IPO VALUATION USING PEER MULTIPLES- Evidence of Overvaluation from Europe 1990-2008.

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PURPOSE OF THE STUDY

The purpose of this study is to analyze the valuation of European initial public offerings (IPOs) relative to peer group of comparable firms by using price-to-value (P/V) multiples. Furthermore, the intention of this thesis is to study underpricing, short-run abnormal returns, and long-run underperformance in price-to-value valuation context. The objective of the study is threefold. First, I empirically test whether the European initial public offerings are overvalued in relation to their listed peer companies by using various price multiples. Secondly, I examine the relationship between IPO underpricing and valuation results. Lastly, I study possible differences in short- and long-run abnormal returns between under- and overvalued IPOs.

DATA

The initial listing data for European IPOs is gathered from the Thomson Financial SDC Global New Issues database, and it has been completed with the financial and secondary market data from the Thomson ONE-banker and DataStream databases. The financial and aftermarket data for peer companies is solely retrieved from the Thomson ONE-banker. After all the limitations, my final sample consists of 614 European IPOs from the time period of 1.1.1990-31.12.2008.

RESULTS

My results indicate that European IPOs are systematically overvalued by 60% relative to their industry peers, and the overpricing is significantly highest by about 150% during the "dot-com" boom in years 1999-2000. The results also suggest that investors pay too much information to optimistic growth forecasts and too little attention to current profitability in valuing IPOs which creates unique patterns in IPOs' aftermarket returns. I find that overvalued IPOs earn 27% (p.a.) higher risk-adjusted abnormal returns than undervalued IPOs during the first six months but earn 40% to 110% lower buy-and-hold abnormal returns on a five-year time scale.

KEYWORDS

Initial Public Offering, IPO, Overvaluation, Investor sentiment, Underpricing, After-market performance, Buy-and-hold abnormal return, BHAR

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TUTKIMUKSEN TAVOITTEET

Tutkimuksen tavoitteena on tarkastella listautumisantien suhteellista hinnoittelua pörssissä jo olemassa oleviin toimialan samanlaisiin yrityksiin nähden markkinakertoimiin perustuvaa menetelmää hyväksi käyttäen. Tutkimus kyseenalaistaa listautumisantimarkkinoiden tehokkuuden Euroopassa ja ehdottaa että sentimentti sijoittajat näyttelevät suurta osaa listautumisantien hinnan määrityksessä. Vertaan tutkimuksessa listautumisantien ali-/yliarvostuksen suhdetta ensimmäisen kaupankäyntipäivän ylisuuriin tuottoihin sekä niiden lyhyen ja pitkän aikavälin markkina-arvon kehitykseen.

DATA JA TILASTOLLISET MENETELMÄT

Tutkimuksen aineisto koostuu 614 Eurooppalaisesta listautumisannista aikaväliltä 1.1.1990-31.12.2008. Emissiotiedot on haettu Thomson Financials SDC Global New Issues tietokannasta. Listauneiden ja vertaisyritysten tunnuslukujen laskemiseen käytettävät ja jälkimarkkinahintoihin liittyvät tiedot on kerätty Thomson Financials Compustat, ja Datastream tietokannoista.

TULOKSET

Tutkimuksen tulokset antavat viitteitä siitä, että Eurooppalaiset listautumisannit ovat noin 60 %:a ylihinnoiteltuja suhteessa pörssiin listattuihin saman toimialan yrityksiin, ja ylihinnoittelu on korkeinta teknologiakuplan aikaan vuosina 1999-2000, jolloin listautumisannit ovat keskimäärin 160 %:a ylihinnoiteltuja. Tämän lisäksi, tutkimus paljastaa että eniten yliarvostetut listautumisannit tuottavat 26%:a korkeampia riskikorjattuja tuottoja kuin aliarvostetut listautumisannit ensimmäisten kuuden kuukauden aikana, mutta viiden vuoden ajanjaksolla tuotot ovat 40-110%:a pienempiä kuin aliarvostetuilla listautumisanneilla.

AVAINSANAT

Listautumisanti, Arvonmääritys, Yliarvostus, Sijoittajasentimentti, Jälkimarkkinakäyttäytyminen, Epänormaali tuotto

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1 INTRODUCTION

1.1 Background and Motivation for the Study

There are several anomalous aspects to the process by which firms go public (Ritter and Welch 2002). Initial underpricing, and the long-run underperformance are two well-known 'anomalies' associated with initial public offerings (IPOs). Even though, IPO pricing has been popular topic for academic studies during the past three decades, the academic literature does not offer a consensual explanation to these anomalies (see, e.g., Ljungqvist, Nanda, and Singh, 2006). At the first glance, under the efficient market hypothesis these anomalies seem contradicting. There are several theories explaining the IPO underpricing, however most of these theories fail to clarify the connection in between IPO underpricing and long-run underperformance.

McCarthy (1999) points out, that the pricing of IPOs is often described as a combination of art and science. In financial research, the underpricing phenomenon has been studied extensively since the beginning of the 1980s. The traditional view is that investors who invest in IPOs earn large abnormal returns during the first trading day. This phenomenon is commonly referred as IPO "underpricing". The underpricing premium has not remained constant throughout the time. Ritter et al. (2002) argues that the average first-day returns on U.S. IPO markets have increased remarkably from 1980s. He points out that the average first-day return doubled to during 1990-1998, before jumping remarkably during the internet bubble years of 1999-2000.

Traditional asymmetric information models assume that capital markets are efficient, and underpricing is done respect to issuing firm's fair value. In contrast to asymmetric models, Purnanandam and Swaminathan (2004) represent an alternative view to interpret underpricing context. Their model suggests that stock markets are inefficient and the stock prices can deviate from their fair values in the short run. Hence, issuing firms can be overvalued and underpriced at the same time.

Also, the long-run performance has been studied and documented in a large number of papers, and many studies have documented a long-run decline in companies' post-IPO operating performance. As early as 1990s, studies by Ritter (1991), Loughran (1993), and Loughran and Ritter (1995) have found that IPOs underperform the market in the long-run. But still, the notion of long-run performance of IPOs is under debate in the academic literature. Brav and Gompers (1997) and Brav, Geczy, and Gombers (2000) argue that the long-run underperformance of IPOs is caused by the poor performance of small companies with high market-to-book ratios in general, regardless whether they are IPOs or not. In the more recent studies, investor overconfidence has been raised one the key drivers of the poor long-run performance (see e.g. Daniel and Titman, 1999; Purnanandam and Swaminathan, 2004).

1.2 Research Question

The objective of this study is to empirically test whether European IPOs are overpriced at their offer price. The objective of the study can be condensed into three phrases.

- Are European IPOs systematically overvalued against their non-IPO peers?

- Are there relationship between IPO valuation, first-day returns, and after-market performance?

- Are there differences in short- and long-run aftermarket returns in the case of undervalued and overvalued IPOs?

1.3 Contribution to Literature

This thesis contributes to existing literature of IPOs by being, to the best of knowledge, the first academic research paper that is able to connect the valuation of European Initial public Offerings (IPOs) and aftermarket abnormal returns in both short- and long-run. In valuation process, I use comparable single firm market multiples instead of industry average multiples. This unique matching should give me more accurate estimates about IPOs' 'fair' intrinsic values, since both IPOs and matching firms reflect similar kind of operating risks and profitability. As a large sample size is one of fundamental requirements in applying comparable firm multiples, the European-wide sample improves the explanatory power models remarkably.

Furthermore, this thesis is one of the first researches that studies IPO valuation relative to peer group in Europe during the 'dot-com' bubble. My results indicate that European IPOs are systematically and persistently overvalued regardless of years 1998-2000. Consistently with Lerner (1994), Ritter (1991), Baker and Wurgler (2000), my findings suggest that stock prices periodically diverge from fundamental values, IPO companies' owners, managers and investment bankers are trying to take advantage of overpricing by selling stock overly optimistic investors.

This thesis also shows that the overvaluation computed based on peer multiples significantly affects both short- and long-run abnormal, and either book-to-market effect or 'dot-com' bubble are able to explain five-year underperformance documented by Ritter (1991) and Loughran (1995). This research superior evidence that sentiment investors play major role in IPO price setting context, and it creates specific patterns in IPOs' aftermarket returns. From individual investors' perspective, these patterns enables to earn high abnormal in both short- and long-term.

1.4 Limitations of the Study

This study will concentrate mainly on IPO valuation in European stock markets by using comparable firm multiples. The comparable firm approach works under the assumption that there exists a peer group of comparable firms. This approach is relatively easy to implement in highly populated and traded stock markets (e.g., in the US) where appropriate comparable firms are readily available. Despite the fact that the comparable firm approach is a frequently recommended and used quantitative model for pricing IPO companies (see, e.g., Beninga and Sarig, 1997; How, Lam, and Yeo, 2007; Joyce and Roosma, 1991; Kaplan and Ruback, 1995; Kim and Ritter, 1999; Penman, 2001), the earlier literature has highlighted that the valuation based on comparable accounting multiples has its own drawbacks.

Several studies have pointed out that better valuation results are commonly achieved by using a specialist company doing the analysis rather than valuing IPOs by using a set of comparables in the same industry (see e.g. Kim and Ritter, 1999). However, Ritter and Welch (2002) state that if the sample size is large enough the testing against company peers can be prove out to be admissible.

Ljunqgvist and Ritter state in their homepages (*http://pages.stern.nyu.edu/~aljungqv/research.htm / http://bear.cba.ufl.edu/ritter/SDCcorrections.pdf*) that Thomson Financial SDC Global New Issue database has several data errors. They summarize in their homepages that SDC is lacking notable number of the issuing companies. Besides missing companies, figures such as shares outstanding and venture backing are quite often reported incorrectly. In Ljunqgvist's (2001) hand-collected data sample of 2399 IPOs only 584 issuing companies (24.4%) were correctly reported and found in SDC. All in all, European nation-wide markets are smaller and less developed compared to U.S. stock markets, hence the represented biases are more likely to greater.

1.5 Structure of the Thesis

This study proceeds as follows. The first chapter presents an introduction in which the motivations, objective and limitations together with the research problem are stated. The second section will focus on revealing the theoretical background of the IPO pricing theories and the evidence of long-term underperformance of IPOs, together with the literature related to research problem. The third chapter develops the hypotheses of the study based on the theories presented in the previous chapter. After having stated the hypotheses, the fourth chapter concentrates on the data, variables, and the methodology used in the quantitative analysis. In addition, the chapter includes an overview to the sample data. The empirical findings and discussion of their effect are presented in the fifth chapter. The last chapter draws conclusions concerning the findings from practical, theoretical, and methodological perspective. There will also be presented the possible need for further research related to the problem of the study.

2 LITERATURE REVIEW

This section presents the most relevant theoretical and empirical literature associated with initial public offerings; especially the IPO associated anomalies, such as market timing, underpricing and long-run underperformance are at the centre of attention. To tackle the vast of area relevant literature, I will first provide a brief overlook to these anomalies in order to understand the IPO theories. After that, I present the key theories and prior empirical findings related to market timing, underpricing and overvaluation. The underpricing section concentrates mainly on the asymmetric information based theories not forgetting the behavioural side of IPO pricing. Finally, I am introducing the idea behind IPO overvaluation and the former academic research relating to post-IPO performance.

2.1 Anomalies associated with IPOs

IPOs have interested financial economists for a long time, and IPO related literature has been under continuous debate at least for three decades. As the time has passed, a large number of academic studies have brought out several new insights, explanations and angles to IPO underpricing, market timing, and long-run performance.

The decision of going public is considered as an important turning point in the life of young company, and it is frequently the largest equity issue a corporation ever makes. In fundamental stage, it provides access to public equity capital and that way can lower the cost of funding the company's operations and investments. From company's existing shareholders' view initial public offering enables to diversify their investments, and provides a venue for trading the company's shares. Usually the companies' main driver behind the listing decision is increased demand for capital, and thus most companies that go public do so via an initial public offering of shares to investors.

The key parties involved in IPO transaction are the issuing firm, the bank underwriting and marketing the deal, and investors. The offer price is usually determined by the investment bank and firms owners. Traditionally, the former IPO literature assumes that the owners and the

management of the company going public have an informational advantage towards investors since they have better knowledge of the company's past performance, current financial position, and future prospects. At the same time, the outsiders, including underwriters and investors, must rely on financial statement information until the beginning of capital market trading and underwriters set an offer price using accounting variables (see, e.g., Titman and Truman, 1986; DeAngelo, 1988; Kim and Ritter, 1999). To decrease this informational advantage, the issuing firms' commonly offer their shares to investors at 'discounted price', by so that the new shareholders receive their shares at the discount and part of the original owners' wealth is transferred to them. The IPO literature has offered several possible explanations why issuers leave money on the table in IPOs. Most of the theories explaining the underpricing concern asymmetric information between parties involved in the IPO process.

Under the assumption of efficient market hypothesis, this underpricing is done respect to company's 'fair' intrinsic value. Alternatively, study by Purnanandam and Swaminathan (2004) suggests that IPOs are not underpriced relative to their fair value, but relative to some maximum value the investment bank and the issuing company could charge given the demand they observe at the time of pricing. Hence, they argue that IPOs could at the same time be both overvalued and underpriced, which could explain both underpricing and the poor after-market performance of issuing firms' stocks. Similarly with Purnanandam's et al. (2004) study, a large number other theoretical paper have noted that the appearance of investor sentiment can be one of the most important determinants of IPO volume, and the fluctuations in IPO volume can be related to various forms of market irrationally. (see, e.g., Lerner 1994; Pagano, Panetta, and Zingales, 1995)

Since Ritter's (1991) seminar study many papers document that IPO firms underperform relative to benchmark indices, or similar stocks, following their initial public offerings (IPOs). Later, the evidence in several other stock markets around the world have proved the long-run underperformance following initial public offerings: Levis (1993) and Espenlaub et al. (2000) in UK; Ljungqvist (1997) and Stehle, Ehrhardt and Przyborowsky (2000) in Germany; Lee, Taylor and Walter (1996) in Australia; Page and Reyneke (1997) in South Africa; and Keloharju (1993) in Finland.

Behavioral finance theory has offered several possible reasons for poor stock price performance. As one possible explanation for poor after-market performance has been proposed that investors are overoptimistic about the earnings potential of issuing firm. Hence, the after-market underperformance occurs as these overoptimistic expectations are gradually corrected in the post-offering period (see, e.g., Ritter, 1991; Lerner, 1994; Loughran and Ritter, 1995, 2000; Baker and Wurgler, 2000; and Hirshleifer, 2001). More closely, these studies suggest that when stock prices periodically diverge from fundamental values, company's managers and investment bankers are trying to take advantage of overpricing by selling stock overly optimistic investors. In line with pre-existing studies of IPO long-run performance, Purnanandam et al. (2004) interestingly find that overvalued IPOs offer high returns in the short-run and revert to fair value in the long-run.

Several studies have suggested that the source for this investors' overoptimism could be earnings management practices around the time of the issue. Earnings management literature generally assumes that IPO firms have incentives to engage in income-increasing activities to extract higher offer prices (see, e.g., Aharony et al., 1993; Friedlan, 1993; Teoh et al., 1998, Li et al., 2006). Teoh, Welch and Wong (1998) and Teoc, Wong and Rao (1998) find that abnormal accruals are unusually high in the IPO year, and issuers with higher discretionary accruals have poorer stock returns in the subsequent years. Lerner and Tsai's (2000) study confirms the fact that the periods of low IPO volume occurs when private firms "cannot" access the equity markets on favourable terms which could explain cyclical pattern in IPO markets.

Both the number of initial public offerings (IPOs) and the total proceeds raised in the offerings vary substantially over the time (see, e.g., Lowry, 2003; Ibbotson and Jaffe 1975; Ibbotson, Sindelar and Ritter, 1994). Baker et al. (2000) argue that firms are able to time their IPO to coincide with periods of excessive valuations. According to Ritter and Welch (2002), the asymmetric information theories are unlikely to be the primary determinant fluctuations in IPO activity and underpricing, especially during the internet bubble period. Instead, they believe that non-rational explanations and agency explanations will play bigger role in the future research agenda.

2.2 Cycles in the IPO market

The phenomenon of "hot IPO markets" has been recognized for a long time in the financial community (see, e.g., Lowry et al., 2002). Hot IPO markets have been characterized by an unusually high volume of offerings and severe underpricing, while cold IPO markets have much lower issuance and less underpricing. Studies by Ritter et al. (1994) and Baker et al. (2000) claim that issuers "time" their IPOs to coincide with periods of excessive optimism, consistent with the finding in Lee, Shleifer, and Thaler (1991) that more companies go public when investor sentiment is high. In the following, I am representing Lowry's (2003) theoretical framework related to three rational drivers behind cyclical nature of IPO markets. In addition, I am connecting Lowry's theoretical framework to the latest studies in IPO cycles.

Lowry (2003) shows that the observed fluctuations in IPO volume are closely related to three factors:

1. Changes in private firms' aggregate demand for capital
2. Changes in the adverse selection costs of issuing equity
3. Variation in investor optimism.

Her findings indicate that more companies' demand for capital and the appearance of irrational investors with excessive optimism, explain a significant amount of the variation in IPO volume. She also points out that adverse selection costs are statistically significant, but they are not significant in economic terms, suggesting that they are of secondary importance. Overall, these findings propose that temporary overvaluations contribute to the periods of high IPO volume.

2.2.1 Demand for Capital

As general economic conditions vary over time, Lowry (2003) suggests that one of the key factors causing variation in IPO volume is private firms' aggregate demand for capital. She argues that when market conditions are better and expected growth in the economy is higher, companies tend to have higher demands for capital. Moreover, this higher economy-wide demand

for capital transfers into more companies seeking finance. In line with Lowry's results, Yung et al. (2008) argue that positive shocks in economy and higher share prices lead to more firms going public.

It is commonly known that private firms can obtain financing through several sources, such as bank loans, public debt, venture capital, or public equity. Assuming that managers want to maximize firm value, they will evaluate their current demand for capital, the cost raising that capital, and their demand for and expected costs of obtaining future capital to choose appropriate financing vehicle. Thus, a firm has an IPO only if public equity provides the greatest net benefits. (Lowry, 2003)

In contrast to Lowry, He (2007) argues that the existence of IPO market dynamics is a puzzle, and the aggregate capital demand of private firms cannot fully explain the fluctuation in IPO volume, especially in the context of the past "dot-com mania". Ritter (1984) notes that adverse selection of listed firms can explain IPO time-series patterns if, for some reason, the composition of firms changes across the time. Consistently, Yung et al. (2008) suggest that higher prices increase the temptation of bad firms to pool. In addition, compared to cold markets, their study notes that IPOs underwritten in hot markets are nearly twice as likely to delist within three years, consistent with the notion that the left tail of distribution expands during the hot markets.

Even further, He (2007) brings out an interesting point of view suggesting that besides private companies also investment banks behave asymmetrically in information production depending on IPO market cycle. He's (2007) study concludes that in hot periods, the information produced by investment banks improve the quality of IPO firms, and further this allows ex ante low quality firms to go public and increases the secondary market prices. According to Kuhn (1990), an investment banker's ability to arrange successful marketing campaign for IPO is critical. The key is to stimulate investor demand for the stock so that, as in basic economics, the demand will exceed the supply. Similarly, also many recent studies find out that the role of marketing, and particularly promotion, in the pricing and trading of securities is limited in the most asset pricing models (see, e.g., Ljungqvist, Nanda, and Singh, 2006; Yung, Colak, and Wang, 2008).

2.2.2 Adverse Selection Costs of Issuing Equity

Lowry's (2003) *"information asymmetry hypothesis"* asserts that the adverse-selection costs of issuing public equity change over time. Information asymmetry represents the difference between managers' information and the market's information about the firm value. Because managers have an incentive to issue equity when firm is overvalued, the market lowers its estimate of firm's value when a firm announces an equity offering. The prior literature has identically proof the existence of hot IPO markets characterized by extremely high initial returns [see, e.g., Ibbotson, Sinderlar, and Ritter (1988, 1994)]. Hot IPO markets are commonly associated with periods of generally heightened uncertainty, and hence all stocks may be riskier during these periods.

On the other hand, Myers (1977), Myers and Majluf (1984), and Korajczyk, Lucas, and Mcdonald (1992) elicit the fact that these adverse selection costs prevent many firms with positive NPV projects from raising the equity necessary to finance their projects. Consequently, a firm only issues equity if the benefits of obtaining this financing exceed the direct issue cost plus any adverse-selection costs. According to Yung et al. (2008), the positive relation between volume and underpricing is perplexing, since it apparently implies that firms prefer to go public precisely when they are least able to obtain full pricing. At the same time, the latest behavioural studies propose that the presence of irrational sentiment investors can overweight the overall costs of issuing equity in the hot IPO markets.

2.2.3 Variation in Investor Optimism

Finally, the "*investor sentiment hypothesis*" posits that variation in the level of investor optimism causes the costs of issuing equity and therefore IPO volume to fluctuate over time. During some periods, investors are overly optimistic and are willing to pay more firms than they are worth. During these periods the costs of going public are especially low, and the benefits of listing exceed overall listing costs remarkably. Under these circumstances, a large number of firms find it optimal to go public. In contrast, during periods of low investor sentiment, investors may undervalue firms, causing IPO volume to be low.

It is obvious that most of the securities reflect heterogeneous investor expectations, producing so called unbiased estimate of a securities value. Miller (1977) suggests that heterogeneous investor expectations are a typical characteristic of IPOs of common stock because of their high degree of value uncertainty. Miller claims that the early aftermarket prices of IPOs, facing widely divergent investor valuations, can be biased upward. Derrien (2005), Ljungqvist Nanda, and Singh (2006) build upon the work of Miller (1977) and claim that issuers and the regular customers of investment bankers benefit from the presence of sentiment investors (noise traders) in the market for an initial public offering (IPO).

The findings of Lowry, Officer, and Schwert (2008) highlight the fact that also underwriters face difficulties in valuing companies, and, as a result, they raise the question about efficacy of the traditional firm commitment underwritten process. Ljungqvist et al. (2006) raise the important question: What should profit maximizing issuer do in the presence of exuberant investor demand and short sale constrains? Their model propose that the issuer should seek to capture as much as possible of the surplus under the exuberant investors' demand curve, in a setting in which demand may built over time. Moreover, their model shows that value to the issuer is maximized if underwriters allocate IPO shares to their regular (institutional) investors for gradual sale to sentiment investors who arrive to the markets over time.

Using brokerage records, Barber and Odean (2002) find that retail investors are more likely to purchase attention-grabbing stocks. Similarly, Frieder and Subrahmanyam (2005) determine that individual investors are more likely to hold stock in highly visible company. Cook, Kieschnick, and Van Ness (2006) examined data for a sample of IPOs from 1993 through 2000, and they find evidence that an investment banker's ability to market an IPO to sentiment investors is important.

Cook et al. (2006) find that investment bankers' compensation is positively correlated with their promotional efforts. Their study also points out that higher pre-offer publicity has a positive effect on offer price revisions and initial returns, and offer valuations tend to exceed that comparable firms more often when pre-offer publicity is greater.

2.3 IPO Underpricing and Asymmetric Information Models

The secondary market trading price for issuing company's stock is on average much higher than in advanced determined offer price which means that IPOs are underpriced on average. Besides, numerous studies in the U.S. markets have noted that the extent of underpricing has fluctuated over the time. The general tendency for initial public offerings (IPOs) to be underpriced has been a subject to considerable amount of academic and practical interest.

One of the first well-known studies concerning the IPO underpricing was published by Logue (1973), who documented that when companies go public, the share price seems to jump substantially on the first day of trading. Since the 1960s, this 'underpricing discount' has averaged around 19% in the United States, suggesting that firms leave considerable amounts of money on the table (see, e.g., Ljungqvist, 2003).

A wide variety of explanations have been proposed for this underpricing phenomenon. Jenkinson and Ljungqvist (2001), and Ritter and Welch (2002) review the various theories and conclude that no single theory can explain the variation in observed underpricing. Ritter et al. (2002) classify these theories based on whether they assume asymmetric information or symmetric information. The asymmetric information based models are unquestionably the best known theories explaining the underpricing phenomenon, and according to Ritter et al. (2002) symmetric theories seem unconvincing.

The underpricing of the shares sold through initial public offerings (IPOs) is generally explained in the literature with asymmetric information about security's value and with its fundament risk. Asymmetric information models of underpricing assume that one of involving parties knows more about the quality and prospects of IPO company than the others. In practice, there are two possible outcomes how information asymmetries can occur. One possible way is that the issuer and its co-operating underwriter are more informed than investors in general and they possess superior information over investors. Another possibility is that investors are more informed than the issuer or its underwriting bank.

The pricing of an IPO can be double-edged sword. Although, the issuer and its investment bank know considerably more about the firm's own prospects than any single market participant does, Lowry, Officer, and Schwert (2008) note that market participants as a whole are generally more aware of the firm about one critical input to the IPO pricing process: the aggregate demand for the firm's shares (see e.g. Rock 1986). Aggregate demand uncertainty is one of the principal problems facing issuers and their investment banks when attempting to price an IPO.

2.3.1 Issuers' Rationalizations for Underpricing

If issuer is more informed than investors, rational investors should fear a lemon's problem since only issuers with worse-than-average quality are willing to sell their shares at the average price. To distinguish themselves from the pool of low-quality issuers, high-quality issuers may attempt to signal their quality by underpricing themselves highly, and inducing informed investors to produce information.

On the other hand, going public, in many cases, is also a step towards the eventual separation of ownership and control. Ownership matters for the effects it can have on management's incentives to make optimal operating and investment decisions. In particular, where the separation of ownership and control is incomplete, an agency problem between non-managing and managing shareholders can arise [see, e.g., Jensen and Meckling, (1976)]: rather than maximizing expected shareholder value, managers may maximize the expected private utility of their control benefits.

At the same time, institutional explanations for underpricing suggest that issuing companies deliberately sell their shares at discount to reduce the likelihood of future lawsuits from shareholders disappointed with the post-IPO performance of their shares (see, e.g., Logue, 1973; Ibbotson, 1975). However, Ljunqvist (2004) suggests that this explanation is somewhat U.S.-centric, and it can be considered as a possible second-order driver of IPO underpricing. Another institutional explanation for underpricing rationing from issuer's perspective can be tax advantages achieved through IPO underpricing. This results in a trade-off between the tax benefits and the dilution cost of underpricing. Depending on their tax situation managers may

prefer more or less underpricing. In the following, I am representing the main theories explaining IPO underpricing from issuer's perspective.

Signaling Model

A well-known category of explanations for IPO underpricing is the signaling-based theories proposed by Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989). In these models, the issuer has private information about the present value of future cash flows that is unavailable to the investors. These models assume that firm type is revealed exogenously after IPO, and the high-quality firms are willing to bear the cost of the signal in order to distinguish themselves from low-quality firms. By issuing a costly signal, firms can expect to have subsequent actions such as seasoned equity offerings or dividend increases received more favorably by the market. Hence, these are two-stage selling models, where the cost of the signal is recovered at the second stage and the firm and insiders maximize the expected value of the proceeds of two-stage sale. Allen and Faulhaber (1989) and Welch (1989) use IPO underpricing as the signal. Grinblatt and Hwang (1989) use an additional signal, the retention rate by insiders. Grinblatt and Hwang (1989) show that there should be a positive relationship between IPO underpricing and insider retention rate at the IPO. Later, Jegadeesh et al. (1993) argue that there should be a positive relationship between IPO underpricing and the probability of seasoned equity offering.

Michaely and Shaw (1994) outright reject signaling: in a simultaneous equation model, they find no evidence of either a higher propensity to the market for a seasoned offering or of a higher propensity to pay dividends for IPOs that were more underpriced. Still, aside from the persistence of the signaling explanation on the street, its most appealing feature is that some issuers voluntarily desire to leave money on the table to create "a good taste in investors' mouths". As such, it is relatively compatible with higher levels of IPO underpricing.

Information Production Model

Chemmanur (1993) proposes a model where insiders know the value of the firm and plan to sell shares in both the IPO and SEO. He assumes that underpricing is not effective as a signal in revealing the firm type to investors and argues that managers want to reduce the information asymmetry by inducing informed investors to produce information. The firm compensates the investors for the costly information production by underpricing the IPO. This model suggests that underpricing is greater for firms with projects that are costlier to assess. Specifically, Chemmanuer (1993) concludes that relatively obscure firms or those with projects that are costlier to evaluate will have greater underpricing. Kennedy et al. (2006) contend that firms that are in the high-tech sector face greater uncertainty and, as a result, are more costly to assess and will have greater underpricing.

The Information Momentum Model

Aggarwal et al. (2002) develop a model in which managers strategically underprice initial public offerings in order to create information momentum after IPO, in the form of increased research coverage, so as to shift the demand curve for the stock upward. The information momentum will generate higher prices at the lockup expiration leading to the sale of insider sales at that time. Their model shows that IPO underpricing will be positively related to insider retention of shares at the IPO. In addition, their model shows that IPO underpricing will be positively related, through the creation of information momentum, to insider sale of shares at the lockup expiration. However, focusing exclusively on the lock-up expiration date is misleading. Brav and Gompers (2003) document that 60% of firms have insider sales before the lockup expiration date, and Lee (1997) document significant insider sales during seasoned equity offerings (SEOs).

Underpricing as a Means to Retain Control

Brennan and Franks (1997) argue that underpricing gives managers an opportunity to protect their private benefits by allocating shares strategically when taking their company public. Managers seek to avoid allocating large stakes to investors for fear that their non-value-

maximizing behavior would receive unwelcome scrutiny. Small outside stakes reduce external monitoring, owing to two free-rider problems. First, because it is a public good, shareholders will invest in a sub-optimally low level of monitoring (see, e.g., Shleifer and Vishny, 1986). Second, greater ownership dispersion implies that the incumbent managers benefit from a reduced threat of being ousted in a hostile takeover (see, e.g., Grossman and Hart, 1980). The role of underpricing in this view is to generate excess demand. Excess demand enables will managers to ration investors so that they end up holding smaller stakes in the business.

The Changing Issuer Objective Function Model

Loughran and Ritter (2004) propose a model based on agency problems between the decision makers who compromise the top management and the general partners of the lead venture capital firms and other pre-IPO shareholders. The previous models assumed asymmetric information regarding the value of the firm whereas Loughran and Ritter (2004) assume that investors cannot observe the actions of the managers.

First, the authors argue that managers are concerned with buying reputable analyst coverage. Hence, they hire a lead underwriter with highly ranked analyst despite the fact that the underwriter has a reputation of underpricing. Cliff and Denis (2004) find support for this argument. Loughran and Ritter (2004) also suggest that co-lead managers are present in the syndicate to provide research coverage. Their model predicts a positive relationship between IPO underpricing both the underwriter ranking and the number of co-lead managers. Second, Loughran and Ritter (2004) argue that underwriters bribe the decision makers by allocating hot IPOs to their personal accounts to influence their choice of lead underwriter. Hence, insiders seek to maximize a weighted average of IPO proceeds, subsequent insider sales and side-payments from underwriters. While cannot observe the amount of side-payments, their model implies a positive relationship between IPO underpricing and insider combined proceeds from the IPO and subsequent sales. Their model also implies a positive relationship between IPO underpricing and insider retention at the IPO as insiders prefer to sell subsequent to the IPO.

2.3.2 Underwriter as a Intermediate

In contrast to asymmetric information models, this section focuses on investment banks' role in firms´ listing process. In the beginning, it briefly discusses on different issuing mechanisms but the main attention is concentrated on bookbuilding method. In this section, I question the academic view of bookbuilding and elicit alternative behavioural explanations on how bookbuilding method allows underwriters to execute their allocation strategies preferentially.

Issuing Mechanisms

As a response for heterogeneous investor expectations and uncertainty of demand, a various auction mechanisms have been introduced to sell and market IPOs to investors. According to Sherman (2001) and Titman (2002), the largest IPOs in the U.S, and increasingly around the world are marketed in way that is known as a book-building. In book-building method, the investment bank first sets a price range, and collects non-binding bids from limited number of investors. After preliminary indications of investors demand, the final price is set, and the underwriter allocates the shares with complete discretion. Even though, the book-building method is more costly than traditional auction, the common believe is that valuation advantages offset the costs of acquiring information about the demand.

On the other hand, the book-building method has also received a fair amount of criticism and brought out IPO scandal in the United States in the recent years. The main criticism has appeared towards the fact that the method allows IPO shares to be preferentially allocated. Investors complain that they are shut out of the allocation process, calling for changes that will give everyone a fair chance.

Book-building, Allocation and Underpricing

When book-building method is used to price initial public offerings (IPOs), underwriters have discretion to allocate the shares in the way, which they consider as the best one. The allocation strategies to choose from can be classified into three different categories (see, Nimalendran,

Ritter, and Zhang, 2007): 1) the academic view, 2) the pitchbook view and 3) the profit-sharing view. The academic view, first presented by Benveniste and Spindt (1989) argue that the common practice of "book-building" allows underwriters to obtain information from informed investors (usually institutional). The idea is to get investors to reveal their best estimates of the value of an IPO company, and in an exchange underwriters must give them allocations that are fair in the terms of the quality of the valuations. The pitchbook view is based on a publicly expressed investment bank practice that banks try to allocate shares to the investors, who most likely to be buy-and-hold investors. The profit-sharing view, introduced by Loughran and Ritter (2002, 2004) and Reuter (2006), is the macchiavellic out of these three. The view argues that investment banks and investors engage into profit sharing arrangements, under which the banks allocate the best IPOs to their best customers, i.e. the ones that pay biggest commissions.

As mentioned, the underpricing of IPOs is practice that is widely accepted among academics as well as among practitioners and as mentioned it can be rationalized in numerous ways. However, the degree to which IPOs should be underpriced remains still under debate. At the turn of the millennium, the underpricing of IPOs occurred in massive scale. Some investment banks, in US, have been accused for allocating hot IPOs selectively in order to get more trading commissions. Securities and Exchange Commission (SEC) has investigated these cases but none of them have resulted in a juridical verdict. However, a few banks, including for instance Credit Suisse First Boston (CFSB) and Robert Stephens, have ended up with settling their cases with SEC by paying fines without admitting anything. Following the SEC, for instance Financial Service Authority (FSA), initiated its own investigations in the UK markets in 2002. The report tells that there are some indications of the existence of dubious practices in the UK. However, the magnitude of the effects these practices may have caused is not reported.

Even though the ethics of profit-sharing can be questioned, it is commonly agreed that customer relationships are the one important factor to be taken into account when allocating IPO shares. This also stated by SEC and FSA. But the both regulators also clearly imply that the commissions business should not be the determining factor in allocations. However, inferring whether or not IPO allocations are driving factor that increases the commissions paid to an underwriter is a non-trivial task for regulators as well as for academics.

2.3.3 Investors' Rationalization for Underpricing

Aggregate demand uncertainty is one of the principal problems facing issuers and their investment bank when attempting to price an IPO. If investors are more informed than the issuer, for instance about the general market demand for shares, then the issuer faces a placement problem. The issuer does not know the price the market is willing to bear, and issuer faces an unknown demand for its stocks. A number of theories model a specific demand curve. One can simply assume that all investors are equally informed, and thus purchase shares only if their price is below their common assessment. Hence, observed (successful) IPOs thus are necessarily underpriced. There are, however, some overpriced IPOs going public, which would not be predicted because all investors are assumed to know that these would be overpriced. A more realistic assumption is that investors are differentially informed. Pricing too high might induce investors and issuers to fear a winner's curse (Rock 1986) or negative cascade (Welch 1992).

Winner's Curse

Perhaps the best-known asymmetric information model is Rock's (1986) *winner curse*, which assumes an information asymmetry among different investors. The author assumes that some investors possess more information than others, which helps the investors with superior information to subscribe the underpriced IPOs and withdraw from the overpriced. Informed investors bid only for attractively priced IPOs, whereas the uninformed bid indiscriminately. Hence, the underpriced IPOs are oversubscribed leading to a rationing of the share allocation. In the case of the uninformed investors, they would receive a full-allocation of shares in the overpriced IPOs but only partial allocation in the underpriced IPOs. This 'bias' in the allocation would lead to the withdrawal of the uninformed investors from the participation IPOs. Therefore, IPOs have to be underpriced on average to attract all the investors to take part in the offerings. The underpricing, according to Rock (1986), compensates the uninformed investors for the risk of trading against superior information.

Beatty and Ritter (1986) extend Rock's (1986) model and find that the value of information, the bias against uninformed investors, and the underpricing compensating the uninformed are higher

for uncertainty IPOs. They argue that the uncertainty must be compensated with the underpricing of the IPO. These studies argue that the issuing companies more or less reluctant underprice the offerings and leave money on the table.

Market Feedback Model

In a contrast to Chemmanur's (1993*) information production model*, Jegadeesh et al. (1993), van Bommel, van Bommel and Vermaelen (2002,2003) have develop a market feedback model, where they propose that investors are better informed about firm value than the managers. It assumes that the true value of the firm is revealed to the managers by the post-IPO price, and the owner-managers choose the amount of the IPO and the offer price to maximize information production by informed investors. Based on the IPO underpricing and returns in the period immediately after the IPO (post-issue returns), firms revise upwards the estimated marginal returns from projects and conduct seasoned offerings to raise additional capital to finance these projects.

The entrepreneurial losses model

In the entrepreneurial model losses model, which is an extension to Rock's (1986) asymmetric information model, Habib and Ljungqvist (2001) assume that some investors are better informed than others. Consequently, the authors introduce information production at the IPO stage itself in order to decrease the adverse selection problem. Owners incur the costs of promoting the issue to reduce the information asymmetry so that their underpricing related wealth losses are minimized. The authors argue that the extent to which owners care about underpricing depends on how many shares they sell at the IPO. The more shares the owners sell, the greater their incentive to decrease underpricing. The costs could include those associated with choosing a reputable underwriter or auditor. Their model implies IPO underpricing should decrease with increased promotion costs (e.g. a higher-ranked underwriter) and increase with higher insider retention at the IPO and uncertainty. Habib and Ljungqvist (2001) argue that empirical tests of IPO underpricing theories should be conditioned on the owners' incentives to incur costs to reduce losses.

2.4 IPO Overvaluation

The previous chapter highlighted that there are several rational reasons why IPOs should generally earn large first-day returns. But if there is underpricing, what is it respect to? As the underpricing is a widely known practice, also the notion that IPOs have poor aftermarket performance is at least as well-known (see Chapter 2.5). The long-run underperformance of IPOs seems to indicate that IPO are overvalued at least relative to their long-term fair value. As one possible explanation for poor after-market performance has been proposed that investors are overoptimistic about the earnings potential of issuing firm (see, e.g., Ritter, 1991; Lerner, 1994; Loughran and Ritter, 1995, 2000; Baker and Wurgler, 2000). If these studies are right, and the stock prices can actually periodically diverge from their fundamental values in the short-term, then there exists a possibility that IPOs can be overvalued in general terms.

Also study by Cornelli, Goldreich, and Ljungqvist (2005) states that behavioral biases such as ´conservatism´ or ´over-confidence´ have become popular explanations for a variety of assets pricing phenomena that is hard to reconcile with a rational decision-making framework. Behavioral finance is interested in the effect on stock prices of 'irrational' or 'sentiment' investors. The potential for such an effect would seem particularly large in the case of IPOs, since IPO firms are young, immature, and relatively informationally opaque and hence hard to value.

2.4.1 IPO Valuation in Inefficient Market

A large literature, both theoretical and empirical, has attributed these IPO patterns to the presence of sentiment investors. The notion that issuers intentionally underprice IPOs and offer them at prices below their fair value is prevalent in the theoretical literature on IPOs (see previous asymmetric information models of Rock (1986), Benveniste and Spindt (1989), Allen and Faulthaber (1989), Welch (1989), and Grinblatt and Hwang (1989). Since the market price reflects fair value in an efficient market, the increase in IPO stock prices on the first day of trading is taken as evidence of underpricing (or more accurately undervaluation) at the offer.

Purnanandam and Swaminathan (2004) make a distinction between value and price. In their study, the authors assume that securities prices may deviate from their "fair" values. Hence, the authors represent an alternative view of underpricing (in an inefficient market), they suggest that issuers underprice IPOs with respect to the maximum price they could have charged given the observed demand in the pre-market but not necessarily with respect to the long-run fair value. In other words, IPOs may be underpriced but not undervalued which could also explain the long-term underperformance of IPO. Purnanandam et al. (2004) reveals the surprising result that IPOs are systematically overvalued at the offer with respect to fundamentals. They find that, in sample more than 2000 relatively large- capitalization IPOs from 1980 to 1997, the median IPO firm is overvalued by about 50% relatively to its industry peers. These results are inconsistent with the notion of underpricing with respect to fair value, which pervades most rational models of IPO underpricing.

Besides, Purnanandam et al. (2004) note that there are significant differences in the way overvalued and undervalued IPO (based on ex ante valuations) perform in the after-market. Overvalued IPOs exhibit higher sales growth rates temporarily but earn persistently lower profit margins and returns on assets than undervalued IPOs over the next five years suggesting that any projected growth opportunities implicit in the initial valuation fail to materialize subsequently. In the cross-section, overvalued IPOs earn 5% to 7% higher first day returns than undervalued IPOs but earn 20% to 50% lower return over the next five years. These findings are consistent with the long-run IPO underperformance put forth in Ritter (1991), and Loughran and Ritter (1995). The findings of Purnanandam and Swaminathan (2004) could explain the underperformance as overvalued IPOs revert to their fair values in the long run.

Furthermore, the behavioral model of Cornelli, Goldreich, and Ljungqvist (2004) shows empirically similar kind of results. Their model predicts when the grey market price is high, demand for sentiment investors will cause the shares to trade at a high price relatively to fundamentals in the short-run. In the long-run, prices will revert to the fundamental value, as the true value is revealed through time, and their model predicts negative result. As a result, they suggest that book-building investors value the shares at the maximum of the fundamental value and small investors' reservation price.

2.4.2 Investor Sentiment

Baker and Wurgler (2007) argue that stocks of low market capitalization, younger, unprofitable, high volatility, non-dividend paying, growth companies, or companies in financial distress, are likely to be disproportionately sensitive to broad waves of investor sentiment. Investor sentiment, defined broadly, is a belief about future cash flows and investment risks that is not justified by the facts at hand. A period of extraordinary investor sentiment pushed the prices of speculative and difficult-to-value technology stocks to unfathomable levels in the late 1990s. Instead of creating opportunity for contrarian arbitrageurs, the period forced many out of business, as prices that were merely high went higher still before an eventual crash.

As, IPO companies are relatively young, growth the after-market valuations of IPOs are likely to be driven by sentiment investors. Hence, I also assume that at least the short-term valuations of IPOs are biased since sentiment investors tend to overreact to intangible information produced by underwriters and institutional investors. Also, Purnanandam et al. (2004) argue that investors' overconfidence may be one of the primary sources of IPO overvaluation, since underwriters market aggressively IPO through road shows. They suggest that such marketing strategies may also play an important role in creating excess demand for IPOs.

2.5 IPO Long-Run Underperformance

Ritter (1991) found that a strategy of investing in IPO stocks at the end of the first day of public trading and holding them for three years would left investors only 83 cent to each invested dollar in matching companies listed in the American and New York stock exchanges. He also found that the IPOs underperformed the CRSP (Center for Research in Securities Prices) value-weighted NASDAQ index, the CRSP value-weighted Amex-NYSE index, and an index of the lowest decile of NYSE market capitalization companies for the first three years after the offering date. His sample consisted of 1,526 IPOs between 1975 and 1984. He found that the underperformance of young companies and companies going public in the high IPO volume years was even greater than average. Ritter's findings are broadly consistent with the notion that many companies go public near the peak of industry-specific fads, which offer companies a window of opportunity.

The fads refer to hot markets where IPO volumes are increased. Ritter (1991) suggests that the reason for the underpricing was the over optimism of the investors when the companies went public.

Loughran (1993) found that during the period 1973-1988 NASDAQ IPOs underperformed similarly-sized NASDAQ securities that had been listed for at least six years. According to his findings, the average six-calender-year holding-period return for IPO is 17.29 % compared to the 76.23 percent return for holding the NASDAQ index for the same period. He finds that the underperformance is concentrated to years of high IPO volumes suggesting overvaluation of IPOs.

Loughran and Ritter (1995) find that long-term investments in issues of new equity, IPOs or SEOs, have been poor. Their data consists of 4,753 IPOs and 3,702 SEOs in the U.S. between 1970 and 1990. They find that IPOs offer an annual return of only 5 percent compared with a 12 percent return for non-issuing matching companies over a five-year period after the issue. The magnitude of the underperformance is large. The findings imply that an investor would have to invest 44 percent more in the issuers compared to the non-issuers to be left with the same wealth five years later. Loughran and Ritter (1995) suggest that the underperformance is due to companies exploiting windows of opportunity put in Lerner (1994) and issuing new shares when they are overvalued. The markets realize the initial overvaluation in the long-run, and IPOs tend to perform poorly.

3 HYPOTHESES

In this section, I will present the hypotheses that will be applied and tested in Chapter 5. Altogether, I have four hypotheses relating to IPO overvaluation, underpricing and aftermarket performance. First, I introduce the hypotheses related to overvaluation and first-day returns. Following, I represent two separate hypotheses that are tied up very closely to IPOs' short- and long-term abnormal returns and overvaluation.

3.1 Hypotheses Related to IPO Valuation and Underpricing

The main focus of this chapter is to explain why I believe that European IPOs are overvalued in general. Purnanandam and Swaminathan (2004) studied the valuation of initial public offerings in U.S. using comparable firm multiples, and find that the median U.S. IPO in between years 1980-1997 was overvalued at the offer by about 50% relative to its industry peers. In their study, they assumed that IPOs can be overvalued and underpriced at the same time. Similarly, I assume that the securities prices could deviate from their 'fair' long-term values for various reasons.

Several studies have noted the fact that private firms choose to go public when IPO provides the greatest net profits to obtain additional financing (see e.g. Lowry 2001). In line with notion, I also assume that the owners of private companies time their listing in the periods when they believe that the public offering will provide greatest net benefits compared to alternative sources of financing. Generally, this would mean that that the existing owners will issue new equity only if they think that their company is overvalued or at least fairly valued compared to their peer group. Also, Loughran and Ritter (1995) suggest that this would explain the underperformance of companies exploiting 'windows of opportunity' put in Lerner (1994) and issuing new shares when they are overvalued. Academics suggest the overvaluation is often driven by sentiment investors with overoptimistic belief future prospects. IPO firms are more likely to be young and hence often associated with higher-degree of uncertainty relating to growth and profitability than their listed counterparts. I believe that the investors overweight their personal experience concerning to difficult-to-value stocks, such as IPO stocks, and thus overreact to intangible information produced by investment banks and issuers.

Similarly with Loughran and Ritter (2002, 2004) I believe that the underwriters are profit maximizers since their compensation is largely tied to proceeds. As underwriting banks are able to observe indications of aftermarket demand in the pre-market, I assume that the offer price will be set so that it maximizes the proceeds, but at the same time ensures relatively good aftermarket performance in the short-run. Assuming inefficient capital markets where profit maximizing issuers and underwriters take advantage the appearance of favourable market conditions created by sentiment investors, I believe that European IPOs are overvalued at the offer compared to their industry peers.

H1. *European IPOs are overvalued on average compared to their industry peers.*

The literature has widely noted that IPOs exhibit price run-ups during the first day of trading. This phenomena is commonly referred as IPO underpricing. Hence, it is logical to assume that European IPOs exhibit positive abnormal returns during the first day of trading. However, this phenomena is so well-documented that I do not construct own hypothesis relating to underpricing in general level. But if there is underpricing, what is the underpricing respect to? One possible explanation is that the underpricing is with respect to fair value. The notion that issuers intentionally underprice IPOs and offer them at prices below their fair value is prevalent in the theoretical literature on IPOs (see, e.g., Section 2.3). Since the market prices reflects the fair value in an efficient market, the increase in IPO stock prices on the first day of trading is taken as evidence of underpricing (or more accurately undervaluation) at the offer.

As I believe that European IPOs are overvalued in general, I expect that issuers underprice IPOs with respect to the some maximum value that they could have charged given the observed demand in the pre-market but not necessarily with respect to the long-term value. Another interesting feature to test is the connection between underpricing and IPO valuation. Purnanandam et. al. (2004) find that the most overvalued IPOs have also the highest abnormal returns after the first trading day. In line with Purnanandam's et al. (2004) findings, I also assume that issuers who know that their firm is overvalued at the offer are more willing to leave larger amounts of cash on the table.

H2. *Overvalued IPOs are more underpriced than undervalued IPOs.*

3.2 Hypotheses Related to Overvaluation After-Market Performance

Baker and Wurgler (2007) argue that stocks of low market capitalization, younger, unprofitable, high volatility, non-dividend paying, or growth companies, are likely to be disproportionately sensitive to broad waves of investor sentiment. Most of these features become materialized in the case of IPOs. In this study, I divide my IPO sample into three P/V (price-to-value) portfolios based on peer multiple valuation results and analyze the portfolios' abnormal returns in three months to five-year time scales. If investor sentiment and favorable market conditions are the primary drivers of overvaluation, the findings of Baker et al. (2007) suggest that the overvalued (high P/V) IPOs should be smaller-sized and unprofitable companies with high anticipated growth.

I believe that the overvalued (high price-to-value) IPOs will continue to earn positive abnormal returns in the after-market as long as the true nature is concealed from the sentiment investors. In practice this would mean that the overvalued IPOs will earn abnormal returns until the true nature of issuing firm reveals as a form of weakened future prospects, lower profitability and growth. I believe that a lot of additional 'insider' information is revealed when lock-up agreements expires. Typical lock-up period for European IPOs is 180 days. I use that as a turning point for investors' over-optimism.

> **H3.** *Overvalued IPOs earn higher abnormal returns than undervalued IPOs during the first six months.*

Several academics have noticed that IPOs in general perform poorly in the long-run (see, e.g., Ritter, 1991; Loughran, 1993). I also assume that European IPOs exhibit negative abnormal return in the long-run on average. And if my valuation procedure does a reasonable job and the underwriting banks value IPOs with respect to the observed demand not related to long-term fair value, than overvalued (high price-to-value) IPOs should earn more negative abnormal returns than undervalued (low price-to-value) IPOs in the long-run.

> **H4.** *Overvalued IPOs earn more negative abnormal returns than undervalued IPOs in the five-year period.*

The decline in operating performance for up to five years post-IPO has been well documented in the IPO literature, and several studies have confirmed the fact that IPOs in general underperform various benchmark indices and firms (See, e.g., Ritter 1991; Loughran and Ritter, 1995; Mikkelson et al., 1997; Jain and Kini, 1994). Thus, it is reasonable to assume that IPOs are overvalued on average respect to their long-run value.

4 DATA AND METHODOLOGY

In this section, I present the data and the research methods. First, I present the selection criteria for my sample of IPOs. Second, I elaborate the matching process and valuation. After that, I present the methodology of the study.

4.1 Choosing Data Sample

The sample of IPOs and their peer companies is collected from years 1990 to 2008. The reason for choosing this specified period relies on the one hand, the fact that before year 1990 the size of European stock markets were relatively small, and the extension of sample period in the earlier years would have provided only a few more IPOs to the sample.

The initial listing data of European IPOs is from the *Thomson Financial Securities Data Corporation (SDC) Global New Issues database*, and it has been completed with the supplementary data from the *Thomson ONE banker* database. In contrast to IPOs, the peer companies' data is solely retrieved from the *Thomson ONE banker*.

From these databases, I choose the sample of IPOs and peer companies by using several criteria. Some of the criteria are only concerning either IPOs or peer companies, but the following criteria are common for both groups:

a) The companies should be listed in the one of the European stock exchanges and the data should be available in *Datastream Advance*, *Security Data Corporation* or *Thomson ONE banker* database

b) The companies should be consisted of common shares, excluding all the others (like close-end funds, unit offerings, real estate investment trusts (REITs) etc.)

c) The companies should be a non-financial firm

d) There should exist financial information of sales and EBITDA (earnings before interest taxes depreciation and amortization) in the prior year of IPO

e) The companies' EBITDA should be positive in the prior fiscal year of IPO

4.1.1 Choosing IPO Sample

Besides the restrictions above, I exclude also smaller IPOs from the IPO sample. IPOs with an offer price less than $ 5 are excluded. Therefore, it is important to remember that this selection criterion eliminates many of the smaller IPOs which are more likely to underperform in the long-run. Overall, the sample identification procedure follows exactly the guidelines of former studies done by Purnanandam et.al (2004) and Zheng (2007).

Table 1: Description of the IPO Sample

This table reports descriptive statistics on my sample of IPOs from 1990 to 2008. Panel A provides statistics on the key variables of the offering, which are obtained from the Securities Data Corporation (SDC) database. Panel B compares and concludes the firm fundamentals of the IPO firms with their matching firms. Sales, EBITDA, and Net Income numbers are obtained from Thomson ONE-banker. EBITDA stands for Earnings Before Interest Taxes and Depreciation & Amortization.

PANEL A: Descriptive Statistics (Number of Issues = 614)				
Variable	Mean	25 %	Median	75 %
Offer Price in $	41,0	11,3	18,8	31,4
Gross Proceeds in Millions of $	373,0	14,0	42,6	162,3

PANEL B: Characteristics of IPO Firms and Matching Firms (Number of issues =614)								
Characteristics	IPO Firms				Matching Firms			
	Mean	25 %	Median	75 %	Mean	25 %	Median	75 %
Net Sales, $ Millions	1500,6	26,6	116,0	588,8	1362,6	32,8	120,6	489,6
Operating Profits (EBITDA), in $ Millions	358,4	4,7	17,2	79,7	271,7	4,9	17,2	80,7
Net Income, $ Millions	67,4	1,0	4,3	20,7	74,8	1,1	4,6	26,1

My final sample consists of 614 European IPOs in between years 1990 to 2008. Table 1 provides summary statistics on my IPO sample and matching firms. The median offer price is $ 18.8 which is 7 $ higher than what Purnanandam et al. (2004) observed in the U.S. markets between 1980 and 1997. The median sales of the IPOs in my sample is $ 116 million, median EBITDA is about $ 17 million which are both remarkably higher than in former studies in U.S. markets. The reason behind higher sales and EBITDA figures could be different time period, but moreover the fact that European firms tend to go public in more mature stage than U.S counterparts can explain the differences. Figure 1, breaks up my final sample (total 614 IPOs).
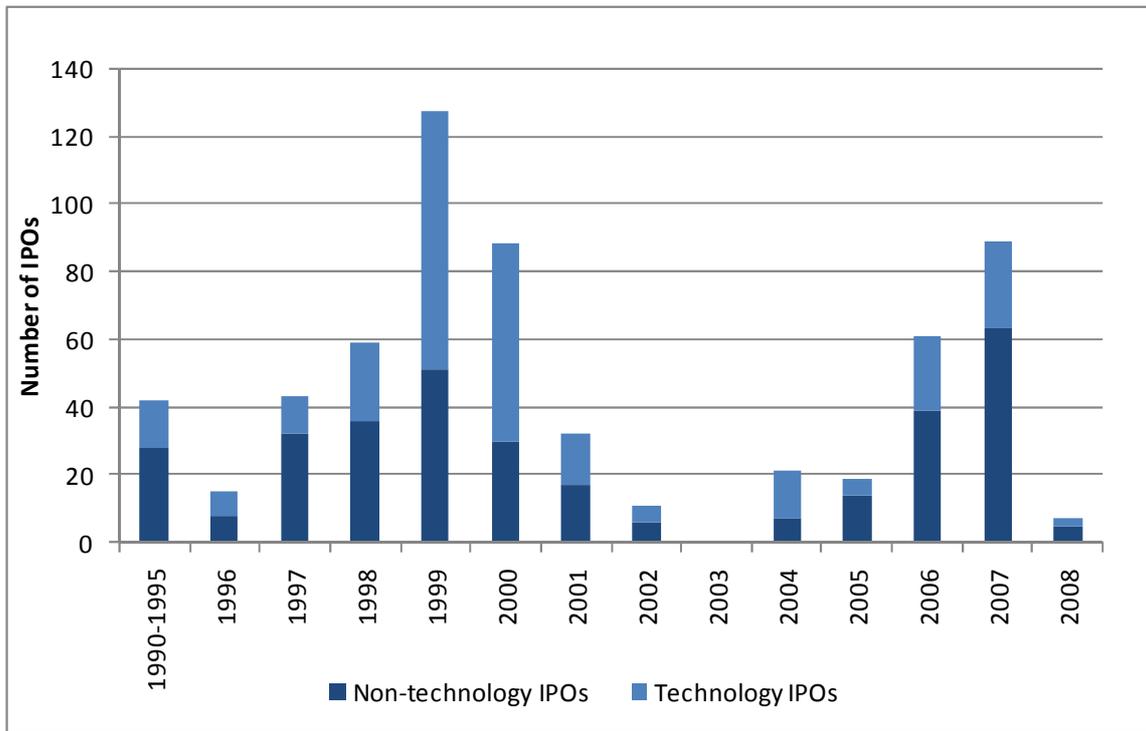
Figure 1: Final IPO sample

This figure illustrates yearly number of IPOs in fnal sample after selection criteria mentioned above. Besides the actual number, it shows classification in between non-technology and technology IPOs. High-tech sectors are defined as biotech, computer equipment, electronics, communications, and general technology (as defined by SDC). The data is retrieved from SDC and Thomson ONE-banker.

In the SDC data sample, there is 2314 European IPOs reported in between years 1990 and 2008. After excluding the financial firms (four digit SIC code is 6000-6799), the sample size decreases into 1746 IPOs. The availability of prior's year financial information excludes 666 non-financial IPOs, and cuts down the sample into 1080. The requirement of positive EBITDA limits the number of IPOs in the sample to 895. And finally, the decision to exclude so called 'penny IPOs' which have offer price less than $ 5, the final IPO sample consists of 614 IPOs.

The identification criteria applied by Purnanandam et al. (2004) and Zheng (2007) decreases the number of suitable IPOs remarkably from my initial SDC sample, and hence it is important to answer the question that how well the final sample (614 IPOs) represents the initial SDC sample (2314 IPOs). The former study by Purnanandam and Swaminathan (2004) does not present any

breakdown for the IPOs that are outlined from their sample. As a robustness check, I retrieved their initial IPO sample before any limitations. Interestingly, I find that in their study the number of U.S IPOs in between years 1980 and 1997 shrinks from 8637 to 2028 IPOs, and thus also excludes significant number of IPOs in from their initial data set.

While comparing the number of IPOs excluded from the initial samples, I find that in my data set 64,8% IPOs are excluded, in contrast to Purnanandam's et al.(2004) study where 76,5% of all IPOs are excluded. Consequently, the number of excluded IPOs is in line with Purnanandam's et al. (2004) study. To address the concern which IPOs are excluded, in *Appendix A* I represent a yearly based breakdown of excluded IPOs. The availability of prior year financial data and secondary market prices seems to be highest before the 'dot-com' bubble, and hence limits radically number of IPOs before year 1997. The number of companies going public with negative operating profits (EBITDA) is foreseeable highest during years 2000 (66 IPOs) and 2007 (30 IPOs). This notion is uniform with idea that owners of private companies are able time their listings to the periods when investors are overly optimistic and are willing to pay more firms than they are worth represented by Baker et al. (2000) and Ritter et al. (2002). On the other hand, it is important remember my selection criteria excludes IPOs with negative operating profits from my final sample, and could have a more negative effect on long-run performance and positive effect on underpricing. The decision to eliminate 'penny IPOs' affects the most in years 2006 and 2007, where together 67 IPOs were drop off, and as mentioned earlier also these IPOs are more likely to underperform in the long-run.

4.1.2 Choosing Matching Firms for the IPOs

For every IPO in my sample I find an industry peer with comparable sales and EBITDA profit margin, and which did not go public within the past three years. Firstly, I use the Fama-French (1997) industry classification to find industry matched firms which are operating in the field with IPOs (industry peers). This industry classification classifies the companies into 48 different industries on the basis their four-digit SIC codes (see, *Appendix B*). This classification should provide a reasonable control for the growth, since the firms in same industry tend to share similar kind growth opportunities in objective level. For assuring the quality of matching firms,

companies which have been listed within the past five-year period of certain IPO must drop off, since those companies can be considered as an IPO firms, and hence the results of this study would be biased.

Secondly, after finding the industry peers that did not go public in the prior three year period, I match on the basis of past sales. According to Purnanandam et al. (2004) the amount of sales can be perceived as an ex ante measure of size, and by so control the differences between large- and small-sized firms.

Finally, I match one-to-one based on EBITDA profit margin. It controls the differences in profitability across matching firms and to ensure that my matching firms are as close as possible to the IPO on fundamentals. The reason for choosing the EBITDA profit margin (defined as EBITDA/Sales) as a measure of profitability relies on the fact that it is more stable than net income and it is not affected by non-operating items. When the sample is already very restricted, net income would restrict it from before than EBITDA, which is more often positive. I do not also restrict the same matching firm from being chosen for several IPOs, because of limited number of matching firms.

To select an appropriate matching firm, I first consider all the companies in *Thomson ONE-banker* and research files for the fiscal year prior to the IPO year. From these, I eliminate firms that went public during the past five years, firms that are not ordinary common shares, REITs, close-end funds, ADRs, and firms with stock price less than five dollars. For the remaining firms, I obtain SIC codes from *Thomson ONE-banker*. I group these firms into 48 industries using industry classifications in Fama and French (1997), which are constructed, by grouping various four-digit SIC codes (see, *Appendix B*). I group firms in each industry into three portfolios based on past sales and then each sales portfolio into three portfolios based on past EBITDA profit margin (defined as EBITDA/Sales) giving me a maximum of nine portfolios in each industry based on past sales and profit margin.

Overall, my matching process is quite similar with Bhojraj and Lee (2002), but it gives me more accurate matching firms than using industry average multiples. Therefore, this unique matching

method should give me more accurate estimates, and improve the idea that IPOs and matching firms should reflect similar kind of operating risks, profitability and growth. Above Table 1 provides information about matching firms' distribution of sales, operating profits (EBITDA), and net income. Table 1 also shows that the matching firms' characteristics are very close to their IPO counterparts, and by so I believe that the accounting multiple valuations are more accurate than using industry average multiples.

4.2 IPO Valuation Using Price Multiples

For every IPO firm, I compute a price-to-value (P/V) ratio where P is the IPO offer price multiple and V is the fair/intrinsic value calculated from comparable firm's market multiples. I leave off all of the book based multiples, because according to Liu, Nissim and Thomas (2002), book values tend to be rather low for IPO firms and moreover tend to do poorly in terms of valuation accuracy. So, I use three different market multiples to value these IPOs. Firstly, I use price-to-sales (P/S) multiple because sales are most commonly available. Secondly, I use price-to-EBITDA (P/EBITDA) multiple because EBITDA measures operating cash flow and by so describes better the firms' characteristics and as mentioned it is less subject to accounting distortions. Lastly, I use price-to-earnings (P/E) multiple because they are the most popular.

The P/V ratio for the IPO is computed by dividing the IPO offer price multiple by the comparable firm's market multiple. The IPO offer price multiples are computed as follows:

$$\left(\frac{P}{S}\right)_{IPO} = \frac{\text{Offer Price} \times \text{Shares outstanding}}{\text{Prior Fiscal Year Sales}}$$

$$\left(\frac{P}{EBITDA}\right)_{IPO} = \frac{\text{Offer Price} \times \text{Shares outstanding}}{\text{Prior Fiscal Year EBITDA}}$$

$$\left(\frac{P}{E}\right)_{IPO} = \frac{\text{Offer Price} \times \text{Shares outstanding}}{\text{Prior Fiscal Year Earnings}}$$

All fiscal year data end at least three months prior to the offer date. *Earnings* refer to net income. *Shares outstanding* refer to the number of matching firm's shares outstanding at the end of the offer date. The market price multiples for matching firms are calculated as follows:

$$\left(\frac{P}{S}\right)_{MATCH} = \frac{\text{Market Price} \times \text{Shares outstanding}}{\text{Prior Fiscal Year Sales}}$$

$$\left(\frac{P}{EBITDA}\right)_{MATCH} = \frac{\text{Market Price} \times \text{Shares outstanding}}{\text{Prior Fiscal Year EBITDA}}$$

$$\left(\frac{P}{E}\right)_{MATCH} = \frac{\text{Market Price} \times \text{Shares outstanding}}{\text{Prior Fiscal Year Earnings}}$$

Matching firms´ *market price* refers to the company's stock price and *shares outstanding* refer to the number of shares outstanding at the close of the day to the IPO offer date. The P/V ratios of the IPO firm based on market price multiples which are computed as follows:

$$\left(\frac{P}{V}\right)_{SALES} = \frac{(P/S)_{IPO}}{(P/S)_{MATCH}} \tag{1}$$

$$\left(\frac{P}{V}\right)_{EBITDA} = \frac{(P/EBITDA)_{IPO}}{(P/EBITDA)_{MATCH}} \tag{2}$$

$$\left(\frac{P}{V}\right)_{EARNINGS} = \frac{(P/E)_{IPO}}{(P/E)_{MATCH}} \tag{3}$$

How these P/V ratios should be interpreted? The answer is obvious, the matching firm's multiples form so called *fair value* status which can be considered as 1. While industry, sales, EBITDA profit margin should be relatively similar, the only variables left are number of shares

and offer/market price. Thus, if IPO's market capitalization exceeds matching firm's capitalization, the price-to-value (P/V) multiple is then higher than 1, and the IPO can be considered as *overvalued* with respect to its fair value, and vice versa.

4.3 Computing Long Run Abnormal Returns

I calculate long-run abnormal returns for IPOs using the *buy-and-hold abnormal returns* (BHAR) approach. According to Barber & Lyon (1997), BHAR approach can be seen as superior to the *cumulative abnormal return* (CAR) approach because (1) CAR is positively biased and (2) BHAR represents better the returns earned over the long-term by the average or median sample of the firm. The last argument is especially justified for overvalued IPO firms which tend to run-up in the beginning and lose all of the initial gains in the long-run. In practice, using CAR approach would mean that when IPOs would add an initial 50% gain to a subsequent 50% loss and conclude that the average return is zero, by so the method would be biased against finding long-run IPO underperformance. For these reasons, in the IPO literature it is common practice to calculate long-run returns using the BHAR approach [see, e.g., Loughran and Ritter, (1995); Brav and Gompers, (1997); Krigman, Shaw, and Womack, (1999); Michaely and Womack, (1999)].

The buy-and-hold returns of an IPO firm *i* and the benchmark firm/portfolio *m* are computed as follows:

$$R_{iT} = \prod_{t=\text{offerdate}+1}^{\min(T)} (1 + r_{it}) - 1$$

$$(4)$$

$$R_{mT} = \prod_{t=\text{offerdate}+1}^{\min(T)} (1 + r_{mt}) - 1$$

where r_{it} and r_{mt} are the weekly returns of issues *i* and benchmark firm *m* respectively on date *t*, T is the end date up to which buy-and-hold returns are calculated.

The BHAR for the IPO firm is calculated as the difference between the buy-and-hold returns of the issuing firm and the matching firm/portfolio:

$$\text{BHAR}_{iT} = R_{iT} - R_{mT}$$

The mean BHAR and t-statistic under the assumption of independence of returns are computed as follows:

$$\overline{\text{BHAR}}_T = \frac{1}{N} \times \sum_{t=1}^{N} \text{BHAR}_{iT} \qquad (5)$$

$$t(\text{BHAR}) = \sqrt{N} \times \overline{\text{BHAR}}_T / \sigma\sigma(\text{BHAR}_{iT}) \qquad (6)$$

where *N* is the number of IPOs in my sample and $\sigma(\text{BHAR}_{iT})$ is the sample standard deviation of BHAR computed under the assumption of independence.

4.4 OLS Regressions Models

The factors affecting IPO valuation and aftermarket performance will be studied with multivariate ordinary least square (OLS) regression. The dependent, explanatory and control variables for each regression will be explained in more detail in Sections 5.3.1 and 5.3.3. In Section 5.3.1 I will regress my peer multiple valuation results (P/V ratios) and test multiple variables that may have an effect on IPO valuation based on former literature. The regression models in Section 5.3.3 concentrate on analyzing buy-and-hold abnormal returns (BHARs) from ninety days to five-year event windows. To ensure that error terms have constant variance, I use in all regression models SPSS macro for White's (1980) heteroscedasticy corrections provided by Hayes et al. (2007).

5. ANALYSIS AND RESULTS

In this section, I present the results and key findings of the study. First, I enlighten the valuation results concerning the comparable multiple method. Besides Purnanandam's et al. (2004) valuation multiples, I use new modified enterprise value multiples and alternative matching procedures to ensure the robustness of my original valuation results. After that, I present OLS regressions results concerning the determinants affecting IPO valuation. Chapter 5.2 concentrates on underpricing of P/V IPO portfolios, and the following chapter (5.3) discusses on the short-and long-term aftermarket performance of P/V portfolios.

5.1 IPO Valuation

This section presents one of the key findings of this study. One of the central findings is that European IPOs are about 70% to 90% overvalued at the offer price depending on which price multiple is used. This overvaluation is statistically significant, and there is variation in the overvaluation relating to time and industry. These findings are parallel with hypothesis 1, suggesting that European IPOs are significantly overvalued compared to their peers. As the potential distribution of the P/V ratios is asymmetric and theoretically ranging from zero to infinity, I report mainly the median P/V ratios. In addition, I find that some of the IPOs tend to get really overvalued skewing the distribution and decreasing the reliability of the mean P/V ratios. Furthermore, the positive skewness makes the median P/V ratio a more conservative estimate of overvaluation compared with the mean P/V ratio, since some IPOs tend to get really overvalued.

5.1.1 Comparable Firm Multiple Method

I find that the IPOs are systematically overvalued at the offer price. Table 3 presents the 25th, 50th, and 75th percentile of the cross-sectional P/V values based on P/S, P/EBITDA, and P/E multiples, respectively. The table also provides the p-values from the Wilcoxson rank sum test for testing the hypothesis that the median P/V is equal to 1. I find that the median P/Vs for the entire sample of 614 IPOs are 1.91, 1.79, and 1.90 using P/S, P/EBITDA, and P/E multiples,

respectively. Regardless which multiple is used, the median P/V ratios for the entire sample are statistically significantly above one suggesting that systematic and persistent overvaluation of IPOs. Figure 2 presents the distribution median of P/V respect to P/S and P/EBITDA on the yearly basis. The figure shows that the IPO overvaluation is highest during dot-com bubble in the turn of the millennium. The figure also suggests a possible mean reversion of the overvaluation as it declines from the peak of 1999 to below 1 in the year 2002. Actually, in 2002 the median IPOs seem to be more likely undervalued rather than overvalued compared to their industry peers. This undervaluation could explain the fact there are no IPOs which satisfied my selection criteria in year 2003. In years 2004-2007 the IPOs seem to be again significantly overvalued, but at this time less than during dot-com boom.
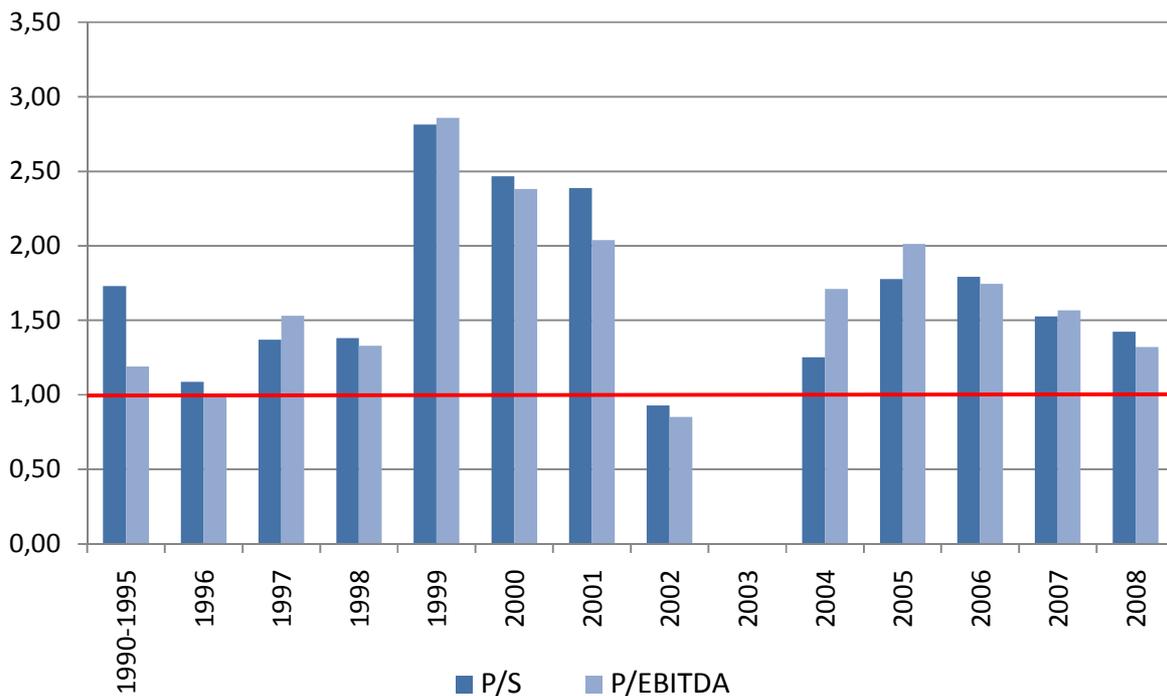
Figure 2: Median P/V ratios of calendar year.

This figure plots the median P/V ratios for IPOs calculated by P/S and P/EBITDA. P refers to the offer price and V refers to the fair value calculated on comparable firm multiples. The data is retrieved from SDC and Thomson ONE-banker

The represented valuation results are paraller with Purnanandam et al. (2004) finding that U.S. IPO are overvalued about 50 % compared to their industry peers. If the years 1998-2000 are omitted, I find consistently that European IPOs are overvalued by about 45% to 60 % compared to their peers (see, Table 3). The systematic and significant overvaluation is also consistent with Lee, Shleifer, and Thaler (1991), Loughran, Ritter, and Rydqvist (1994), and Baker and Wurgler (2002).Several academic studies have noted that the valuation of IPO stocks is relatively difficult, and the valuation process is commonly associated with high degree of demand and value uncertainty (see e.g. Miller (1977)). In addition, academics argue that the degree of value uncertainty is higher in the case of technology IPOs, since they are generally more difficult to value than non-technology IPOs. Table 2 shows the valuation results concerning the valuation of these two categories.

Table 2: IPO Valuation of Technology and Non-technology IPOs

This table reports median price-to-value (P/V) ratios for technology firms and all other non-technology firms in my sample. Technology firms are defined as biotech, computer equipment, electronics, communications, and general technology (as defined by SDC). IPOs are retrieved between years 1990 to 2008. The value is the fair value of the IPO firm computed based on market price-to-sales (P/S), market price-to-EBITDA, or market price-to-earnings ratio of an industry peer. EBITDA is the sum of earnings before interest and taxes (EBIT) and depreciation and amortization (DA) and represents operating cash flows. The industry peer is comparable publicly traded firm in the same industry in the same Fama and French (1997) 48 industry as the IPO firm and has the closest sales and EBITDA profit margin (EBITDA-%) in the former fiscal year. P/V is the ratio of the offer price-to-sales, offer price-to-EBITDA, or offer price-to-earnings divided by the corresponding price-to-sales, price-to-EBITDA, or price-to-earnings of the comparable firm.

Year	Technology (IPOs = 273)			Non-technology (IPOs = 341)		
	Based on P/S	Based on P/EBITDA	Based on P/E	Based on P/S	Based on P/EBITDA	Based on P/E
1990 -1995	0,87	0,89	0,91	2,27	1,40	1,12
1996	0,61	0,60	0,78	1,40	1,29	0,86
1997	1,40	1,29	1,42	1,67	1,72	1,36
1998	1,73	1,76	2,05	1,16	1,23	1,44
1999	3,79	3,93	3,63	2,58	2,41	2,92
2000	2,38	2,47	3,59	2,51	2,56	2,26
2001	2,44	2,41	2,42	2,22	1,96	1,76
2002	0,80	1,87	2,15	0,91	0,90	1,48
2003	-	-	-	-	-	-
2004	1,86	1,97	3,73	0,45	0,48	0,50
2005	7,42	7,29	12,81	1,55	1,53	0,97
2006	1,44	1,61	1,31	1,91	1,97	2,10
2007	1,66	1,50	2,06	1,44	1,42	1,68
2008	2,47	2,80	2,26	0,23	0,24	0,13
Overall	2,09	2,03	2,27	1,77	1,63	1,67

My results indicate that technology IPOs are overvalued about 40 % more than their non-technology counterparts. The median P/Vs for the technology IPOs are 2.09, 2.03, and 2.27 using P/S, P/EBITDA, and P/E multiples, respectively. This finding supports the traditional behavioral view that investors overreact intangible information, and are overconfident about their own information concerning the IPOs' future prospects. This overreaction would naturally increase the demand for IPO stocks, and hence underwriters can intentionally value these IPOs against observed demand rather than their long-term 'fair' value. However, this finding needs to be ensured in regression analysis.

On the other hand, former studies argue that also underwriters can face difficulties in valuing companies, and hence the valuation differences in between technology and non-technology IPOs can solely occur because of difficulties in valuation process [see, e.g., Lowry, Officer, and Schwert (2008)]. Overall, the number of companies going public seems to be highly correlated with valuation results. This finding is again in line with former studies regarding IPO market cycles and investor overoptimism which suggest companies that companies may use the 'window opportunity' time their listing so that they can obtain excess valuations.

Table 3: IPO Valuation based on Comparable Firm Multiples

This table reports cross-sectional distribution of offer price-to-value (P/V) ratios for IPOs from 1990 to 2008. The value is the fair value of the IPO firm computed based on market price-to-sales (P/S), market price-to-EBITDA, or market price-to-earnings ratio of an industry peer. EBITDA is the sum of earnings before interest and taxes (EBIT) and depreciation and amortization (DA) and represents operating cash flows. The industry peer is comparable publicly traded firm in the same Fama and French (1997) industry as the IPO firm and has the closest sales and EBITDA profit margin (EBITDA-%) in the former fiscal year. P/V is the ratio of the offer price-to-sales, offer price-to-EBITDA, or offer price-to-earnings divided by the corresponding price-to-sales, price-to-EBITDA, or price-to-earnings of the comparable firm The table presents the 25th,50th, and 75th percentiles of the cross-sectional distribution of P/V each year from 1990 to 2008. Wilcoxon p-value corresponds to the Wilcoson rank sum test for median equal to 1. Overall represents the aggregate sample of IPOs across years. The final row represents overall sample without IPOs that take place during the 'dot-com' bubble 1.9.1998-31.7.2000. The statistics corresponding to overall are based on pooled time-series cross-sectional data. The IPOs are from Security Data Corporation (SDC) and all other data from Compustat and Thomson Financial. ***, **, and * denote two-tailed statistical significance at the 1%, 5%, 10% level, respectively.

	P/V Ratio Based on P/S Multiple					P/V Ratio Based on P/EBITDA Multiple					P/V Ratio Based on P/E Multiple				
Year	No. of issues	25%	Median P/V	75%	Wilcoxon p-value	No. of issues	25 %	Median P/V	75 %	Wilcoxon p-value	No. of issues	25 %	Median P/V	75 %	Wilcoxon p-value
1990-1995	42	1,05	1,98	2,90	0,022	42	0,62	1,19	3,30	0,002***	36	0,48	1,05	2,10	0,172
1996	15	0,89	1,70	2,51	0,256	15	0,48	0,99	5,10	0,139	13	0,69	0,78	1,80	0,861
1997	43	0,46	0,83	2,56	0,000***	43	0,97	1,53	2,39	0,000***	39	0,93	1,36	2,48	0,001***
1998	59	0,23	0,33	0,71	0,002	59	0,61	1,33	3,31	0,001***	44	0,60	1,49	4,46	0,001***
1999	127	0,10	0,52	2,30	0,000***	127	1,44	2,83	6,23	0,000***	84	1,26	2,99	8,04	0,000***
2000	88	0,33	0,86	1,61	0,000***	88	1,04	2,38	8,52	0,000***	64	1,04	3,10	6,23	0,000***
2001	32	0,27	1,11	2,15	0,000***	32	0,87	2,04	3,43	0,000***	27	1,26	1,82	4,31	0,000***
2002	11	0,78	0,93	1,62	0,722	11	0,77	0,85	1,19	0,534	8	1,47	1,87	2,18	0,012**
2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2004	21	0,71	1,25	4,09	0,025**	21	0,71	1,71	3,56	0,030**	17	0,77	2,87	6,70	0,019**
2005	19	1,00	1,78	6,21	0,004***	19	1,29	2,01	6,14	0,008***	15	0,67	2,03	3,90	0,061*
2006	61	0,84	1,79	3,10	0,000***	61	0,92	1,75	3,45	0,000***	46	0,58	1,99	3,28	0,000***
2007	89	0,80	1,53	3,42	0,000***	89	0,79	1,57	3,57	0,000***	74	0,75	1,79	3,47	0,000***
2008	7	0,11	1,42	2,46	0,735	7	0,12	1,32	2,37	0,612	6	0,06	0,38	1,55	0,753
Overall	614	0,85	1,91	4,78	0,000***	607	0,85	1,79	4,73	0,000***	473	0,78	1,90	4,70	0,000***
Excluding bubble															
9/1998 -7/2000	438	0,74	1,61	3,38	0,000***	438	0,73	1,45	3,42	0,000***	371	0,66	1,58	3,36	0,000***

5.1.2 Alternative Valuation Multiples

Cash Holdings

Zheng (2007) argue that presented Purnanandam and Swaminathan (2004)'s valuation method may possess some possible biases. Firstly, it omits firms' cash holdings. The IPO firms and matching firms may have different cash holdings. These cash holdings affect the market values of the firms. However, if these cash holdings are not used for daily operations of the firms, then they do not affect the sales, EBITDA, or earnings of the firms. In this case using the accounting performance measures to scale the market value of the firms will again bring bias to the valuation measure. To measure the valuation of the two firms correctly, the cash holdings should be subtracted from the market value of the two firms before calculating the price multiples.

Capital Structure

Another problem with Purnanandam et al. (2004)'s valuation is about leverage. The IPO firms and matching firms may have very different amounts of debt. Given the same sales and EBITDA, when a firm uses more debt and less equity in its capital structure, it will have a lower market value of equity. And its P/S ratio and P/EBITDA ratio will be lower. Purnanandam and Swaminathan (2004)'s valuation method will suggest that the firm has become undervalued. But obviously this is not true. The correct way to do the calculation in this case is to find the enterprise value to sales ratio and enterprise value to EBITDA ratio. The enterprise value should include both the value of debt and the market value of equity.

IPO Valuation Using Enterprise Value Multiples

As discussed earlier, I use a modified method to calculate the P/V ratios of the IPO firms to measure IPO valuation. For both IPO firms and matching firms, I exclude cash and short-term investments when calculating the price multiples. For P/S and P/EBITDA ratios, I add total debt to the price of equity. This modified method can be expressed by formulas below:

Enterprise value multiples for IPOs:

$$\left(\frac{P}{S}\right)^{M}_{IPO} = \frac{(\text{Offer Price} \times \text{Shares Outstanding}) - \text{Cash} + \text{Total Debt}}{\text{Prior Fiscal Year Sales}}$$

$$\left(\frac{P}{EBITDA}\right)^{M}_{IPO} = \frac{(\text{Offer Price} \times \text{Shares Outstanding}) - \text{Cash} + \text{Total Debt}}{\text{Prior Fiscal Year Sales}}$$

$$\left(\frac{P}{E}\right)^{M}_{IPO} = \frac{(\text{Offer Price} \times \text{Shares Outstanding}) - \text{Cash}}{\text{Prior Fiscal Year Sales}}$$

Enterprise value multiples for matching firms:

$$\left(\frac{P}{S}\right)^{M}_{Match} = \frac{(\text{Offer Price} \times \text{Shares Outstanding}) - \text{Cash} + \text{Total Debt}}{\text{Prior Fiscal Year Sales}}$$

$$\left(\frac{P}{EBITDA}\right)^{M}_{Match} = \frac{(\text{Offer Price} \times \text{Shares Outstanding}) - \text{Cash} + \text{Total Debt}}{\text{Prior Fiscal Year Sales}}$$

$$\left(\frac{P}{E}\right)^{M}_{Match} = \frac{(\text{Offer Price} \times \text{Shares Outstanding}) - \text{Cash}}{\text{Prior Fiscal Year Sales}}$$

By doing the same valuation with new modified multiples I find that the median price-to-value multiples drop only slightly (around 0.1), suggesting that IPOs are still significantly overvalued. After modifications, the median P/Vs for the entire sample are 1.73, 1.90, and 1.80 using P/S, P/EBITDA, and P/E multiples, respectively. Not surprisingly, all valuation results seem to be positively and statistically significantly correlated with each others. Table 6 presents Spearman rank correlations among discussed P/V ratios. All correlations are above 0.6 and statistically significant at the 0.01 level (two-tailed test).

Table 4: Correlations among P/V Ratios

This table plots the Spearman rank correlations among the Purnanandam's et al. (2004) and new modified P/V ratios. P refers to market value of equity without taking debt and cash holdings into account. EV refers to enterprise value, where differences in capital structure and leverage have been subtracted. Enterprise value is computed by adding outstanding debt to the market value of equity at the offer, and eliminating the companies' cash holdings. All correlations are statistically significant at the 0.01 level. Data for this table is retrieved from the Security Data Corporation (SDC) and Thomson ONE-banker. ***, **, and * denote two-tailed statistical significance at the 1%, 5%, 10% level, respectively.

	P/EBITDA	P/Sales	P/Earnings	EV/EBITDA	EV/Sales	EV/Earnings
P/EBITDA	1	0,97***	0,74***	0,92***	0,89***	0,90***
P/Sales		1	0,73***	0,89***	0,91***	0,92***
P/Earnings			1	0,73***	0,71***	0,68***
EV/EBITDA				1	0,97***	0,90***
EV/Sales					1	0,93***
EV/Earnings						1

Furthermore, it can be noticed that all other valuation results highly correlated with each others' (over 0,85), except *P/Earnings* and *E/Earnings* multiples. On the one hand, this is in line with the notion that net income is more likely to be subjected to accounting distortions such as earnings management, and by so tend to more fragile than EBITDA and sales as valuation determinants. On the other hand, I control for both sales and EBITDA margin in matching procedure, and hence the valuation results are very closely indicating the same.

5.1.3 IPO Valuation Regressions

Besides the regression results, this section presents regression model that is applied in peer multiple valuation regression and its dependent and independent variables. Purnanandam et al. (2004) did not use any corresponding regression model in their study; hence I will use special attention to explain why certain variables are included in this model.

The P/V ratio regression model is following:

$$\frac{P}{V}ratio_i = a + b \times lnSales_i + c \times EBITDA\,profit\,margin_i + d \times Bubble\,dummy_i$$
$$+e \times Growth_i \quad + f \times Tech\,dummy_i + g \times VC\,dummy_i$$
$$+h \times Bookbuilding\,dummy_i + i \times Oversubscription\,dummy_i + u_i$$

The dependent variable *P/V Ratio* is a ratio that is calculated based on price-to-value (P/V) ratios (see chapter 4.2 and 5.1.2). The value is the fair value of the IPO firm computed based on market price-to-sales (P/S), or market price-to-EBITDA ratio of an industry peer. The P/V ratio is used to measure IPO valuation relative to its fair intrinsic value.

I use eight explanatory variables in order to control size, profitability, firm and deal specific characteristics, growth and general market conditions. I use the natural logarithm of the number of IPO firm's *sales* (in millions dollars) as a proxy for IPO's size. Natural logarithm is taken to address the problems relating to skewed data. Since, larger IPOs tend to have more information available about their future prospects, hence I believe that larger companies are more difficult to overvalue. I assume that the sales exhibits negative coefficients with valuation results. *EBITDA profit margin* (Earnings before Interest Taxes Depreciation and Amortization) is used for controlling profitability. It is calculated by dividing IPO's prior's year's operating profit (EBITDA) with sales. Similarly with Baker and Wurgler (2007), I believe that the companies that are more unprofitable are likely to be disproportionately sensitive to broad waves of investor sentiment.

Bubble dummy equals one if the firm is listed between 1.9.1998-1.8.2000, and zero otherwise. Since my prior valuation results suggest that IPOs that take place during the 'dot-com' bubble are the most overvalued, I expect positive coefficients in my regression models. The bubble period is defined consistently with Lowry et al. (2008). *Bookbuilding dummy* equals one if bookbuilding method is used as pricing technique (as defined by SDC), and zero otherwise. Since bookbuiding method allows underwriters to acquire information about pre-market demand, and by so to be more ascertain about IPO's secondary market demand in advance. Hence, I expect that if underwriters are better informed about after-market demand compared to traditional auction

methods, the likelihood for excess valuations is higher. *Tech dummy* equals one if the firm is in a high tech industry [biotech, computer equipment, electronics, communications, and general technology (as defined by SDC)], and zero otherwise. The value of technology firms tend to be much harder to estimate precisely because of their intangible growth options. Investors tend to overreach their intangible private information; hence I expect that also this variable will exhibit positive coefficients with valuation results. *VC dummy* (Venture capital) equals one if the firm received financing from venture capitalists prior to the IPO (as defined by SDC), and zero otherwise. Academics share a common view that venture capitalists able to time their listing by the times of excess valuations, hence I expect that it more likely that venture capitalist backed IPO is overvalued. *Oversubscription dummy* equals one if the demand for an initial public offering of securities exceeds the number of shares issued (as defined by SDC), and zero otherwise. If underwriters face excess demand for issuing stock, they are more likely to readjust offer price upwards especially if the IPOs are bookbuilt.

Table 5 in below shows the correlation matrix for independent variables. Since, none of the correlations are above 0.5, it seems that there does exist any multicollinearity in between independent variables (see Garson 2006). The question whether independent variables are multicollinear can be also answered by using specified collinearity statistics, such as tolerance and VIF (variance-inflation-factor) measures. According to Garson (2006), the independent variables which have tolerance over 0.2 and VIF-figures below 5.0 are not multicollinear. All the tolerances among variables are above 0.7, and the bubble dummy have the highest VIF figure which is 1.35. Therefore can be said that that there is no multicollinearity between independent variables.

Table 5: Correlation Matrix on the Explanatory Variables of P/V Ratio Model

Table 2 shows the correlation coefficients between various characteristics that are used to explain P/V valuation results in the multivariate regression of this study. *High tech* is a dummy variable that takes the value of one for IPOs that are in high-tech sectors (as defined by SDC) .*Venture (VC)* is a dummy variable that takes the value of one for IPOs that received financing from venture capitalists prior to the IPO (as defined by SDC). *Bookbuilding* is a dummy variable that equals one for IPOs which used bookbuiding as a pricing technique (as defined by SDC). *Market Capitalization* is the natural logarithm of the IPO's market capitalization at the offer. *Oversubscription* is a dummy variable that takes the value of one if the demand for IPO shares exceeds the number of shares issued (as defined by SDC). *EBITDA-%* is the natural logarithm of the EBITDA divided by sales for prior year to IPO. *Bubble* is a dummy variable that equals one for IPOs that take place 1.9.1998-1.8.2000. *Debt ratio-%* is the ratio of book value of IPO firm's total debt at the latest balance sheet before listing divided by the market value of its assets defined as the sum of sum of total debt (at the same date as in numerator) and the market value of equity at the offer. *Sales* is the natural logarithm of sales in the prior of listing.

	EV/EBITDA	ln Sales	EBITDA-%	Bubble dummy	Growth	Tech dummy	VC dummy	Bookbuilding dummy	Oversubscription dummy
EV/EBITDA	1,00	-0,15	-0,11	0,16	0,03	0,12	-0,04	0,05	-0,09
ln Sales		1,00	-0,04	-0,22	-0,21	-0,24	0,04	0,02	0,10
EBITDA-%			1,00	-0,11	0,04	-0,12	-0,07	0,03	0,09
Bubble dummy				1,00	-0,05	0,25	-0,10	0,16	-0,24
Growth					1,00	0,02	-0,03	0,01	-0,04
Tech dummy						1,00	-0,01	0,03	-0,05
VC dummy							1,00	0,04	0,12
Bookbuilding dummy								1,00	0,01
Oversubscription dummy									1,00

Table 6 presents the result of P/V ratio regressions. The results suggest that overvaluation is driven by several characteristics. R^2 gives information about the goodness of fit of a model. R^2 is a statistical measure of how well the regression line approximates the real data points, and if the regression line fits perfectly, R^2 equals to 1. In my models the R-squared is ranging from 0.078 to 0.125 indicating that there are also several other variables which affect P/V ratios.

Consistently significant and negative coefficients for logarithmic transformation of sales and operating profits (EBITDA-%) are suggesting that overvalued IPOs (high P/V IPOs) tend to be small-sized and unprofitable companies compared to undervalued IPOs (low P/V IPOs). One potential question to answer is whether these variables are self-explanatory variables for P/V ratios. Correlation matrix shows that correlations between P/V ratios and these explanatory variables are modest, thus it seems there is linear combination among dependent and independent variables. The reason for avoiding linear combination relies on the fact that I control both EBITDA and sales in my matching process. While industry, sales, EBITDA profit margin should be relative similar, the only variables left are number of shares and offer/market price. Thus, if IPO's market capitalization exceeds matching firm's capitalization, the price-to-value (P/V) multiple is then higher than 1, and the IPO can be considered as overvalued with respect to its fair value, and vice versa.

In line with my prior findings (see Table 3), the bubble dummy variable shows significantly positive coefficients in every P/V ratio regression model, suggesting that IPOs are remarkably overvalued during the 'dot.com' boom. High tech dummy is also showing relatively high positive coefficients in all regression models, however these finding are statistically insignificant in five models. Interestingly, oversubscription dummy have negative coefficients with P/V ratios in regression models. This is opposite what I assumed since I believed that underwriting banks would raise up offer price if they face excess pre-market demand.

None of the other variables are credibly related to P/V ratios. Bookbuilding and venture capital dummies and growth all have the right sign in predicting P/V ratios, but are not statistically significant in my sample. One possible explanation for statistical insignificance may be the fact that my sample size is relatively small 614 IPOs.

Table 6: OLS Regression Results Concerning Valuation Results

This table reports OLS regression coeffients together with t-statistics (in parentheses) for six different ordinary least square regressions for P/V and E/V ratios used as valuation measures in this study. The dependent variables in the regressions are the P/V and E/V ratios calculated respect to EBITDA. *Bubble dummy* is a dummy variable that equals 1 for IPOs that were listed 1.9.1998-1.8.2000 ; *Bookbuilding dummy* is a dummy variable that equals 1 for IPOs which used bookbuiding as a pricing technique (as defined by SDC); *Tech dummy* is a dummy variable that equals 1 for IPOs that are in high-tech sectors (as defined by SDC) ; *VC dummy* is a dummy variable that equals one for IPOs were venture capitalist backed prior to listing (as defined by SDC); *Oversubscription dummy* is a dummy variable that equals 1 if pre-market demand for IPO shares exceeds the number of shares issued (as defined by SDC) ; *Ln (Sales)* is the natural logarithm of the dollar denominated prior year's sales ; *EBITDA-%* is a ratio that is computed by dividing prior year's EBITDA to prior year's sales. Data for this table is retrieved from the Security Data Corporation (SDC) and Thomson ONE-banker databases. ***, **, and * denote two-tailed statistical significance at the 1%, 5%, 10% level, respectively.

Independent Variables	Dependent Variable					
	$P/V_{[EBITDA]}$	$P/V_{[EBITDA]}$	$P/V_{[EBITDA]}$	$E/V_{[EBITDA]}$	$E/V_{[EBITDA]}$	$E/V_{[EBITDA]}$
Intercept	9.07	8,43	6,83	7,75	3,93	12.26
	[4.24]	[3.51]	[2.34]	[2.22]	[1.34]	[4.22]
Ln (SALES)	-0,70**	-0,65**	-0,66**	-1.02**		-1,10***
	[-2.26]	[-2.00]	[-2.02]	[-2.49]		[-2.80]
EBITDA-%	-0,09**	-0,09**	-0,09**			-0,10**
	[-2.57]	[-2.59]	[-2.56]			[-2.41]
Bubble dummy	4,00***	3,83***	3,00**	4,45**	4,32**	4,36***
	[2.97]	[2.80]	[2.10]	[2.56]	[2.45]	[2.58]
Growth		0,42	0,34	0,25		
		[0.65]	[0.53]	[0.31]		
Tech dummy		0,87	0,95	2,48	3,20**	1,98
		[0.68]	[0.74]	[1.55]	[2.04]	[1.25]
VC dummy			-1,13		-0,36	
			[-0.45]		[-0.11]	
Bookbuilding dummy			2.70	2,21	1,95	
			[1.36]	[0.88]	[0.79]	
Oversubscription dummy			-2.12		-3,08*	
			[-1.42]		[-1.65]	
Country dummies	yes	yes	yes	yes	yes	yes
Number of observations	614	614	614	614	614	614
(p-value)	(0,00)	(0,00)	(0,00)	(0,01)	(0,04)	(0,00)
R^2	0,109	0,118	0,125	0,088	0,078	0,092

5.2 Underpricing of P/V Portfolios

In this section, I test the relationship between peer multiple valuation results and IPO underpricing. Since, the number of IPOs is relatively large during the years 1999-2001, the underpricing results are mainly driven by events during the 'dot-com' bubble IPOs. Study by Purnanandam et al. (2004) study in U.S. market 1980-1997 suggests that there exists a positive relationship between valuation results and underpricing.

5.2.1 Valuation Results and Underpricing

I divide IPOs into three P/V portfolios, and based on P/EBITDA multiple. I use P/EBITDA valuation for classification since it allows me to make my thesis more comparable with Purnanandam et al. (2004) findings in U.S. markets. Table 7 summarizes the IPO valuations, first-day returns and other IPO characteristics of these three portfolios. Figure 3 illustrates the yearly valuation results and average underpricing of European IPOs in my sample.
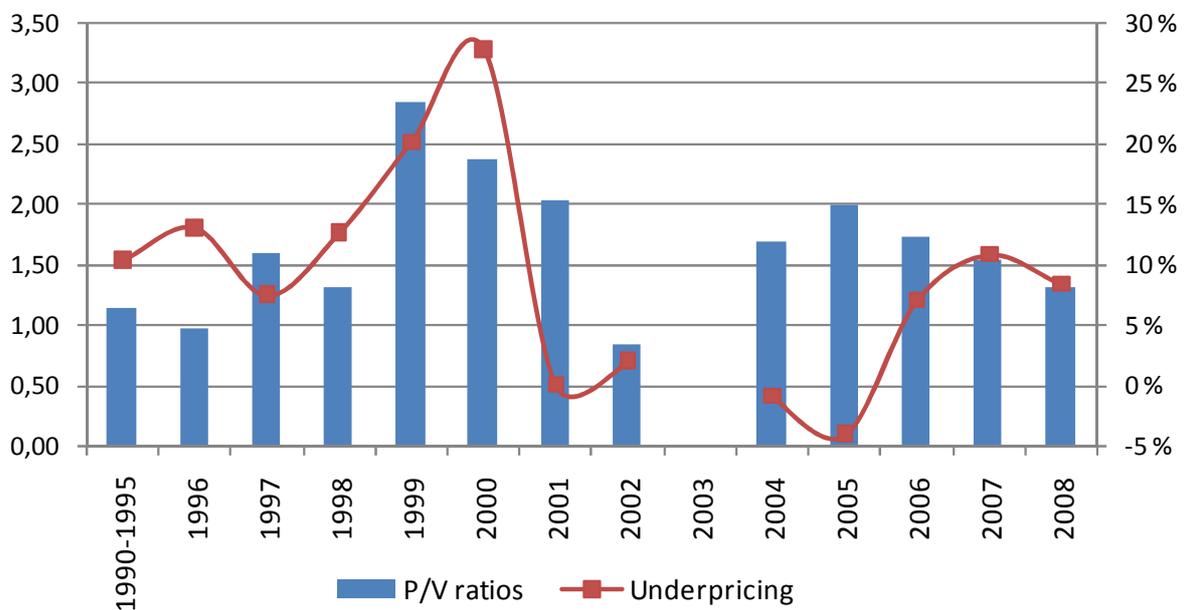
Figure 3: IPO underpricing and median P/V ratios by calendar year.

This figure illustrates both the yearly median P/V ratios for IPOs (calculated by P/EBITDA), and equally-weighted average underpricing by the cohorent year. The data is retrieved from SDC and Thomson ONE-banker.

After excluding so called ´penny´ IPOs and the ones with negative operating profits (EBITDA-%), the average first-day return for the total sample of 614 IPOs is 13.3%. Though, it is important to remember that for instance in the year 2000 there were almost 25% of all IPOs which had negative operating profits in the prior year of the listing. Before any limitations the average underpricing was over 20% which is consistent with Ritter's (2008) online survey in the European IPO markets. It seems that my matching criterion excludes many riskier IPOs during the 'dot-com' bubble which may have demanded for higher underpricing to 'go through'. The median first-day return for the whole sample is 1.6% which is quite close to zero. By comparing the means and medians it seems that some IPOs tend to get very highly underpriced. The average first-day turnover for all IPOs is 7.7% which is again in line with existing literature (see e.g. Purnanandam et al. 2004).

Table 7: First-Day Return and Other Characteristics for P/V Portfolios

This table reports the first-day returns, and other firm-specific characteristics for three IPO portfolios based on their P/V multiple valuation results. The P/V ratios are calculated respect to P/EBITDA without taking debt and cash holding into account. Low P/V portfolio refers to lowest 25th quartile, and high P/V portfolio refers to highest 75th quartile of P/V IPOs. *First-day return* represents the equally weighted average return earned by the firms in the IPO portfolio. *First-day turnover* is ratio of first day trading volume divided by the shares outstanding at the end of first trading day. *Sales*, and *EBITDA profit margin* refers to IPO's prior year financial items. *Size* is the median market capitalization computed as of the end of the first trading day after the IPO. *Sales* and *Size* are reported in millions. Z-value stands for Wilcoxon rank sum test for equality of medians and t-value stands for student's t-test for data equality of means. Data for this table is retrieved from the Security Data Corporation (SDC) and Thomson ONE-banker.

IPO Portfolio	No. of Issues	Median P/V	First-day Returns		First-day Turnover		Median Sales	Median EBITDA-%	Median Size
			Median	Mean	Median	Mean			
Low P/V	154	0,50	3,2 %	15,6 %	4,0 %	7,3 %	234,2	17,6 %	181,8
Medium P/V	306	1,79	1,2 %	9,1 %	4,0 %	7,0 %	147,8	15,7 %	254,5
High P/V	154	9,11	1,7 %	19,9 %	5,5 %	9,4 %	46,8	12,2 %	221,5
Low P/V- High P/V		-8,61	1,6 %	-4,3 %	-1,6 %	-2,0 %	187,5***	5,4 %***	-39,7
T-/ Z-statistics			[-0.23]	[-0.69]	[-1.40]	[-1.32]	[-5.60]	[-3.81]	[-1.03]
All IPOs	614	1,79	1,6 %	13,3 %	4,0 %	9,4 %	121,1	15,2 %	225,2

***, **, and * denote two-tailed statistical significance at the 1%, 5%, 10% level, respectively.

High P/V IPOs earn largest first-day returns (19.9%), and have highest turnover (9.4%) on average during the first-day of trading. However, the difference in means or medians is not statistically significant. Actually, these findings are slightly in line with my own expectations that

pre-existing owners are more willing to leave money on the table and secure the successful listing process if they already know that their firm is overvalued. Interestingly, I find that low P/V IPOs are more underpriced than medium P/V IPOs. This is somewhat confusing since why anyone would be willing to leave more money on the table if they already know that their company undervalued compared to their industry peers. One possible explanation can be the fact that the most undervalued (Low P/V) IPOs want to signal their quality by using higher underpricing.

Different IPO portfolios appear to have considerable differences in their financial characteristics. High P/V IPOs seem to have significantly lower sales (difference in medians $187,5 million) and operating profits than low P/V IPOs (difference in medians 5,4%). In contrast, the medium market capitalization for high P/V IPOs is $40 million more which could indicate that the most overvalued IPOs are more likely to be equity financed smaller growth companies with lower profitability.

5.3 IPO Valuation and Long-Run Performance

This section focuses on studying, whether there exists a connection between P/V valuation results and after market buy-and-hold abnormal returns. The long-run underperformance of IPOs is well-documented phenomena, thus I also assume that IPOs earn remarkably lower returns than their benchmarks in general level. In more detail level, I assume that the most overvalued IPOs will earn highest abnormal returns as long as investors truly believe in their overly optimistic growth assumptions and justify excess valuations. Hence, I believe that the most overvalued IPOs will revert to their mean and below in the long run. In contrast to high P/V IPOs, I believe that the undervalued IPOs are relatively 'fairly' priced at the offer, and thus will succeed better than medium or high P/V IPOs in the long run. Figure 4 captures the daily buy-and-hold abnormal returns (BHARs) compared to MSCI Europe index for high, medium and low P/V portfolios.
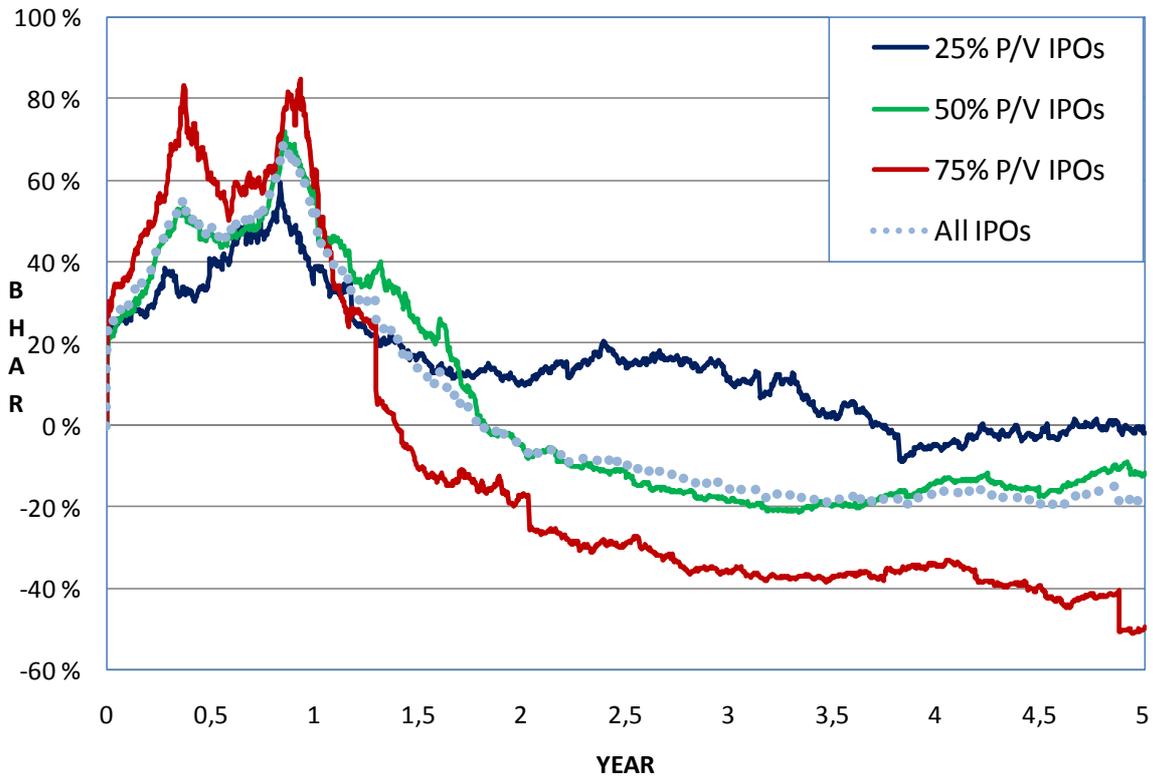
Figure 4: Daily buy-and-hold abnormal returns (BHARs) for different P/V portfolios.

This figure breaks down five-year buy-and-hold abnormal returns (BHARs) for low, medium and high P/V IPOs. Categorization is based on P/EBITDA price multiples. Daily closing prices are non-adjusted for splits or other capital changes. As a benchmark portfolio has been used MSCI Europe Index. The data is retrieved from SDC and Thomson ONE-banker.

Figure 4 suggests that the high P/V IPOs earn highest abnormal returns during the first year in the after-market, which is uniform with Purnanandam's et al. (2004) study. Both high P/V and medium P/V IPO portfolios have one significant peak around 180 days after the listing. At the first glance, this may seem a bit confusing but when the fact that lock-up period for European IPOs usually ends 180 days after the listing into account, there is a logical explanation for such behavior. Lock-up agreements prevent insiders to trade their shares in the early after-market, but as the lock-up period ends it is rational that the well-informed owners that hold overvalued stocks will immediately sell their portions to outsiders. For undervalued (low P/V) IPOs there is no such pattern as high or medium P/V IPOs.

5.3.1 After-Market Buy-and-hold Abnormal Returns

As my results indicate that European IPOs are systematically overvalued by 60% relative to their industry peers, they should also underperform their peer groups in the long run. In line with this notion and previous studies, I find that European IPOs in between years 1990-2003 earn lower abnormal returns than various peer groups in the five year period after going public. And in contrast to long run findings, my short-term findings indicate that all IPOs tend to get even more overvalued in the in the short-term which is line with 3rd hypothesis. Reason for limiting the time period to year 2003 is solely based on the fact that impossible to obtain full after-market time series for later IPOs. As a robustness check, I also calculated BHARs for the whole sample without making any limitations, and these results also indicate consistent patterns with presented findings. Figure 5 captures the difference in BHARs for various time periods.
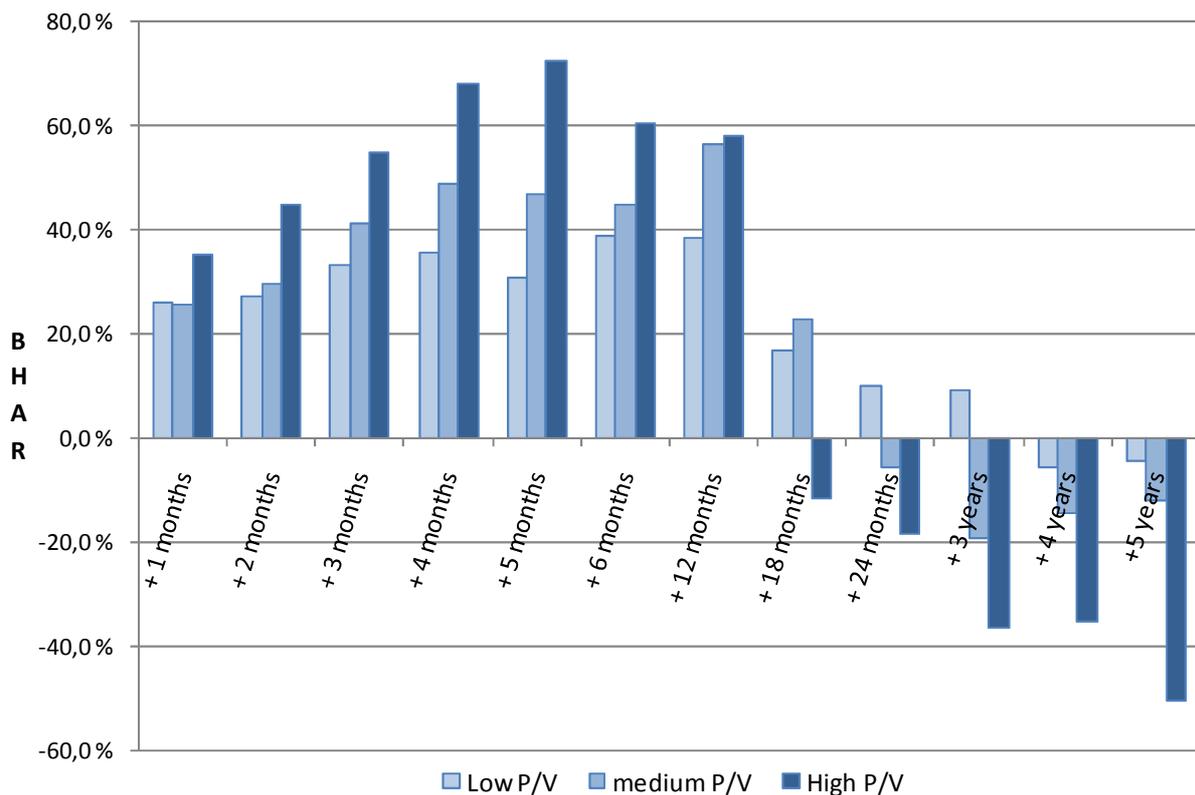
Figure 5: P/V portfolios' average buy-and-hold abnormal returns (BHARs) for different time periods.
This figure shows average BHARs for low, medium and high P/V IPOs calculated by P/EBITDA price multiples. Daily closing prices are non-adjusted for splits and other capital changes. The mean is equally-weighted mean. As a benchmark portfolio has been used MSCI Europe Index. The data is retrieved from SDC and Thomson ONE-banker.

Table 8: Long-term Market Adjusted Buy-and-Hold Abnormal Returns for P/V Portfolios

This table reports the first-day returns, and other firm-specific characteristics for three IPO portfolios based on their P/V multiple valuation results. The P/V ratios are calculated respect to P/EBITDA without taking differences in debt or cash holdings into account. Z-value stands for Wilcoxon rank sum test for equality of medians and t-value stands for student's t-test for data equality of means. Data for this table is retrieved from the Security Data Corporation (SDC) and Thomson ONE-banker. ***, **, and * denote two-tailed statistical significance at the 1%, 5%, 10% level, respectively.

Portfolios	Market Adjusted Buy-and-Hold Abnormal Returns (Median)					
	0-6 months	0-12 months	0-24 months	0-36 months	0-48 months	0-60 months
Low P/V	8,78 %	8,5 %	-2,9 %	-15,4 %	-21,9 %	-25,4 %
Medium P/V	10,33 %	14,8 %	-30,1 %	-37,8 %	-38,8 %	-40,1 %
High P/V	21,59 %	-3,0 %	-51,0 %	-54,6 %	-59,8 %	-65,6 %
Low P/V -High P/V	-12,8 %	11,5 %	48,1%***	39,2%***	37,9%***	40,2%***
Z-statistics	[0.52]	[-0.01]	[-3.78]	[-4.36]	[-3.46]	[-3.48]
	Market Adjusted Buy-and-Hold Abnormal Returns (Mean)					
Low P/V	38,7 %	38,5 %	10,2 %	9,0 %	-5,5 %	-3,8 %
Medium P/V	44,9 %	56,5 %	-5,5 %	-19,0 %	-14,5 %	-13,0 %
High P/V	60,4 %	58,0 %	-18,4 %	-36,5 %	-35,1 %	-50,6 %
Low P/V -High P/V	-21,7 %	-19,5 %	28,6%***	45,5%***	29,5%***	46,8%***
T-statistics	[-1.22]	[-0.79]	[2.12]	[3.99]	[2.72]	[3.49]

I find that there are significant differences how different P/V IPO portfolios perform in different periods. Table 8 shows that the most overvalued IPOs earn higher BHARs during the first twelve months after the listing. However, the difference in mean and median is statistically insignificant.

In contrast, the long-term BHARs for high P/V IPOs are statistically significantly lower than undervalued (low P/V) IPOs. It seems that, consistently with Purnanandam et al. (2004), the overvalued IPOs are poor investment in the five-year period but in the short-term investors will earn relatively large abnormal returns. I use various benchmarks to ensure the robustness of my after-market returns. Table 10 presents both median and mean buy-and-hold abnormal returns compared to (a) MSCI Europe Index, (b) MSCI World, and (c) Industry, sales, and profit margin matched peers.

Table 9: 5-Year Buy-and-Hold Abnormal Returns of Low, Medium, and High P/V Portfolios of IPOs

This table reports *median* and *(equal-weighted) mean* five-year buy-and-hold abnormal returns (BHARs) earned by IPOs in portfolios formed on the basis of their P/V ratios computed from P/EBITDA multiples. The BHARs are calculated with respect to (a) MSCI Europe Index (b) MSCI World Index, and (c) Matching firm based on industry, sales, and EBITDA profit margin (same firm which was used in matching process). Panel A presents median BHARs. Panel B reports equal-weighted mean BHARs. In Panel A, the numbers in parentheses below the row titled (Low P/V – High P/V) are Wilcoxson-Mann-Whitney non-parametric t-statistics for testing differences in medians under the assumption of independence of observations. The numbers in parentheses in Panel B are simple t -statistics for differences in mean also computed under the assumption of independence of observations. Data for this table is retrieved from the Thomson ONE-banker and Security Data Corporation (SDC) databases. ***, **, and * denote two-tailed statistical significance at the 1%, 5%, 10% level, respectively.

IPO Portfolio	PANEL A: Median 5-Year Buy-and-Hold Abnormal Returns								
	MSCI Europe Matched			MSCI World Matched			Industry, Sales and Profit Margin Matched		
	IPOs	Bench.	BHAR	IPOs	Bench.	BHAR	IPOs	Bench.	BHAR
Low P/V	-22,8 %	2,5 %	-25,4 %	-22,8 %	-5,7 %	-17,1 %	-22,8 %	-41,6 %	18,7 %
Medium P/V	-49,1 %	-9,0 %	-40,1 %	-49,1 %	-6,4 %	-42,7 %	-49,1 %	-26,2 %	-22,9 %
High P/V	-74,0 %	-8,4 %	-65,6 %	-74,0 %	-9,5 %	-64,5 %	-74,0 %	-3,0 %	-71,0 %
Low P/V- High P/V	51,2%***	10,9%***	40,2%***	51,2%***	3,81%***	47,4%***	51,2%***	-38,6%**	89,7%***
Z-Statistics	[-4.75]	[-3.65]	[-3.48]	[-4.75]	[-4.47]	[-3.37]	[-4.75]	[-2.32]	[-4.76]
All IPO Firms	-49,6 %	-8,3 %	-41,3 %	-49,6 %	-7,1 %	-42,5 %	-49,6 %	-25,0 %	-24,6 %
	PANEL B: Mean 5-Year Buy-and-Hold Abnormal Returns								
Low P/V	17,3 %	21,1 %	-3,8 %	17,3 %	25,8 %	-8,6 %	17,3 %	-7,8 %	25,0 %
Medium P/V	-4,9 %	8,1 %	-13,0 %	-4,9 %	13,0 %	-17,8 %	-4,9 %	12,2 %	-17,1 %
High P/V	-48,0 %	2,6 %	-50,6 %	-48,0 %	5,8 %	-53,7 %	-48,0 %	32,0 %	-79,9 %
Low P/V- High P/V	65,2%***	18,5%***	46,8%***	65,2%***	20,1%***	45,2%***	65,2%***	-39,7%**	105,0%***
T-Statistics	[4.50]	[3.07]	[3.49]	[4.50]	[2.95]	[3.35]	[4.50]	[-2.19]	[4.65]
All IPO Firms	-10,3 %	9,9 %	-20,2 %	-10,3 %	14,5 %	-24,8 %	-10,3 %	12,3 %	-22,6 %

Regardless of the benchmark used to compute BHAR or the choice of median or mean returns the results show a consistent pattern. Low P/V IPOs earn significantly higher returns than High P/V IPOs over the next five years. I report medians in addition to equally-weighted average since the medians are more robust for distributions that are highly skewed. The difference in median raw returns is 51.2% while the difference in mean returns is 65.2%. The difference in median abnormal returns varies from 40.2% in the case of MSCI Europe matched to 89.7% in the case of industry, sales, and EBITDA profit margin matched firms. Mean abnormal returns vary from 46.8% to 105.0%. The mean and median differences are all statistically significant based on either the non-parametric Wilcoxson-Mann-Whitney test or the traditional t-test.

Ritter (1991) found that a strategy of investing in US IPO stocks at the end of the first day of public trading and holding them for three years would left investors only 83 cent to each invested dollar in matching companies listed in the American and New York stock exchanges. Consistently with Ritter (1991), I find that five year buy-and-hold investors are left only 79.8 cent to each invested dollar compared to MSCI Europe Index. Hence, it seems that the long-run results concerning the IPOs' after-market performance are in line previous studies of IPOs underperformance.

However, from my opinion one the most appealing and interesting is the total turnaround in BHARs earned by High P/V IPOs which appears while comparing the short and long event-windows. Overvalued IPOs earn highest positive abnormal returns in the short-run but lowest abnormal returns in the long-run. The reasons behind such behavior need to be analyzed more accurately.

5.3.3 The Factors Affecting Buy-and-Hold Abnormal Returns

This section studies the factors that affect buy-and-hold abnormal returns in the short- and long-term. My results indicate that the long-run abnormal returns are strongly associated with P/V valuation results, and there is significant differences in abnormal returns that low and high P/V IPO portfolios earn in both short- and long-term. I use the following cross-sectional regression analysis to study the relationship between P/V ratios and buy-and-hold abnormal returns (BHARs). The division of the five year period into short- and long categories is based on the fact that the lock-up periods typically expire after six months.

Short-run OLS regression model:

$$r_i - r_{mt} = a + b \times lnPV_i + c \times Bubble\ dummy + d \times EBITDA\ margin_i + e \times lnSales_i$$

$$+f \times Growth_i + g \times Tech\ dummy_i + h \times VC\ dummy_i + i \times Bookbuilding\ dummy_i$$

$$+j \times Oversubscription\ dummy_i + u_i$$

Long-run OLS regression model:

$$r_i - r_{mt} = a + b \times lnPV_i + c \times lnBM_i + d \times EBITDA\ margin_i + e \times lnSales_i + f \times VC\ dummy_i$$

$$+g \times Bubble\ dummy_i + u_i$$

The index *i* represents the IPO firm. $r_i - r_{mt}$ is the excess return on the MSCI Europe index. In both equations I use the logarithmic transformation of sales to control size, and EBITDA profit margin to control profitability. I also include several of qualitative firm and deal specific characteristics in my models that Purnanandam et al. (2004) did not use in their regression models. In order to control market conditions and firm's pre-existing ownership structure, I include *bubble dummies* and *VC dummies* (venture capital) in both equations. In long-term equation, I include *book-to-market ratios* since prior work suggests that they are related to cross section of stock returns. To test whether investors are overoptimistic about technology firms' future prospects, I use *Tech dummies* to control IPO's field of business. Both *bookbuilding*

dummies and *oversubscription dummies* are used to control the balance between supply and demand in short-run. Tables 10 and 11 present the results of the OLS regressions, where the buy-and-hold abnormal returns (BHAR) calculated respect MSCI Europe are regressed on a number of qualitative firm and deal specific characteristics and P/V valuation results.

Short-Run Buy-and-Hold Abnormal Returns

I test both 90 and 180 days buy-and-hold abnormal returns (BHARs). The results in Table 10 (consistently in all models) suggest that IPOs that take place during the 'dot-com' boom (1.9.1998-1.8.2000) are significantly positively related to both 90 and 180 days buy-and-hold abnormal returns. The relationship is robust in both time periods and in different models.

It seems that there does not exist a reliable relationship between P/V ratios and short-run BHARs. Since, I believe that P/V ratios reflect the long-term 'fair' intrinsic value of issuing firms; these findings are in line with my expectations. Pre-existing cumulative average growth rate (CAGR) have statistically significant coefficient with 90 and 180 days BHARs. This finding reinforces my own intentions, and gives me slight indications that investors may overreact IPOs future prospects. If the pre-existing growth is temporary, it could explain both short-term run-up and long-term underperformance. This finding is also consistent with behavioural finance theories which suggest that investors tend to overreact to intangible information, such as growth expectations.

The results also show that the sales variable is significantly negatively related to short-term returns. Hence, it seems that small-sized, highly growing IPOs earn the highest abnormal returns in the short-run. Venture capital backed IPOs have positive coefficient with 90 days BHARs, modestly suggesting that venture capitalist may be able to time IPOs more appropriately. None of the other variables are readily related to short-run returns. Bookbuiding and tech dummies both have the right sign predicting short-term returns, but are not statistically significant in my sample. In contrast oversubscription dummy has again opposite sign what was predicted. It would have been logical if the initial oversubscription would have led to positive abnormal returns in the short-run.

Table 10: IPO Valuation and Short-Run Buy-and-Hold Abnormal Returns

This table reports OLS regression coefficients together with t-statistics (in parentheses) for six different ordinary least square (OLS) regressions for 90 and 180 days buy-and-hold abnormal returns (BHARs) used as measuring the after-market performance of IPOs in this study.

$$r_i - r_{mt} = a + b \times lnPV_i + c \times Bubble\ dummy + d \times EBITDA\ margin_i + e \times lnSales_i + f \times Growth_i + g \times Tech\ dummy_i +$$

$$h \times VC\ dummy_i + i \times Bookbuilding\ dummy_i + j \times Oversubscription\ dummy_i + u_i$$

r_{pt} is the IPO returns, r_{mt} is the MSCI Europe index return, $(R_i - R_{mt})$ is the excess return on the MSCI Europe index. *LnPV$_i$* is the natural logarithm of P/V ratio calculated respect to EBITDA. *EBITDA margin* is the ratio of EBITDA to sales for the fiscal year ending at least three months before the IPO goes public. *Bubble dummy* is a dummy variable that equals 1 for IPOs that were listed 1.9.1998-1.8.2000. *Growth$_i$* is a cumulative average growth rate (GAGR) of firm's sales before listing obtained at least for two years. *Tech dummy$_i$* is a dummy variable that equals 1 for IPOs that are in high-tech sectors (as defined by SDC). *VC dummy$_i$* is a dummy variable that equals one for IPOs were venture capitalist backed prior to listing (as defined by SDC). *Bookbuilding dummy$_i$* is a dummy variable that equals 1 for IPOs which used bookbuiding as a pricing technique (as defined by SDC). *Oversubscription dummy$_i$* is a dummy variable that equals if pre-market demand for IPO shares exceeds the number of shares issued (as defined by SDC). Data for this table is retrieved from the SDC and Thomson ONE-banker databases. ***, **, and * denote two-tailed statistical significance at the 1%, 5%, 10% level, respectively.

Independent Variables	Dependent Variable					
	BHAR[0-90 days]	BHAR[0-90 days]	BHAR[0-90 days]	BHAR[0-180s]	BHAR[0-180 days]	BHAR[0-180 days]
Intercept	0,41	0,69	0,65	1,57	1,91	1,73
	[3.28]	[3.23]	[2.36]	[12.2]	[8.67]	[7.85]
Ln (P/V Ratio)	0,024	-0,03	-0,02	0,02	-0,002	-0,04
	[0.55]	[-0.56]	[-0.41]	[0.46]	[-0,05]	[-0.76]
Bubble dummy	0,39***	0,31***	0,28**	0,43***	0,38***	0,36***
	[3.28]	[2.63]	[2.24]	[3.43]	[3.00]	[2.87]
EBITDA margin		0,31	0,34		0,12	0,07
		[0.96]	[1.04]		[0.36]	[0.19]
Ln (Sales)		-0,07**	-0,07**		-0,07**	-0,05
		[-2.55]	[-2.50]		[-2.31]	[-1.60]
Pre-Growth		0,003***	0,003*			0,004***
		[2.85]	[2.68]			[3.98]
Tech dummy			0,14			
			[1.21]			
VC dummy			0,55*			
			[1.91]			
Bookbuilding dummy			-0,04			
			[-0.19]			
Oversubscription dummy			-0,05			
			[-0.37]			
Country dummies	yes	yes	yes	yes	yes	yes
Number of observations	411	411	411	411	411	411
R^2	5,3 %	9,3 %	9,4 %	8,5 %	9,4 %	12,9 %

Long-term Buy-and-Hold Abnormal Returns

Table 11 presents the result of long-term cross-sectional regressions. In contrast to short-term findings, my five year results indicate significantly negative relationship between P/V ratios and five year returns. I find that P/V valuation results become statistically significant explanatory variable in all models that are explaining five-year returns. The negative coefficients are in line with my own expectations and indicate that overvalued IPOs tend to have worse after-market performance than undervalued IPOs in the five year period.

The results presented in below show a significant positive relation between venture capital backing and long-term returns. Hence, my findings slightly indicate that venture capital backed IPOs have better aftermarket performance in both short- and long-term. This notion is in line with pre-existing academic studies; since the former literature has raised up the fact that venture capital backed firms are better managed and have better operational performance compared to non-venture backed peers. Bubble dummy is statistically insignificant for explaining five year underperformance. Actually, the IPOs that take place during the 'dot-com' boom have positive coefficient with five year BHARs. Without testing the relationship between 'dot-com' bubble and long-term buy-and-hold abnormal returns, one could have easily argue that the underperformance of P/V IPOs is solely driven by overvalued IPOs that take place in years 1998-2000. This positive coefficient only reinforces my P/V ratio related findings.

There is no book-to-market effect in my sample. In fact book-to-market ratio has the wrong sign in predicting long-run returns. Hence, the results in Table 11 show that the relationship that I document between P/V ratios and long-run abnormal returns is not driven by book-to-market ratios, or bubble period. Similarly with Purnanandam et al. (2004), I find that the sales variables have positive and statistically significant coefficients with 3-5 year BHARs. I use IPO's prior fiscal year sales as a proxy of ex ante size, though my results indicate that larger companies tend to perform relatively well in the long-run compared smaller IPOs. These patterns are totally opposite in the short-term. However, this pattern is consistent with Baker and Wurgler (2007) who argue that stocks of low market capitalization, younger, unprofitable, growth companies, are likely to be disproportionately sensitive to broad waves of investor sentiment.

Table 11: IPO Valuation and Long-Run Buy-and-Hold Abnormal Returns

This table reports OLS regression coefficients together with t-statistics (in parentheses) for six different ordinary least square (OLS) regressions for buy-and-hold abnormal returns (BHARs) from two to five years used as measuring the after-market performance of IPOs in this study.

$$r_i - r_{mt} = a + b \times lnPV_i + c \times lnBM_i + d \times EBITDA\ margin_i + e \times lnSales_i + f \times VC\ dummy_i + g \times Bubble\ dummy_i + u_i$$

r_i is the IPO returns, r_{mt} is the MSCI Europe index return, ($R_i - R_{mt}$) is the excess return on the MSCI Europe index. $LnPV_i$ and $LnBM_i$ are the natural logs of P/V ratio and book-to-market ratio. The P/V ratio calculated respect to EBITDA, and the book value of equity is for the fiscal year after the firm goes public. *EBITDA margin* is the ratio of EBITDA to sales for the fiscal year ending at least three months before the IPO goes public. *VC dummy* is a dummy variable that equals one for IPOs were venture capitalist backed prior to listing (as defined by SDC). *Bubble dummy* is a dummy variable that equals 1 for IPOs that were listed 1.9.1998-1.8.2000. Data for this table is retrieved from the Security Data Corporation (SDC) and Thomson ONE-banker databases. ***, **, and * denote two-tailed statistical significance at the 1%, 5%, 10% level, respectively.

Independent Variables	Dependent Variable					
	$BHAR_{[0-2year]}$	$BHAR_{[0-3year]}$	$BHAR_{[0-4year]}$	$BHAR_{[0-5year]}$	$BHAR_{[0-5year]}$	$BHAR_{[0-5year]}$
Intercept	1,20	-0,38	-0,48	-0,55	-0,59	-0,65
	[4.12]	[-3.08]	[-3.58]	[-3.30]	[-3.57]	[-3.55]
Ln (P/V Ratio)	0,01	-0,09***	-0,05	-0,10**	-0,09**	-0,09**
	[0.13]	[-2.96]	[-1.46]	[-2.26]	[-2.06]	[-2.20]
Ln (B/M)	-0,001	-0,003***	-0,001	-0,001	-0,001	-0,001
	[0.55]	[-4.64]	[-1.39]	[-1.59]	[-1.62]	[-1.43]
EBITDA margin	-0,21	0,07	0,07	-0,09	-0,07	-0,06
	[0.40]	[0.32]	[0.29]	[-0.30]	[-0.23]	[-0.19]
Ln (Sales)	-0,13***	0,06***	0,07***	0,09***	0,09***	0,10***
	[-2.83]	[3.10]	[3.26]	[3.48]	[-3.57]	[-3.53]
VC dummy					0,87***	0,87***
					[3.31]	[3.31]
Bubble dummy						0,081
						[0.74]
Number of observations	411	411	411	411	411	411
F-stat	2.37	12.43	4.84	6.59	7.59	6.29
(p-value)	(0,05)	(0,00)	(0,00)	(0,00)	(0,00)	(0,00)
R^2	1,4 %	10,4 %	3,8 %	5,4 %	7,7 %	7,5 %

5.3.3 Portfolio tests based on the three-factor model

The evidence in Section 5.3.-5.3.2 suggests that low P/V IPOs outperform high P/V IPOs over the five years following the year of the IPOs. This finding, however, is based on index-adjusted abnormal returns, which do not fully control for the various systematic risk or style influences affecting IPO returns. I control such risks by computing monthly risk-adjusted returns (alphas) of the zero investment portfolio (low P/V-high IPO P/V) based on the Fama and French (1993) three factor model. I also present results based on the market model and a two-factor model containing only the market and the size factor for comparison.

The monthly portfolio returns are calculated as follows. Each IPO is allotted to one of three P/V portfolios and it is held for either 6 months starting from the beginning of the first calendar month after the IPO (six-month returns) or for 54 months from the end of the six month after the offer month (long-run returns). The division of the five-year period into these two periods is based on the fact that lock-up periods usually expire after six months. At the end of the holding period IPO drops out of its portfolio. Once all IPOs are allotted to this manner, I compute returns across all stocks for each calendar month from the beginning of 1990 to the end of 2008.

Estimates based on the three-factor model using monthly calendar time returns suffer from fewer misspecification problems than the BHAR approach. This approach avoids from autocorrelation problems present in overlapping five-year buy-and-hold returns, takes into account the cross-correlation among returns across clustered events, and presents the most reliable test statistics. It also provides a way to control book-to-market effects in the situations in which control firm approach is difficult to use because individual book-to-market ratios tend to be noisy (as in case of IPOs). On the other hand, there are some issues associated with the power of these tests to detect abnormal performance [see Loughran and Ritter (2000)].

Table 12 presents the regression results for both the 6-month and the 54-month holding period. Based on the three factor model, at the six-month, the high P/V portfolio earn 53 % (4.42 % × 12 months) on annualized basis and outperforms the low P/V portfolio by about 27 % (2.25 % × 12

months) on annualized basis. In contrast, the low P/V IPOs earns 26 % (2.17 % × 12 months) per annum, which is also statistically significant.

At the 54-month horizon, the "risk-adjusted" abnormal return earned by the high P/V portfolio based on the three-factor model is a statistically significant -19.2 % (-1.60 × 12 months) per annum. In contrast, the abnormal return earned by the low P/V IPOs is -4.32 % (-0.36 × 12 months) and statistically insignificant.

The difference in abnormal returns (low P/V – high P/V) is 14.9 % (1.24 × 12) when using three-factor model. The difference increases to about 22.7 % (1.89 × 12) when two-factor model is used to control for risk and to about 22.2 % per annum when only the single-factor model is used to control for risk. I provide the single-factor and two-factor result since there is still controversy over whether HML (Table 12) is a risk factor or just a style factor.

The results also provide clues as to the style characteristics of low P/V and high P/V stocks. There is not much difference the market (b = -0.003), HML (h = 0.43) and SMB (s = 0.04) betas across the two portfolios in 54-month period (or 6-month), suggesting that the zero-investment (low P/V- high P/V) portfolio is fairly well hedged in the terms of market and small firm risks. Consequently, it seems that there is not significant differences in the risk-factors' betas that could explain either short-term positive abnormal returns, or long-term remarkable underperformance that high P/V IPO portfolio earn in different time periods.

Table 12: IPO Valuation and Long-Run Risk-Adjusted Returns

This table reports the results of Fama and French (1993) three-factor regressions involving equal-weighted monthly calendar time results of low, high, and low-high IPO portfolios. The portfolios are constructed by allocating IPOs to low, medium, or high P/V portfolios as they become public. The IPOs stay in their respective portfolios for (a) a period of six months starting from the month after they go public or (b) for a period of 54-months starting six months after they go public. The 54-month results are provided under the heading Long-run returns. The regression model is given below:

$$r_{pt} - r_{Ft} = a_p + b_p(R_{mt} - R_{ft}) + s_p SMB_t + h_p HML_t + u_t$$

r_{pt} is the monthly portfolio returns, r_{Ft} is the one-month Treasury-bill return, $(R_{mt} - R_{ft})$ is the monthly excess return on the MSCI Europe index, SMB is the return on small firms minus the return on large firms in the month t, and HML is the return on high book-to-market stocks minus the return on low book-to-market stocks in month t. a_p is the monthly risk-adjusted abnormal return in percent and b_p, s_p, h_p are factors loadings. The raw data for this table is obtained from SDC, Thomson Financial, and Kenneth French's data library. ***, **, and * denote two-tailed statistical significance at the 1%, 5%, 10% level, respectively.

IPO Portfolio	Six-month returns					Long-run returns				
	a	b	s	h	Adj. R^2	a	b	s	h	Adj. R^2
Low P/V	2,17***	0.21	0,56**	-0,43**	16,6 %	-0,51**	0,43***			12,3 %
	[2.07]	[1.17]	[2.52]	[-2.11]		[-2.17]	[8.82]			
						-0,63	0,40***	0,17***		13,1 %
						[-2.62]	[7.91]	[3.19]		
						-0,36	0,36***	0,15***	-0,25***	14,5 %
						[-1.45]	[7.05]	[2.88]	[-4.35]	
High P/V	4,42***	-0,24	0,32	-1,12***	21,4 %	-2,36***	0,48***			11,3 %
	[3.03]	[-0.09]	[1.33]	[-4.62]		[-8.09]	[8.06]			
						-2,52***	0,43***	0,19***		12,0 %
						[-8.49]	[7.13]	[2.89]		
						-1,60***	0,36***	0,11	-0.68***	18,2 %
						[-5.17]	[5.97]	[-1.62]	[-9.97]	
All IPOs	1,43***	0,24***	0,77***	-0,61***	28,1 %	-0,57***	0,31***	0,08***	0,41***	14,0 %
	[3.30]	[2.88]	[9.76]	[-7.45]		[-4.10]	[11.1]	[2.65]	[-13.3]	

5.3.4 IPO Valuation and Ex-Post Growth

In this section, I examine the operational performance and growth of low, medium, and high P/V portfolios. I test that whether the high long-run expectations are realized ex post. In other words, I try to find out whether the high P/V IPOs experience superior long-run growth opportunities which could justify the excess valuations. This is another way to evaluate whether the "overvaluation" finding reported in the previous tables represent a missing growth opportunity.

At this point a short recap concerning my long-run findings would be in place. My long-term results suggest that high P/V IPOs underperform low P/V IPOs statistically significantly over the five year period after the listing, but in the short-term my findings are indicating totally opposite. The high P/V IPOs earn remarkably higher abnormal returns in both 90 and 180 days period than low P/V IPOs. A rational explanation for such behavior could be the fact that if high P/V IPOs show temporarily higher growth rates and profitability, and by so leave room for speculative trading. If the investors initially overreact the information about IPOs' growth and profitability, it would explain both the short-term run-up and long-run underperformance.

The following patterns stand out in Table 13. The sales of high P/V IPOs grow faster than those of low P/V IPOs immediately after going public. In year 1, the difference in growth rates between low P/V- high P/V portfolios is -8.47 % in median, and -15.9 % in equally weighted mean which both are statistically significant. However, the higher sales growth does not seem to carry out long. My results indicate that in the end of year five there is no significant differences in sales growth between high and low P/V portfolios. Hence, it seems that investors may be overoptimistic about high P/V IPOs' future prospects.

The ex post operating performance of IPOs has also been under several studies. Michelson, Partch and Shah (1997) report that the median IPO has a subsequent deterioration in its operating performance. Sales may grow, but the total cash flows do not grow sufficiently to justify high valuations at the time of offering. Following table also reports annual EBITDA profit margin defined as the ratio of EBITDA to sales. It has been used to measure ex post operating performance over the next five years for low, medium, and high P/V IPO portfolios. The low P/V

IPOs have significantly better and more stable operating profitability than high P/V IPOs throughout the five year period. This could also explain the relatively good long-term performance of low P/V IPOs. Even though, the EBITDA profit margin tends to drop in each IPO portfolio during the five period, the most overvalued IPO portfolio have the lowest profitability in each and every year.

Table 13: Ex Post Growth and Profitability for P/V Portfolios

This table reports the first-day returns, and other firm-specific characteristics for three IPO portfolios based on their P/V multiple valuation results. The P/V ratios are calculated respect to P/EBITDA without taking debt and cash holding into account. Z-value stands for Wilcoxon rank sum test for equality of medians and t-value stands for student's t-test for data equality of means. Data for this table is retrieved from the Security Data Corporation (SDC) and Thomson ONE-banker. ***, **, and * denote two-tailed statistical significance at the 1%, 5%, 10% level, respectively.

Portfolios	Annual Growth Rate in Sales (Median)					
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Low P/V	-	6,5 %	6,6 %	5,0 %	4,7 %	4,4 %
Medium P/V	-	6,3 %	9,0 %	5,7 %	7,2 %	5,5 %
High P/V	-	15,0 %	12,4 %	5,0 %	7,4 %	4,7 %
Low P/V -High P/V	-	-8,47%***	-5,86%***	0,04 %	-2,71%*	-0,36 %
Z-statistics		[-4.06]	[-2.66]	[-0.54]	[-1.73]	[-0.16]
	Annual Growth Rate in Sales (Mean)					
Low P/V	-	9,6 %	8,8 %	6,2 %	4,2 %	4,6 %
Medium P/V	-	10,5 %	12,2 %	6,8 %	6,6 %	5,1 %
High P/V	-	25,5 %	14,0 %	10,0 %	7,2 %	3,7 %
Low P/V -High P/V	-	-15,9%***	-5,19 %	-3,79 %	-3,06 %	0,85 %
T-statistics		[-4.35]	[-1.62]	[-1.41]	[-1.34]	[0.31]
	EBITDA Profit Margin (Median)					
Low P/V	18,3%	17,6%	18,8%	16,5%	15,4%	15,3%
Medium P/V	15,3%	14,1%	12,6%	12,1%	11,7%	10,9%
High P/V	11,9%	12,2%	11,1%	7,5%	6,0%	9,9%
Low P/V -High P/V	6,38%***	5,34%***	7,74%***	8,95%***	9,40%***	5,45%***
Z-statistics	[-4.21]	[-3.55]	[-4.27]	[-4.68]	[-4.49]	[-3.25]

In general level, the initial run-up and long-term underperformance of European IPOs could be explained by two reasons. First of all, the ex post profitability seems to drop systematically for

every IPO category in the after-market. Secondly, the growth rates seem to decline dramatically after the listing. If the market agrees to believe that the higher temporary sales growth and profitability are persistent, it would explain the initial run-up. And when the investors realize that the growth assumptions and profitability assumptions were upwards biased then the well-known underperformance of IPOs starts. However, there may be also other firm more specific reasons which also have an effect on BHAR returns. One interesting feature for future study would be differences in earnings management practices among different P/V portfolios, but I leave that for future research.

6. SUMMARY AND CONCLUSIONS

This study examines the valuation of European initial public offerings (IPOs) by using comparable firm market multiples. The study was inspired by the findings of Purnanandam et al. (2004), who find that substantial and persistent overvaluation in U.S. IPO markets between years 1980-1997. More importantly, the authors showed that the IPO overvaluation is closely connected to underpricing and post-IPO returns in United States. However, their research is U.S.-centric and outdated, and consequently raises several potential questions: Are European IPOs also overvalued? Does the 'dot-com' bubble have an effect on peer multiple valuations? Are there similar patterns in aftermarket performance in Europe that Purnanandam et al. (2004) observed in U.S. markets?

This study consists of three main parts. First, I use peer multiple valuation for calculating a price-to-value (P/V) ratios for each IPO. This ratio is used to indicate a relative valuation respect to its industry peer (matching firm). Secondly, I test underpricing and its relation to price-to-value ratios. Lastly, I construct three separate portfolios based on P/V ratios, and test the differences in short-and long-term aftermarket abnormal returns earned by low, medium and high P/V IPO portfolios.

The final IPO sample used in this study consists of 614 European companies that have been listed between 1.1.1990-31.12.2008. I use six different multiples to ensure the robustness of my result (see, e.g., Zheng, 2007; Purnanandam and Swaminathan, 2004). All my valuation results indicate that 614 European IPOs are systematically and persistently overvalued regardless of 'dot-com' bubble. These findings are consistent with *Hypothesis 1*. More closely, the results suggest that European IPOs are 70% to 90% overvalued at their offer price, and the overvaluation is significantly highest about 150% during the years 1999-2000. I also find indicative evidence that technology IPOs are more likely to be overvalued than non-technology IPOs. In addition to these findings, my results shows that IPOs with lower profitability and smaller size are more often overvalued at their offer. Consistently with Lerner (1994), Ritter (1991), Baker and Wurgler (2000), my findings suggest that stock prices periodically diverge from fundamental values, and

the owners and managers of IPO companies and investment bankers are trying to take advantage of overpricing by selling stock overly optimistic investors.

I find strong evidence that overvalued IPOs earn significantly higher abnormal returns than undervalued IPOs before the lock-up expiration date, but only suggestive evidence that they are more underpriced than undervalued IPOs. Short-term findings are uniform with my *Hypothesis 3*. The three-factor model suggests that during the first six months overvalued IPOs earn 27% (2.25 % × 12 months) higher risk-adjusted returns than undervalued IPOs on annualized basis. Despite the huge difference in (Low P/V- High P/V) IPO portfolio returns, also undervalued IPOs earn significantly positive risk-adjusted returns (alphas) in six-month period.

My three- and six-month regressions indicate that 'dot-com' bubble is statistically significant positive explanatory factor in explaining buy-and-hold abnormal returns (BHARs). The positive coefficient shows that companies which were listed in between 1.9.1998-1.8.2000 earned significantly positive buy-and-hold abnormal returns during the first six months. The regression results also give suggestive hints that IPOs' with higher prior growth and smaller size earn significantly higher BHARs in three- to six-month period.

Besides, I find strong evidence that overvalued IPOs earn significantly lower BHARs than undervalued IPOs. High P/V IPOs underperform low P/V IPO by about 40% to 100% (depending on benchmark and whether median or mean is used) five-year post-IPO period. Also risk-adjusted returns indicate similar results in the long-run which creates unquestionable support to *Hypotheses 4*. By comparing three-factor model's factor loadings for over- and undervalued IPOs, I find only modest margin suggesting that there is no significant style or systematic risk differences in between portfolios.

Five-year BHAR regressions show that IPO underperformance is not driven either book-to-market effect or 'dot-com' bubble IPOs. Besides P/V ratios, the five-year regressions models indicate that the long-run underperformance is driven by small companies. Interestingly, I find that venture capital backed IPOs have significantly positive coefficient with long-term abnormal

returns which is consistent with common notion that venture capital backed firms have superior long-term performance.

Lastly, I examined ex post growth and profitability in order to understand remarkable differences in aftermarket abnormal returns. My results suggest that overvalued IPOs grow significantly faster immediately after going public, but the higher sales growth does not seem to carry out long. In the end of year five I do not find significant differences in sales growth in between high and low P/V portfolios. The ex post operating performance of IPOs has been under several studies. Michelson et al. (1997) report that that the median IPO has subsequent deterioration in its operating performance. Sales may grow, but the total cash flows do not grow sufficiently to justify high valuations at the time of offering. I also find that overvalued (high P/V) IPOs have statistically significantly lower profitability throughout the five-year period. These findings suggest that IPO investors pay too much attention to optimistic growth forecasts and too little attention to current profitability.

The observed patterns in European markets are similar with Purnanandam et al. (2004) study except in greater magnitude. In general level, my results show consistently that European IPOs are overvalued at their offer, and tend to run-up in after market but revert to fair value in the long run. My results seem consistent with the mispricing view of IPOs put forth in Ritter (1991) and Loughran and Ritter (1995). Overall, the findings of study suggest that investor sentiment plays considerable role in IPO pricing, and the issuers underprice IPOs with respect to the maximum price they could have charged given the observed demand in the pre-market but not necessarily with respect to the long-run fair value.

This topic still leaves a lot of possibilities for questions. My results point out the need to understand the role of marketing in IPO pricing context. The study by Cook et al. (2006) shows, that IPO valuation is positively correlated with underwriter's ability to arrange successful marketing campaign. Another interesting extension to this study would be to study abnormal trading volumes before the lock-up expiration date between over- and undervalued IPOs. The observed patterns in *Figure 4* suggest that insiders who own significantly overvalued stocks may

be more willing to trade (flip) their shares in the early market than the owners of undervalued IPO stocks.

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Appendix A

The Yearly Breakdown of Excluded IPOs

This table illustrates my sample identification procedure and the number of IPOs that satisfied the identification criteria described in the text. The initial SDC sample is consisted of European IPOs between 1.1.1990-31.12.2008. Data for this table is retrieved from the Security Data Corporation (SDC) and Thomson ONE-banker.

The number IPOs of after each criteria:

1. All IPOs excluding financial sectors   1746
2. Available financials (EBITDA & Sales)   1 080
3. Negative EBITDA   895
4. Offer price > $ 5   708
5. Available after-market prices   614
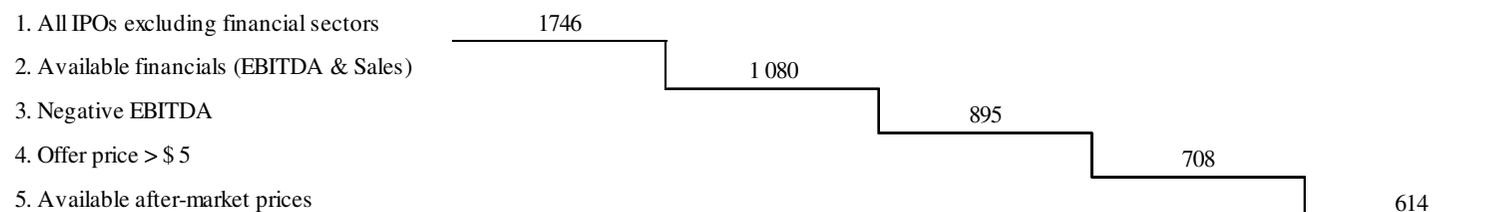
Identification Criteria / Year	All IPOs excluding financial sectors	1. Unavailable prior year financials	2. Negative EBITDA	3. Offer price less than $ 5	4. Unavailable aftermarket prices	5. Excluded IPOs All IPOs
1990 -1995	215	-120	-4	-9	-40	80 %
1996	95	-73	-1	-3	-3	84 %
1997	118	-61	-5	-9	0	64 %
1998	140	-49	-8	-14	-10	58 %
1999	241	-63	-21	-6	-24	47 %
2000	273	-95	-66	-16	-8	68 %
2001	63	-10	-10	-8	-3	49 %
2002	31	-9	0	-6	-5	65 %
2003	8	0	-2	-6	0	100 %
2004	63	-17	-8	-17	0	67 %
2005	70	-23	-12	-16	0	73 %
2006	147	-45	-12	-29	0	59 %
2007	233	-76	-30	-38	0	62 %
2008	49	-25	-6	-10	-1	86 %
The number of excluded IPOs		-666	-185	-187	-94	64,8 %

Appendix B

Fama-French 48 Industry Classification

This table presents the Fama-French (1997) 48 industry classification of which I used for determining matching companies for IPO sample. The technology firms are defined as those in Fama and French (1997) industry groups referred to as *Entertainment*, *Printing and Publishing*, *Telecommunication*, *Computers*, *Electronic Equipment*, and *Measuring and Control Equipment*.

	Short name	Long name	High-tech sector	SIC Codes
1.	Agric	Agriculture		0100-0799, 2048-2048
2.	Food	Food Products		2000-2046, 2050-2063, 2070-2079, 2090-2095, 2098-2099
3.	Soda	Candy and Soda		2064-2068, 2086-2087, 2096-2097
4.	Beer	Alcohol Beverages		2080-2085
5.	Smoke	Tobacco Products		2100-2199
6.	Toys	Recreational Products		0900-0999, 3650-3652, 3732-3732, 3930-3949
7.	Fun	Entertainment	Yes	7800-7841, 7900-7999
8.	Books	Printing and Publishing	Yes	2700-2749, 2770-2799
9.	Hshld	Consumer Goods		2047-2047, 2391-2392, 2510-2519, 2590-2599, 2840-2844, 3160-3199, 3229-3231, 3260-3260, 3262-3263, 3269-3269, 3630-3639, 3750-3751, 3800-3800, 3860-3879, 3910-3919, 3960-3961, 3991-3991, 3995-3995
10.	Clths	Apparel		2300-2390, 3020-3021, 3100-3111, 3130-3159
11.	Hlth	Healthcare		8000-8099
12.	MedEq	Medical Equipment		3693-3693, 3840-3851
13.	Drugs	Pharmaceutical Products		2830-2836
14.	Cems	Chemicals		2800-2829, 2850-2899
15.	Rubbr	Rubber and Plastic Products		3000-3000, 3050-3099
16.	Txtls	Textiles		2200-2295, 2297-2299, 2393-2395, 2397-2399
17.	BldMt	Construction Materials		0800-0899, 2400-2439, 2450-2459, 2490-2499, 2950-2952, 3200-3219, 3240-3259, 3261-3261, 3264-3264, 3270-3299, 3996-3996
18.	Cnstr	Construction		1500-1549, 1600-1699, 1700-1799
19.	Steel	Steel Works, Etc.		3300-3369, 3390-3399
20.	FabPr	Fabricated Products		3400-3400, 3443-3444, 3460-3479,
21.	Mach	Machinery		3510-3536, 3540-3569, 3580-3599
22.	ElcEq	Electrical Equipment	Yes	3600-3621, 3623-3629, 3640-3646, 3648-3649, 3660-3660, 3691-3692, 3699-3699
23.	Misc	Miscellaneous		3900-3900, 3990-3990, 3999-3999, 9900-9999
24.	Autos	Automobiles and Trucks		2296-2296, 2396-2396, 3010-3011, 3537-3537, 3647-3647, 3694-3694, 3700-3716, 3790-3792, 3799-3799, 3720-3729
25.	Aero	Aircraft		3720-3729
26.	Ships	Shipbuilding, Railroad Eq		3730-3731, 3740-3743
27.	Guns	Defence		3480-3489, 3760-3769, 3795-3795
28.	Gold	Preicous Metals		1040-1049
29.	Mines	Nonmetallic Mining		1000-1039, 1060-1099, 1400-1499
30.	Coal	Coal		1200-1299
31.	Enrgy	Petroleum and Natural Gas		1310-1389, 2900-2911, 2990-2999
32.	Util	Utilities		4900-4999
33.	Telem	Telecommunications	Yes	4800-4899
34.	PerSv	Personal Services		7020-7021, 7030-7039, 7200-7212, 7215-7299, 7395-7395, 7500-7500, 7520-7549, 7600-7699, 8100-8199, 8200-8299, 8300-8399, 8400-8499, 8600-8699, 8800-8899
35.	BusSv	Business Services		2750-2759, 3993-3993, 7300-7372, 7374-7394, 7397-7397, 7399-7399, 7510-7519, 8700-8748, 8900-8999
36.	Comps	Computers		3570-3579, 3680-3689, 3695-3695, 7373-7373
37.	Chips	Electronic Equipment		3622-3622, 3661-3679, 3810-3810, 3812-3812
38.	LabEq	Measuring and Control Equip	Yes	3811-3811, 3820-2830
39.	Paper	Business supplies		2520-2549, 2600-2639, 2670-2699, 2760-2761, 3950-3955
40.	Boxes	Shipping Containers		2440-2449, 2640-2659, 3210-3221, 3410-3412
41.	Trans	Transportation		4000-4099, 4100-4199, 4200-4299, 4400-4499, 4500-4599, 4600-4699, 4700-4799
42.	Whlsl	Wholesale		5000-5099, 5100-5199
43.	Rtail	Retail		5200-5299, 5300-5399, 5400-5499, 5500-5599, 5600-5699, 5700-5736, 5900-5999
44.	Meals	Restaurant, Hotel, Motel		5800-5813, 5890-5890, 7000-7019, 7040-7049, 7213-7213
45.	Banks	Banking		6000-6099, 6100-6199
46.	Insur	Insurance		6300-6399, 6400-6411
47.	REITs	Real Estate		6500-6553
48.	Fin	Trading		6200-6299, 6700-6799