” markets than under “cold” markets. This is indicative of the strong influence of investor sentiment in driving a limited supply of shares, in a market characterized by institutional arrangements unrelated to fundamentals.

The negative relation between public float and aftermarket performance for the European IPO market is consistent with several explanations in the literature. Primary among these are the Jensen and Meckling (1976) agency hypothesis and the Leland and Pyle (1977) signaling hypothesis. In Jensen and Meckling (1976), a higher ownership retention rate, hence lower public float, reduces incentives to undertake non value maximizing projects. Leland and Pyle (1977) suggest that, by retaining a significant stake in the firm, entrepreneurs can signal the quality of their firm since ramification can be costly. For US IPOs, Jain and Kini (1994) confirm the relatively superior post-IPO operating performance where entrepreneurs retain a large stake in the firm.

#### *C.5. Performance Categorized by Sector*

The sample period has been characterized by an unprecedented change caused by the increasing role of information and communications technologies. In our final analysis of cross-sectional offerings characteristics, we study whether the aftermarket performance of European IPOs mirrors this change.

For this purpose, we segment firms according to the attached Dow Jones STOXX global sector classification scheme. Initially, we categorize IPOs according to 18 market sectors. Then, we pool all companies in Sectors 5, 13, 16 and 17 into one group that represents the New Economy sectors (Technology, Media, Telecommunications and Healthcare). For our sample of 973 European IPOs, 270 accounted for New Economy IPOs (28 percent). All other IPOs are classified as Old Economy firms. The average New Economy firm is 16 years old and has a median size of €51.7 million when going public. Conversely, we record an average age of 32 years and a median size of €84.9 million for Old Economy firms. As seen in Table I, the sample composition of European IPOs has changed in favor of New Economy IPOs at the expense of Old Economy IPOs over time. The change in industry representation is indicative of the flow of capital into growth industries.

**Table VIII**  
**Aftermarket Performance Categorized by Sector**

$$R_i = \alpha + \beta D_i + \varepsilon_i$$

The model is estimated for each of the return measurement horizons (1, 3, 12, 36 and 60 months) and for different market conditions (All Market Conditions, Hot Markets and Cold Markets).  $R_i$  is the broad-market-adjusted return.  $D_i$  is a (0,1) dummy variable taking the value of 0 if the firm belongs to a market sector defined as New Economy and 1 otherwise. New Economy firms belong to Market Sectors 5, 13, 16 and 17, representing Technology, Media, Telecommunication and Healthcare, respectively. Old economy firms belong to all other sectors; Standard Errors (S.E.) in parentheses.

*Panel A: Aftermarket Performance Categorized by Market Sector: All Market Conditions*

Aftermarket	$R_i$	$\alpha$	S.E.	$\hat{\beta}$	S.E.	Number of Issues		
						Total	D=0	D=1
Month 1	0.0134 <sup>b</sup>	0.0477 <sup>a</sup>	(0.0125)	-0.0475 <sup>a</sup>	(0.0147)	973	270	703
Month 3	0.0315 <sup>a</sup>	0.1160 <sup>a</sup>	(0.0196)	-0.117 <sup>a</sup>	(0.0230)	972	270	702
Month 12	0.1229 <sup>b</sup>	0.3685 <sup>a</sup>	(0.1087)	-0.340 <sup>a</sup>	(0.1280)	970	270	700
Month 36	0.0845	1.3080 <sup>a</sup>	(0.3555)	-1.593 <sup>a</sup>	(0.4056)	686	159	527
Month 60	-0.0205	0.7982 <sup>a</sup>	(0.2733)	-1.010 <sup>a</sup>	(0.3034)	381	72	309

*Panel B: Aftermarket Performance Categorized by Market Sector: Hot Markets*

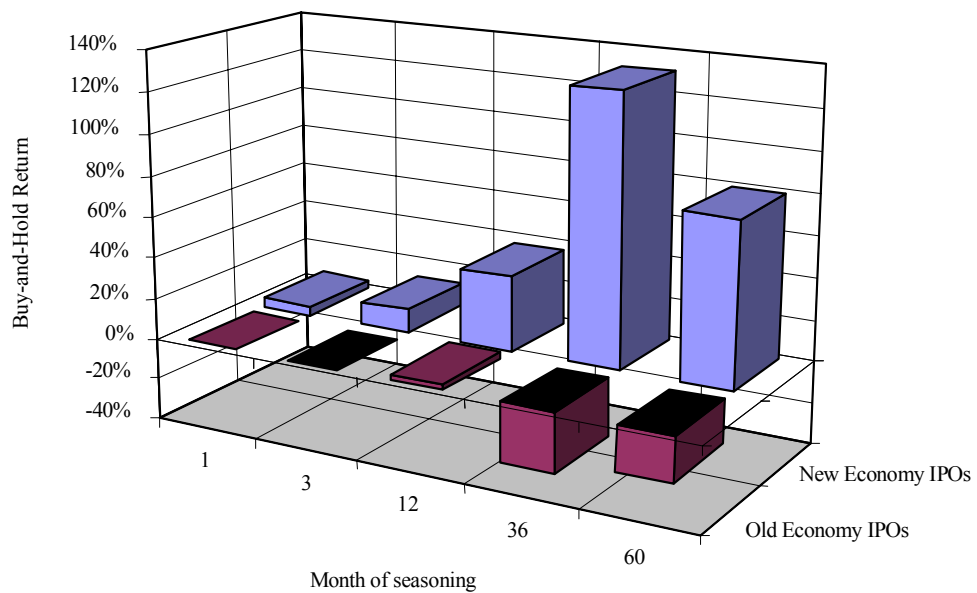
Aftermarket	$R_i$	$\alpha$	S.E.	$\hat{\beta}$	S.E.	Number of Issues		
						Total	D=0	D=1
Month 1	0.0210 <sup>b</sup>	0.0566 <sup>a</sup>	(0.0160)	-0.053 <sup>a</sup>	(0.0196)	657	217	440
Month 3	0.0458 <sup>a</sup>	0.1315 <sup>a</sup>	(0.0253)	-0.128 <sup>a</sup>	(0.0309)	656	217	439
Month 12	0.1614 <sup>c</sup>	0.3749 <sup>a</sup>	(0.1451)	-0.319 <sup>c</sup>	(0.1774)	655	217	438
Month 36	0.2448	1.8065 <sup>a</sup>	(0.5673)	-2.147 <sup>a</sup>	(0.6651)	389	106	283
Month 60	0.1531	0.5148 <sup>c</sup>	(0.2663)	-0.458	(0.2997)	119	25	94

*Panel C: Aftermarket Performance Categorized by Market Sector: Cold Markets*

Aftermarket	$R_i$	$\alpha$	S.E.	$\hat{\beta}$	S.E.	Number of Issues		
						Total	D=0	D=1
Month 1	-0.0025	0.0114	(0.0166)	-0.017	(0.0182)	316	53	263
Month 3	0.0020	0.0524 <sup>b</sup>	(0.0236)	-0.061 <sup>b</sup>	(0.0259)	316	53	263
Month 12	0.0427	0.3420 <sup>a</sup>	(0.0792)	-0.360 <sup>a</sup>	(0.0869)	315	53	262
Month 36	-0.1254 <sup>c</sup>	0.3109 <sup>c</sup>	(0.1718)	-0.531 <sup>a</sup>	(0.1895)	297	53	244
Month 60	-0.0994	0.9490 <sup>b</sup>	(0.3857)	-1.278 <sup>a</sup>	(0.4257)	262	47	215

<sup>a,b,c</sup> denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively, based on a simple t-test.

Table II displays significant differences in terms of underpricing between New and Old Economy IPOs. The findings on aftermarket performance of New Economy versus Old Economy IPOs reported in Table VIII follow a similar, clearly distinctive performance pattern. New Economy stocks outperform the market as well as their peers during all measurement periods. Figure 2 graphs the performance dynamics. The return differences are pervasive. For example, the spread in benchmark adjusted returns between New and Old Economy IPOs widened from 4.75 percent after the first month, to 34.0 percent over one year and to 159.30 percent after three years of aftermarket trading. Associated statistics underline the significance of the results that also prevail for IPOs issued in “hot” and “cold” markets. Within sectors, telecommunications, technology and healthcare had the best long-run performance, benefiting from deregulation, the global technology boom and the shift towards private medical care in Continental Europe. IPOs in sectors representing basic materials or industrial firms - many of which went public in the early 1990s during the boom in German construction



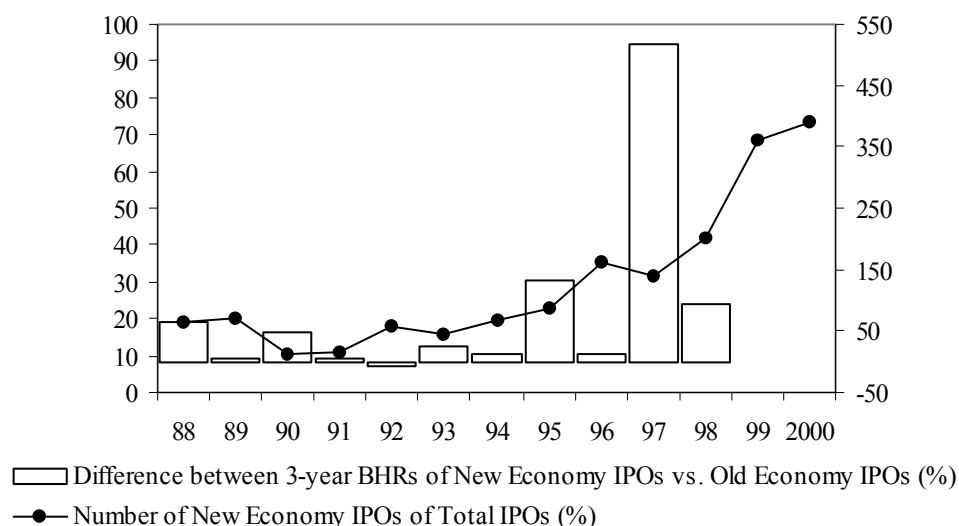
**Figure 2. Average market-adjusted aftermarket Performance Categorized by Sector.**

The initial sample is comprised of 703 Old Economy IPOs and 270 New Economy IPOs. New Economy firms belong to Market Sectors 5, 13, 16 and 17, representing Technology, Media, Telecommunication and Healthcare. Old Economy firms belong to all other economic sectors in the Dow Jones STOXX global sector classification standard. Returns are measured as buy-and-hold returns from the close at the day of going public where one month is defined as consecutive 21-day-trading period using European trading days.

activity following the German Unification - fared the worst. All but 5 of the 18 industry groups recorded long-run underperformance. The magnitude of the performance differences in New versus Old Economy IPOs over such a long time period is puzzling. Generally, the findings are strongly supportive of Brav and Gompers' (1997) conjecture that investors should not treat IPOs as a homogenous group and that subsample analysis can shed more light on the generality of the performance patterns. For Old Economy IPOs, the findings can be interpreted as evidence that is consistent with the fact that firms take advantage of "windows of opportunity" in bringing their relatively old, mature companies with less growth and less earnings potential to the market. The evidence on New Economy IPOs, however, is not consistent with the predictions of either the "windows of opportunity" (Ritter (1991)) or "fads" (Shiller (1990)) hypothesis. It is also not consistent with theories that address the negative link between short- and long-run performance from an institutional perspective (Miller (1977)). The overperformance in New Economy stocks may stem from risk mismeasurement, investor sentiment or unexpected positive shocks, such as the sharp increase of the contribution of the New Economy to productivity growth during a period of unexpectedly prolonged economic growth during the 1990s (Gordon (2000)).<sup>28</sup>

In Figure 3, we graph the difference in three-year performance of New Economy IPOs versus Old Economy IPOs for IPOs issued on a year-by-year basis. We also display the composition of the European IPO sample and extend the information to include the sample composition of European IPOs during 1999 and 2000, the period

<sup>28</sup> See also Fortune (March 18, 2002): "The productivity miracle is for real" (page 51).



**Figure 3. IPO Activity and Performance of New Economy IPOs.** The initial sample of is comprised of 703 Old Economy and 270 New Economy IPOs offered between 1988-1998. During 1999 and 2000, a total of 535 companies went public in the seven countries under study, 366 of those are classified as New Economy companies. New Economy IPOs belong to Market Sectors 5, 13, 16 and 17, representing Technology, Media, Telecommunication and Healthcare. Old Economy firms belong to all other economic sectors in the Dow Jones STOXX global industry classification scheme. Returns are measured as buy-and-hold returns (BHRs) from the close of the first day of trading to their three-year anniversary on the stock market whereas one month is defined as ac consecutive 21-day-trading period using European trading days.

commonly referred to as “Internet Bubble”. Figure 3 underlines how New Economy IPOs issued between 1988 and 1998 outperformed their Old Economy peers consistently over a three-year horizon. The possible exceptions are Old Economy IPOs issued during 1992, which slightly overperformed over a three-year return window.<sup>29</sup> We also find a remarkable change in the sample composition during the “Internet Bubble”. This seems to be at least partly driven by the outperformance of previous years’ New Economy IPOs.

#### D. Regression Results

The previous analysis shows that the cross-sectional patterns in European IPO performance are not mutually exclusive. For example, IPOs in New Economy sectors experienced the highest initial returns, tended to be the younger companies and also recorded higher returns across all measurement horizons compared their Old Economy peers. This observation holds for New Economy firms issued during “hot” and “cold” markets.

To disentangle these observations, we perform univariate regression analysis using the raw return of the IPOs as the dependent variable similar to Ritter (1991). The explanatory variables are the unadjusted initial return, the logarithm of one plus age, the aftermarket return on the broad-market benchmark, the logarithm of one plus size, the public float and a (0,1) dummy variable representing New Economy firms. The results are displayed in Table IX. For the sample as a whole, the coefficient of determination is

<sup>29</sup> We also perform the analysis for the three individual “hot” and three “cold” markets defined in Table I and find that Old Economy IPOs issued in each of the “hot” and “cold” markets underperform.



Table IX

### OLS Regression Results for Aftermarket Performance

$$R_t = \alpha + \beta_1 IR_t + \beta_2 \text{Log}(1+\text{age}_t) + \beta_3 \text{Market}_t + \beta_4 \text{Log}(\text{Size}_t) + \beta_5 \text{PublicFloat}_t + \beta_6 D_1 + \varepsilon_t$$

$R_t$  is the raw return (not reported separately), measured from the first closing price.  $IR_t$  is the initial return, defined as the difference between the first closing price and the offering price.  $\text{Log}(1+\text{age}_t)$  is the natural logarithm of one plus the difference between the year of going public and the year of foundation, with firms founded before 1901 assumed to be founded in 1901.  $\text{Market}_t$  is the return on the value-weighted Dow Jones STOXX broad-market index for the same return interval as the dependent variable.  $\text{Log}(\text{Size}_t)$  is the natural logarithm of inflation adjusted size/market capitalization, defined as the total number of shares issued times the first closing price.  $\text{PublicFloat}_t$  is the Percentage of Equity offered to the public.  $D_1$  is a (0,1) Dummy variable taking on the value of 0 if the issuing firm belongs to a New Economy sector, and 1 otherwise. Standard Errors (S.E.) in parentheses. This table assumes a declining sample size.

Panel A: Aftermarket Performance Categorized by Size: All Market Conditions

Aftermarket	$\alpha$	S.E.	$\hat{\beta}_1$	S.E.	$\hat{\beta}_2$	S.E.	$\hat{\beta}_3$	S.E.	$\hat{\beta}_4$	S.E.	$\hat{\beta}_5$	S.E.	$\hat{\beta}_6$	S.E.	$R^2$	N
Month 1	0.209 <sup>b</sup>	(0.0886)	0.060 <sup>a</sup>	(0.0215)	-0.026	(0.0156)	0.835 <sup>a</sup>	(0.1303)	-0.018 <sup>c</sup>	(0.0109)	-0.103 <sup>a</sup>	(0.0307)	0.028 <sup>c</sup>	(0.0154)	0.082	973
Month 3	0.056	(0.1389)	0.028	(0.0338)	-0.050 <sup>b</sup>	(0.0246)	1.106 <sup>a</sup>	(0.0947)	0.006	(0.0172)	-0.140 <sup>a</sup>	(0.0485)	0.100 <sup>a</sup>	(0.0242)	0.155	972
Month 12	-0.386	(0.7798)	-0.024	(0.1888)	-0.137	(0.1375)	1.730 <sup>a</sup>	(0.3240)	0.083	(0.0958)	-0.513 <sup>c</sup>	(0.2709)	0.304 <sup>b</sup>	(0.1350)	0.041	970
Month 36	0.438	(2.3137)	0.480	(0.7465)	-0.196	(0.4008)	1.282 <sup>a</sup>	(0.3892)	-0.047	(0.2790)	-0.862	(0.7806)	1.439 <sup>a</sup>	(0.4259)	0.044	686
Month 60	0.045	(1.5609)	1.466 <sup>a</sup>	(0.5574)	0.149	(0.2641)	0.950 <sup>a</sup>	(0.1737)	-0.039	(0.1899)	-0.806	(0.5330)	0.934 <sup>a</sup>	(0.3092)	0.116	381

Panel B: Aftermarket Performance Categorized by Size: Hot Markets

Aftermarket	$\alpha$	S.E.	$\hat{\beta}_1$	S.E.	$\hat{\beta}_2$	S.E.	$\hat{\beta}_3$	S.E.	$\hat{\beta}_4$	S.E.	$\hat{\beta}_5$	S.E.	$\hat{\beta}_6$	S.E.	$R^2$	N
Month 1	0.276 <sup>b</sup>	(0.1287)	0.036	(0.0267)	-0.039 <sup>c</sup>	(0.0226)	0.868 <sup>a</sup>	(0.1695)	-0.023	(0.0157)	-0.136 <sup>a</sup>	(0.0438)	0.033	(0.0204)	0.078	657
Month 3	0.071	(0.2031)	-0.003	(0.0423)	-0.073 <sup>b</sup>	(0.0356)	1.179 <sup>a</sup>	(0.1208)	0.012	(0.0249)	-0.223 <sup>a</sup>	(0.0697)	0.114 <sup>a</sup>	(0.0323)	0.158	656
Month 12	-0.785	(1.1858)	-0.075	(0.2463)	-0.210	(0.2073)	1.788 <sup>a</sup>	(0.4429)	0.151	(0.1440)	-0.670 <sup>c</sup>	(0.4037)	0.316 <sup>c</sup>	(0.1868)	0.035	655
Month 36	1.017	(4.2188)	0.095	(1.1723)	-0.636	(0.7309)	1.079	(0.6607)	-0.036	(0.4931)	-0.828	(1.3604)	1.955 <sup>a</sup>	(0.7043)	0.040	389
Month 60	2.556	(1.7854)	0.557	(0.4746)	-0.228	(0.2906)	0.497	(0.3643)	-0.275	(0.2035)	0.102	(0.5341)	0.286	(0.3167)	0.073	119

Panel C: Aftermarket Performance Categorized by Size: Cold Markets

Aftermarket	$\alpha$	S.E.	$\hat{\beta}_1$	S.E.	$\hat{\beta}_2$	S.E.	$\hat{\beta}_3$	S.E.	$\hat{\beta}_4$	S.E.	$\hat{\beta}_5$	S.E.	$\hat{\beta}_6$	S.E.	$R^2$	N
Month 1	0.036	(0.0847)	0.200 <sup>a</sup>	(0.0361)	-0.036	(0.0151)	0.739 <sup>a</sup>	(0.1657)	-0.005	(0.0106)	-0.037	(0.0294)	0.010	(0.0179)	0.145	316
Month 3	-0.097	(0.1263)	0.176 <sup>a</sup>	(0.0530)	0.003	(0.0224)	0.766 <sup>a</sup>	(0.1297)	0.009	(0.0158)	0.005	(0.0436)	0.066 <sup>b</sup>	(0.0270)	0.166	316
Month 12	0.255	(0.4229)	0.271	(0.1789)	0.038	(0.0753)	1.515 <sup>a</sup>	(0.2553)	-0.037	(0.0531)	-0.262 <sup>c</sup>	(0.1472)	0.304 <sup>a</sup>	(0.0915)	0.179	315
Month 36	0.514	(0.9272)	1.049 <sup>a</sup>	(0.3974)	-0.298 <sup>c</sup>	(0.1613)	1.423 <sup>a</sup>	(0.1700)	-0.148	(0.1158)	-0.794 <sup>b</sup>	(0.3214)	0.474 <sup>b</sup>	(0.1899)	0.263	297
Month 60	-0.630	(2.1128)	2.437 <sup>a</sup>	(0.9183)	0.272	(0.3631)	0.983 <sup>a</sup>	(0.2388)	0.024	(0.2650)	-1.296 <sup>c</sup>	(0.7414)	1.279 <sup>a</sup>	(0.4302)	0.134	262

<sup>a,b,c</sup> denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively, based on a simple t-test.

rather low across the measurement periods.<sup>30</sup> It is markedly higher for IPOs issued in “cold” than in “hot” markets. The parameter estimates support the conclusions that were obtained earlier. The initial return category is correlated with the aftermarket performance of IPOs issued in “cold” markets, with four out of five measurement horizons being significantly positive. Age is correlated with immediate aftermarket returns for IPOs issued in “hot” markets, with all signs being negative across return windows. The coefficient on the market indicates that the beta for our sample of European IPOs is time-varying. Given the technology-led rise in share prices, particularly throughout the second half of the sample period, the coefficient on the market return of 1.28 over three years is in line with our expectation that IPOs are slightly riskier than the market. There is only weak evidence to support that size is correlated with returns, confirming our finding that value-weighting does not change our findings regarding aftermarket performance. Moreover, during 14 out of the 15 return horizons studied, the coefficient on the public float is negative, supporting the signaling hypothesis. We also find a strong correlation between market sector and raw returns, underlining the substantial impact of the New Economy sectors on the results of overall aftermarket performance.

#### IV. Summary and Conclusion

The European IPO market has gone through a period of unprecedented change. New Economy sectors have gradually taken a bigger share of total IPO activity, indicating that money previously flowing into mature industries with lower growth prospects had started to flow into young, technology-oriented companies that focus on growth. This process was facilitated by rising stock markets, the initial success of privatizations fuelling a boom in European share ownership, and the creation of market segments dedicated to young, growth-oriented companies. However, it is unclear whether these developments represent either a structural shift or are just symptoms of a time-varying market condition.

This study has focused on the return performance of a large sample of European IPOs during the period 1988-1998. The analysis has been pursued for the sample as a whole and also under two alternative market conditions: for IPOs issued in “hot” markets, when initial returns are high and the general level of the stock market is increasing; and for IPOs issued in “cold” markets, when initial returns are low and the general stock market level is stable or declining. We have split the research agenda into two units: the examination of initial returns and the examination of aftermarket performance. We find significant autocorrelation, which is higher for the number of offerings than for the initial returns. Not surprisingly, we also find significant underpricing, which is related to ex-ante characteristics of uncertainty. We attribute the large amounts of money left on the table during our sample period to some large privatizations.

While we present evidence of short-term overperformance, the results do not indicate that IPOs offered underperform in the long-run. This result appears to be robust across time periods underlining the most recent literature arguing that the long-run underperformance of IPOs is a time-varying phenomenon. Our results are also sensitive to the benchmark employed and return methodology with IPO outperformance being most magnified when compared against small- and medium- sized company

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<sup>30</sup> We have also experimented with adjusted  $R^2$  s, and do not find qualitatively different results.

benchmarks. The long-run positive aftermarket performance, however, is limited to IPOs issued in “hot” markets. In “cold” markets, the broad-market-adjusted equally-weighted performance is strongly negative. Moreover, the results on aftermarket performance worsen substantially when looking at the median picture, with some extreme returns driving the performance.

In order to shed some light on the underlying dynamics of aftermarket performance, we categorize returns according to a set of issuing characteristics. We find a strong impact of the initial return category. Here, companies with higher initial returns fare best, underlining the role of underpricing as a signal of firm quality. The quality of the underpricing signal is best in “cold” markets which are characterised by less “noise”. The evidence also points to a strong signaling role of the size of the public float, in the sense that it is positively related to aftermarket performance across measurement horizons. This is true for IPOs issued in both “hot” and “cold” markets. Moreover, the cross-sectional findings in this study provide definitive testimony of the overriding influence of the New Economy during the 1990s, which had a dramatic impact on the investment world in general and the European IPO market in particular. We show that the relatively good average performance of European IPOs issued between 1988 and 1998 is due to offerings in the New Economy that account for just 28 percent of the sample. While we do not adjust for risk, it is unlikely that beta alone can account for the performance differences. These results extend across all measurement horizons. Through the outburst of IPO activity in the New Economy sectors relative to the Old Economy on the “New Market” segments during the height of the “Internet Bubble” in 1999 and part of 2000, this multi-year pattern ultimately reversed.

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**Table AI**  
**Global Sector Classification Standard<sup>31</sup>**

The Dow Jones STOXX global sector classification standard groups companies that have similar primary revenue sources. There are 10 economic sectors and derived from these – in increasingly finer classifications – are 18 market sectors (used for this study), 51 industry groups and 89 sub-groups. New Economy firms (270) belong to Market Sectors 5, 13, 16 and 17, representing Media [MDI], Healthcare [HCR], Technology [TEC] and Telecommunications [TLS], respectively. For the purpose of this study, all other Market Sectors are defined as belonging to the Old Economy. Europe (EU) = Total Number of IPOs issued between 1988 and 1998 in Germany (BD), France (FR), Italy (IT), the Netherlands (NL), Spain (SP), Sweden (SD) and Switzerland (SW).

<i>Market Sectors</i>	<i>Country and Number of IPOs</i>							
	EU	BD	FR	IT	NL	SP	SD	SW
1 Basic Resources [BAS]	46	5	13	3	3	9	11	2
2 Chemicals [CHM]	27	4	10	4	5	1	0	3
3 Automobiles [ATO]	36	10	11	4	4	1	6	0
4 Cyclical Goods and Services [CGS]	124	33	39	21	6	9	10	6
5 Media [MDI]	32	3	18	3	1	2	5	0
6 Retail [RTS]	44	16	19	1	3	1	4	0
7 Food & Beverage [FOB]	51	7	24	2	1	12	3	2
8 Non-Cyclical Goods & Services [NCG]	63	13	26	1	8	9	5	1
9 Energy [ENE]	11	0	4	2	1	2	2	0
10 Banks [BNK]	20	3	2	6	0	6	2	1
11 Financial Services [FSV]	58	12	13	6	4	9	13	1
12 Insurance [INS]	17	4	5	5	0	2	0	1
13 Healthcare [HCR]	54	7	22	1	4	0	14	6
14 Construction [CNS]	47	18	8	2	3	13	3	0
15 Industrial Goods & Services [IGS]	147	32	45	12	7	9	34	8
16 Technology [TEC]	170	43	56	1	24	1	34	11
17 Telecommunications [TLS]	14	4	6	0	1	0	2	1
18 Utilities [UTI]	12	5	2	3	0	2	0	0
Total	973	219	323	77	75	88	148	43

<sup>31</sup> For the complete classification standard see: [http://www.stoxx.com/indexes/guide/index\\_guide.pdf](http://www.stoxx.com/indexes/guide/index_guide.pdf)

**Table AII**  
**Aftermarket Performance (Value-Weighted)**

The initial sample contains 973 European Initial Public Offerings between 1988 and 1998. Aftermarket returns are measured as *value-weighted* buy-and-hold returns whereas one month is defined as consecutive 21-day trading interval from the close of the first day of trading using European trading days, assuming a declining sample size. If the IPO is delisted before the end of the measurement period, we calculate the return until the delisting date. Aftermarket returns are compared with alternative benchmarks. The Dow Jones STOXX, size-based benchmarks, ex. UK, were used as a proxy for the European market. The wealth relative (WR) is the ratio on one plus the average aftermarket period buy-and-hold IPO return divided by one plus the average aftermarket benchmark buy-and-hold return. For example, for the month 36 adjustment of IPO returns for the movement in the broad market,  $(1+0.7414)/(1+0.6495) = 1.06$ ; Standard Errors (S.E.) in parentheses.

*Aftermarket Performance of IPOs: All Market Conditions*

Aftermarket	IPO and Benchmark Returns								
	Raw Return	Broad-Market	Wealth Relative	Large-Caps	Wealth Relative	Mid-Caps	Wealth Relative	Small-Caps	Wealth Relative
Month 1 (N=973)	0.0059 (0.0068)	0.0116 (0.0117)	0.99 (0.0067)	0.0147 (0.0148)	0.99 (0.0067)	0.0057 (0.0057)	1.00 (0.0053)	-0.0049 (-0.0048)	1.01 (0.0066)
Month 3 (N=972)	0.0374 <sup>a</sup> (0.0111)	0.0463 (0.0467)	0.99 (0.0104)	0.0526 (0.0534)	0.99 (0.0104)	0.0321 (0.0319)	1.01 (0.0105)	0.0096 (0.0093)	1.03 <sup>a</sup> (0.0105)
Month 12 (N=970)	0.2422 <sup>a</sup> (0.0582)	0.1513 (0.1402)	1.08 (0.0575)	0.1766 (0.1673)	1.06 (0.0576)	0.0882 (0.0773)	1.14 <sup>a</sup> (0.0576)	0.0147 (0.0120)	1.22 <sup>a</sup> (0.0578)
Month 36 (N=686)	0.7412 <sup>a</sup> (0.1746)	0.6495 (0.6153)	1.06 (0.1729)	0.7625 (0.7718)	0.99 (0.1733)	0.3784 (0.2996)	1.26 <sup>b</sup> (0.1733)	0.1128 (0.0721)	1.56 <sup>a</sup> (0.1735)
Month 60 (N=381)	0.7763 <sup>a</sup> (0.1245)	1.1732 (1.4353)	0.82 <sup>a</sup> (0.1178)	1.4143 (1.9223)	0.74 <sup>a</sup> (0.1177)	0.6698 (0.6296)	1.06 (0.1193)	0.2003 (0.1353)	1.48 <sup>a</sup> (0.1210)

<sup>a,b,c</sup> denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively, based on a simple t-test.



**Table AIII**  
**Cumulative Average IPO Returns (CARs) for**  
**Alternative Benchmarks**

Aftermarket Returns are measured as Cumulative Average Returns (CARs) (not in percent), with associated Standard Errors (S.E.) (in parentheses) for 60 months after going public, excluding the initial returns. One month is defined as a consecutive 21-day trading interval using European trading days. The value-weighted Dow Jones STOXX size indices (Broad-Market, Large-Caps, Mid-Caps and Small Caps), excluding UK, were used as a proxy for the market benchmark respectively.

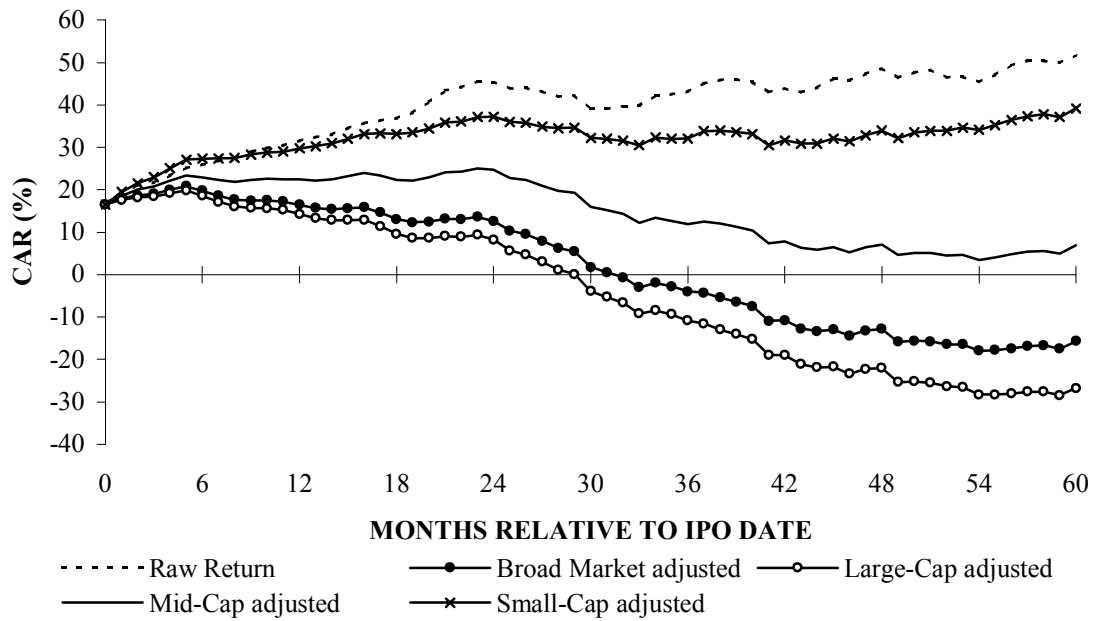
Month	IPO Return		Broad Market adjusted		Large-Cap adjusted		Mid-Cap adjusted		Small-Cap adjusted	
	CAR	S.E.	CAR	S.E.	CAR	S.E.	CAR	S.E.	CAR	S.E.
1	0.0312 <sup>a</sup>	(0.0068)	0.0134 <sup>b</sup>	(0.0066)	0.0106	(0.0067)	0.0208 <sup>a</sup>	(0.0066)	0.0296 <sup>a</sup>	(0.0066)
2	0.0461 <sup>a</sup>	(0.0087)	0.0215 <sup>b</sup>	(0.0084)	0.0166 <sup>b</sup>	(0.0084)	0.0347 <sup>a</sup>	(0.0084)	0.0500 <sup>a</sup>	(0.0085)
3	0.0512 <sup>a</sup>	(0.0105)	0.0252 <sup>a</sup>	(0.0098)	0.0187 <sup>c</sup>	(0.0098)	0.0431 <sup>a</sup>	(0.0098)	0.0646 <sup>a</sup>	(0.0098)
4	0.0678 <sup>a</sup>	(0.0122)	0.0346 <sup>a</sup>	(0.0112)	0.0263 <sup>b</sup>	(0.0112)	0.0569 <sup>a</sup>	(0.0113)	0.0857 <sup>a</sup>	(0.0114)
5	0.0862 <sup>a</sup>	(0.0141)	0.0432 <sup>a</sup>	(0.0131)	0.0332 <sup>b</sup>	(0.0131)	0.0685 <sup>a</sup>	(0.0131)	0.1054 <sup>a</sup>	(0.0133)
6	0.0933 <sup>a</sup>	(0.0151)	0.0327 <sup>b</sup>	(0.0141)	0.0203	(0.0142)	0.0636 <sup>a</sup>	(0.0142)	0.1083 <sup>a</sup>	(0.0143)
7	0.1036 <sup>a</sup>	(0.0158)	0.0205	(0.0149)	0.0060	(0.0150)	0.0582 <sup>a</sup>	(0.0149)	0.1091 <sup>a</sup>	(0.0151)
8	0.1097 <sup>a</sup>	(0.0165)	0.0115	(0.0156)	-0.0045	(0.0159)	0.0540 <sup>a</sup>	(0.0156)	0.1094 <sup>a</sup>	(0.0158)
9	0.1247 <sup>a</sup>	(0.0173)	0.0093	(0.0162)	-0.0085	(0.0162)	0.0577 <sup>a</sup>	(0.0162)	0.1176 <sup>a</sup>	(0.0164)
10	0.1339 <sup>a</sup>	(0.0179)	0.0097	(0.0171)	-0.0091	(0.0171)	0.0605 <sup>a</sup>	(0.0170)	0.1227 <sup>a</sup>	(0.0172)
11	0.1391 <sup>a</sup>	(0.0183)	0.0069	(0.0176)	-0.0127	(0.0175)	0.0593 <sup>a</sup>	(0.0174)	0.1246 <sup>a</sup>	(0.0176)
12	0.1499 <sup>a</sup>	(0.0197)	-0.0005	(0.0204)	-0.0226	(0.0188)	0.0588 <sup>a</sup>	(0.0188)	0.1322 <sup>a</sup>	(0.0190)
13	0.1588 <sup>a</sup>	(0.0210)	-0.0081	(0.0201)	-0.0323	(0.0201)	0.0564 <sup>a</sup>	(0.0200)	0.1374 <sup>a</sup>	(0.0202)
14	0.1651 <sup>a</sup>	(0.0226)	-0.0110	(0.0215)	-0.0370 <sup>c</sup>	(0.0215)	0.0590 <sup>a</sup>	(0.0214)	0.1440 <sup>a</sup>	(0.0216)
15	0.1800 <sup>a</sup>	(0.0240)	-0.0089	(0.0227)	-0.0368	(0.0228)	0.0673 <sup>a</sup>	(0.0228)	0.1550 <sup>a</sup>	(0.0228)
16	0.1917 <sup>a</sup>	(0.0257)	-0.0065	(0.0242)	-0.0361	(0.0242)	0.0738 <sup>a</sup>	(0.0242)	0.1662 <sup>a</sup>	(0.0243)
17	0.1977 <sup>a</sup>	(0.0264)	-0.0188	(0.0250)	-0.0512 <sup>b</sup>	(0.0250)	0.0688 <sup>a</sup>	(0.0251)	0.1673 <sup>a</sup>	(0.0251)
18	0.2028 <sup>a</sup>	(0.0272)	-0.0346	(0.0257)	-0.0694 <sup>a</sup>	(0.0258)	0.0579 <sup>b</sup>	(0.0258)	0.1662 <sup>a</sup>	(0.0258)
19	0.2170 <sup>a</sup>	(0.0275)	-0.0424	(0.0261)	-0.0794 <sup>a</sup>	(0.0262)	0.0560 <sup>b</sup>	(0.0262)	0.1697 <sup>a</sup>	(0.0262)
20	0.2413 <sup>a</sup>	(0.0282)	-0.0408	(0.0268)	-0.0795 <sup>a</sup>	(0.0269)	0.0636 <sup>b</sup>	(0.0270)	0.1793 <sup>a</sup>	(0.0269)
21	0.2688 <sup>a</sup>	(0.0292)	-0.0342	(0.0279)	-0.0743 <sup>a</sup>	(0.0280)	0.0758 <sup>a</sup>	(0.0281)	0.1930 <sup>a</sup>	(0.0280)
22	0.2762 <sup>a</sup>	(0.0290)	-0.0349	(0.0281)	-0.0758 <sup>a</sup>	(0.0281)	0.0772 <sup>a</sup>	(0.0282)	0.1959 <sup>a</sup>	(0.0280)
23	0.2902 <sup>a</sup>	(0.0295)	-0.0294	(0.0285)	-0.0717 <sup>b</sup>	(0.0286)	0.0856 <sup>a</sup>	(0.0286)	0.206 <sup>a</sup>	(0.0285)
24	0.2893 <sup>a</sup>	(0.0301)	-0.0388	(0.0291)	-0.0833 <sup>a</sup>	(0.0292)	0.0817 <sup>a</sup>	(0.0292)	0.2066 <sup>a</sup>	(0.0291)
25	0.2733 <sup>a</sup>	(0.0302)	-0.0621 <sup>b</sup>	(0.0291)	-0.1088 <sup>a</sup>	(0.0292)	0.0628 <sup>b</sup>	(0.0293)	0.1945 <sup>a</sup>	(0.0291)
26	0.2748 <sup>a</sup>	(0.0305)	-0.0703 <sup>b</sup>	(0.0294)	-0.1181 <sup>a</sup>	(0.0295)	0.0572 <sup>c</sup>	(0.0295)	0.1928 <sup>a</sup>	(0.0294)
27	0.2661 <sup>a</sup>	(0.0307)	-0.0860 <sup>a</sup>	(0.0295)	-0.1351 <sup>a</sup>	(0.0296)	0.0438	(0.0296)	0.1832 <sup>a</sup>	(0.0295)
28	0.2548 <sup>a</sup>	(0.0311)	-0.1022 <sup>a</sup>	(0.0297)	-0.1538 <sup>a</sup>	(0.0298)	0.0321	(0.0299)	0.1794 <sup>a</sup>	(0.0299)
29	0.2574 <sup>a</sup>	(0.0313)	-0.1109 <sup>a</sup>	(0.0298)	-0.1645 <sup>a</sup>	(0.0298)	0.0269	(0.0300)	0.1812 <sup>a</sup>	(0.0299)
30	0.2250 <sup>a</sup>	(0.0316)	-0.1482 <sup>a</sup>	(0.0302)	-0.2043 <sup>a</sup>	(0.0302)	-0.0060	(0.0302)	0.1567 <sup>a</sup>	(0.0303)
31	0.2258 <sup>a</sup>	(0.0319)	-0.1599 <sup>a</sup>	(0.0303)	-0.2179 <sup>a</sup>	(0.0304)	-0.0134	(0.0306)	0.1551 <sup>a</sup>	(0.0305)
32	0.2315 <sup>a</sup>	(0.0327)	-0.1718 <sup>a</sup>	(0.0312)	-0.2315 <sup>a</sup>	(0.0312)	-0.0223	(0.0313)	0.1505 <sup>a</sup>	(0.0313)
33	0.2325 <sup>a</sup>	(0.0342)	-0.1951 <sup>a</sup>	(0.0323)	-0.2575 <sup>a</sup>	(0.0324)	-0.0434	(0.0324)	0.1397 <sup>a</sup>	(0.0325)
34	0.2569 <sup>a</sup>	(0.0353)	-0.1850 <sup>a</sup>	(0.0332)	-0.2495 <sup>a</sup>	(0.0333)	-0.0317	(0.0333)	0.1579 <sup>a</sup>	(0.0335)
35	0.2595 <sup>a</sup>	(0.0365)	-0.1929 <sup>a</sup>	(0.0342)	-0.2591 <sup>a</sup>	(0.0343)	-0.0381	(0.0343)	0.1550 <sup>a</sup>	(0.0344)
36	0.2658 <sup>a</sup>	(0.0376)	-0.2052 <sup>a</sup>	(0.0350)	-0.2742 <sup>a</sup>	(0.0350)	-0.0467	(0.0351)	0.1552 <sup>a</sup>	(0.0353)
37	0.2854 <sup>a</sup>	(0.0383)	-0.2082 <sup>a</sup>	(0.0356)	-0.2808 <sup>a</sup>	(0.0357)	-0.0407	(0.0357)	0.1730 <sup>a</sup>	(0.0359)
38	0.2938 <sup>a</sup>	(0.0388)	-0.2199 <sup>a</sup>	(0.0362)	-0.2947 <sup>a</sup>	(0.0362)	-0.0451	(0.0363)	0.1742 <sup>a</sup>	(0.0364)
39	0.2952 <sup>a</sup>	(0.0391)	-0.2293 <sup>a</sup>	(0.0365)	-0.3053 <sup>a</sup>	(0.0365)	-0.0519	(0.0366)	0.1708 <sup>a</sup>	(0.0368)

**Appendix C continued:**

40	0.2898 <sup>a</sup> (0.0403)	-0.2399 <sup>a</sup> (0.0378)	-0.3175 <sup>a</sup> (0.0378)	-0.0607 (0.0379)	0.1658 <sup>a</sup> (0.0381)
41	0.2651 <sup>a</sup> (0.0389)	-0.2748 <sup>a</sup> (0.0362)	-0.3548 <sup>a</sup> (0.0362)	-0.0923 <sup>b</sup> (0.0363)	0.1396 <sup>a</sup> (0.0367)
42	0.2736 <sup>a</sup> (0.0394)	-0.2732 <sup>a</sup> (0.0368)	-0.3551 <sup>a</sup> (0.0368)	-0.0874 <sup>b</sup> (0.0370)	0.1511 <sup>a</sup> (0.0373)
43	0.2652 <sup>a</sup> (0.0400)	-0.2926 <sup>a</sup> (0.0375)	-0.3767 <sup>a</sup> (0.0375)	-0.1024 <sup>a</sup> (0.0376)	0.1433 <sup>a</sup> (0.0379)
44	0.2752 <sup>a</sup> (0.0403)	-0.2986 <sup>a</sup> (0.0376)	-0.3838 <sup>a</sup> (0.0376)	-0.1065 <sup>a</sup> (0.0377)	0.1436 <sup>a</sup> (0.0381)
45	0.2968 <sup>a</sup> (0.0413)	-0.2951 <sup>a</sup> (0.0384)	-0.3826 <sup>a</sup> (0.0385)	-0.1012 <sup>a</sup> (0.0386)	0.1552 <sup>a</sup> (0.0389)
46	0.2930 <sup>a</sup> (0.0416)	-0.3097 <sup>a</sup> (0.0386)	-0.3995 <sup>a</sup> (0.0386)	-0.1133 <sup>a</sup> (0.0388)	0.1490 <sup>a</sup> (0.0392)
47	0.3083 <sup>a</sup> (0.0440)	-0.2975 <sup>a</sup> (0.0411)	-0.3882 <sup>a</sup> (0.0411)	-0.1012 <sup>b</sup> (0.0412)	0.1634 <sup>a</sup> (0.0416)
48	0.3210 <sup>a</sup> (0.0452)	-0.2934 <sup>a</sup> (0.0423)	-0.3855 <sup>a</sup> (0.0423)	-0.0946 <sup>b</sup> (0.0425)	0.1742 <sup>a</sup> (0.0429)
49	0.2990 <sup>a</sup> (0.0450)	-0.3239 <sup>a</sup> (0.0419)	-0.4188 <sup>a</sup> (0.0419)	-0.1194 <sup>a</sup> (0.0421)	0.1565 <sup>a</sup> (0.0427)
50	0.3113 <sup>a</sup> (0.0448)	-0.3212 <sup>a</sup> (0.0420)	-0.4174 <sup>a</sup> (0.0420)	-0.1141 <sup>a</sup> (0.0422)	0.1696 <sup>a</sup> (0.0427)
51	0.3181 <sup>a</sup> (0.0455)	-0.3232 <sup>a</sup> (0.0430)	-0.4205 <sup>a</sup> (0.0430)	-0.1136 <sup>a</sup> (0.0431)	0.1735 <sup>a</sup> (0.0435)
52	0.3000 <sup>a</sup> (0.0465)	-0.3296 <sup>a</sup> (0.0444)	-0.4289 <sup>a</sup> (0.0444)	-0.1200 <sup>a</sup> (0.0445)	0.1733 <sup>a</sup> (0.0449)
53	0.3011 <sup>a</sup> (0.0464)	-0.3295 <sup>a</sup> (0.0444)	-0.4305 <sup>a</sup> (0.0443)	-0.1181 <sup>a</sup> (0.0443)	0.1814 <sup>a</sup> (0.0446)
54	0.2895 <sup>a</sup> (0.0474)	-0.3448 <sup>a</sup> (0.0451)	-0.4480 <sup>a</sup> (0.0451)	-0.1310 <sup>a</sup> (0.0450)	0.1756 <sup>a</sup> (0.0454)
55	0.3057 <sup>a</sup> (0.0481)	-0.3432 <sup>a</sup> (0.0459)	-0.4483 <sup>a</sup> (0.0459)	-0.1251 <sup>a</sup> (0.0459)	0.1876 <sup>a</sup> (0.0462)
56	0.3281 <sup>a</sup> (0.0480)	-0.3394 <sup>a</sup> (0.0459)	-0.4456 <sup>a</sup> (0.0459)	-0.1167 <sup>b</sup> (0.0459)	0.1991 <sup>a</sup> (0.0462)
57	0.3385 <sup>a</sup> (0.0493)	-0.3339 <sup>a</sup> (0.0474)	-0.4413 <sup>a</sup> (0.0474)	-0.1114 <sup>b</sup> (0.0473)	0.2075 <sup>a</sup> (0.0474)
58	0.3388 <sup>a</sup> (0.0501)	-0.3322 <sup>a</sup> (0.0482)	-0.4412 <sup>a</sup> (0.0483)	-0.1094 <sup>b</sup> (0.0480)	0.2127 <sup>a</sup> (0.0482)
59	0.3347 <sup>a</sup> (0.0505)	-0.3404 <sup>a</sup> (0.0487)	-0.4501 <sup>a</sup> (0.0487)	-0.1157 <sup>b</sup> (0.0485)	0.2061 <sup>a</sup> (0.0485)
60	0.3525 <sup>a</sup> (0.0532)	-0.3220 <sup>a</sup> (0.0506)	-0.4328 <sup>a</sup> (0.0506)	-0.0964 <sup>c</sup> (0.0505)	0.2263 <sup>a</sup> (0.0506)

<sup>a,b,c</sup> denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively, based on a simple t-test.

## EUROPE



**Figure A1. The Long-Run Performance of IPOs in Europe.** Cumulative average returns (CARs) for an equally-weighted portfolio of European Initial Public Offerings, with monthly rebalancing, month 1 to 60. One month is defined as a consecutive 21-day trading interval using European trading days. Five CAR series are plotted for the first 60 months after the IPO date: 1) Raw returns (no adjustment), 2) broad-market adjustment using the STOXX broad-market index (value-weighted), excluding UK, 3) large-cap adjustment using the STOXX large-cap index (value-weighted), excluding UK, 4) mid-cap adjustment using the STOXX mid-cap index (value-weighted), excluding UK and 5) small-cap adjustment using the STOXX small-cap index (value-weighted), excluding UK. Month 0 is the initial return interval. Returns were calculated on the basis of final closing prices.