Research Journal of Finance and Accounting
ISSN 2222-1697 (Paper) ISSN 2222-2847 (Online)
Vol.8, No.17, 2017

Determinants of Initial Public Offer Underpricing in the United Kingdom: Pre and Post Financial Crisis Evidence

Torbira, Lezaasi Lenee[1] Joshua Oki[2]
1. Finance and Banking Department, University of Port Harcourt, Port Harcourt, Nigeria
2. BPP University, Birmingham, United Kingdom

Abstract
Initial Public Offer Under-pricing is a global phenomenon that is continuously experienced in various countries and capital markets with well-established theories supporting the concept. The present study investigates the determinants of Under-pricing before and after the financial crisis on 341 UK issues between 2003 and 2013 and also attempted to analyse their long run performance defined as one year after their listings. Four econometric models were specified using secondary data sourced from Thomson Reuters' database. Ordinary least squares (OLS) regression technique was used for estimation. The results reveal that Initial Public Offer Under-pricing was most in 2004 with 92 issues having first day initial returns averaging 145%, and the total of 341 issues were 62% for the 10 years period. Major causes of Under-pricing identified include size of the issue and market capitalization of firm before offer, which was also seen to impact on buy-and-hold returns in the long run. The ex-ante uncertainty theory is therefore supported in part and the Authors recommend that future research studies should examine why the High Technology industry is seen to be less risky after the financial crisis, and to also elongate the time frame for long run performance analysis.
Keywords: IPO, Underpricing, UK, Offer price, First day return, Underwriters

1.0 Introduction

Every company has the potential to live indefinitely by increasing profitability and expanding, which demands investments of more capital into operations as well as the fulfilment of other requirements identified as necessary for continuous existence. On the one hand, companies can obtain more funds through bank loans or by issuing specialised financial debt instruments and on the other hand, they can raise new equity in capital markets. It is the obtaining of new equity—a major landmark for any organisation, that is referred to as an Initial Public Offer[ing] (IPO) or going public for short; which is usually done on a large scale in the sense that the offering of shares for purchase is open to the wide public. An important phase of the going public process is the authentication of a Venture Capitalist's (VC) initial valuation of the company by an Underwriter or Bookrunner to an accurate figure that can practically represent its per share value, hence its offer price. This in theory should represent the discounted sum of net cash flows from the share and determine its' performance in the long run. It is no doubt Barry et al (1990) were of the opinion that "a Venture Capitalist's expertise and experience in monitoring investments can send important signals to investors at the time of an Initial Public Offer."

Agrawal (2009) defined Initial Public Offer Underpricing as the degree of difference in the price of an 'offer-to-buy-shares' and the closing price of the share at the end of the first day of trading. In simpler terms, the equation can be specified as: $First\ day\ closing\ price - Offer\ price = Underpricing$. This definition although simple, should not be confused with the concept of Overpricing which is apparently the opposite. The concept of IPO Underpricing suggests that there is a price run-up or increase so much so that the first day closing price less the offer price gives a positive value usually expressed in percentage, with the extra fund that accrues to investors due to the increase being referred to as 'money left on the table'. This is not to say that Underpricing cannot be negative, which was a typical case of the Facebook IPO one day after its offering. It is in fact the price run-down of an IPO issue that is referred to as Overpricing or negative Underpricing.

Authors like Ljungqvist (2007), Ritter and Welch (2002), Jenkinson and Ljungqvist (2001) and many others have each develop theories in an attempt to explain Underpricing, with some supporting the concept and others against it. For instance, Nocera (2011) opined that the LinkedIn IPO was a scam underwritten deal which made investors earn more than 100% return at the end of the first day trade. Hundreds of millions of dollars were lost to LinkedIn who will now be faced with the dilemma of having to grow very fast in order for its share price to reflect its true value. But Sorkin (2011) disagreed by explaining that Underwriters are in an untenable middle position that requires them on one end to determine a fair price for the issuing company to raise enough capital while also ensuring that their investing clients at the other end are happy to part ways with their money. He went on to argue that LinkedIn only sold a little more than 5% as a fraction of their company and therefore still has the opportunity to raise much more capital in the future, which coincides with the opinion of Chambers (2011) who asserts that managers will obviously care more about Underpricing, the greater the proportion of the company being sold.

Some of the available IPO pricing studies have found differing results across many countries. For example, a research on US IPOs by Ritter (2014), reveals that in more than 20 years, average percentage first day returns

for over 5,000 IPOs is approximately 22% as a result of underpricing with 13%, 26% and 13% as averages between the years 1990—1997, 1998—2005 and 2006—2013 respectively. Solomon (2011) posits that while other countries record averages above 20%, China's IPO Underpricing scene has been severe—averaging over 130% in 20 years, but Britain on the other hand has averaged only 16% in 50 years. It is therefore important to study the causes of IPO Underpricing in the UK in a bid to discern why the UK IPO scene is a whole lot different from other parts of the world.

The London Stock Exchange (LSE) comprising of the Main Market, Alternative Investment Market (AIM), Specialist Fund Market (SFM) and the Professional Securities Market (PSM), is one of the most sophisticated capital markets in the world where firms raise capital and Private Equity (PE) and Venture Capital (VC) firms exit investments through IPOs, with its history dating far back as the 17th century. The Main Market and AIM is currently home to approximately 2,653 companies some of which are the world's most successful and dynamic organisations, representing 40 sectors with a combined market capitalisation of £3.7 trillion and £65 billion respectively. (LSE Plc and White Page Ltd, 2010). Although the UK along with other European IPO markets has not been able to compete with that of the US for decades, it was observed by Ritter (2003) that IPO volume exceeded that of the US in 1998 and during the internet bubble of 1999 and 2000.

Since 2004 however, IPOs and further issues of indigenous and international companies amounting to almost £400 billion has been raised in the Main Market with these companies fulfilling a set of specific requirements stipulated by the LSE and regulatory authorities. In the same vein, since the AIM's inception in 1995, some 520 international growing companies who were not able to meet up with some of the specific requirements of the Main Market has been able to raise capital there with over 200 of them still currently active. Baba and Cox (2014) revealed that the LSE's performance has been boosted by IPOs and has seen its first-quarter revenue go up by 20%. This is particularly interesting because the number of IPO issues of new quoted and listed companies has also risen from 33 in 2013 to 78 this year, which is a two-fold increase.

It is of interest to compare new IPO issues of UK firms before and after the financial crisis of 2007—2008 because the markets were much more uncertain post-crisis so that this might mean investors may require a higher first day return and Underwriters will be willing to deliberately underprice issues. This in fact is in line with the viewpoint of King and Banderet (2014) who studied the underpricing of 588 US IPOs during the crisis and non-crisis years defined as 2008—2009; and 2003—2007 with 2010 respectively. They argued that issuing firms have to more aggressively underprice their stocks because investors have less cash and will require higher returns to participate in an offer. Their study however found no statistically significant difference in underpricing between the crisis and non crisis periods. In contrast, Fauzi et al (2012) found significant differences in short run performance before, during and after the financial crisis of 23 IPOs that listed on the New Zealand Stock Exchange (NZSX) between 2006 and 2010[1], opining that the New Zealand IPO market was of interest because it is mature like that of the US and UK.

This study therefore aims to discover the major determinants of short-run underpricing through empirical tests of established theories and by the use of certain proxies to represent the independent variables, in order to support the theoretical underpinnings that have been previously formulated. As Unlu et al (2004) posits, the UK capital market is significant to the global economy because of its depth, maturity and a common legal regime that defines its structure. More so, there is an abundance of data available that will allow for meaningful investigation. Subsequently, there is also an attempt to analyse and review Post-IPO long-run returns of 1 year after listing in order to evaluate the market performance of these companies.

This research therefore continues from this section into the survey of past related studies which reveals vast amounts of literature on IPO Underpricing. The hypotheses, sample, variables and dataset are further described in two separate sections there after, and following is the presentation of results, as well as discussions of their practical implications of which major inferences are drawn. Thus, the study concludes with suggestions for further research.

2.0 Literature Survey

The initial public offering underpricing phenomenon is a global concept that first gained cognizance in the field of finance in the 1970s and suddenly grew in popularity during the internet bubble years of the 90s. As Jenkinson and Ljungqvist (2001) rightly put it, the international perspective is especially valuable due to the fact that it allows explanations based upon particular institutional, legal, or regulatory arrangements to be tested, because the financial systems in which IPO Underpricings are observed differ greatly. But before dealing with this seemingly complicated issue, it may be relevant to first delve into the obvious reasons companies go public and the processes involved.

[1] Fauzi et al (2012) further posit that they only selected companies that listed in the NZSX because the market is suited to large and established enterprises which can be used to represent the total leverage in the country.

2.1 The process of Going Public:

In consideration of the fact that a company can go public only once should immediately trigger the thought of how important this milestone is once reached. Few events in the life of a company are as great in magnitude and consequence as an IPO (Draho, 2005). According to a PWC (2010) report, a public company has access to more and often deeper sources of capital than a private company, that is why going public is a monumental decision for any company, because it forever changes how a company goes about raising finance (equity vs. debt). This has consequences for its growth strategy. The rationale for going public therefore apart from just accessing more capital in an equity market, can be to build a reputation and capability for mergers and acquisitions, attract and keep hold of talented employees as well as provide an exit for investments held by existing company owners among other reasons. The timeframe of the going public process can be several months and occurs in various stages—from holding all-hands meetings, preparing the prospectus and filing pricing amendments, performing road shows and executing underwriting agreements to issuing a press release[1]. Investment Banks who act as Underwriters and/or advisors for companies however have the ultimate choice of a number of pricing techniques and methods of listing issues on an exchange.

2.1.1 IPO Pricing Techniques

The three major techniques of IPO pricing dominant in literature are auction, book-building and fixed price or open offer. Over time, they have evolved into more complex systems especially in consideration of the business model as well as environment at which a company mainly operates.

Auction: Underwriters use this technique to inform investors to bid for the securities of a company in both quantity and price and then the highest bid is used as the final price of the offer. Mekjian (2012) compiled 203 French issues between 1991—1998 to study auctions as an alternative to book-building. His results reveal that the book-building mechanism controls underpricing better than the auction pricing mechanism, but when considering a subset of the data with 91 large firms[2], he discovered that the auction method created a lower mean and variability of underpricing, recommending that large firms in the US should use this technique as it is not disadvantageous when the offer is huge.

'Book-building': Here, Underwriters discover a price range of an issue by taking demand from institutional investors over a period of time. After a consideration of other factors, the final price is set. The book-building approach to IPO pricing is perhaps the most popular method Underwriters use in modern times and it is said that firms benefit from information acquisition during the process (Benveniste and Spindt, 1989 cited in Ljungqvist and Wilhelm, 2003, p.90). This technique is also referred to as the information revelation technique because of the active involvement of Underwriters in marketing the issues to potential investors. The explicit description of the book-building process here is very different and more complex in practice.

Fixed Price or Open Offer: As the name suggests, a company's share price simply is fixed at a specific price and marketed to investors for purchase. Benveniste and Busaba (1997) opined that this has historically been the dominant approach in India, Singapore, UK and most of Europe. Their study further reveals that the fixed price method creates cascading demand with weak early investor interest, and generates lower expected proceeds but with reduced uncertainty when compared to the book-building approach because, a fixed offer price issue is discounted in order to counteract the potential adverse effect of investors' non-interest, and an active information gathering process is not carried out to find out investors' valuations and expectations of the market in general.

Table 2.1: Comparison of IPO Pricing Techniques

	Auction	Book-building	Fixed Price or Open Offer
Information extraction from investors	Yes	Yes	No
Investment Bank has its discretion on allocation	No	Yes	No
Underpricing and its variance	Lowest	Low	Highest
Determination of Offer price	Determined during subscription through different price bids	Determined before subscription	Determined before subscription

Source: Adopted and adjusted from Shengfeng (2010)

[1] The length of time of the going public process which is regarded as IPO duration is measured in Colaco and Hedge (2013) as the number of calendar days between the filing of an IPO and the issue date. His study observed an average of 88 days of a sample of 4,430 US IPOs between years 1986 to 2009. He further posited that IPO duration has been increasing since the internet bubble burst in 2000 and the passing of the Sarbanes-Oxley Act (SOX).

[2] In trying to describe the superiority of the auction pricing technique when used by large companies, Mekjian (2012), had to use 203 French companies in order to recommend his findings to the US market, because since 1999, only 2 of the 22 auction IPOs in the US have been by large companies. He subtly explains "large companies" by justifying that the 2 of these offerings were by companies with after-market capitalisations of $800 million.

Shengfeng (2010) compiled *Table 1* above in order to summarise the different IPO pricing techniques based on three major mechanisms observed between the methods namely: information extraction mechanism, share allocation mechanism and offer price determination mechanism. He argues that the information extraction mechanism is the most important in determining the price of an offer, while the book-building approach has an associated high cost.

2.1.2 IPO Offering Methods

Private placements and Public offers are commonly used as ways in which companies raise equity capital from financial markets. Public offers are further separated into the Offer-for-sale and Offer-for-subscription methods.

Private Placements: An IPO private placement raises capital from a small group of investors. A company using this method has the opportunity to specifically select her investors. Fjesme and Norli (2010) specified a Probit regression model to study the benefits of using auction or a private placement method to issue shares on the Oslo Stock Exchange of a total of 211 Norwegian companies that sold a large fraction of their company to the general public between the years of 1993 to 2007. Based on their findings, they argue that a private placement transaction allows owners or initial investors of a company to gain more private benefits of control. They further reveal that owners or group of investors with more block ownership of shares in a company before initial offerings would prefer to privately place their shares on the market than using any other method. Thus, a major challenge of the placement method is the lack of liquidity that may result.

Public Offers: The Offer-for-sale method allows existing company owners to sell a fraction of their shares to the public on the open market at the time of an IPO, but usually at a fixed price. This usually precedes an Offer-for-subscription that is also open to the public. By using this method, a wide array of investors creates ownership dispersion that is desirable for the company. Chambers and Dimson (2009) used a linear regression model to investigate IPO Underpricing over the very long run in Britain on over 4,000 companies between the years of 1917 to 2007. Their results reveal that between the 1917—1929 sub-period, the 315 IPOs that listed through public offers had an average return of 6%, which was significantly lower than more than 30% average return of 42 IPOs that used the private placement method. Through the years till 1986, private placement IPOs consistently beat public offer IPOs on mean returns.

Mixed Method: This is a hybrid of placements and public offers. Goergen et al (2007) study reveals that 21% of 106 UK mixed offers out of 240 were more underpriced than placements between years 1991 to 1995.

2.2 Theoretical Underpinnings

Explanations for Underpricing have since being developed in the 70's[1] and can be mainly summarised into asymmetric information, behavioural and information revelation theories[2]. Asymmetric information attempts to explain that there is a communication gap between investors (less informed) and a company (better informed), about what they know and don't know and will usually affect investment decisions. The behavioural reasons for Underpricing assume that there are irrational investors that will usually bid the price of an issue beyond its true value (Zhang, 2011). Issuers on the other hand fail to put enough pressure on investment banks to endeavour to reduce underpricing possibly because of general biases that Underpricing is good for the long term performance of the company. According to Jenkinson and Ljungqvist (2001), information revelation arises due to the actions of Investment Banks to elicit information from better informed investors, even if it seems the issuers have information advantage. It is believed that institutional investors could know more about the prospects of the company than the company's management themselves because of the wealth of experience they possess, and first hand information about the current state of the equity market.

2.2.1 The Winner's Curse Case

Developed by Rock (1986), it states that there is a problem of adverse selection because the issuing company and the Investment Bank do not have the same information with the market. Since some investors in the market are better informed than others, they would usually avoid participating in the IPO which they regard as 'lemons' and would leave investments for less informed investors. The Investment Bank will therefore endeavour to encourage investments by deliberately underpricing the offer. Levis (1990) and Jenkinson (1990) each support the Winner's curse theory in their study of IPO Underpricing in the UK with the former observing empirically that first day returns tend towards a risk free rate due to adverse selection. Leite (2007) also suggests that there is a positive relationship between Underpricing and market returns but does not represent an inefficiency in the pricing of IPOs.

2.2.2 The Case of Ex-Ante Uncertainty

This theory presupposes that demand for an issue by investors cannot be guaranteed, hence uncertainty, which will lead to intentional Underpricing. Investors will only have confidence in participating in an offering only

[1] It is the view of Jenkinson and Ljungvist (2001) that Underpricing studies are an international stylised fact, so extensive in financial and economic literature. Logue (1973) and Ibbotoson (1975) are among the earliest studies that dealt with IPOs.

[2] Unless other wise stated, classification of IPO underpricing theories are adapted from Jenkinson and Ljungqvist (2001), but adjusted to fit this study.

when they realise that the issuer is certified. Underwriting fee, venture capital backing and underwriter's reputation are proxies used by Habib and Ljungqvist (2001) and Hamao et al (2000) to represent certification. Both studies found differing relationships with first day returns. In particular, Hamao et al (2000) discovered that first day returns was seen to be insignificant with the venture capital backing dummy variable for 355 firms in Japan between the years of April 1989 and December 1994 due to conflict of interest problems when the lead underwriting firm is also the lead venture capital backer.

2.2.3 Signalling Case

The argument on signalling is similar to Rock's (1986) theory on information asymmetry between a company and the market. It states that signalling is a deliberate attempt by the issuer to convince potential investors of the high intrinsic value of an issue in order to solicit more buying. Allen and Faulhaber (1989) and Welch (1989) each developed models to test these assumptions and provided support with an explanation that the owners of the company later benefit from the initial underpricing, because they can sell their stake in the IPO after-market for its intrinsic value, and subsequent offerings by the company will receive effective participation from investors. Additionally, studies by Kanatas and Stefanadis (2005) as well as Francis et al (2008) both support the signalling case. In Kanatas and Stefanadis (2005), they argue that an inventor will deliberately underprice an issue to signal his good technological and managerial type, while Francis et al (2008) observed that there is a positive and significant relationship between the degree of IPO Underpricing and segmented market foreign firms' seasoned equity offerings (or subsequent offering of shares by a public company), because of higher information asymmetry and lack of access to external capital markets.

A variation of the signalling theory is 'window-dressing' which is common with young companies in high growth industries. It can perhaps be regarded as over-signalling in the sense that a company goes to great lengths in controlling her financial performance through pre-issue earnings management, in such a way as to convince potential investors to partake in their offering during listing. Investors in turn aggravate this situation by over-bidding the issue that may already be overpriced. In the end, entrepreneurs and existing shareholders are the ones that benefit greatly when they dispose some of their stakes in the market. Dritsakis et al (2004) studied the 'window-dressing' behaviour on 38 new listings in the Athens Stock Exchange (ASE) in a 3 year period. By formulating a model that tried to identify income smoothing on IPO issues, they found out that only 12 firms actually smoothed income. They further opined that there are other peculiar factors that motivate Greek issuers to smooth profits than mere signalling.

2.2.4 The Case of Principal—Agent

This theory identifies a conflict of interest that can exist between the issuing company and its underwriter especially when the underwriting market is highly competitive. In trying to balance both interests, an Underwriter will underprice an issue in order to reduce the risk of not being able selling off all shares. This conflict can also arise when there is less ownership control in the issuing firm. According to Lin and Chuang (2011), there was a rise in Underpricing when family and institutional ownership was increased and CEO duality was introduced on 525 IPOs in Taiwan. They posited that the principal-agent problem is actually principal-principal in nature and the employing of an independent outside director tends to mitigate Underpricing.

2.2.5 Information Revelation Theory

This is developed with the reverse winner's curse assumption in mind that some investors may be better informed than the issuing company and underwriter. Therefore, there is need for an active information sharing engagement which is carried out through the book-building process between Underwriters and Investors before an offer, to enable the best possible price to be set. In Benveniste and Busaba (1997), it was revealed that companies who use the book-building approach benefit from higher gross proceeds. This was consistent to the findings of Michaely and Shaw (1994), but on larger offerings, denoting that Underwriters will tend to underprice because of the effort it will require to market these offers to investors.

2.2.6 Behavioural Theories

Behavioural finance theories have identified investor sentiments, information cascades, prospect theory and lockup commitments as typical behavioural explanations for Underpricing. Li et al (2011) analysed factors affecting IPO Underpricing in China by sampling 233 and 144 SME and GEM IPOs respectively. Using a sequential sequence regression approach[1], their result reveal that heterogeneous expectations affect IPO Underpricing in both markets while investor sentiments has a significant relationship with IPO Underpricing in the SME market.

Welch (1992) explained information cascades or 'herding' behaviour as a situation by which irrational investors tend to ignore their own valuation of an issue, and instead join the bandwagon of other investors bidding up the price of an issue. Lockup commitments on the other hand can be understood as the ratio of a share stake company management and insiders own and that which they are allowed to dispose off. This was applied

[1] A Sequential sequence regression is a series of regression models that attempts to solve the problem of missing data (Bieren, 2007). SME and GEM are acronyms for Small and Medium Scale Enterprise and Growth Enterprise Market respectively.

as an independent variable on 280 IPOs listed on Bursa Malaysia between 2000—2010 by Yahya et al (2013) to test its significance with flipping activity[1]. It was observed that lockup provisions do not sufficiently reduce flipping activity, but initial return does instead. Thus, the higher the degree of underpricing, the more flipping activities will take place.

A company's background, past and present performance, existing shareholding pattern, industry and market regulations as its characteristics can also cause Underpricing as opined by Agrawal (2009) pointing to the works of authors like Shelly and Singh (2008) as well as Pande and Vaidyanathan (2009) to support his view.

2.3 Institutional Explanations

Reasons for Underpricing here fall under legal responsibility, price support, ownership dispersion and agency cost reduction. Jenkinson and Ljungqvist (2001) further argue that political interference can also be a cause.

2.3.1 Litigation Risk

Regulatory statutes in developed equity markets protect investors by giving them the right to sue a company that has been proven to misrepresent material facts in their IPO prospectus. A company therefore underprices its issue in order to provide an insurance cover for themselves in any case that they may have to fight against any lawsuit. Studies by Spindler (2009) and Walker, et al (2010, 2014) each had contrasting views on this theory. It was found that the amount of IPO prospectus disclosure, a proxy for litigation risk was positively significantly related to first day underpricing in the former, while monetary stakes are seen to be the most likely predictors of after-IPO litigation activity, and not actual legal merits in the later.

2.3.2 Price Support

Apart from just underwriting and marketing IPOs, investment banks are also market-makers in that they have the analogous role of ensuring demand and supply for issues in the equity market, hence the price stabilisation theory. This role creates an inherent risk for an Underwriter who will wish to underprice the issue in order to reduce its downside risk of buying back the shares of the issuer. Empirical evidences of this theory have consistent findings. For example, Prabhala and Puri (1998) built up a cross-sectional dataset of up to 3000 IPOs between sub-periods of 1923—1930 (75), 1981—1982 (208) and 1985—1994 (2,723). Their results reveal a statistically significant relationship between price support and aftermarket mean IPO returns by the observance of the change in the skewness and kurtosis of share prices non-normal distribution up to 20 days after offerings. The work of Yung and Rahman (1999) also has similar findings.

2.3.3 Ownership Dispersion

The theory of ownership dispersion highlights the need for companies to have control by expecting existing managers and owners to sell existing stakes of their shares in the IPO aftermarket. Underpricing is thus desirable so much so that a dispersed or large base of investors will be encouraged to partake in the offering which will be seen as less than its intrinsic value. However, two opposite views of ownership dispersion is observed in the works of Bernnan and Franks (1997) who asserted that ownership control can be achieved by the avoidance of monitoring by a dispersed base of Shareholders; and Stoughton and Zechner (1998) arguing that Underpricing should be supported because it minimises agency costs and encourages monitoring.

2.4 The International IPO Scene

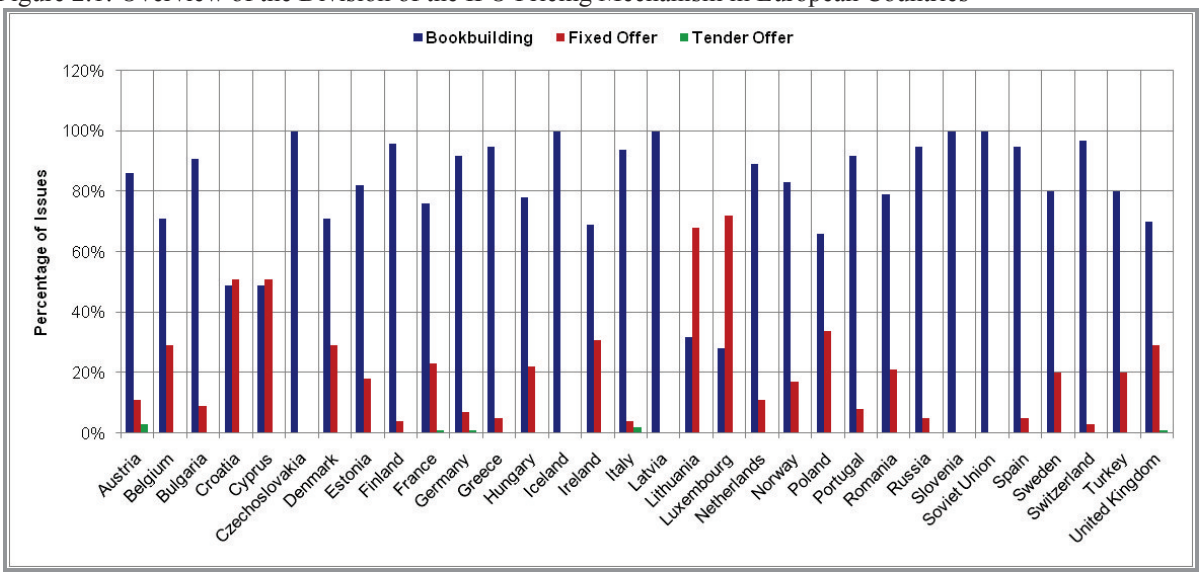
Determinants of IPO Underpricing have shown stark differences in academic literature across many countries. 38 countries surveyed by Ritter (2003) reveals that in 1959 to 2001, mean first day returns of IPOs in Denmark, Finland, France, Germany and UK ranged between 5% to almost 30%. In particular, the 3,122 new issues in the UK had an average first day return of 17%. This is closely comparable with approximately 18% returns in the US for about the same time frame on 14,840 issues. Emerging countries like Nigeria, Indonesia and South Africa had returns of 19% (63 issues), 20% (237 issues) and 33% (118 issues) during 1989—1993, 1989—2001, and 1980—1991 respectively. But Malaysia and China were highest with 104% (401 issues) and 257% (432 issues) during 1980—1998 and 1990—2000 respectively.

A similar study on a cross-section of 6 continental European markets by Schuster (2003) sampled 973 IPO issues between 1988 to 1998 in Germany, France, Italy, the Netherlands, Spain, Sweden and Switzerland, representing 90% of IPO activity in Europe reveal that the mean first day returns of all IPOs was statistically significant at about 17%. In hot and cold market conditions, the mean return varies from 21% to 7% respectively. Furthermore, it was observed that firms that were less than 14 years and firms that were between 15 and 35 years of age before going public had mean returns of 21% and 17% respectively. Similarly, firms above 36 years of age before going public had mean returns of approximately 10%.

Another study by Gajewski and Gresse (2006) of 15 European countries attempted to identify listing requirements, IPO-mechanism choices, performance and secondary market liquidity as major features of the

[1] Aggarwal (2001) describes flipping activity as the quick selling off of one's stake in an IPO after-market to catch in on the initial return caused by Underpricing. This is why lockup provisions are introduced to provide some restrictions.

European IPO market between years 1995 to 2004. They argue that a wide diversity exists in listing requirements between the Main, Parallel and New Markets, as book-building mechanism gets increasingly popular. However, analysis on initial underpricing suggests that the 15 sampled countries had an average first day return of 22% across various sub-periods. Initial Underpricing was also positively linked to information asymmetry post-IPO, which resulted in the same levels of shares trade volume but higher overall turnover.
Figure 2.1: Overview of the Division of the IPO Pricing Mechanism in European Countries



Source: Adopted from Demenint (2014). 'TENDER' represents auctioned IPOs.

A more recent study on European IPOs (Demenint, 2014) evaluates differences that exist between the book-building, fixed price and auction pricing techniques across countries of 820 IPOs between 1988 and 2008. Again, the total of 416 IPOs of Denmark (3 issues), Finland (6 issues), France (117 issues), Germany (66 issues) and UK (224 issues) that used the book-building pricing technique had a first day initial return range of about 4% to 9% with the lowest being Denmark and the highest, UK. Correspondingly, 161 IPOs were issued using the fixed price technique in the above countries with the exception of Finland in the same time frame under analysis. Their first day initial return ranged from 10% (Denmark, 5 issues), 4% (France, 35 issues), less than 1% (Germany, 8 issues) and 20% (UK, 113 issues). Subsequently, the total average underpricing among the 15 countries was 8% and 14% under the book-building and fixed price techniques respectively. Estonia and Poland each had the highest first day return of 68% and 53% between the book-building and fixed price techniques while Spain (-12%) and Russia (-13%) were surprisingly overpriced. Furthermore, the grand totals of issues in the sample that mainly applied two of the pricing techniques are 625 for book-building and 195 for fixed price.

2.5 Characteristics of Uk IPOs

The basic features of UK IPOs include their pricing techniques and offering methods as described above, as well as the market in which they are traded.

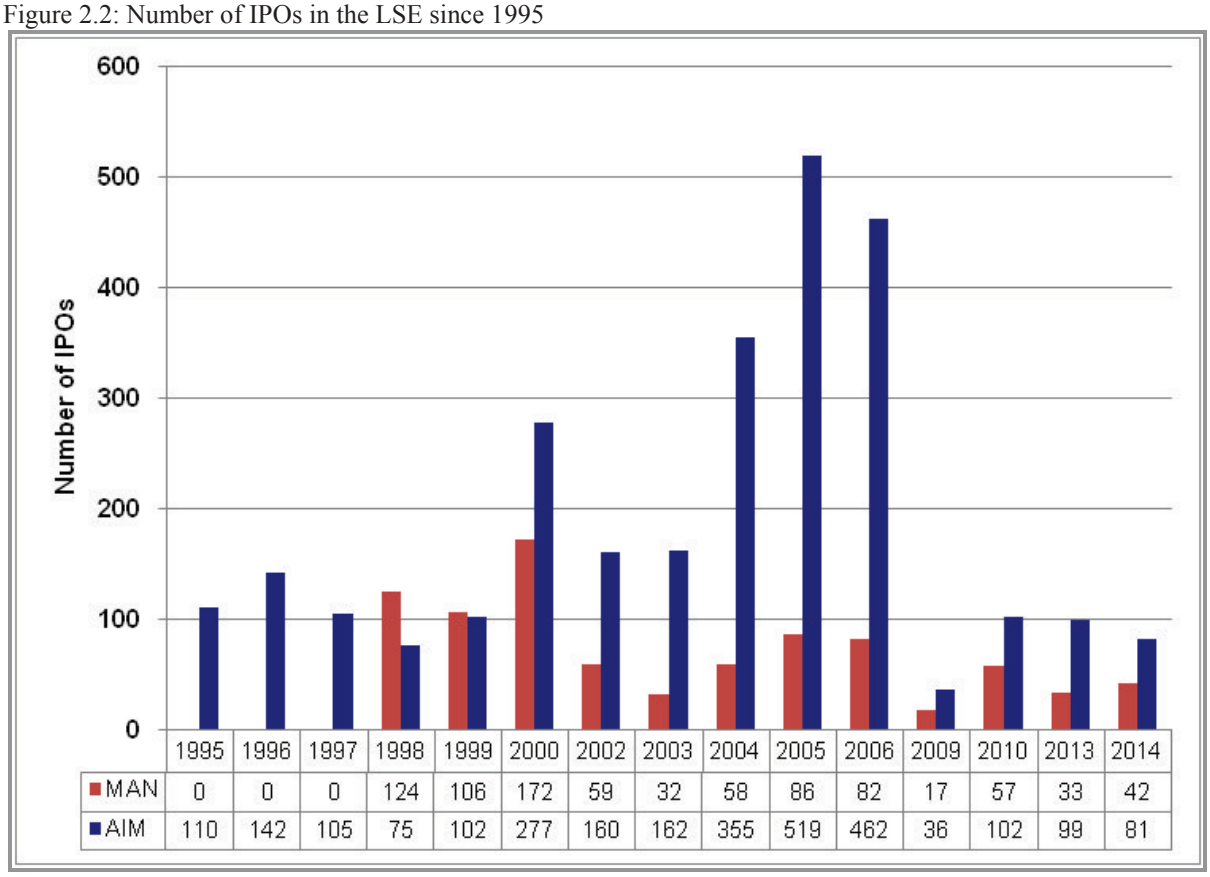
2.5.1 Pricing and Offering

Benveniste and Busaba (1997) first posited that the fixed price or open offer has been the most popular IPO pricing technique in many European countries including the UK, and then later Ljungqvist and Wilhelm (2003) were of the opinion that the book-building technique became popular in modern times. In the application of IPO offering methods, private placements of IPO offerings in the UK is said to have slowly gained dominance between the years of 1917 to 2007 as revealed in Chambers (2011).

2.5.2 New Issues Statistics

The London Stock Exchange (LSE) and Alternative Investment Market (AIM) are the two major markets where firms list new securities. However, there still exist the Specialist Fund Market (SFM) and the Professional Securities Market (PSM) where companies who meet a different set of requirements are quoted. Regulatory statutes, rules and restrictions also vary across these market segments.

Figure 2.2: Number of IPOs in the LSE since 1995



	1995	1996	1997	1998	1999	2000	2002	2003	2004	2005	2006	2009	2010	2013	2014
MAN	0	0	0	124	106	172	59	32	58	86	82	17	57	33	42
AIM	110	142	105	75	102	277	160	162	355	519	462	36	102	99	81

Source: Researcher's illustration with data obtained from the LSE (2014).

An updated list of all issues in the LSE as at 9th September, 2014 puts the total number of public quoted and listed companies at 5,097 with 1,180 in the main market, 335 in the international main market, 3,541 in AIM, 26 in the SFM and only 15 in the PSM. Pure placement issues since 1995 are over 2,000, public offers, 211 while hybrid offerings are 300 in the same time frame under analysis, which is consistent with the claims that placements are more common in the UK. The total amount of money all public companies have raised that is, gross proceeds currently stand at more than £200 billion while the total market value of these companies is almost £1.8 trillion. More than 75% of the 434 companies in the technology industry are in AIM with a total market capitalisation of almost £69 billion with total gross proceeds of about £9.8 billion. In terms of international quotations and listings, the LSE has a total of 983 companies incorporated in both developed and emerging countries with a total market capitalisation of about £705 billion.

2.6 Variables for IPO Underpricing Studies

Many proxies have been developed in an attempt to subject established theories into testable models, and an example of such proxy widely used in literature is the dependent variable of first day initial returns, which measures Underpricing. This variable is also used in this study.

2.6.1 Underpricing and Ex-Ante Uncertainty

As discussed earlier, one of the theoretical reasons for Undepricing is risk. In light of this, Chambers and Dimson (2009) used market capitalisation before issue, firm age and industry dummies as proxies for ex-ante uncertainty on 2,553 UK IPOs through a period of 1917—1986 and discovered that all except firm age had a significant relationship with first day returns. Zhu (2013) investigated the causes of IPO Underpricing on 2,489 issues in China between 1991 to 2012 and used 'GAP' as the time interval between the offering date and the listing date as a proxy for ex-ante uncertainty. His study found a positive and statistically significant relationship between GAP and first day returns, implying that ex-ante uncertainty increases as the time between offering and listing an issue increases, resulting to higher Underpricing.

2.6.2 Underpricing and Certification

With the assumption that certification of IPOs solves Underpricing, Coakley et al (2006), Bessler and Seim (2011) and Chambers (2011) used proxies such as: 'underwritten-by-third-party', underwritter's reputation and venture-capital backing to represent certification, the independent variable. The studies found both positive and negative significant relationships between all 3 proxies with first day initial returns implying that certification

can either reduce or increase underpricing.

2.6.3 Underpricing, Issue Technique and Offer Method

Fjesme and Norli (2010) and Mekjian (2012) referred to earlier are also typical examples of recent papers that have dealt with pricing technique and method of issue as determinants of Underpricing. Fjesme and Norli (2010) observed a statistically significant result between Underpricing with private placements and public offers which represented offer methods. Mekjian's (2012) study on the other hand also found statistically significant relationships between auction, book-building and open offer approaches as pricing techniques with first day return.

2.6.4 Underpricing and Calendar Year

A full set of dummy variables which takes the value of 1 for the respective years of some 1,455 IPOs are included in a multiple regression model formulated in an earlier work of Chambers (2006) in order to suppress the constant. This helped to capture specific characteristics across various years especially as the study cuts across 1960—1986). Specifically, year dummies assist in encapsulating or revealing any peculiar impact of underpricing that may be a result of structural changes and regulatory policies of industry and markets among firms in their respective years of IPO issue.

2.6.5 Underpricing and Macroeconomic Variables

In the same vein, macro-economic proxies like interest rate and gross domestic product (GDP), unemployment and per capita income help to capture the state of the economy in which a domiciled company's issue is listed. Zhu (2013) mentioned earlier also used interest rates and GDP as control variables in his model, but found that his results revealed insignificant relationships with first day return.

2.6.6 Under-pricing and Long Run Performance

Studies on long run performance are not nearly as extensive as those of short run under-pricing. The issue perhaps is how long run performance should be measured—particularly, popular proxies used to represent long run performance are the cumulative abnormal returns (CAR) and buy-and-hold abnormal returns (BHAR). But these two have been argued in literature that they have fallen short many times in truly evaluating a company in the long-term. For example, Gur-Gershgoren et al (2008) argues that finance scholars are engaged in a continuing debate concerning the appropriate measure of long-run abnormal performance despite considerable interest in the long-run behaviours of prices relative to expectations. They developed a new model using the buy-and-hold abnormal return taking concerns of critics on previous models into consideration.

Previous to that, a study by Goergen et al (2007) had a similar opinion and used the market adjusted cumulative abnormal return ('MACAR'), market adjusted buy-and-hold abnormal return ('MABHR') and the Fama and French three-factor model to get the best possible results on the evaluation of 3 years long run performance of 240 UK IPOs sampled between 1991 to 1995. Their study revealed that the percentage of company shares issued for an IPO and degree of 'multinationality' of a company has predictive ability on long run performance.

3.0 Hypotheses

Consistent with many of the IPO Under-pricing studies and in line with some of the established theories discussed in the literature survey, the hypotheses below are formulated in their null forms. Additionally, the study hypothesises that Underpricing should be significantly higher in the years after the financial crisis than it was before, simply because investors will normally expect a higher return to take on more risk. The US FCIC (2011) report on the causes of the financial crisis, asserts that all investments in the capital market dried up post-crisis and there was lack of confidence in the entire financial system. Thus, long run performance is also hypothesised to be impacted by one or more of the determinants of Underpricing, and therefore the Author expects to see better long run performances for issues listed before the financial crisis.

3.1 The Ex-Ante Uncertainty Theory

Following studies like Chambers (2006), Chambers and Dimson (2009), and Zhu (2013), hypotheses formulated here will discover if the gross proceeds, age of the firm, industry of the firm, and market capitalisation before issue can explain first day returns. The Author also includes number of share units, a measure for issue size and primary exchange of trade of the firm as probable proxies that can be classified under ex-ante uncertainty. Particularly, $H0_4$ is stipulated owing to the study of Unlu et al (2004) among others that document evidence of firms in the high technology industry of countries like the US and the UK showing signs of higher Underpricing, because they are deemed high risk by investors.

3.1.1 Firm Risk

Hypothesis 1: There is no relationship between first day return and the initial public offering number of units of share (issue size) offered for sale of a firm.

Hypothesis 2: There is no relationship between first day return and the total gross proceeds of a firm.

Hypothesis 3: There is no relationship between first day return and the market capitalisation before issue of a

firm.

Hypothesis 4: There is no relationship between first day return and the age of a firm.

3.1.2 Industry Risk

Hypothesis 5: There is no relationship between first day return and a firm in the high technology macro industry.

3.1.3 Market Risk

Hypothesis 6: There is no relationship between first day return and the primary exchange of listing of a firm.

3.2 The Certification Theory

Similarly, number of underwriters used to certify an issue, reputation of lead underwriter and venture capital backing are used as proxies for the certification hypotheses in parallel with Chen and Mohan (2003), Guner et al (2004), Coakley et al (2006) and Bessler and Seim (2011) among others.

3.2.1 Underwriter Certification

Hypothesis 7: There is no relationship between first day return and third party underwritten deal.

Hypothesis 8: There is no relationship between first day return and the reputation of the underwriters used to certify a deal.

3.2.2 Venture Capital Certification

Hypothesis 9: There is no relationship between first day return and venture capital backing.

3.3 The Institutional Explanation Theory

Since the placement method is common in the UK market as asserted by Fjesme and Norli (2010) in testing ownership dispersion, hypotheses are also formulated to test this with the public offer and hybrid method.

3.3.1 Ownership Dispersion

Hypothesis 10: There is no relationship between first day return and placement method used to list the shares of a firm.

Hypothesis 11: There is no relationship between first day return and the public offer method used to list the shares of a firm.

Hypothesis 12: There is no relationship between first day return and the hybrid method used to list the shares of a firm.

3.4 Control Hypotheses

In order to capture any structural and regulatory changes of the economy and financial markets, calendar year dummies are included. The level of interest rate and GDP of the UK representing macroeconomic variables controls for the state of the economy, while lagged returns of the FTSE all-share index up to 30 days before issue control for the state of the equity market.

3.4.1Year of Issue

Hypothesis 13: There is no relationship between first day return and the calendar year of listing of shares of a firm.

3.4.2 Macroeconomic State

Hypothesis 14: There is no relationship between first day return and prevailing interest rate of the economy.

Hypothesis 15: There is no relationship between first day return and gross domestic product of the economy.

3.4.3 Market State

Hypothesis 16: There is no relationship between first day return and 30 days lagged corresponding market return.

Table 3.1: Summary of Testable Hypotheses for Underpricing

HYPOTHESIS		EXPLANATORY VARIABLE		NAME	IMPACT
1)	**Ex-ante Uncertainty**				
a)	Firm risk	i)	Total units of issues (normalized)	*SIZE*	+
		ii)	Total gross proceeds (normalized)	*PRO*	+
		iii)	Pre-IPO Market Cap. (normalized)	*MCAP*	-
		iv)	Firm age in years (normalized)	*AGE*	-
b)	Industry risk	v)	Technology macro industry (dummy)	*TECH*	+
c)	Market risk	vi)	Primary exchange of listing (dummy)	*EXCH*	+
2)	**Certification**				
a)	Underwriter	vii)	Underwritten by third party (dummy)	*UND*	-
		ix)	Reputation of underwriter (dummy)	*REP*	-
b)	Venture Capital	x)	Venture-backing (dummy)	*VCBK*	-
3)	**Institutional**				
a)	Ownership Dispersion	xi)	Placement method (dummy)	*PLACE*	+
		xii)	Public offer method (dummy)	*PBOFF*	-
		xiii)	Hybrid or mixed method (dummy)	*HYBD*	±
4)	**Control**				
a)	Macroeconomic	xiv)	Prevailing BOE Base rate	*INT*	±
		xv)	Gross domestic product	*GDP*	±
b)	Market	xvi)	Lagged market return (-30 days)	*MKTR*	±
c)	Year	xvii)	Calendar year of issue (dummy)	*YEAR*	±

Source: Researcher's description

3.5 Long Run Performance Hypotheses

Variables used to test for the causes of underpricing are also used to check for its predictive power on long run performance of the issues 1 year after their listing date. The buy-and-hold abnormal return is used to proxy for long run performance.

3.5.1 Ex-Ante Uncertainty

Hypothesis 17: There is no relationship between buy-and-hold abnormal return and the IPO issue size of a firm.

Hypothesis 18: There is no relationship between buy-and-hold abnormal return and the total gross proceeds of a firm.

Hypothesis 19: There is no relationship between buy-and-hold abnormal return and the market capitalisation before issue of a firm.

Hypothesis 20: There is no relationship between buy-and-hold abnormal return and the age of a firm.

Hypothesis 21: There is no relationship between buy-and-hold abnormal return and a firm in the high technology macro industry.

Hypothesis 22: There is no relationship between buy-and-hold abnormal return and the primary exchange of trade of a firm.

3.5.2 Certification

Hypothesis 23: There is no relationship between buy-and-hold abnormal return and a third party underwritten deal.

Hypothesis 24: There is no relationship between buy-and-hold abnormal return and the reputation of underwriters used to certify a deal.

Hypothesis 25: There is no relationship between buy-and-hold abnormal return and a firm with venture capital backing.

3.5.3 Institutional Explanation

Hypothesis 26: There is no relationship between buy-and-hold abnormal return and the placement method used to list the shares of a firm.

Hypothesis 27: There is no relationship between buy-and-hold abnormal return and the public offer method used to list the shares of a firm.

Hypothesis 28: There is no relationship between buy-and-hold abnormal return and the hybrid method used to list the shares of a firm.

Table 3.2: Summary of Testable Hypotheses for Long Run Performance

HYPOTHESIS	EXPLANATORY VARIABLE		NAME	IMPACT
1) Ex-ante Uncertainty				
a) Firm risk	xviii)	Total units of issues (normalized)	*SIZE*	+
	xix)	Total gross proceeds (normalized)	*PRO*	+
	xx)	Pre-IPO Market Cap. (normalized)	*MCAP*	-
	xxi)	Firm age in years (normalized)	*AGE*	-
b) Industry risk	xxii)	Technology macro industry (dummy)	*TECH*	+
c) Market risk	xxiii)	Primary exchange of listing (dummy)	*EXCH*	+
2) Certification				
a) Underwriter	xxiv)	Underwritten by third party (dummy)	*UND*	-
	xxv)	Reputation of underwriter (dummy)	*REP*	-
b) Venture Capital	xxvi)	Venture-backing (dummy)	*VCBK*	-
3) Institutional				
a) Ownership Dispersion	xxvii)	Placement method (dummy)	*PLACE*	+
	xxviii)	Public offer method (dummy)	*PBOFF*	-
	xxix)	Hybrid or mixed method (dummy)	*HYBD*	±

Source: Researcher's description

.

4.0 DATA AND METHODS

Similar IPO records and statistics related to the studies discussed in Chapter 3 were composed for the research and the methodology employed was also technically suitable to the nature of the data.

4.1 Sample and Data Sources

A dataset comprising of all IPOs issued from 2003 to 2013 were sourced from Thomson Reuters' (2014) database. The researcher is unaware of any publicly available study principally focusing on IPO Underpricing in the UK before and after the financial crisis. The sourcing of data was done in three stages. First, a complete dataset of 1,555 IPOs for 10 years were collected, and then this dataset was divided into two, with the first category comprising of IPOs between July 2003—June 2007 and the second category comprising of issues between July 2009—June 2013. From July 2007—June 2009 were deliberately left out because of stock market volatility caused by the sub-prime lending crisis, credit crunch and the aftershocks of the global financial crisis as mentioned in Elliot (2011), The FCIC (2011) and Davies (2014)[1]. The researcher sees this as necessary owing to the main objective of the paper to critically investigate and analyse the empirical findings regarding pre and post financial crisis IPO issues. The timeframe of data collection ending in June, 2013 is to allow for at least 1 year of post IPO long run performance analyses, in which monthly share price data for all the companies were sourced from Yahoo!® Finance (2014).

In the second stage, both datasets were cleaned up by removing issues that had incomplete information and issues that were repeated in the series in order to avoid the pitfalls of biased estimates. The total number of IPOs for the pre financial crisis was 278 while that of the post financial crisis was 63. After log-normally transforming both distributions and dropping outliers[2], the final sample left was 257 and 53 respectively. Dummy Variables to control for a number of factors were also created along with other independent variables to be used for the tests.

The third and last stage of data collection involved composing relevant data for up to 1 year to be used in analysing performance. Key performance variables of the 278 and 63 pre and post financial crisis issues respectively were collected, log-normally transformed and observations with missing data were also deleted. In the end, the sample contained 104 and 49 IPOs respectively. A summary of the data is shown in *Table 4.1*.

[1] Elliot (2011) posited that phase one of the financial crisis principally began on the 9th of August 2007 and fiscal stimulus packages were announced in the winter of 2008—2009; specifically on 2nd April 2009, leaders of the G20 summit met in London to agree to a £3 trillion fiscal expansion. Davies (2011) opined that the crisis began in July 2007 and President Obama proposed federal spending of around $1 trillion in January 2009; while the national commission report of the US FCIC (2011) on the causes of the financial crisis revealed that the aftershocks were still being felt even more than two years after the crisis reached its peak in September, 2008.

[2] An outlier is defined as a data point or observation that is abnormally distant from other observations in a random sample of a population (Kalla, 2009). It is removed in order to cause the distribution of the sample to be closer to normal.

Table 4.1: Excerpt Summary of data collected on IPO Issues for 10 years

S/N	YEAR	IPOs	EXCHANGE			NUMBER OF SHARES OFFERED	TOTAL GROSS PROCEEDS (£'m)	FIRM AGE	IPOs
			LSE	AIM	OTHER				
1.	2003	19	2	17	0	531,886,336	901,649,413.34	0-5 yrs	176
2.	2004	92	9	79	4	2,353,837,502	1,934,922,687.22	6-10 yrs	67
3.	2005	61	22	38	1	2,545,390,267	3,463,754,906.52	11-15 yrs	26
4.	2006	58	12	36	10	2,992,941,627	7,213,604,211.71	16-20 yrs	16
5.	2007	48	13	31	4	2,486,841,334	5,082,398,128.04	21-25 yrs	20
6.	2009	2	0	1	1	22,569,319	66,850,004.50	26-30 yrs	8
7.	2010	25	16	9	0	1,991,084,792	3,367,111,249.87	31-35 yrs	7
8.	2011	14	2	11	1	605,844,885	479,416,264.89	36-40 yrs	3
9.	2012	11	0	7	4	234,861,415	458,299,290.35	41-45 yrs	3
10.	2013	11	7	3	1	320,000,000	151,700,000.00	Above 45	15
	PRE	**278**	**58**	**201**	**19**	**10,910,897,066**	**18,596,329,346.83**		
	POST	**63**	**25**	**31**	**7**	**3,174,360,411**	**4,523,376,809.60**		
	TOTAL	**341**	**83**	**232**	**26**	**14,085,257,477**	**23,119,706,156.43**		
					MINIMUM	**22,569,319**	**66,850,004.50**	**0**	**3**
					MAXIMUM	**2,992,941,627**	**7,213,604,211.71**	**95**	**176**
					MEAN	**1,408,525,748**	**2,311,970,615.64**	**47.50**	**34**

Source: Researcher's computation using Microsoft Office Excel 2007

4.2 Variables

Dependent and Independent variables which include dummy and control variables, similar to the earlier reviewed studies of Chen and Mohan (2003), Guner et al (2004), Unlu et al (2004), Coakley et al (2006), Chambers (2006, 2011), Chambers and Dimson (2009), Fjesme and Norli (2010), Bessler and Seim (2011), and Zhu (2013) among others are used.

4.2.1 Dependent Variables

The dependent variable, first day return is created based on Agrawal's (2009) definition of Under-pricing, which is the difference between the log[1] of initial offer prices and closing prices at the end of the first day of trading.

$\boldsymbol{LRET_B}$ and $\boldsymbol{LRET_A}$ refer to log of first day returns before and after the financial crisis respectively given by:

$$LRET_{i1} = Log(P_{i1}) - Log(P_{01}) \quad (1)$$

Where: P_{i1} = Closing first day price for firm *i*

P_{i0} = Issue price for firm *i*

To evaluate long run performance of IPO issues, Buy-and-Hold Abnormal Returns (BHAR) are also used as dependent variables. Thus,

$\boldsymbol{LBHAR_B}$ and $\boldsymbol{LBHAR_A}$ represent log-normal returns of IPO issues pre and post financial crisis. The equations are given by:

$$LBHAR_i = Log(AAR_{i1} + A) - Log(AAR_m + A) \quad (2)$$

$$AAR_i = \left({}^{R_{i1}}/_{R_{i0}}\right) - 1 \quad (3)$$

$$AAR_m = \left({}^{R_{m1}}/_{R_{m0}}\right) - 1 \quad (4)$$

Where: AAR_i and AAR_m = 12 months average abnormal return for firm *i* and FTSE all-share benchmark market return respectively

A = Integer (constant) between *1* to *100*

R_{i1}, R_{i0}, R_{m1}, R_{m0} = Monthly closing and opening prices for firm *i* and FTSE all-share market benchmark respectively

4.2.2 Independent Variables

$\boldsymbol{LSIZE_B}$ and $\boldsymbol{LSIZE_A}$ is a measure for the log of size of the number of units of issue.

[1] In order to normalise the distribution of a random variable, logs are added to minimise its skewness. This is very necessary as it fulfils one of the assumptions of an OLS regression (Brooks, 2008), because it is in line with the law of large numbers and central limit theorem that states that, the average of a sample will converge to the population mean which in itself converges to a normal distribution.

$LPRO_B$ and $LPRO_A$ is another measure for the size of the issue which is log of gross proceeds for IPO issues before and after the financial crisis respectively.

$$LPRO_i = Log(O_i * S_i) \quad (5)$$

Where: O = Issue (offer) Price for firm *i*
S = Number of shares issued for firm *i*

$LMCAP_B$ *and* $LMCAP_A$ are logs of market capitalisation that captures the market value of firms that issued IPOs before and after the financial crisis respectively.

$LAGE_B$ and $LAGE_A$ refer to the log of the age or number of years a company before and after the financial crisis respectively have been in existence, or date of incorporation (whichever is available) before issuing its IPO.

$TECH_B$ and $TECH_A$ are dummy variables for firms in the High Technology[1] industry of the UK issuing IPOs before and after the financial crisis respectively. 'TECH' takes value of 1 if a high technology firm is encountered and 0 otherwise.

$EXCH_B$ and $EXCH_A$ are dummy variables that attempts to separate firms that primarily trades on the London Stock Exchange (LSE) main market from that of the Alternative Investments Market (AIM) before and after the financial crisis respectively. 'EXCH' takes the value of 1 if an IPO was issued in the main market and 0 if in AIM.

UND_B and UND_A as in Chambers (2011) are dummy variables that attempts to identify firms that were underwritten by a third party, in order to check the impact of certification as a determinant of Underpricing for IPOs issued before and after the financial crisis respectively. 'UND' takes the value of 1 if an IPO issue was underwritten by three or more parties and 0 if less than three.

REP_B and REP_A is a measure of the lead Underwriter's reputation or prestige which also aims to check the impact of certification for firms that issued IPOs before and after the financial crisis respectively. The measure used for 'REP' here is adopted from Migliorati and Vismara (2014) and slightly adjusted to fit the sample timeframe which takes fractions between the values of 0 and 1 in an attempt to rank high, average and low prestigious Underwriters.

$VCBK_B$ and $VCBK_A$ are dummy variables that takes the value of 1 if an IPO with venture capital backing is encountered and 0 otherwise, for all issues before and after the financial crisis respectively.

$PLACE_B$, $PBOFF_B$, $HYBD_B$, $PLACE_A$, $PBOFF_A$ and $HYBD_A$ are dummy variables representing the placement, public offer, and hybrid method of IPO issues before and after the financial crisis in various respects. These variables take the value of 1 if a particular method is used and 0 otherwise.

INT_B and INT_A are macroeconomic variables representing the Bank of England base rate in the year of an IPO either before or after the financial crisis respectively, to check if key monetary policy indicators can affect market conditions.

GDP_B and GDP_A are macroeconomic variables representing the gross domestic product in the year of issue of an IPO either before or after the financial crisis respectively, in order to check the directional prospect of the `.

$LMKTR_B$ and $LMKTR_A$ are logs of 30-days lagged market returns before and after the financial crisis respectively which attempts to explain if Equity market conditions prior to an IPO issue can affect Underpricing. The FTSE all-share index is used to compute market returns.

$$LMKTR_{-30} = Log\left(\left[{}^{R_{m1}}/_{R_{m0}}\right] - 1\right) + A \quad (6)$$

Where: R_{m1} and R_{m0}= Closing and Opening market price
A = Integer (constant) between *1* to *100*

$YEAR_B$ and $YEAR_A$ represents a set of year dummies that captures each calendar year in which an IPO was issued either before (-5 years) or after (+5 years) the financial crisis respectively.

[1] Companies defined in the UK under the 'creative services' sector in the Office of National Statistics reports belong to the 'High Technology' macro industry in Thomson Reuter's database which has the second highest number of issues in the dataset.

Table 4.2: Summary of the Dependent and Independent Variables

S/N	TITLE	'Y' VARIABLES	'X' VARIABLES
1.	Pre-Crisis Underpricing	First Day Return = ∫	(issue size, total gross proceeds, market capitalisation of firm before issue, age of issuing firm, high technology industry, primary exchange of trade, 3rd party underwriter per deal, reputation of lead underwriter, venture capital backing, method of issue, level of interest rate, gross domestic product, 30-day lagged corresponding market return, calendar year of issue)
2.	Post-Crisis Underpricing		
3.	Pre-Crisis Performance	Buy-and-Hold Abnormal Return = ∫	(issue size, total gross proceeds, market capitalisation of firm before issue, age of issuing firm, high technology industry, primary exchange of trade, 3rd party underwriter per deal, reputation of lead underwriter, venture capital backing, method of issue)
4.	Post-Crisis Performance		

Source: Researcher's description

4.3 MODEL

The paper employs a common methodology of the studies listed above on the cross-sectional dataset.

4.3.1 THE EQUATIONS: Transforming these models into linear equations, we have:

$$\textbf{Model 1: } LRET_B = \alpha_1 + \alpha_2 LSIZE_B + \alpha_3 LPRO_B + \alpha_4 LMCAP_B + \alpha_5 LAGE_B + \alpha_6 TECH_B + \alpha_7 EXCH_B + \alpha_8 UND_B + \alpha_9 REP_B + \alpha_{10} VCBK_B + \alpha_{11} PLACE_B + \alpha_{12} PBOFF_B + \alpha_{13} HYBD + \alpha_{14} INT_B + \alpha_{15} GDP_R + \alpha_{16} LMKTR_B + \alpha_{17\cdots21} YEAR_B + \mu_t \quad (7)$$

$$\textbf{Model 2: } LRET_A = \beta_1 + \beta_2 LSIZE_A + \beta_3 LPRO_A + \beta_4 LMCAP_A + \beta_5 LAGE_A + \beta_6 TECH_A + \beta_7 EXCH_A + \beta_8 UND_A + \beta_9 REP_A + \beta_{10} VCBK_A + \beta_{11} PLACE_A + \beta_{12} PBOFF_A + \beta_{13} HYBD_A + \beta_{14} INT_A + \beta_{15} GDP_A + \beta_{16} LMKTR_A + \beta_{17\cdots21} YEAR_A + v_t \quad (8)$$

$$\textbf{Model 3: } LBHAR_B = \lambda_1 + \lambda_2 LSIZE_B + \lambda_3 LPRO_B + \lambda_4 LMCAP_B + \lambda_5 LAGE_B + \lambda_6 TECH_B + \lambda_7 EXCH_B + \lambda_8 UND_B + \lambda_9 REP_B + \lambda_{10} VCBK_B + \lambda_{11} PLACE_B + \lambda_{12} PBOFF_B + \lambda_{13} HYBD_A + q_t \quad (9)$$

$$\textbf{Model 4: } LBHAR_A = \theta_1 + \theta_2 LSIZE_A + \theta_3 LPRO_A + \theta_4 LMCAP_A + \theta_5 LAGE_A + \theta_6 TECH_A + \theta_7 EXCH_A + \theta_8 UND_A + \theta_9 REP_A + \theta_{10} VCBK_A + \theta_{11} PLACE_A + \theta_{12} PBOFF_A + \theta_{13} HYBD_A + z_t \quad (10)$$

Where: μ_t, v_t, q_t and z_t = Stochastic or error terms assumed to be i.i.d normal

4.3.2 Testing Procedure

A good model is one that satisfies all assumptions of the ordinary least square (OLS) regression test and explains the data very well. Therefore diagnostics test will be performed on the models after the multivariate regression analyses are carried out. Unless otherwise stated, computation of variables and running of the econometric tests are done using the Microsoft Office Excel version 2007 application package and Econometric Views (E-Views) version 8 statistics software.

5.0 Analyses and Results

The specified models have been estimated with the respective techniques and analytical tools. This section presents and interprets the results.

5.1 Preliminary Analysis

It is proper to first analyse comparative statistics of data on IPO issues before and after the financial crisis. Specifically, the average first day returns, gross proceeds and distribution of IPOs by industry and firm age are examined.

5.1.1 First Day Returns of IPOs

Figure 5.1 presents Underpricing measured by first day returns of IPOs in their respective calendar years. It is observed that 2004 had the highest number of IPOs (92) with an average initial return of approximately 145% and 2009 had only 2 IPOs, that were overpriced by approximately -7%. This is not surprising due to the state of the market in 2009 when the investing community had not regained confidence in the financial system consistent with US FCIC (2011). Other years with initial returns above 100% include 2005 and 2007 with 121% and 116% respectively. Overall, the entire dataset has an average first day return of 62% with 341 IPOs between the years.

5.1.2 Gross Proceeds

Table 5.1: Average Gross Proceeds for Sample Period Classified by Industry

	YEARS (£'million)									
INDUSTRY CLASSIFICATION	**2003**	**2004**	**2005**	**2006**	**2007**	**2009**	**2010**	**2011**	**2012**	**2013**
Financials	245	30	48	287	77	0	191	9	0	356
Real Estate	14	1	82	60	64	0	175	0	7	137
Industrials	6	44	3	25	66	57	60	0	100	80
Telecommunications	0	12	94	7	0	0	7	0	0	212
High Technology	7	23	36	154	51	0	65	0	15	2
Consumer Staples	5	26	211	0	0	0	0	0	0	2
Healthcare	14	16	28	12	1	0	0	9	50	0
Materials	89	14	79	57	288	0	203	13	11	0
Media and Entertainment	0	13	28	9	37	0	211	0	233	0
Consumer Products and Services	0	6	25	124	12	0	1	0	7	0
Energy and Power	40	30	60	27	87	10	6	94	6	0
Retail	0.38	35	0	64	929	0	167	0	0	0
AVERAGE	**35**	**21**	**58**	**69**	**134**	**6**	**91**	**10**	**36**	**66**

Source: Researcher's computation using Microsoft Office Excel 2007

Table 5.1 shows total yearly gross proceeds of the issues classified by industry for the entire dataset. It can be seen that the retail industry raised the most money in the equity market in 2007 with gross proceeds of £929 million, also making the year have the highest average across all the industries with £134 million. Interestingly, the same industry raised the lowest money in the dataset in 2003 with total proceeds of only £380,000 and a total average of £35 million. Many industries had no IPO issues in some years, as an example, only industrials as well as energy and power raised a total of £67 million in 2009, making the year have the lowest average of only £6 million. But this should apparently be because the year had only 2 companies issuing IPOs in the dataset. The financials industry had the highest gross proceeds in 2013 of £356 million, while the high technology industry raised its highest proceeds of £154 million in 2006.

5.1.3 Distribution of IPOs By Industry

According to *Table 5.2* 64 issues representing 19% of the dataset are in the financials industry with an average first day return of 150%. High technology came second with 56 IPOs consuming 16%, but fell fourth with an average return of 102% behind consumer product and services (112%) and energy and power (104%). This is parallel with many studies like those of Loughran and Ritter (2004) who posit that technology companies are more risky. Consumer staples and retail too had the lowest number of issues of only 7 and 11, with average first day returns of 95% and 85% respectively. For the corresponding 30-day lagged market return, the media and entertainment industry was the highest with a return of 25% while industrials underperformed with the lowest return of -0.38%.

Table 5.2: Industry Distribution of IPOs for the Sample Period (2003—2013)

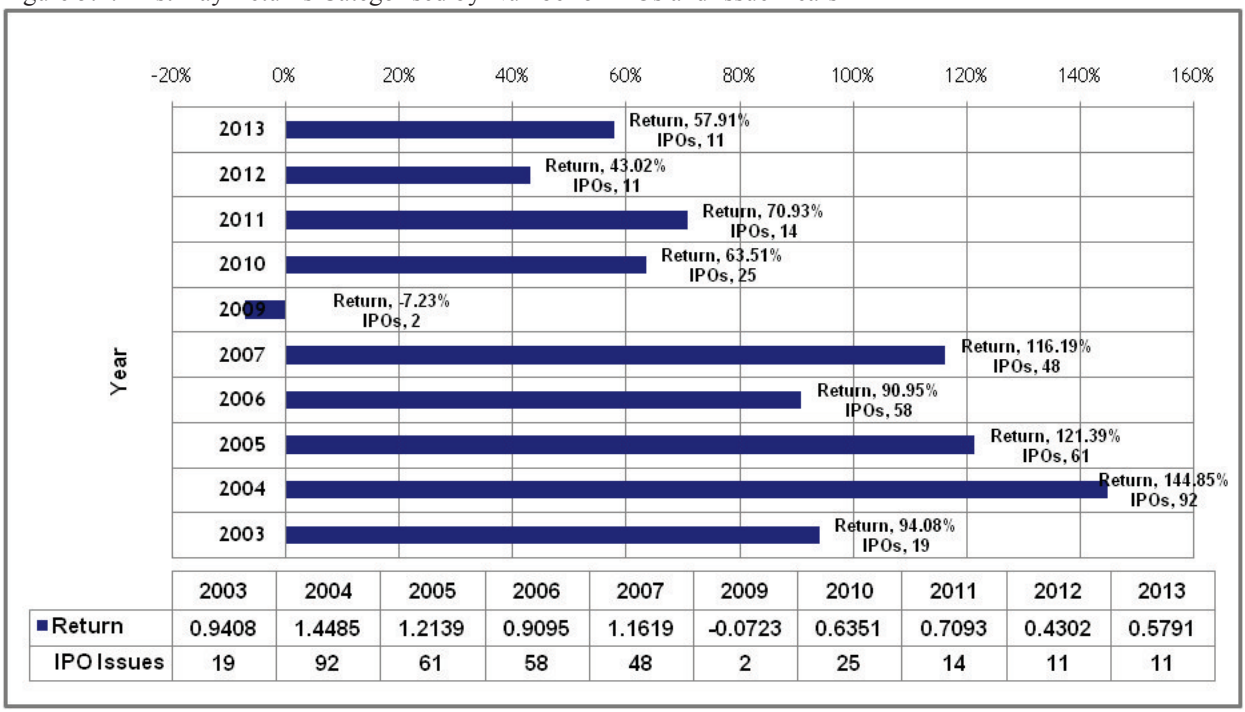
INDUSTRY CLASSIFICATION	NUMBER OF IPOs	PERCENTAGE PROPORTION	AVERAGE	
			FIRST DAY RETURN	30-DAY LAGGED MARKET RETURN
Financials	64	19%	150%	-0.02%
Real Estate	16	5%	101%	0.19%
Industrials	27	8%	80%	-0.38%
Telecommunications	11	3%	97%	-0.21%
High Technology	56	16%	102%	0.06%
Consumer Staples	7	2%	95%	0.09%
Healthcare	24	7%	101%	-0.03%
Materials	43	13%	101%	0.06%
Media and Entertainment	18	5%	89%	0.25%
Consumer Products and Services	30	9%	112%	-0.02%
Energy and Power	34	10%	104%	-0.22%
Retail	11	3%	85%	0.00%
TOTAL	**341**	**100%**	**101%**	**-0.02%**

Source: Researcher's computation using Microsoft Office Excel 2007

5.1.4 Distribution Of IPOs By Firm Age

No pattern is observed in *Figure 5.2* below showing firm age and IPO Underpricing. The 92 firms that went public in 2004 had an average age of 12 with a combined average first day return of 145%; and an overpricing of issues in 2009 as recorded by the first day returns of about -7% is observed for firms with an average age of 3. 2005 and 2013 had the same average firm age of 13, but with returns of approximately 121% and 58% respectively. This is consistent with Chambers and Dimson's (2009) research that firm age was insignificantly related to Underpricing. It is also expected that the regression result will reveal this too.

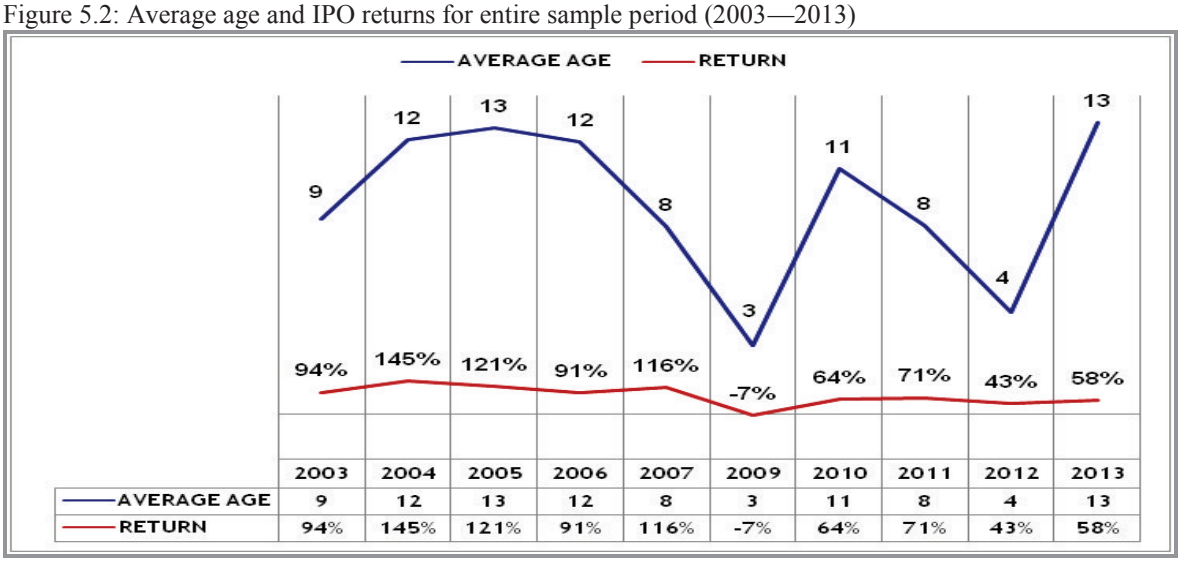
Figure 5.1: First Day Returns Categorised by Number of IPOs and Issue Years



	2003	2004	2005	2006	2007	2009	2010	2011	2012	2013
Return	0.9408	1.4485	1.2139	0.9095	1.1619	-0.0723	0.6351	0.7093	0.4302	0.5791
IPO Issues	19	92	61	58	48	2	25	14	11	11

Source: Researcher's illustration using Microsoft Office Excel 2007

Figure 5.2: Average age and IPO returns for entire sample period (2003—2013)



	2003	2004	2005	2006	2007	2009	2010	2011	2012	2013
AVERAGE AGE	9	12	13	12	8	3	11	8	4	13
RETURN	94%	145%	121%	91%	116%	-7%	64%	71%	43%	58%

Source: Researcher's illustration using Microsoft Office Excel 2007

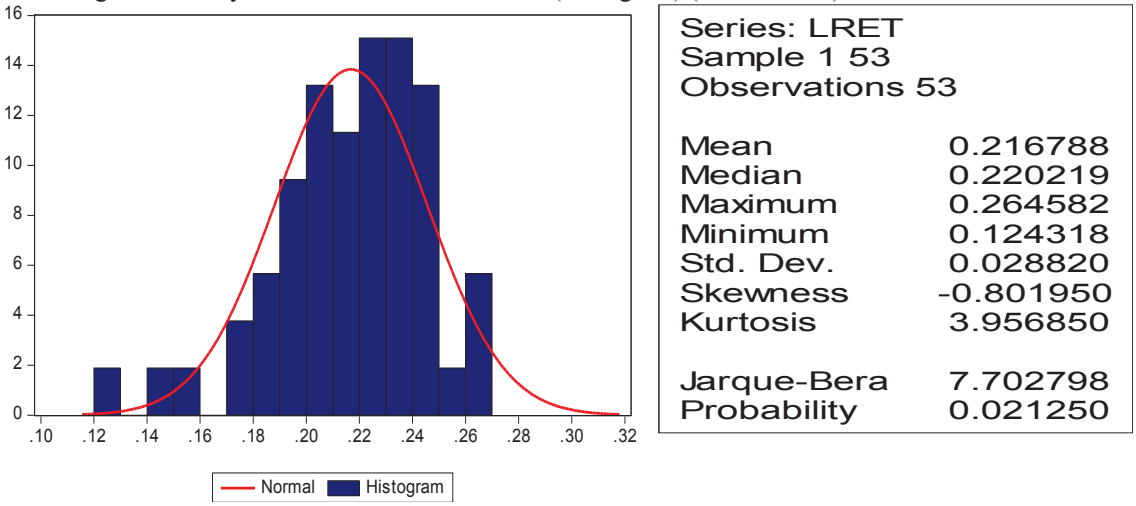
5.2 Descriptive Statistics

The following tables show descriptive statistics for the entire cross-sectional dataset categorised by the models specified in the previous chapter.

5.2.1 Common Sample

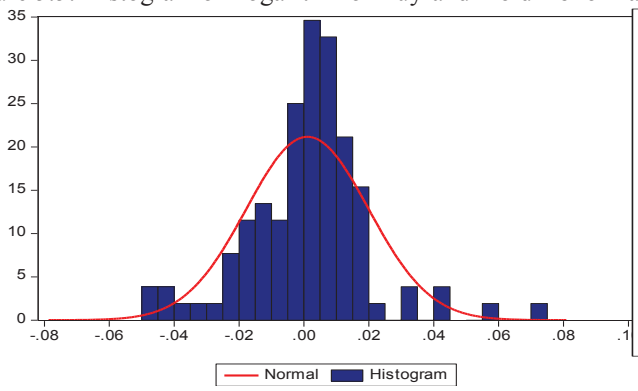
Tables 5.4, 5.5, 5.6 and *5.7* show a total of 257, 53, 104 and 49 total observations for the variables of the respective models in their pooled samples, which is as a result of outliers being removed to normalize the distribution of their dependent variables.

Figure 5.4: Log of First Day Returns of Post-Crisis IPOs (Histogram) (2009—2013)



Source: Researcher's illustration using E-Views version 8

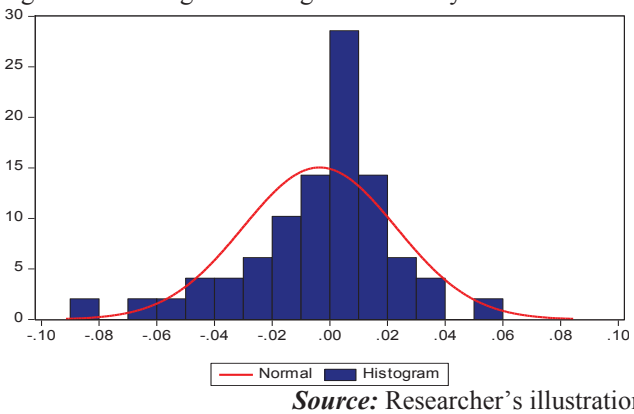
Figure 5.5: Histogram of Logarithm of Buy-and-Hold Abnormal Returns of Pre-Crisis IPOs (2003—2007)



Series: LBHAR	
Sample 1 104	
Observations 104	
Mean	0.001083
Median	0.002510
Maximum	0.073993
Minimum	-0.048123
Std. Dev.	0.018849
Skewness	0.311936
Kurtosis	5.489411
Jarque-Bera	28.54099
Probability	0.000001

Source: Researcher's illustration using E-Views version 8

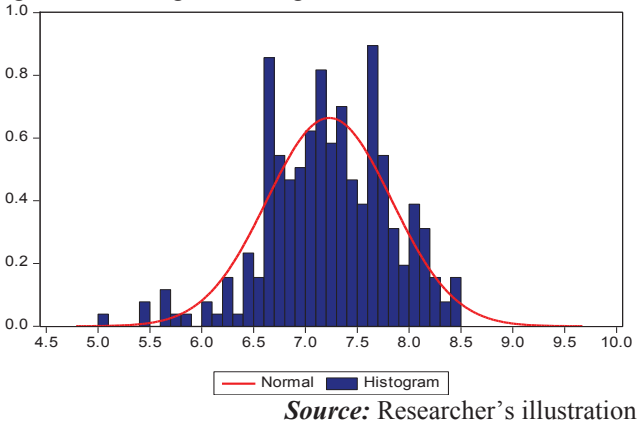
Figure 5.6: Histogram of Logarithm of Buy-and-Hold Abnormal Returns of Post-Crisis IPOs (2009—2013)



Series: LBHAR	
Sample 1 49	
Observations 49	
Mean	-0.003566
Median	0.000416
Maximum	0.052907
Minimum	-0.083876
Std. Dev.	0.026528
Skewness	-0.900356
Kurtosis	4.101269
Jarque-Bera	9.096351
Probability	0.010587

Source: Researcher's illustration using E-Views version 8

Figure 5.7: Histogram of Logarithm of Number of Units of Shares Offered (SIZE) (2003—2007)



Series: LSIZE	
Sample 1 257	
Observations 257	
Mean	7.229976
Median	7.221849
Maximum	8.490801
Minimum	5.000000
Std. Dev.	0.600578
Skewness	-0.457208
Kurtosis	3.612707
Jarque-Bera	12.97386
Probability	0.001523

Source: Researcher's illustration using E-Views version 8

5.2.5 Normality Test

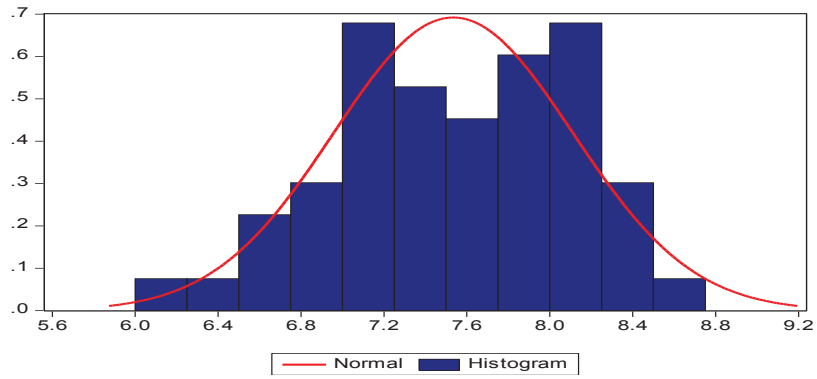
Figures 5.3, 5.4, 5.5 and *5.6* show the normality distribution of the dependent variables of all 4 models. Overall, the variables passed the test as evidenced by the Jarque-Berra and probability values.

Note that the variables and their mean, minimum, maximum, standard deviation, skewness, kurtosis and Bera-Jarque statistics are given in table 5.4, 5.5, 5.6 and 5.7 for the four models respectively. The mean values of these variables are all positive implying that their first difference displays increasing tendency. Premium motor spirit popularly called petrol has the highest maximum changes (0.75) over time and appears to be the most volatile among these macroeconomic variables because it has the highest standard deviation (0.113). The variables- PBOFF, LAGE, HYBD, LRAT, LSIZE, LPRO, LMCAP and LMKTR - are negatively skewed; while the others are positively skewed. There is mix in the kurtosis because while some variables are platykurtic in nature; the remaining variables are leptokurtic. Also, the JB statistics correspond to zero p-value for all the variables. In view of this, it means that all the variables follow normal distribution process.

5.3 Correlation Analysis

Positive correlation exists between LPRO and LIZE above 50% in all model matrices shown in *Tables 5.8, 5.9, 5.10* and *5.11*. LMCAP is also observed to exhibit similar characteristics with LPRO; and PBOFF with HYBD, but negative in Models 2 and 4 respectively. Surprisingly, dummy variable Y2010 is seen to have a high negative correlation with GDP. Some variables were subsequently dropped off in order to avoid biased estimates[1].

Figure 5.8: Histogram of Logarithm of Number of Units of Shares Offered (SIZE) (2009—2013)

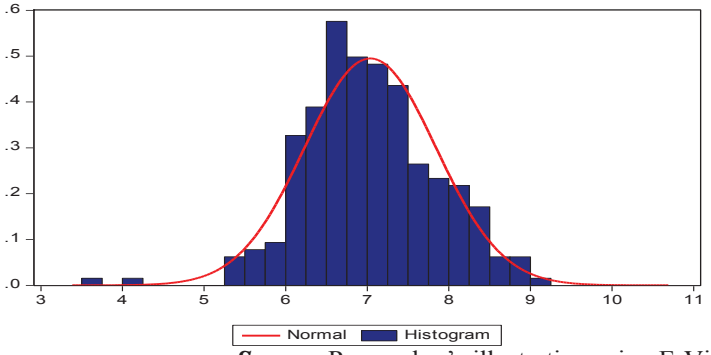


Series: LSIZE
Sample 1 53
Observations 53

Mean	7.534389
Median	7.525045
Maximum	8.662758
Minimum	6.017651
Std. Dev.	0.576501
Skewness	-0.359962
Kurtosis	2.636642
Jarque-Bera	1.436122
Probability	0.487697

Source: Researcher's illustration using E-Views version 8

Figure 5.9: Histogram of Logarithm of Total Gross Proceeds (2003—2007)



Series: LPRO
Sample 1 257
Observations 257

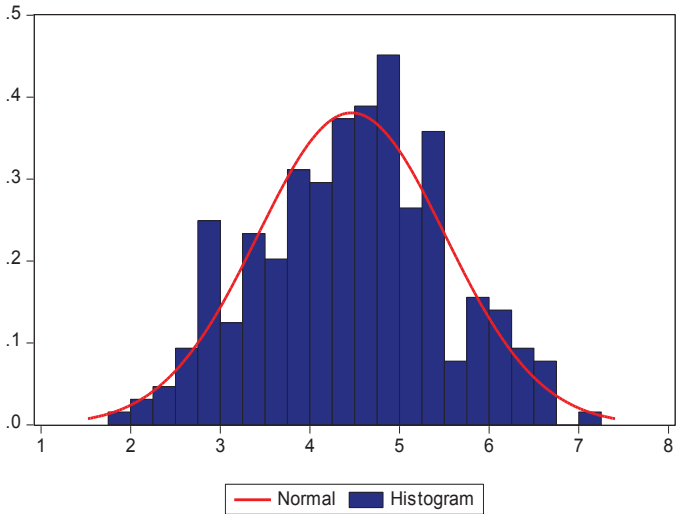
Mean	7.037383
Median	7.000000
Maximum	9.134655
Minimum	3.698970
Std. Dev.	0.806082
Skewness	-0.150857
Kurtosis	3.935324
Jarque-Bera	10.34278
Probability	0.005677

Source: Researcher's illustration using E-Views version 8

5.4 OLS Regression Analysis

The results for the estimated equations using the OLS regression technique show mixed findings for the pre and post crisis tests, but the results for the performance tests largely had insignificant variables.

[1] The control variables Y2005, Y2006 and Y2007 as well as Y2009, Y2012 and Y2013 calendar year dummies were dropped from Models 1 and 2 due to a "Near Singular Matrix" error in E-views. The independent variables PLACE and PBOFF were also dropped off from Models 2 and 4 due to the same problem, although not surprising because there were no placement IPO issues under the periods covered by those models. This ensured the OLS implicit assumption of BLU estimators.

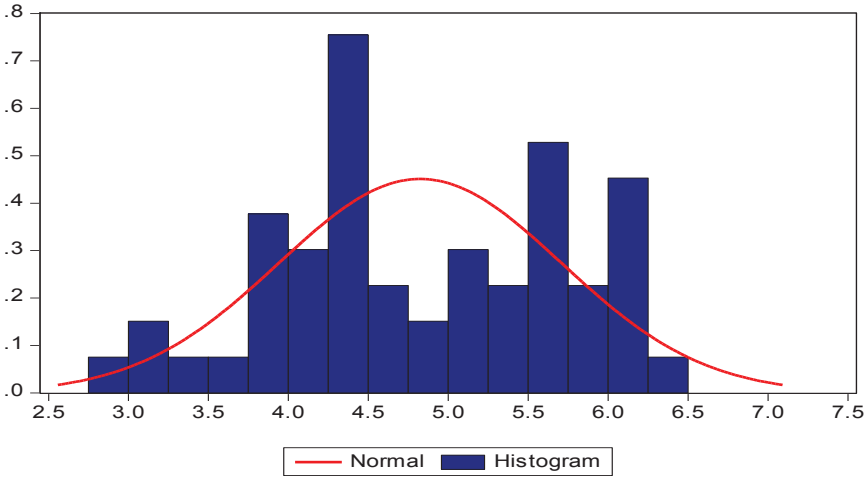


Series: LMCAP
Sample 1 257
Observations 257

Mean	4.464220
Median	4.518251
Maximum	7.009869
Minimum	1.778151
Std. Dev.	1.047698
Skewness	-0.026320
Kurtosis	2.549187
Jarque-Bera	2.205949
Probability	0.331882

Source: Researcher's illustration using E-Views version 8

Figure 5.12: Histogram of Logarithm of Market Capitalisation before Offer (2009—2013)

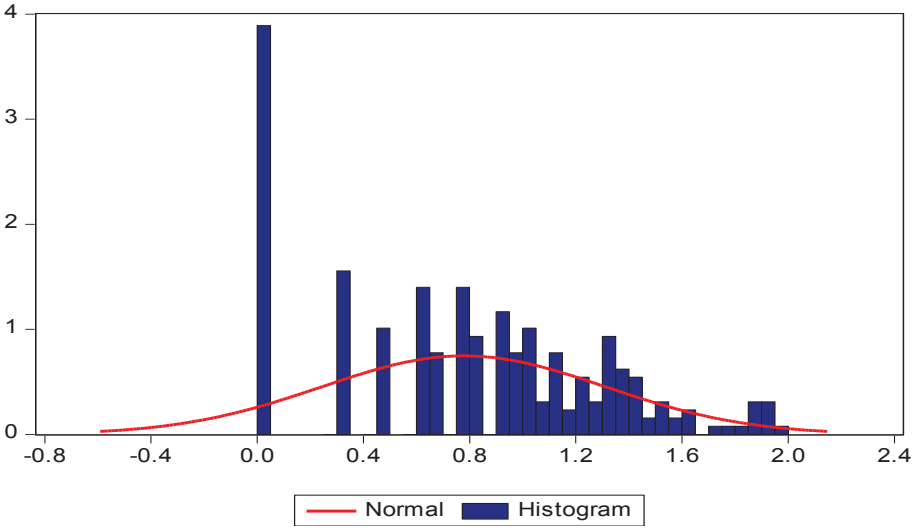


Series: LMCAP
Sample 1 53
Observations 53

Mean	4.824357
Median	4.655331
Maximum	6.292885
Minimum	2.968483
Std. Dev.	0.884390
Skewness	-0.098573
Kurtosis	2.023420
Jarque-Bera	2.191937
Probability	0.334216

Source: Researcher's illustration using E-Views version 8

Figure 5.13: Histogram of Logarithm of Firm Age before Issue (2003—2007)

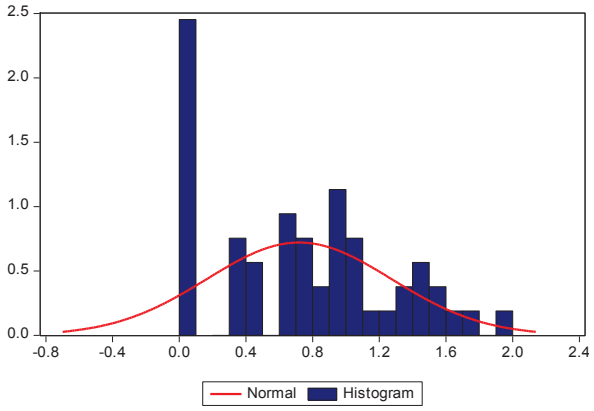


Series: LAGE
Sample 1 257
Observations 257

Mean	0.777741
Median	0.778151
Maximum	1.973128
Minimum	0.000000
Std. Dev.	0.534033
Skewness	0.072383
Kurtosis	2.191607
Jarque-Bera	7.222303
Probability	0.027021

Source: Researcher's illustration using E-Views version 8

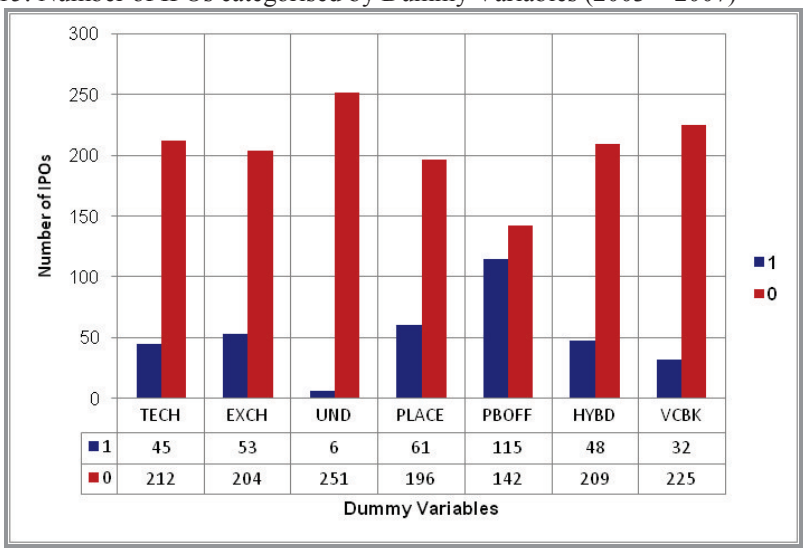
Figure 5.14: Histogram of Logarithm of Firm Age before Issue (2009—2013)



Series: LAGE	
Sample 1 53	
Observations 53	
Mean	0.719389
Median	0.778151
Maximum	1.908485
Minimum	0.000000
Std. Dev.	0.553641
Skewness	0.181260
Kurtosis	2.025234
Jarque-Bera	2.388509
Probability	0.302930

Source: Researcher's illustration using E-Views version 8

Figure 5.15: Number of IPOs categorised by Dummy Variables (2003—2007)[1]



Source: Researcher's illustration using Microsoft Office Excel 2007

5.4.1 Determinants Models

As shown in *Tables 5.12,* log of firm age, technology, exchange, underwritten by third party, venture-backing, placement and Y2004 dummies, as well as underwriter reputation, interest rate and log of 30 day lagged market returns are all insignificant with log of first day returns, LRET. Dropping these variables, Model 1 is re-specified below:

$$\textbf{Model 1b: } LRET_B = \alpha_1 + \alpha_2 LSIZE_B + \alpha_3 LPRO_B + \alpha_4 LMCAP_B + \alpha_5 PBOFF_B + \alpha_6 HYBD + \alpha_7 GDP_R + \alpha_8 Y2003_B + \mu_t \quad (11)$$

Where: μ_t, = Stochastic or error term assumed to be i.i.d normal

The results of the re-estimated model in *Table 5.12b* reveal that log of number of units on offer (LSIZE), log of market capitalisation before issue (LMCAP) and gross domestic product (GDP) are all positive and significant with first day initial returns, LRET at the 1% level; while log of gross proceeds (LPRO), public offer method (PBOFF), hybrid method (HYBD) and Y2003 dummy are also significant but negative. The coefficient of determination or goodness of fit of the model as measured by 'R-squared', which tells the degree at which the independent variables are able to explain the dependent variable has an approximate value of 31%. In other words, the independent variables in the re-specified model above are able to explain at least 31% of the changes in the log of first day IPO returns for issues brought to the market in all 5 years before the financial crisis. Furthermore, the global null hypothesis as reported by the F-statistic and Prob(F-statistic) is also found to be highly significant.

Model 2 regression results in *Table 5.13* for the post-crisis IPO issues, also had a number of

[1] For a proper understanding of these charts, please refer to the explanation of these Variables in Chapter 4.

insignificant variables and was thus re-specified as:

$$\textbf{Model 2b: } LRET_A = \beta_1 + \beta_6 TECH_A + \beta_7 EXCH_A + v_t \quad (12)$$

Where: v_t, = Stochastic or error term assumed to be i.i.d normal

The result displayed in *Table 5.13b* reveals that technology, TECH and exchange, EXCH dummies are negative and highly significant at 1% with log of first day initial returns, and are able to explain at least 23% of its changes throughout the 5 years after the financial crisis as reported by the R-squared. Similarly, the global null hypothesis measured by the F-statistic is also highly significant.

5.4.2 Performance Models

According to *Table 5.15,* only log of gross proceeds, LPRO and log of market capitalisation before issue, LMCAP, are negatively and positively significant respectively with the dependent variable, log of buy-and-hold returns, LBHAR at 1% level in the long run performance period post-crisis. No variable is seen to be significant with LBHAR for issues before the financial crisis however (*Table 5.14)*. Model 3 is very weak with an insignificant Prob(F-statistics) and a goodness of fit of only 9%. This implies that the model is not sufficient in explaining the changes in LBHAR as a performance measure for the pre-crisis IPOs for all 104 observations. In contrast, Model 4 reports an R-squared of approximately 41% and an F-statistic that is significant at the 5% level. This implies that the model is not only fit, but can also explain up to 41% of the changes in log of buy-and-hold returns (LBHAR). This is particularly surprising because both models used the same variables.

Table 5.16: OLS Regression results summary for first day and long run returns[1]

S/N	VARIABLES	PRE-CRISIS		POST-CRISIS	
		Determinants	Performance	Determinants	Performance
	LSIZE	**0.0325 (0.0000)**	0.0034 (0.5110)`	-0.0150 (0.1260)	-0.0070 (0.2854)
	LPRO	**-0.0344 (0.0000)**	-0.0015 (0.7682)	0.0076 (0.4814)	**-0.0231 (0.0024)**
	LMCAP	**0.0069 (0.0113)**	0.0025 (0.4852)	-0.0047 (0.5500)	**0.0299 (0.0001)**
	TECH	-0.0033 (0.6678)	0.0046 (0.3403)	**-0.0238 (0.0118)**	-0.0083 (0.6440)
	EXCH	-0.0009 (0.8976)	-0.0011 (0.5178)	**-0.0262 (0.0008)**	-0.0009 (0.9150)
	PBOFF	**-0.0228 (0.0015)**	0.0065 (0.2588)	NA	-0.0078 (0.3746)
	HYBD	**-0.0142 (0.1021)**	-5.03E-05 (0.9939)	0.0109 (0.3380)	-0.0072 (0.4591)
	GDP	**7.40E-14 (0.0000)**	NA	4.88E-14 (0.8294)	NA
	Y2003	**-0.02934 (0.0037)**	NA	NA	NA
	R-squared	**30.97%**	0.0898	**22.75%**	**40.84%**
	Adjusted R-squared	**29.04%**	-0.0302	**19.66%**	**23.25%**
	F-statistic	**15.9636 (0.0000)**	0.7485 (0.7001)	**7.3615 (0.0016)**	**2.3217 (0.0275)**

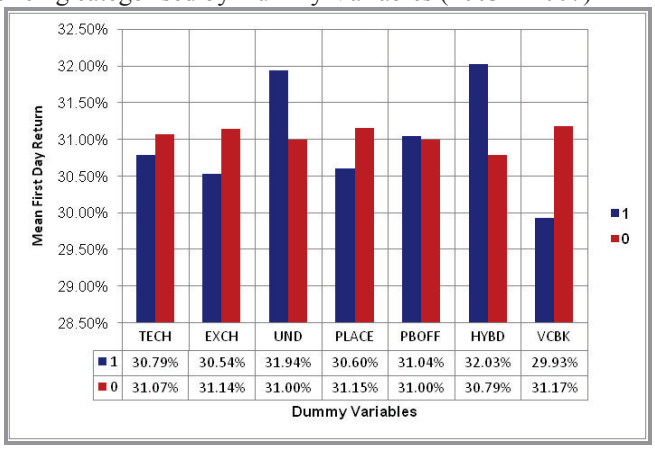
Source: Researcher's description

5.5 Diagnostics Tests

To evaluate the validity and reliability of the model specifications, *Tables 5.17* to *5.24* present results of diagnostics tests carried out. The Heteroskedastic and Ramsey RESET test results for models 2 and 4 are significant while those of models 1 and 3 did not really show high statistical significance.

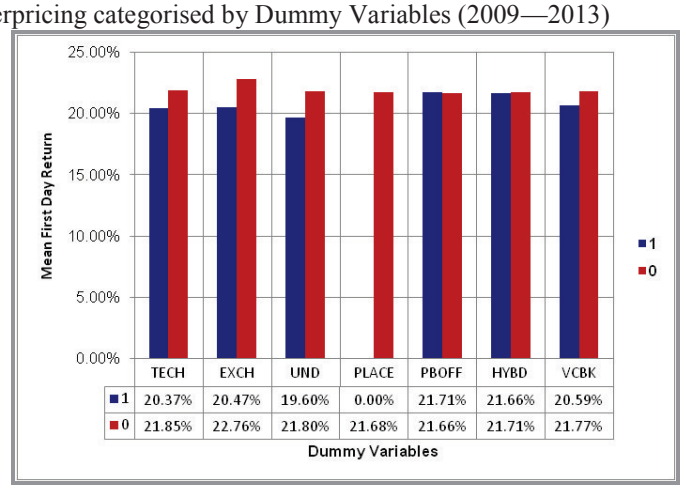
[1] Beta coefficient values on top and probability values in parenthesis; significant values are bold.

Figure 5.17: Mean Underpricing categorised by Dummy Variables (2003—2007)[1]

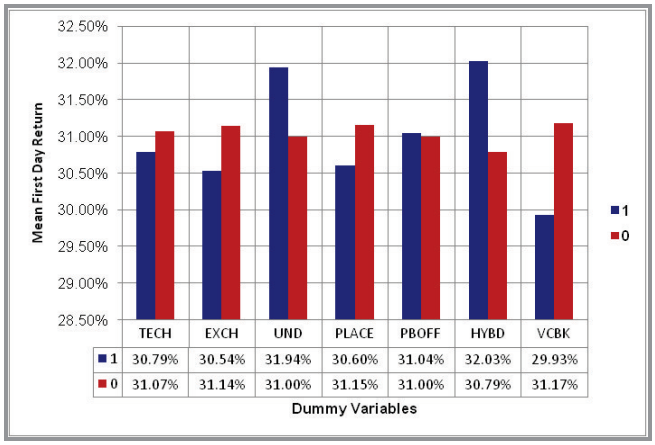


Source: Researcher's illustration using Microsoft Office Excel 2007

Figure 5.18: Mean Underpricing categorised by Dummy Variables (2009—2013)



Source: Researcher's illustration using Microsoft Office Excel 2007



Source: Researcher's illustration using Microsoft Office Excel 2007

Figure 5.18: Mean Underpricing categorised by Dummy Variables (2009—2013)

[1] For a proper understanding of these charts, please refer to the explanation of these Variables in Chapter 4.

6.0 Summary and Conclusion

The study looked into the determinants of IPO Under-pricing in the UK before and after the financial crisis in a bid to check if one or more of the established theories can explain first day initial returns of 341 companies who went public between 2003—2013. There was also an attempt to evaluate long run performance of these companies up to 1 year after listing. There were mixed findings in the results of the statistical tests carried out.

Based on the preliminary analysis, IPO Underpricing was seen to be dominant in the year 2004 with average first day returns of 145% for the 341 firms in the cross-sectional dataset, who had an average age of 9 before going public. These firms raised total gross proceeds in the main and alternative investment market (AIM) of about £6.296 billion during the period under analysis. The overall average of first day returns between 2003—2013 however is 62% with the financial sector contributing the highest of 104% as well as having the highest number of IPOs in the sample, constituting approximately 19%.

The results of the OLS regression tests carried out on the models reveals that the major determinants of Underpricing in the years preceding the financial crisis was number of issue units representing the size of the offer, market capitalisation of a firm before issue and the directional growth of the economy measured by the gross domestic product. The total gross proceeds, public offer and hybrid method of IPO issues however seems to minimise Underpricing. Furthermore, in the years succeeding the financial crisis, Underpricing is seen to be reduced by the technology industry and primary exchange of issue. This implies that technology industry was seen to be less risky contrary to popular views, and investor confidence for the Alternative Investment Market (AIM) was heightened.

In all, the study provided support for some parts of the ex-ante uncertainty theory especially relating to firm risk which is closely parallel to Unlu's et al (2004) findings among others, but inconsistent with the studies of Chambers and Dimson (2009) and Zhu (2013). Firms that issued IPOs after the financial crisis were also found to be less underpriced than those before the financial crisis which was also not expected as it disproves the Author's opinion in section three.

Findings on IPO long run performance before and after the financial crisis were surprising. The pre-crisis long run performance equation was a weak model and revealed that none of the variables formulated were significant with buy-and-hold return. This is possibly due to market interconnectedness, because markets were still volatile and the after-shocks of the crisis were still being felt in the UK in 2009. However, the Federal Reserve Bank of the US has been artificially supporting the financial markets with the quantitative easing (QE) programme of the monthly purchases of mortgage-backed securities launched at late 2008. Still, other factors unknown to the researcher could better explain the long run performance of the 104 IPOs in the 12 months succeeding 2007/2008. The post-crisis long run performance model on the other hand found market capitalisation before offer to positively impact buy-and-hold returns one year after listings. But in contrast, it was observed that total gross proceeds impacted returns negatively. These findings slightly agree with the study of Goergen et al (2007).

6.1 Study Implications

The study provided support for mainly the firm risk hypotheses under the ex-ante uncertainty theory, but does not find sufficient proof for the certification and institutional reasons for Underpricing. It is strongly believed that findings for long run performance can be explained by other variables not specified in the pre-crisis performance model, while the post-crisis performance model lacked suitable time frame for critical evaluation and so does not provide adequate proof to not reject or reject one or more of the hypotheses stipulated.

References

Aggarwal, R. (2001). Allocation of initial public offerings and flipping activity. **Journal of Financial Economics** [online], 68, (2003): 111-135. Available from: http://faculty.msb.edu/aggarwal/jfeflipping.pdf [Accessed 11th September 2014].

Agrawal, D. (2009). IPO Underpricing: A Literature Review. **Social Science Research Network (SSRN)** [online], June 1, 2009. Available from: http://ssrn.com/abstract=1724762 or http://dx.doi.org/10.2139/ssrn.1724762 [Accessed 11th September 2014].

Allen, F. and Faulhaber, G.R. (1989). Signalling by Underpricing in the IPO Market. **Journal of Financial Economics** [online], 23, 1759—1773. Available from: http://finance.wharton.upenn.edu/~allenf/download/Vita/signalling.pdf [Accessed 10th September 2014]

Baba, R.M. and Cox, J. (2014). London Stock Exchange Boosted by IPOs: First-Quarter Revenue Up 20%. **The Wall Street Journal (WSJ): Markets** [online], Wednesday 16th July. Available from: http://online.wsj.com/articles/london-stock-exchange-boosted-by-ipos-1405501635 [Accessed 9th August 2014].

Barry, C.C. Muscarella, C. and Peavy, J. et al (1990) The Role of Venture Capital in the Creation of Public

Companies: Evidence from the Going Public Process. **Journal of Financial Economics,** 27: 447—471.

Benveniste, L.M. and Busaba, W.Y. (1997). Bookbuilding vs. Fixed Price: An Analysis of Competing Strategies for Marketing IPOs. **The Journal of Finance and Quantitative Analysis** [online], 32, (4) Dec. 1997: 383-403. Available from: http://www.jstor.org/stable/2331230 [Accessed 10th September 2014]

Benveniste, L.M. and Spindt, P.A. (1989) In Ljungqvist, A. and Wilhelm Jr., W.J. (2003). IPO Pricing in the Dot-com Bubble. **The Journal of Finance** [online], Vol. LVIII, (2) April, 2003. Available from: http://people.stern.nyu.edu/eofek/PhD/papers/LW_IPO_JF.pdf [Accessed 10th September 2014]

Bessler, W., and Seim, M. (2011). European Venture-backed IPOs: An Empirical Analysis. **EVCA & Justus-Liebug-University Giessen** [online], Available from: http://www.evca.eu/uploadedFiles/News1/News_Items/2011-03-07_PR_EVCA_VC_IPO_Europe_Study_BesslerSeim.pdf [Accessed 12th September 2014]

Bierens, H.J. (2007) **Maximum likelihood estimation of Heckman's sample selection model** [online], Available from: http://grizzly.la.psu.edu/~hbierens/EasyRegTours/HECKMAN_Tourfiles/HECKMAN.PDF [Accessed 11th September 2014]

Brooks, C. (2008) **Introductory Econometrics for Finance** (2nd edition), UK: Cambridge University Press.

Chambers, D. (2006) **Gentlemanly Capitalism Revisited: A Case Study of the Underpricing of Initial Public Offerings on the London Stock Exchange 1946-86.** Department of Economics, University of Oxford Discussion Paper Series [online], Available from: http://www.economics.ox.ac.uk/materials/working_papers/paper253.pdf [Accessed 13th August 2014].

Chambers, D. and Dimson, E. (2009). IPO Underpricing over the Very Long Run. **The Journal of Finance** [online], Vol. LXIV, No. 3, June 2009. Available from: http://www.finance2008.nccu.edu.tw/finance/mem/fnymchiang/CHENGDU/IPO%20very%20long%20run.pdf [Accessed 13th August 2014].

Chambers, D. and Dimson, E. (2011). IPOs on the London Stock Exchange since 1900. **UK: Cambridge University, Judge Business School** [online], Available at: http://www.parisschoolofeconomics.eu/IMG/pdf/29April_Chambers_IPO-overview_PSE.pdf [Accessed 18th September 2014].

Chen, C.R., and Mohan, N.J. (2003). Underwriter Spread, Underwriter Reputation and IPO Underpricing: A Simultaneous Equation Analysis. **Journal of Business Finance & Accounting** [online], Vol. 29, (3-4): 521-540, Apr/May 2002. Available from SSRN: http://onlinelibrary.wiley.com/doi/10.1111/1468-5957.00441/abstract [Accessed 12th September 2014].

Coakley, J., Hadass, L. and Wood, A. (2006). UK IPO underpricing and venture capitalist. **Social Science Research Network (SSRN)** [online], Available from: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=675101 [Accessed 12th September 2014].

Colaco, H. and Hedge, S. (2013) "Underwriter reputation, bookbuilding and IPO duration" In Levis, M. and Vismara S. (eds) **Handbook Research on IPOs.** Cheltenham, UK: Edward Elgar.

Davies, J. (2014) **Global Financial Crisis — What caused it and how the world responded.** Canstar. [online], Friday, 11th April. Available from: http://www.canstar.com.au/home-loans/global-financial-crisis/ [Accessed 14th August 2014].

Demenint, W. (2014). IPO Underpricing in Europe: The effects of Pricing Mechanisms. **Erasmus School of Economics, the Netherlands** [online], Available from: thesis.eur.nl/pub/5162/0509ma26890wm.doc [Accessed 11th September 2014].

Draho J. (2005) **The IPO Decision: Why and How Companies Go Public.** Paperback edition. UK: Edward Elgar Publishing Ltd.

Dritsakis, N.E., Kousenidis, D.V. and Negakis, C.I. (2004). Detecting 'Window Dressing' Behaviour Among Firms That Go Public in the Athens Stock Exchange. **European Research Studies,** Vol. 7, (1-2), 2004 [online], Available from: http://www.ersj.eu/repec/ers/papers/04_12_p1.pdf [Accessed 11th September 2014].

Elloit, L. (2011) Global financial crisis: five key stages 2007—2011. **The Guardian** [online], Sunday 7th August. Available from: http://www.theguardian.com/business/2011/aug/07/global-financial-crisis-key-stages [Accessed 14th August 2014]

Fauzi, F., Wellalage, N.H. and Locke, S. (2012). The Global Financial Crisis' Impact on Short-term Performance of IPO: The Case Study of New Zealand Firms' IPOs. **Asian Journal of Finance & Accounting** [online], Vol. 4, No. 2, 2012 Available from: http://www.macrothink.org/journal/index.php/ajfa/article/view/1829/2179 [Accessed 16th September 2014].

Fjesme, S.L. and Norli, O. (2010). Initial Public Offering or Initial Private Placement? **Centre for Corporate Governance Research (CCGR)** Working Paper, [online], No. 4/2011 Available from:

http://www.bi.edu/OsloFiles/ccgr/WP/CCGR_WP_04_2011.pdf [Accessed 9th September 2014].

Francis, B.B., Hasan, I. and Lothian, J.R. (2008). The Signalling Hypothesis Revisited: Evidence from Foreign IPOs. **Social Science Research Network (SSRN)** [online], 12, May, 2008. Available from: http://www.bnet.fordham.edu/lothian/pages/Papers/Signaling_Revisited_02_25_2008.pdf [Accessed 10th September 2014].

Gajewski, J. and Gresse, C. (2006). A Survey of the European IPO Market. **CEPS European Centre for Minority Issues (ECMI) Research Reports** [online], No. 2, 18 Aug. 2006. Available from: http://aei.pitt.edu/9412/ [Accessed 11th September 2014].

Goergen, M., Khurshed, A. and Mudambi, R. (2007). The long-run performance of UK IPOs: can it be predicted? **Managerial Finance** [online], Vol. 33, (6): 401-419. Available from: http://www.emeraldinsight.com/doi/abs/10.1108/03074350710748759 [Accessed 12th September 2014].

Guner, N., Onder, Z. and Rhoades, S.D. (2004). Underwriter Reputation and Short-run IPO Returns: A Re-evaluation for an Emerging Market. **Social Science Research Network (SSRN)** [online], Available from: http://dx.doi.org/10.2139/ssrn.495742 [Accessed 12th September 2014].

Gur-Gershgoren, G., Hughson, E. and Zender, J.F. (2008). A Simple-But-Powerful Test for Long-Run Event Studies. **Robert Day School of Economics and Finance Research Paper** [online], No. 2008-8. Available from: http://ssrn.com/abstract=847791 [Accessed 12th September 2014].

Habib, M.A. and Ljungqvist (2001). Underpricing and Entrepreneurial Wealth Losses in IPOs: Theory and Evidence. **The Review of Financial Studies** [online], (2001) 14 (2): 433—458. Available from: http://rfs.oxfordjournals.org/content/14/2/433.full.pdf+html [Accessed 10th September 2014].

Hamao, Y., Packer, F. and Ritter, J.R. (2000). Institutional Affiliation and the Role of Venture Capital: Evidence from Initial Public Offerings in Japan. **Pacific-Basin Financial Journal** [online], 8, 529—558. Available from: http://www2.hawaii.edu/~fima/Forthcoming/990906.pdf [Accessed 10th September 2014].

Ibbotson, R.G. (1975) Price performance of common stock new issues. **Journal of Financial Economics** 2: 235-272.

Jenkinson T. and Ljungqvist, A.P. (2001). **Going Public: The Theory and Evidence on How Companies Raise Equity Finance** 2nd revised edition. UK: Oxford University Press.

Jenkinson, T.J. (1990) Initial Public Offerings in the United Kingdom, the United States, and Japan. **Journal of the Japanese and International Economics** 4, 428—449.

Kalla, S. (2009). **Statistical Outliers.** Explorable.com [online], Available from: https://explorable.com/statistical-outliers [Accessed 18th September 2014].

Kanatas, G. and Stefanadis C. (2005). Venture Capital, IPO Underpricing and Going-Public Decisions. **Social Science Research Network (SSRN)** [online], 03, 2006. Available from: http://finance.eller.arizona.edu/documents/seminars/2005-6/CStefanadis.ipo3.10-05.pdf [Accessed 10th September 2014]

King, E. and Banderet, L. (2014). IPO Stock Performance and the Financial Crisis. **Social Science Research Network (SSRN)** [online], Available from: http://ssrn.com/abstract=2456220 [Accessed 16th September 2014].

Leite, T. (2007). Adverse selection, public information and underpricing in IPOs. **Journal of Corporate Finance** [online], 13 (2007) 813—828. Available from: http://www.sml.hw.ac.uk/ms75/GP%20Papers/G162.pdf [Accessed 10th September 2014].

Levis, M. (1990) The Winner's Curse Problem, Interest Costs, and the Underpricing of Initial Public Offerings. **Economic Journal,** 100, 76—89.

Li, Y., Wang, J. and Liu, J. (2011). Factors on IPO under-pricing based on Behavioural Finance Theory: Evidence from China. **Artificial Intelligence, Management Science and Electronic Commerce (AIMSEC)** [online], 8-10/08/11. Available from: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6009796 [Accessed 11th September 2014].

Lin, C. and Chuang, C. (2011). Principal-Principal Conflicts and IPO Pricing in an Emerging Economy. **Corporate Governance: An International Review** Vol. 19, (6): 585-600, Nov. 2011 [online], Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1467-8683.2011.00870.x/pdf [Accessed 10th September 2014].

Ljungqvist, A.P. (2007) "IPO underpricing" In: Eckbo, B.E. (ed.). **Handbook of Corporate Finance,** North-Holland.

Logue, D. (1973) On the pricing of unseasoned equity issues. **Journal of Financial and Quantitative Analysis** 8: 91-103.

London Stock Exchange (LSE) Plc and White Page Ltd. (2010). **A Guide to Listing on the London Stock Exchange,** White Page Ltd. [online], Available from: http://www.londonstockexchange.com/companies-and-advisors/main-market/main-market/home.htm [Accessed 9th August 2014].

London Stock Exchange (LSE) Plc and White Page Ltd. (2010). **A Guide to AIM,** White Page Ltd. [online],

Available from: http://www.londonstockexchange.com/companies-and-advisors/main-market/main-market/home.htm [Accessed 9th August 2014].

Loughran, T. and Ritter, J. (2004). Why Has IPO Changed over Time? **Financial Management** [online], Vol. 33, 5-37. Available from: http://www3.nd.edu/~tloughra/whynew.pdf [Accessed 14th September 2014].

Megginson, W.L. and Weiss, K.A. (1991). Venture Capitalist Certification in Initial Public Offerings. **The Journal of Finance** [online], Vol. 43, (3) July 1991. Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1540-6261.1991.tb03770.x/pdf [Accessed 15th August 2014].

Mekjian, J. (2012). **Auctions as an Alternative to Book Building in the IPO Process: An Examination of Underpricing for Large Firms in France.** PhD Thesis, Duke University, Durham, North Carolina [online], Available from: http://econ.duke.edu/uploads/media_items/john-mekjian-final-draft-thesis.original.pdf [Accessed 12th September 2014].

Michaely, R. and Shaw, W.H. (1994). The Pricing of Initial Public Offerings: Tests of Adverse Selection and Signaling Theories. **Review of Financial Studies** [online], 7: 279-319, Available from: http://forum.johnson.cornell.edu/faculty/michaely/The%20Pricing%20of%20Initial%20Public%20Offerings.pdf [Accessed 10th September 2014].

Migliorati, K. and Vismara, S. (2014). Ranking Underwriters of European IPOs. **European Financial Management** [online], doi: 10.1111/eufm. 12049: 1—35. Available from: http://onlinelibrary.wiley.com/doi/10.1111/eufm.12049/pdf [Accessed 15th August 2014].

Nocera, J. (2011). Was LinkedIn Scammed? **The New York Times: The Opinion Pages** [online], Friday, 20th May. Available from: http://www.nytimes.com/2011/05/21/opinion/21nocera.html [Accessed 3rd August 2014].

Pande, A. and Vaidyanathan, R. (2009) Determinants of IPO Underpricing in the National Stock Exchange in India. **The ICFAI Journal of Applied Finance** Vol. 15 (1) 2009: 14-30.

Prabhala, N.R. and Puri, M. (1998). How does Underwriter Price Support Affect IPOs? Empirical Evidence [online], **Social Science Research Network (SSRN)** Available from: http://depot.som.yale.edu/icf/papers/fileuploads/2468/original/98-93.pdf [Accessed 11th September 2014].

PricewaterhouseCoopers. (2010) **Roadmap for an IPO: A guide to going public.** [online], Available from: http://www.pwc.com/us/en/transaction-services/assets/roadmap-for-an-ipo-a-guide-to-going-public.pdf [Accessed 9th September 2014].

Rahman, H. and Yung, K.. (1999). Insurance IPOs—A Test of the Underpricing Theories. **Journal of Insurance Issues** Vol. 22, (1) (Spring 1999): 61-77 [online], Available from: http://www.insuranceissues.org/PDFs/221RY.pdf [Accessed 11th September 2014].

Ritter, J.R. (2003). Differences between European and American IPO Markets. **European Financial Management** [online], Vol. 9 (4), (Dec. 2003): 421-434 Available from: http://bear.warrington.ufl.edu/ritter/publ_papers/Differences%20between%20European%20and%20American%20IPO%20Markets.pdf [Accessed 11th September 2014].

Ritter, J.R. and Welch, I. (2002). A Review of IPO Activity, Pricing and Allocations. **The Journal of Finance** [online], Vol. Lvii (4), Aug. 2002. Available from: http://bear.warrington.ufl.edu/ritter/publ_papers/ritterwelch.pdf [Accessed 9th August 2014].

Ritter, R.J. (2014). Initial Public Offerings: Updated Statistics. **Cordell Professor of Finance, University of Florida** [online], April 10, 2014. Available from: http://bear.warrington.ufl.edu/ritter/IPOs2013Statistics.pdf [Accessed 3rd August 2014].

Schuster, J.A. (2003). **The Cross-Section of European IPO Returns.** Discussion Paper, London School of Economics and Political Science, UK: London. [online], Available from: http://eprints.lse.ac.uk/24859/1/dp460.pdf [Accessed 11th September 2014].

Shelly and Singh, B. (2008). Oversubscription and IPO Underpricing: Evidence from India. **The ICFAI Journal of Applied Finance,** Vol. 14, (12), 2008:12-73.

Shengfeng, X. (2010). "IPO Pricing Methods of International Investment Banks and its Apocalypse to China." Thesis presented In **The Proceedings of the 7th International Conference on Innovation and Management** [online], Available from: http://www.pucsp.br/icim/ingles/downloads/papers_2010/part_5/63_IPO%20Pricing%20Methods%20of%20International%20Investment%20Bank%20and%20Its.pdf [Accessed 10th September 2014].

Solomon, S.D. (2011). Why I.P.O.'s Get Underpriced. **The New York Times: Dealbook** [online] Friday 27th May. Available from: http://dealbook.nytimes.com/2011/05/27/why-i-p-o-s-get-underpriced/?_php=true&_type=blogs&_r=0 [Accessed 3rd August 2014].

Sorkin, A.R. (2011). **The New York Times: Dealbook. Why LinkedIn's Price May Have Been Right** [online], Monday, 20th May. Available from: http://dealbook.nytimes.com/2011/05/23/why-linkedins-price-was-appropriate/ [Accessed 3rd August 2014].

Spindler, J.C. (2009). **IPO Underpricing, Disclosure and Litigation Risk.** Working Paper, University of

Southern California Law and Economics Working Paper Series. 94 [online], Available from: http://law.bepress.com/cgi/viewcontent.cgi?article=1105&context=usclwps-lewps [Accessed 11th September 2014].

The Financial Crisis Inquiry Commission (FCIC) (2011). **The Financial Crisis Inquiry Report** [online], Available from: http://www.gpo.gov/fdsys/pkg/GPO-FCIC/pdf/GPO-FCIC.pdf [Accessed 14th August 2014].

Thomson Reuters (2014) Equity, Advanced Equity Search: UK Initial Public Offerings (IPOs) for 10 years (2003—2013) **Thomson ONE Banker** [online]. Available from: http://banker.thomsonib.com.ezproxye.bham.ac.uk/ta/?ExpressCode=Birmingham [Accessed 19th August 2014].

Unlu, E., Ferris, S.P. and Noronha, G. (2004). IPO underpricing over time: Evidence from the UK. **Applied Economics Letters** [online], Available from: http://www.tandfonline.com/doi/full/10.1080/13504850420001874 26#tabModule [Accessed 13th August 2014].

Walker, T.J. Turtle, H.J. and Pukthuanthong, K. et al (2010). Legal Opportunism, Litigation Risk, and IPO Underpricing. **Social Science Research Network (SSRN)** [online], Available from: http://www-rohan.sdsu.edu/~kpukthua/publications/JLE-6367.pdf [Accessed 11th September 2014].

Walker, T.J. Turtle, H.J. and Pukthuanthong, K. et al (2014). Legal Opportunism, Litigation Risk, and IPO Underpricing. **Journal of Business Research** [online], (2014) 08, 125 Available from: http://dx.doi.org/10.1016/j.jbusres.2014.06.025 [Accessed 11th September 2014].

Welch, I. (1989). Seasoned Offerings, Imitation Costs, and the Underpricing of Initial Public Offerings. **Journal of Finance** [online], 44: 429—449. Available from: http://www.ivo-welch.info/research/journalcopy/1989-jf.pdf [Accessed 10th September 2014].

Welch, I. (1992). Sequential Sales, Learning and Cascades. **The Journal of Finance** [online], Vol. 47 (2) (Jun., 1992), 695-732 Available from: http://www.jstor.org/stable/2329120 [Accessed 11th September 2014].

Welch, I. and Ritter, J. (2002). A review of IPO Activity, Pricing, and Allocations. **National Bureau of Economic Research (NBER) Working Paper Series (8805)** [online], Available from: http://www.nber.org/papers/w8805 [Accessed 13th August 2014].

Yahya, N.C., Abdul-Rahim, R. and Yong, O. (2013). Influence of Lockup Provision on Flipping Activity of Malaysian IPOs. **Economics and Financial Review** [online], Vol. 3, (4): 11-24, June 2013. Available from: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2407487 [Accessed 11th September 2014].

Zhang, D. (2011). "Behavioural Finance, Lecture 13: IPO Underpricing." **Research Institute of Economics and Management** [online], Available from: https://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CCgQFjAA&url=http%3A%2F%2Friem.swufe.edu.cn%2Friem%2Ffiledown.asp%3Fpath%3D%2Fuploadfile%2F201108%2F30%2F851211003.pdf&ei=5zEbVLy4HIWOONrhgbAJ&usg=AFQjCNEuu857jWSOVmQbOMOoACxcY3JxDw&sig2=-plmqH1qAvi7xVC5syIEKQ [Accessed 18th September 2014].

Zhu, W. (2013). **An Empirical Investigation of IPO Underpricing: New Evidence from Chinese IPO Market.** MSc Dissertation, University of Birmingham, UK.