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Master essay

Macroeconomic forces behind underpricing

-

an empirical approach to investigate the influences of macroeconomic variables to IPO underpricing

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Abstract

The thesis empirically investigates the question whether there is an influence of macroeconomic forces to initial public offering (IPO) underpricing. In addition it tries to find whether unconventional monetary policy has also an impact on underpricing. Thus the thesis tries to find a relationship between macroeconomic variables and the level of IPO underpricing. The variables used as proxies for economic conditions are: interest rate level, GDP growth, consumer confidence index variation and the oil price level. The research is based on IPO data from 20 countries for a sample period of 20 years (1997 – 2017). The so generated data amounts to 7 609 IPO observations. The thesis uses a cross-sectional approach with market adjusted first day returns in several model adjustments. The findings are that macroeconomic variables can explain the level of IPO underpricing. Furthermore, the thesis found that there is a negative relationship between interest rate level and IPO underpricing which proves that unconventional monetary policy affects the level of underpricing.

Keywords: initial public offering, underpricing, macroeconomic variables, cross-section approach, unconventional monetary policy, IPO underpricing, Financial crisis

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List of Abbreviations

BCI	Business Confidence Index
CFO	Chief Financial Officer
CCI	Consumer Confidence Index
CPI	Consumer Price Index
GDP	Gross Domestic Product
IMF	International Monetary Fund
IPO	initial public offering
JB	Jarque Bera
MAIR	Market Adjusted Initial Return
M&A	Mergers and Acquisitions
MSCI	Morgan Stanley Capital International
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
SEO	Secondary equity offering
S&P	Standard & Poor's
UAE	United Arab Emirates
UK	United Kingdom
US	United States
VC	Venture Capitalist

1.0 Introduction

2017 marked another year of very high initial public offerings (IPOs) activity and new IPO value records. In 2017 1700 companies went public, according to financial times, 44 % more than in 2016. It is the highest number since the pre-crisis year 2007 (Bullock et al., 2017).

A topic of interest for research in the context of Initial Public offerings is the so called "underpricing" of IPOs. An IPO is seen as underpriced if the first day return is higher than the return of the market portfolio. First day returns of stocks at the date of first public notice can vary considerably. For example, in 2017 the average first day return for United States stocks were ranging from +39,7 % for Industrials to -38,0 % for Consumer Staples (Statista, 2017)). Thus the first day return of a newly issued stock measures the correctness of the pricing process.

This phenomenon has been widely studied by the literature. During the 80s, the IPO research followed the general trend of corporate finance research and focused on information and agency issues of the IPO underpricing process. Therefore, the research generally focuses on contractual issues of underpricing. "Money left on the table", as underpricing is sometimes called, is considered necessary to attract uninformed investors (Rock (1982), Ritter et al. (1986)), or to signal the quality of the issuing firm (Allen et al. (1989)). Others, like Loughran and Ritter (2002) highlight the fact that agency problem can be a determinant of underpricing.

On the contrary, it does not exist an extensive literature that tries to determine a relation between IPO underpricing and macroeconomic variables like GDP growth and interest rates. As mentioned before, economic surroundings have been seen of less importance in the in the IPO literature as information economics and contract theory emerged. The interesting question of research for this thesis is to ask whether macroeconomic variables are an important determinant for the pricing process and whether these variables have or don't have any influence into the degree of underpricing phenomenon. The work is mainly based on the new findings of Hopp and Dreher (2007), Güntürkün et al. (2012) and Bordo and Landon-Lane (2013). All researchers found that the degree of underpricing is influenced by interest levels and the degree of economic confidence as well as the state of the economic, measured by GDP growth.

In contrast to previous works this thesis enlarges the sample size to a wider range of countries in order to better capture the effects of macroeconomic variables. Thus, more than 7000 observations from 20 countries over a period of 20 years from 1997 to 2017 have been analyzed. The thesis demonstrates that underpricing is significantly positive determined by GDP growth rate and interest rates over the whole period. Moreover, analyzing only the sub-sample after the 2007 crisis, the analysis shows a negative and significant relation between interest rate and underpricing. This can be explained by the fact that unconventional monetary policies lead to a bubble effect on the financial markets and as a consequence, an increase in underpricing (Bordo and Landon-Lane (2013)). No previous research has tried to analyze the effect of unconventional monetary policy on underpricing and the already cited work of Bordo and Landon-Lane (2013) found this effect as a possible consequence of unconventional monetary policy on asset price.

The remaining part of this paper is organized as follow. Chapter 2 analyses the motives for going public and it presents an extensive literature review of the determinants of underpricing. In chapter 3 is presented the methodology followed in the empirical research and the hypothesis on the independent variables are presented. In Chapter 4, the results of the main model and of different specifications are presented and the results are discussed. In Chapter 5 we recapitulate, the main finding, the limits of the models presented and we formulate recommendations for future research.

1.1 Motives for going public

Going public is a milestone in growth of young companies. This choice changes dramatically the structure and decision horizons of the newly listed firms. There are many reasons why companies decide to become public: according to Rydqvist and Högholm (1995), Ritter and Welch (2002), Ljungqvist (2002), the main reason for going public is the necessity to raise new capital. In support of this theory, Pagano and Zingales (1998) found that new listed firms have higher than average growing investment opportunities that require new capital. The same authors found that the size of the company is a main determinant in the decision to go public. Analysing a large sample of Italian private firms, they proved that the higher the size of the firm, the higher the probability of going public. Moreover, they found that firms go public to reduce financial leverage, after a period of abnormal growth and investment. Also, Bancel and

Mittoo (2009) highlighted the importance of improving financial leverage as a driver in the decision of going public.

In the same study, Bancel and Mittoo interviewed CFOs of European companies that went public between 1994 and 2004. They found that another reason for to going public is to acquire reputation and credibility.

Ritter and Welch (2002) found that companies go public to facilitate their M&A activity and as an exit strategy for founders or financiers. These results were confirmed by Brau and Fawcett (2006). However, the latter work is based on a sample of firms that went public during the "dotcom" bubble and for this reason it is difficult to extend the results to other time periods.

In addition to that, Ritter and Welch (2002) and Ritter (2016) found that IPOs are related with momentum on the stock market and business cycle: there are waves of IPOs when market returns are above the average and the economy is growing. The study of Brau and Fawcett (2006) mentioned above contradicts this result and it didn't find a link between IPOs and momentum on the stock market. However, as written above, this study is not reliable given the sample used.

Finally, in the literature there is mixed evidence on the use of IPOs to diversify the portfolio of original shareholders: Pagano and Zingales (1998) found no significance correlation between IPOs and degree of diversification of new-listed firms original shareholders. On the contrary, Chemmanur and Fulghieri (1999) and Bodnaruk, Kandel et at. (2008) found that IPOs are used by shareholders to diversify their portfolio.

1.2 Underpricing in IPO

Underpricing is probably the most known and the most studied stylized evidence on IPO. The literature defines underpricing as the positive difference between the offer price and initial stock price of the newly listed company. The main consequence of underpricing is that original investors face a cost when their firm goes public, often called as "money left on the table".

It exists a vast literature on both the size and the causes of underpricing: in the first study on underpricing, Reilly and Hatfield (1969) found a first day return of 9,9% on the US Market. Moreover, 50% of the stocks in their sample have an average first-day return of 18,3%. McDonald and Fisher (1972) examined IPOs in the first quarter of 1969 on the New York Stock Exchange and found an average underpricing of around 30%. Ibbotson et al. (1975)

found that there was an average underpricing of 11,4% on the US Market. In addition, they discovered a correlation between underpricing and "hot" markets.

Ritter (1984) found a correlation between underpricing and momentum on the stock market. Later studies of Loughran and Ritter (2004) and Ljungqvist (2007) confirmed this initial finding. In particular, in the extensive of Ljungqvist (2007), it has been found that underpricing fluctuates from 21% in the '60s, to 12% in the '70s. Then, it increased to 16% in the '80s, to 21% in the '90s and it skyrocketed to over 40% during the tech bubble in the early 2000.

The literature analysed so far is based only on the US Market. Economists started to investigate other markets only during the 1990s. A study of Loughran, Ritter and Rydqvist (1994) was a pioneer work in the analysis of underpricing with non-US data. It found that underpricing is a worldwide phenomenon that varies dramatically across countries which was attributed to different levels of regulation. Gajewski and Gresse (2006) obtained similar results. Their results are also consistent with the previous finding on the US Market that underpricing increases during periods of "hot" markets. Giudici and Roosenboom (2004) examined IPOs in Europe. They found that underpricing is greater on new markets (34,5%) than on the main markets (13,1%).

1.3 Theoretical explanations of underpricing

The explanations on underpricing can be grouped in four main categories: asymmetric information, institutional reasons, control considerations, and behavioural approaches. In the following sections the main literature on IPO underpricing will be reviewed.

1.3.1 Asymmetric information

Asymmetric information is considered the main determinant of underpricing. The literature distinguishes two types of asymmetric information: the first is between the underwriter and the issuer and the second is between the underwriter and different classes of investors (Baron and Holmström (1980), Rock (1986), Welch (1996)).

Baron and Holmström (1980) argue that underwriters exploit their information advantage to induce underpricing and to reduce their distribution cost. This is a classical principal-agent problem originated by different objectives of the issuers (maximizing the issuing value) and underwriters (maximizing their private profit). The empirical work of Muscarella and Vetsuypens (1989) tested the validity of the agency argument, using a sample of US firms listed

in the period 1970-1989. Their results did not find evidence of agency problem in IPOs. However, the limited sample size of 38 firms could have invalidated the validity of the results.

Other studies of Beatty and Ritter (1986) and Benveniste and Spindt (1989) found a significant relation between the asymmetry of information and IPO underpricing.

Probably, the most known theoretical model on underpricing is the so-called "Winner's Curse Hypothesis", first formulated by Rock (1986): the model assumes the existence two classes of investors, informed and uninformed, and that even if on average IPOs are underpriced, not all IPOs are underpriced. Informed investors are able to distinguish between underpriced and overpriced IPOs, while uninformed investors can't distinguish between IPOs. Since all investors bet on underpriced IPOs there will be excess demand, so underpriced offer is rationed. On the contrary, only uninformed investors bets on overpriced IPOs and in this case they get all their demand. As a consequence, uninformed investors face "winner's curse" since they get rationed allocation of underpriced IPOs and full allocation of overpriced IPOs. Therefore, underpricing is necessary to keep uninformed investors into the IPO market. The study of Thaler (1988) on auction IPOs supports the "winner's curse" theory, arguing that investors who bet on all new stocks have an average negative first-day return. Koh and Walter (1989) found that the "winner's curse" theory holds in South-East Asian Markets. Successive studies of Lee et al. (1996) and of Chowdhry et al. (1996) found strong evidence of the winner's curse in both developed and undeveloped markets.

In the same work discussed above, Rock (1986) sustained that underpricing is also a way to compensate informed investors for the information revealed to issuers and underwriters during the bookbuilding process. Potential informed investors sustain a cost when they try to find the true value of firms and they have an incentive to withhold information with a positive impact on price, in order to maximize their return. Moreover, this cost increases with the risk of the company analyzed. Therefore, underwriters design an allocation system that encourage informed investors to truthfully reveal information on IPOs, by giving large allocations to investors with stronger demand. Jegadeesh et al. (1993) found that the dimension and the frequency of SEOs is associated with underpricing. A vast literature supports the "information-revelation" theory: Beatty and Welch, (1996), Tomczyk (1996), Rahman and Yung (1999), Habib and Ljungqvist (1998), Nanda and Yun (1997), Dunbar (2000), Benveniste et al. (2003). Interesting a more recent study on Facebook IPO conducted by Krigman and Jeus (2016), linked the low underpricing of Facebook IPO to a successive dried up of the US IPO

market and to an increase of average underpricing to 20% compared to a pre-Facebook IPO of 11,9 %. The increase in underpricing was only determined by the increase in underpricing of new IPOs backed by the same underwriters of Facebook IPO. The authors explain the increase of underpricing as a way to compensate "betrayed" Facebook investors by underwriters.

Another line of research on information asymmetry explains underpricing as a consequence of the fact that issuers are more informed than investors. For these researchers IPO underpricing is used to signal the good quality of a firm. Therefore, good quality firms underprice their IPOs to attract uninformed investors and then, in successive periods, when the asymmetry of information is solved, they will raise new capital at the fair price. On the contrary, bad quality firms can't replicate this signal, since they won't regain money with successive SEOs. The first theoretical model on the signal theory is the pioneer work of Ibborston (1975). Successive works of Allen and Faulhaber (1989), Grinblatt and Hwang (1989) and Welch (1989), highlighted the impossibility of bad firms to replicate the signal and the fact that the signal theory produces an equilibrium solution.

At an empirical level, the signal theory should be linked to uncertainty of a firm. The higher the risk of the core activity of a firm and the higher the underpricing. Leland & Pyle (1977) found that original shareholders can signal the quality of their firm by keeping a large fraction of shares. Booth and Smith (1986), Carter and Manaster (1990), Michaely and Shaw (1994) highlighted the importance of the prestige of underwriters in signaling the quality of a firm, Titman and Trueman (1986) of auditors and Megginson and Weiss (1991) and Lee and Wahal (2004) of venture capitalists.

1.3.2 Ipo Process

Michaely and Shaw (1994) showed that more successful subscriptions attract the majority of the investment pool. In order to attract the majority of investors, IPOs must be underpriced. Secondly, from an institutional point of view it is crucial in wich way the IPO auction is organized: simple auction or bookbuilding. Jagannathan and Sherman (2007) found that bookbuilding is a better mechanism to discover the true price of a new stock. In particular, they found that stocks issued with a pure auction are more volatile in the aftermarket. Moreover, in a pure auction mechanism the uncertainty on the number of participants and on the number of bids increase the risk. Therefore, they concluded that underpricing is higher when IPOs are

made with a pure auction system. Faugeron-Crouzet (2002) showed that the main advantage of book-building is that price can be modified as the process going on. Ljungqvist (2007) found that even if bookbuilding fees are higher than pure auction fees, the saving from less underpricing are greater than the increase of fees. However, Kaneko and Pettway (2003) discovered that the bookbuilding method increases underpricing in Japan, compared to a pure auction system and Derrien and Womack (2003) found that the pure auction mechanism used in France produces a lower IPO underpricing than bookbuilding in other developed countries.

1.3.3 The role of underwriters

It exists a significant literature on the impact of underwriters in IPOs. The works of Carter and Manaster (1990), Carter et al. (1998), Dunbar (2000); Beatty and Welch (1996); Carter and Dark (1993) showed that prestigious underwriters signal the good quality of an IPO and therefore, they reduce underpricing. However, a more recent work of Loughran and Ritter (2002) on the US Market, questioned this finding. They discovered that in the past, before 1990, prestigious underwriters reduced underpricing; on the contrary, after the '90s the role of prestigious underwriters changed and they became associated with higher underpricing. The authors attributed this finding to the higher market share of prestigious underwrites that can be exploited against the interest of issuers and on the fact that probably new IPOs are more risky than in the past. Aggarwal et al. (2002) found that underwriters mispriced IPOs to gain as market dealer in the after-market.

1.3.4 Control considerations

Khanna and Rivkin (2000) and Khanna and Palepu (2000) discovered that in developing countries, IPOs of firms that are a part of business groups have a lower underpricing than IPOs of stand-alone companies. They found also a link between underpricing and market imperfections and they concluded that being member of a group reduces the cost of market imperfections in underpricing. A study of chaebol (Korean business group) of Kim and Sung (2005) found that underpricing is higher in the latter than in stand-alone firms because majority owners can expropriate private benefits from the group. However, in his analysis of Japanese business group Beckman (2001) showed that undeprincing is lower than in stand-alone firms because they have more stable earnings. The studies of Ghosh (2005) and of Marisetty and Subrahmanyam (2010) found also that business groups firms have higher underpricing than

stand-alone firms. Khanna and Palepu (2000), Gomes and Livdan (2004) and Boulton (2013) found that more diversified firms face lower underpricing.

Also the stake hold by promoters plays an important role in IPOs: Pagano and Roell (1998) highlight the certification function of the stake detained by promoters. Hence, when promoters have an important stake in an IPO, underpricing tends to reduce. Brav and Gompers (1991) found that also the lockup period has a certification function and it reduces underpricing. Lockup period is a commitment device and its length signal the good quality of the firm. Stoughton and Zechner (1992) argue that underpricing is necessary to attract stockholder that would take part in monitoring activities. Aggarwal (2002) and the already mentioned work of Loughran and Ritter (2002) found that underpricing increases with the stake controlled by managers: they explain the finding arguing that the positive first-day return increases the demand curve and manager will have a higher return, once they sell the stock after the expiration of the lock-up period. Finally, the study of Megginson and Weiss (1991) found that Venture Capitalists (VCs) performs a certification role, while Lee and Wahal (2004) found the opposite and in their work VCs increase underpricing: the rational is that underpricing increases the demand curve and it facilitates their exit strategy.

1.3.5 Market Timing Theory

This theory affirms that firms prefer to do IPOs in "hot" market periods than in "cold" market periods. According to this theory "hot" market periods happen when returns are above long-term historical average. Investors in "hot" market are irrationally over-optimistic and for this reason also IPOs are irrationally overpriced. Therefore, according to this theory, issuers are more willing to accept "higher" underpricing in "hot" market periods, because the underpricing is more than compensated by the over-optimistic valuation of investors. There is a general agreement among authors about the consistency of this theory: Ritter (1984), Lucas and McDonald (1990), Ritter and Rydqvist (1994), Welch and Ritter (2002), Ljungqvist and Wilhelm (2002) and Loughran and Ritter (2004), had all found a positive connection between "hot" market and underpricing.

1.3.6 Behavioral theories

The behavioral economies also tries to explain IPO underpricing. Ljungqvist et al (2004) and Champbell et al. (2008) assumes that investors in IPO are over-optimistic: this sentiment is the main driver of underpricing and it can explain why usually underpriced firms underper-

formed in the long-run. Cook, et al (2006), Cormelli et al (2006) and Dorn (2009) found that investors are influenced by the degree of advertisement in the book-building period and that investors are sticked in their initial valuation of an IPO. Moreover, Welch (1992) argues that investors are conditioned by previous choices of other investors (cascade theory) and they won't take into consideration their own believe and they will imitate other investors. To sum up, according to behavioural theories underpricing can be explained, by initial over-optimistic belief of a group of investors, that trigger other investors to invest in the IPO disregarding their own evaluation.

1.3.7 Cyclicality of public offerings

Initial public offerings (IPOs) happen in waves and theoretical literature has found extensive evidence (Ibbotson and Jaffe (1975)) of that phenomenon. Helwege and Liang (2004) found that IPOs that are conducted during periods of high listing activity are more underpriced than IPOs conducted in markets with less listing activity. Periods of high IPO activity are often called "hot issue markets" (Ritter 1984). the literature explaining this behaviour have recently emerged and it has focused on the determinants of going public. For McKinzey (2007), during hot issue markets the general appetite of investors is higher. The author also investigated how business cycle relates to investment opportunities and he argues that under better economic conditions there are more investments which leads to a higher number of IPOs. Benninga, Helmantel and Sarig (2003) and Lerner, Shane and Tsai (2003) suggest that listing activity is also affected by alternative investment opportunities such as bonds. According to the same work of McKinzy (2007) the lower the expected returns of alternative investments the higher is the demand for dividend paying equity and thus the higher is be the price that investors are willing to pay. Therefore the author concludes that in markets missing alternative investments the attraction of IPOs as investments (as in hot issue markets) increase and underpricing becomes higher.

1.4 Summary

Many theories try to explain underwriters. However, at the empirical level researchers found often contrasting results. It can be affirmed that asymmetric information play a main role in underpricing, but it's unclear both which type of asymmetry of information is more important and sometime also the sign of the effect on underpricing. In any case, it seems that it usually increases underpricing. Furthermore, the role of the institutional setting is debated and there is

no agreement in the literature. Also the control setting plays a role in underpricing. On the contrary, there is a general agreement on the positive effect on market timing on IPOs.

In this review of the literature on IPO underpricing, it is evident that there is a lack of research on the effect of macroeconomic situation on underpricing. Most of the existing theory focuses on agency problems. Only market timing theory indirectly takes into consideration the business cycle effects on underpricing. Thus, the thesis formulates the following research questions:

1. **how does the macroeconomic surroundings affect the level of underpricing for a firm?**
2. **What is the effect of unconventional monetary policy after the 2007 crisis on underpricing?**

In the next chapters possible explanatory variables are introduced and their effects on underpricing will be discussed.

2.0 Factors influencing IPO underpricing

In this section the main factors that influence underpricing in Initial Public offerings will be discussed. The basis for this discussion is the previous discussed literature. Afterwards the results will be taken to formulate hypotheses for the empirical tests.

2.1 Asset size

Asset size measures the value of asset reported in the balance sheet, the year in which the IPO is performed. Ritter (1984) and Beatty and Ritter (1986) found that asset size be used as a proxy of the size of the firm. Smaller firms tend to be riskier than larger firms, and as a consequence underpricing should be higher. Miller et al. (1987), Loughran and Ritter(2002) and Cassia et al. (2004) among others found similar results. Therefore, the literature generally agrees that asset size influences underpricing, it is a proxy of firm risk and it is positive correlated with underpricing in IPOs.

2.2 Revenue

Revenue is the value of revenue reported in the Income statement in the year in which the firm is listed for the first time. As for asset size it should be a proxy of firm risk and the literature agrees that it should be negative related with underpricing.

2.3 Net Income

Net Income is the value of revenue reported in the Income statement in the year of the IPO. The effect of Net is more debated in the literature. Net income could be used as a proxy for market risk and for this reason it should measure intrinsic risk of a firm However, according to the works of Allen and Faulhaber (1989), Grinblatt and Hwang (1989), Welch (1989) and Denis and Mihov (2003) net income should be used as signal of credit worthiness of a firm. According to the signal theory, underpricing is greater in good quality companies and for what we have written in the previous section net income is positively related with underpricing.

2.4 Age

From an intuitive point of view younger firms should be riskier than older firms. Ritter (1984) explains the higher risk of young firms as a problem of asymmetric information. The degree of asymmetry of information between younger firms and investors is logically greater than the degree of asymmetry of information between older companies and investors. In successive studies, Beatty and Ritter (1986) and Ljungqvist and Wilhelm (2003) found similar results on firm age.

2.5 Certified Advisors Reputation

For the purpose of this paper, Certified Advisors are all financial institutions that participate in an IPO as bookrunner or underwriters. The effect of Certified Advisors reputation is debated in the literature. Carter and Manaster (1990) saw underwriter reputation as a certification of the good quality of a firm. Good quality firms are able to pay more costly reputable certified advisors to rate the quality of their IPOs.

In accordance with this early finding, Michaely and Shaw (1994) and Megginson and Weiss (1991) confirmed that underpricing is negatively related with underpricing. they proxied the

underwriter reputation using the market share of underwriters. Carter et al. (1998) found a significant negative relation using a prestige underwriter ranking.

However more recent work like Ljunqgvist (1999) found a positive relation between underpricing and market reputation. The already mentioned study of Loughran and Ritter (2002) point out that this relationship changed in the '90s probably consequently to the increase of market power of more reputable underwriters. Ljungqvist and Wilhelm (2003) found that risky firm tend to benefit more from having prestigious underwriters. Therefore, it is expected that prestigious underwriters exploit this situation increasing underpricing

2.6 Offer size

Offer size measures the money raised during the IPO. Generally it is negative associated with underpricing. The study of Beatty and Ritter (1986) demonstrates that the offer size is a proxy of uncertainty and that small offers are a signal of risk. The studies of Miller & Reilly (1987) and of Ljungqvist (1997) confirmed that initial finding.

2.7 Industry

The industry in which a firm operates is usually used as a factor that measures ex-ante risk of a company. The pioneer work of Ritter (1991) found an enormous first day return in the financial and in the pharmaceutical industries (over 120 % on average), while a modest underpricing in the retail and the mining industries (below 3 %on average).

More recent studies highlights the high first day return in the technological section. We could mention among others the contributions of Guidici and Paleari (2000), Loughran and Ritter (2004), Daily, Certo and Dalton (2005). All these studies found that first day return in the technological sector is on average above 50%. They explained the finding with the higher asymmetry of information that characterizes the sector, but also with an over-optimistic bias of investor toward tech firms.

2.8 Price revision

Price revision is defined as the absolute value of the difference between the IPO price and the median price during the bookbuilding. According to Benveniste and Spindt (1989) price revision is correlated with a problem of asymmetry of information: the higher the price revision, the higher the private information communicate by investors to the underwriters. In order to

compensate these private information, underwriters only partially incorporate them in the price and as a consequence underpricing increases.

Giudici and Roosenboom (2008) found a positive correlation between price revision and underpricing. In addition, they highlight that prices are stickier in Europe than in the US. They attribute mainly the difference to the fact the European underwriters have more market power than the US counterpart: therefore, they use the private information acquired during the book-building to compensate more investors through a greater underpricing.

2.9 Macroeconomic variables

To the best of our knowledge, it exists a small literature that tried to analyse the effect of macroeconomic variables on underpricing. Chowdhry and Sherman (1996) found that on the US and the UK markets underpricing increases in period of high interest rates. The authors argue that it is caused by the fact that with high interest rates issuers gain more from subscription funds and as consequence underpricing is higher. Similar results were found by Johnston andMadura (2003) and Fung and Che (2009), which confirmed a positive relation between underpricing and interest rates. The study of Breinlinger and Glogova (2002), which uses a panel of data from 25 countries, discovered no significant relation between GDP growth and interest rate with underpricing. Also Hopp and Dreher (2007) found no significance relation between underpricing and a series of macroeconomic variables. the study of Güntürkün et al. (2012) tried to analyze the effect of macroeconomic variables on underpricing in IPOs. The study found no or weak significant correlation between different macroeconomic variables and underpricing. However, this study was limited to a short period of 5 years and only on the Turkish market. Finally the work of Tran and Jeon (2011), which include US IPOs from 1970 to 2005 found a long-term equilibrium between macroeconomic variables, as GDP growth, confidence level and interest rate and underpricing.

On the contrary, more researchers have conducted more studies on the effect of macroeconomic variables on stock price. We would try to use partly those result to assess the impact on underpricing.

Therefore, the thesis includes the variables: interest rate, GDP growth, Consumer Price Index and Oil price.

2.9.1 Interest rate

Interest rate is measured as the return on a sovereign bond return denominated in local currency. The price of this bond is supposed to be a proxy of a risk-free asset, since theoretically states can print more money to pay the interest and the principal of this bond. The literature (Chowdhry and Sherman (1996), and Fung and Che (2009)) suggests a positive relation between interest rate and underpricing. However, after the 2007 crisis the economy entered into a period of low interest rates that have not been analyzed and that could have changed the relationship between interest rate and underpricing. The extensive study of Bordo and Landon-Lane (2013) demonstrated that unconventional monetary policies (read negative interest rates) produce boom in the stock market. From the already cited work of Loughran and Ritter (2002) it can be seen that underpricing dramatically increased during the tech bubble of the early 2000. Moreover, there is a general agreement that underpricing increases in "hot" market periods (Ritter (1984), Lucas and McDonald (1990), Ritter and Rydqvist (1994), Welch and Ritter (2002), Ljungqvist and Wilhelm (2003)). For all these reasons, it could be expected a negative relation between interest rate and underpricing in periods of zero interest rates. From a theoretical point of view, underpricing is greater when interest rate are low and it reduces when they return to "normal" values.

2.9.2 GDP growth and consumer price index (CPI)

GDP growth measures the annual increase of GDP in a country. CPI ratio measures the change of price of a basket of product bought by the average household. Both variables are supposed to be proxies for the business cycle. A robust growth of GDP associated with a modest CPI growth is usually associated with a good state of the economy and highly desirable by policymakers. Since good economic conditions are usually associated with high stock prices, we should expect, for the reasons mentioned about "hot" markets, we should expect a positive association between GDP growth and CPI with underpricing.

However, it is worth noted, that only the work of Tran and Jeon (2011) found a significant relation between these two macroeconomic variables and underpricing, whereas the previous works of Breinlinger and Glogova (2002) and of Hopp and Dreher (2007) found no significant relation between the mentioned variables and underpricing. One explanation can be found in the length of the time period used in the former work: Tran and Jeon (2011) covered a period of 35 years, while Breinlinger and Glogova (2002) and of Hopp and Dreher (2007)

used observations only for a period of 17 years. It could be that the positive relation between GPD and underpricing exists only in the very long run, while in the "short" period it is shaded by the noise in the observations.

2.9.3 Consumer Confidence Index (CCI) and Business Confidence Index (BCI)

CCI and BCI measure the overall confidence about current condition and the immediate future (OECD 2018). It is assumed that both CCI and BCI are proxies for the economic situation of a country. A higher CCI or BCI can be associated with a better economic situation (boom), a lower CCI or BCI can be associated with a worse economic situation (recession). If households (read: investors) are more optimistic into the future, there are more investors willing to invest in the stock market. Thus, the demand for IPO subscription increases and the investors are willing to pay a higher premium for a stock. In conclusion during periods of higher CCI the underpricing should be higher. So, we expect a positive correlation between the amount of underpricing and consumer confidence. Similarly, we would expect that a higher BCI represents more confidence in the future situation of firms that will encourage them to do IPOs. Especially during hot market conditions (Ritter 1984) which can be associated with booms, we expect higher levels of BCI and thus a higher willingness to do an IPO. As there is a higher amount of firms entering the stock market, underpricing should be positively correlated to the BCI.

Güntürkün et. al. (2012) found that CCI is weakly significant and increasing over the total sample period. The authors also conclude that if people expect to be better off, they are willing to invest more in IPOs (Güntürkün et. al. 2012). Also Draho (2004) finds that there is a higher demand for risk as the economic outlook is positive. Furthermore, the argues that this higher demand of investors leads to a higher number of firms doing IPOs. Finally Berk and DeMarzo (2013) state that firms need more financing in periods of booms and thus are more willing to raise money through IPOs.

2.9.4 Oil price

According to the literature the impact of the oil price on stock prices is weak or insignificance. The reason could be found in the fact that oil price is influenced by factors like the supply side, the discovery of new oil fields, the development of new technologies that don't affect the stock price in a precise way. Moreover, firms are enough sophisticated to hedge

against fluctuation in oil price and for this reason the price is not influenced by oil price changes.

Pescatori (2008) analyzes a possible relation between movement in the S&P 500 and oil prices. The researcher found that they move together only occasionally and it does not exist a significant relation between them. However Sim and Zhou (2015) found an asymmetric relation between stock price and oil price: negative shocks on oil price affects positive the price of stocks, while positive shocks does not have a significant impact on the price of the S&P 500.

The only work that tried to find a relation between oil price and underpricing is the already cited Güntürkün et al. (2012): it doesn't find a significant relation between oil price and underpricing. However, there are doubts regarding the reliability of this study, given the small sample used and the short time period analysed.

3.0 Methodology

In this chapter the research method used in the thesis is explained. Furthermore, the thesis will take a look at the collected data. Afterwards, it discusses the hypothesis to test and the econometric model that will be covered in the next chapter. Last but not least, the work will discuss the OLS assumptions and check whether these are fulfilled.

As discussed in the previous chapters, the thesis mainly follows a deductive reasoning in this research. First, the hypothesis is formulated on the mainstream theory and empirical research on underpricing. Using these hypotheses as a base, the theoretical and empirical relation between the data is explained. Finally the initial hypothesis is or is not rejected in accordance with the empirical results from the econometric model.

Following the approach described above, first the main literature on IPOs and underpricing has been analysed. On the literature hypotheses will be formed on the main factors that influence underpricing. The thesis has selected a sample of 20 Countries from 1997 to 2017. Based on the results it confirms or rejects the hypothesis on factors that influence underpricing in IPOs.

In addition an inductive research approach has been partly used for what regards macroeconomic variables. There is not much information in the literature, since macroeconomic variables weren't considered by the mainstream theory as an explanation to underwriting. From the

research done, it can be stated that there is no work on the effect of zero interest rates on underwriting or theory that can be used to deduct a hypothesis.

Also descriptive research is used: with this approach it is tried to describe phenomena, without a particular idea on the theory behind and without any particular research question. It is simply described what happened in the observations.

Finally, hypothesis testing is used (or confirmatory research), to examine the significance of a relation of a variable with underpricing. The aim of this type of research is to reduce type I error (rejection of the null hypothesis when it is true). The null hypothesis tested are the ones formulated in the chapters of this work.

4.0 Data

4.1 Data selection

Data from 20 countries has been collected. The countries are: Canada, Italy, Spain, Switzerland, Brazil, Australia, China, India, Mexico, Portugal, Russia, South Africa, Turkey, United Arab Emirates, France, Germany, Japan, Sweden, United Kingdom and United States of America. These countries are for the majority members of the OECD. The countries that have been chosen have sufficiently developed capital markets. Therefore, the inefficiency of capital markets should have a negligible effect on underpricing. Moreover, extensive public data are available on IPOs in these countries.

4.2 Data collection

The data has been collected from secondary sources. The collected data of the mentioned countries ranges from 1997 to 2017. The reason for choosing a twenty year period is that it can cover at least two business cycle and, in this way, anticipate the long-run effect of macroeconomic variables on underpricing. The main source of data has been Bloomberg. Missing information has been collected from company prospectus, annual reports and other secondary sources. More in detail, the collected data includes: underpricing, industrial sector, country, time of IPO, asset value, net income, offer size, underwriters and MSCI world Index. The macroeconomic variables are mainly taken from OECD, World Bank and International Monetary Fund. The dataset also includes information on ten-year Government bonds, GDP growth, Consumer Price Index and Oil Price. Those data (excluding oil prices) were only

available at a quarterly frequency. Therefore, the values are constant for each quarter of the year.

4.3 Excluded data

Following the work of Loughran and Ritter (2004) and Cassia et al. (2004), all IPOs with a value of less than 50 million from the sample, all SEOs, Real Estate Funds and Financial Vehicles (REITS) have been excluded. Those IPOs have been neglected because they are not relevant for the purpose of the research (for instance SEOs). Also IPOs with to much missing information were excluded.

4.4 Sample size

There are 7 634 IPOs in the sample for the period 1997 - 2017. 22 % of observations of IPOs in this time span were excluded because they lacked information which was necessary for further research.

The total number of IPOs divided per country are presented in the following graph:

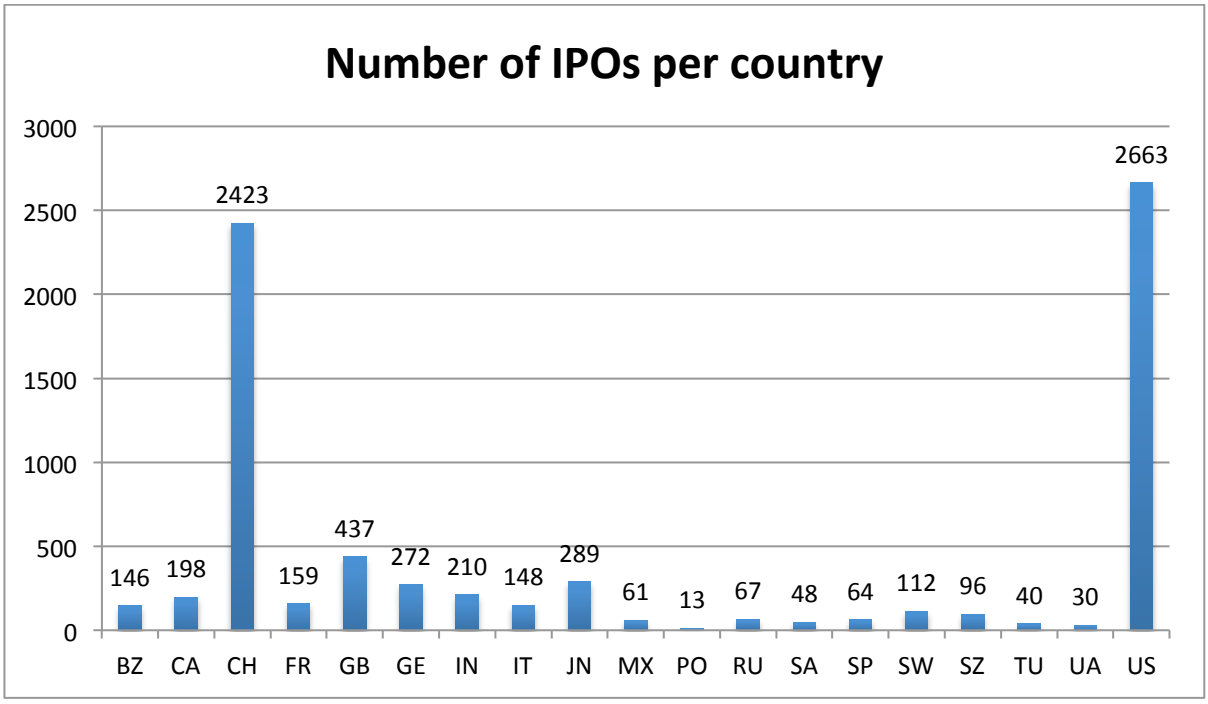

Figure 1 Number of IPOs per country

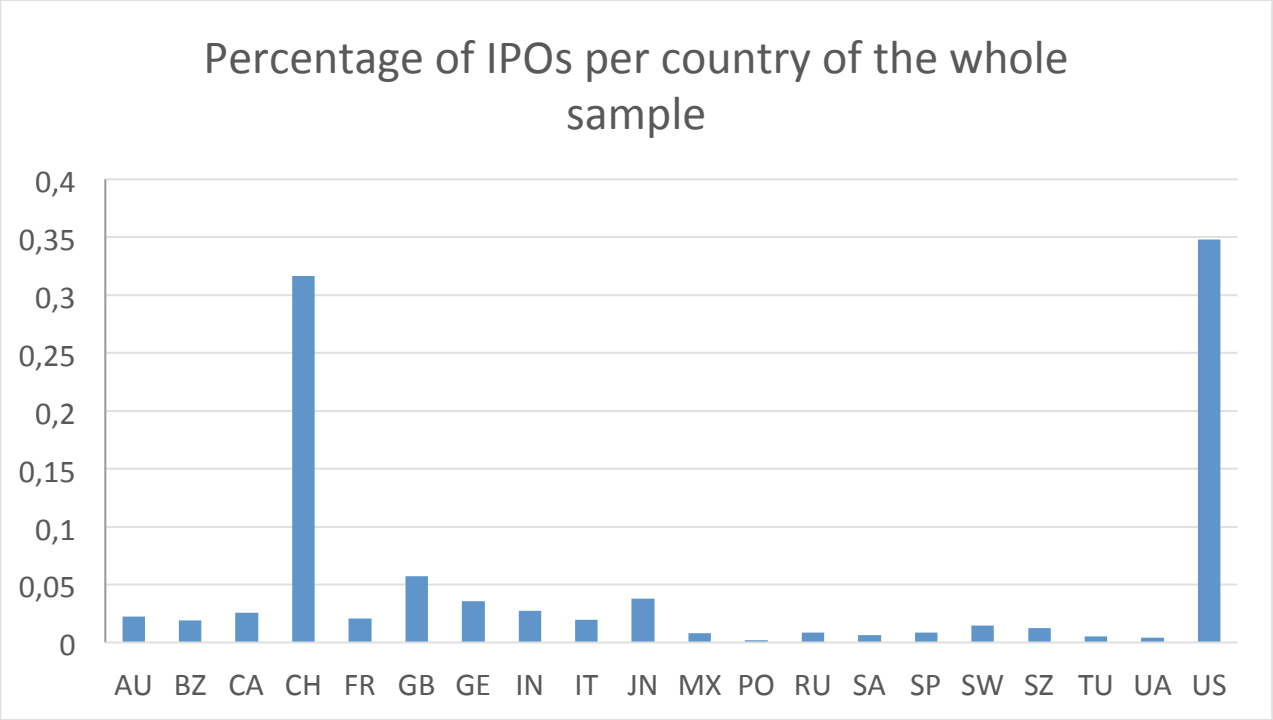

Figure 2 percentage IPOs per country of the whole sample

It is clear from the graph that China and the United States account for more of 60% percent of IPOs (31% and 35% respectively). After these two countries there is United Kingdom with around 6% of IPO and then Japan with 4%. From these first observations our dataset is dominated by IPOs from two countries.

The average number of IPO per year is 365. However, there are peaks before the dot com bubble at the beginning of the 2000s and before the 2007 crisis. The two peaks of 2010 and 2015 are mainly determined by the number of IPOs in China.

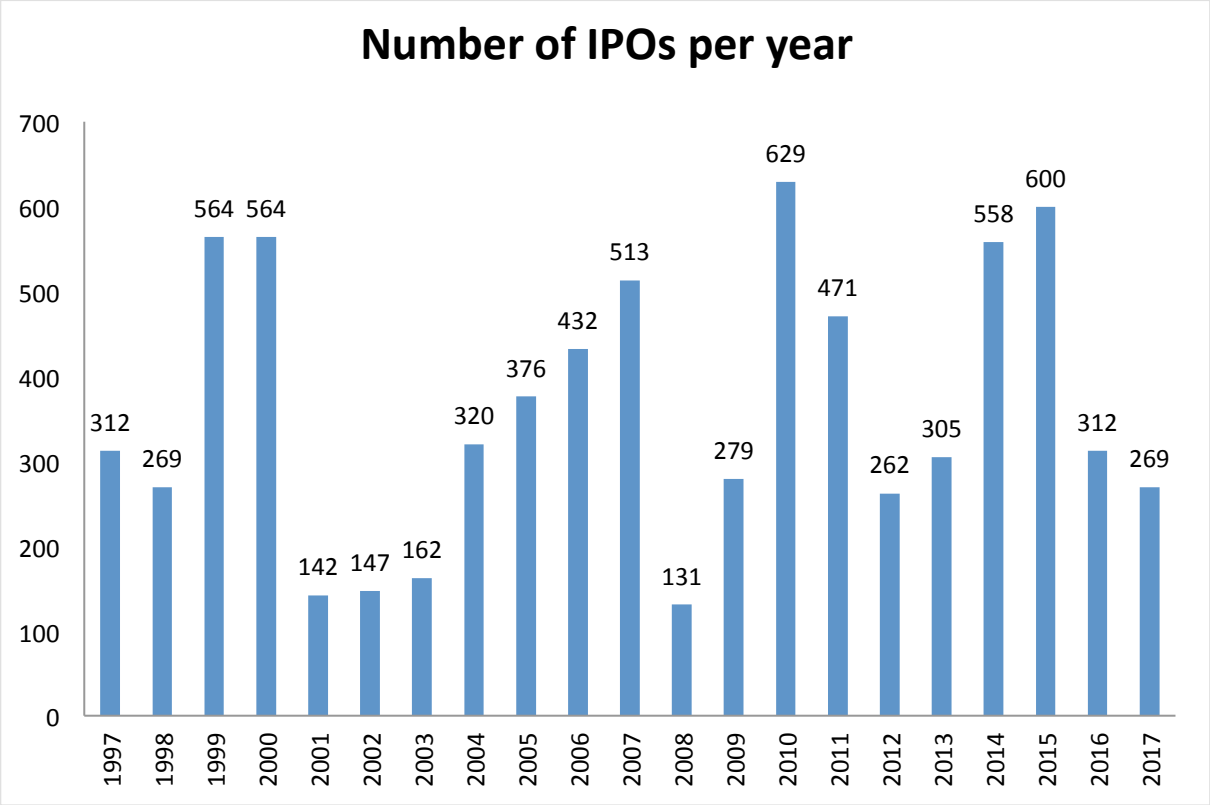

Figure 3 number of IPOs per year

After the crisis, it is evident that the data exhibits a clear reduction of IPOs. From this descriptive analysis, it seems to hold the timing theory, which was extensively discussed in chapter 2.

The next table shows the average and median underpricing for each year in the observation period:

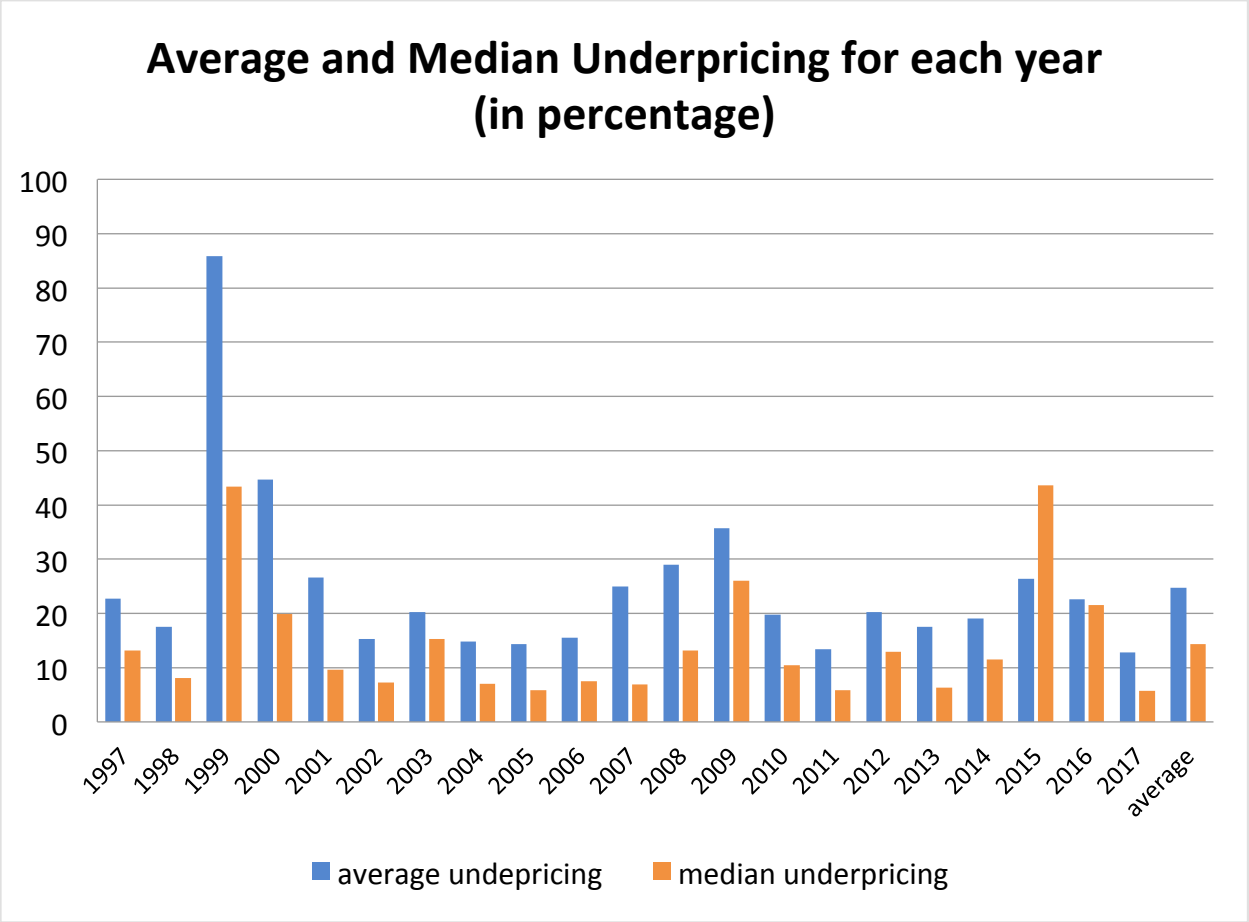

Figure 4 Average and Median Underpricing for each year (in percentage)

Average underpricing is 24,7 % while median underpricing is 14,3%. Average and median underpricing seem to increase before the crisis (tech bubble and 2007 supreme crisis). Average underpricing is always above median underpricing, except in 2015. This means that underpricing is positive skewed and the high average value is mainly driven by enormously underpriced stocks. Moreover, average underpricing is more volatile than median underpricing.

Taking a look at the five-year horizon, it can be seen that:

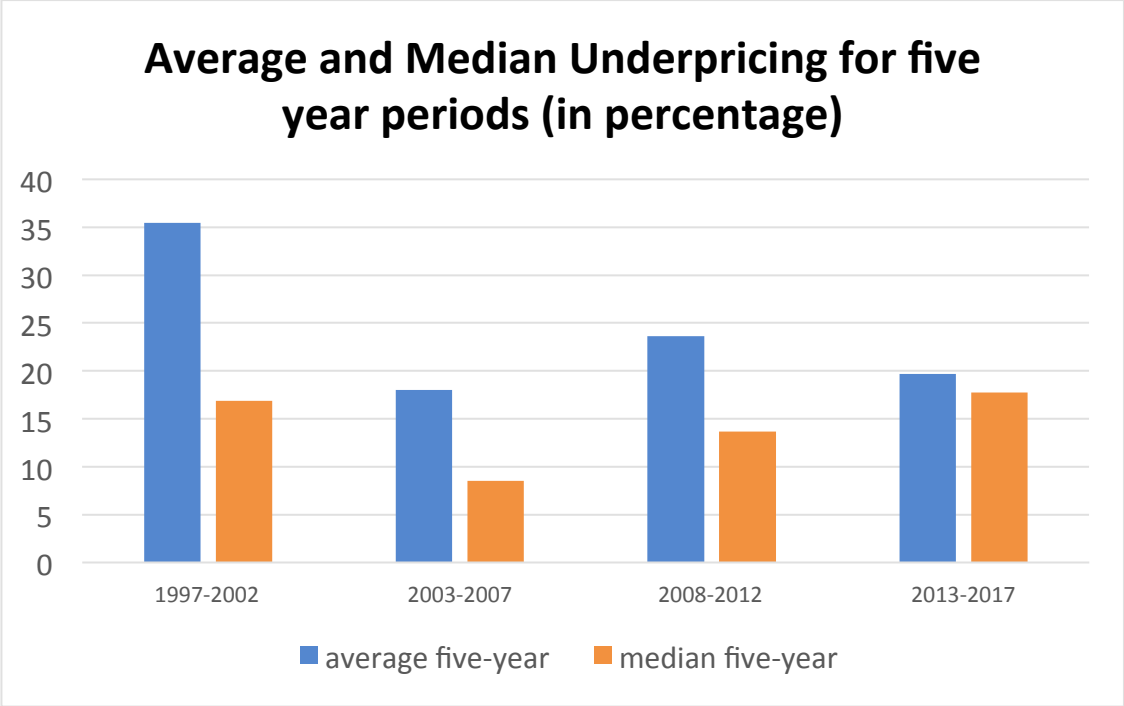

Figure 5 Average and Median Underpricing for five year periods (in percentage)

average underpricing was equal to 35% in the first five year period and then it reduced in the second five-year period. In the third period it increases of 50% and in the last period, it decreases of 20%. From this first analysis it's clear that underpricing is not constant over long periods of time and there are periods of relatively high underpricing and periods of relatively low underpricing.

In the following graph underpricing in different countries is observed:

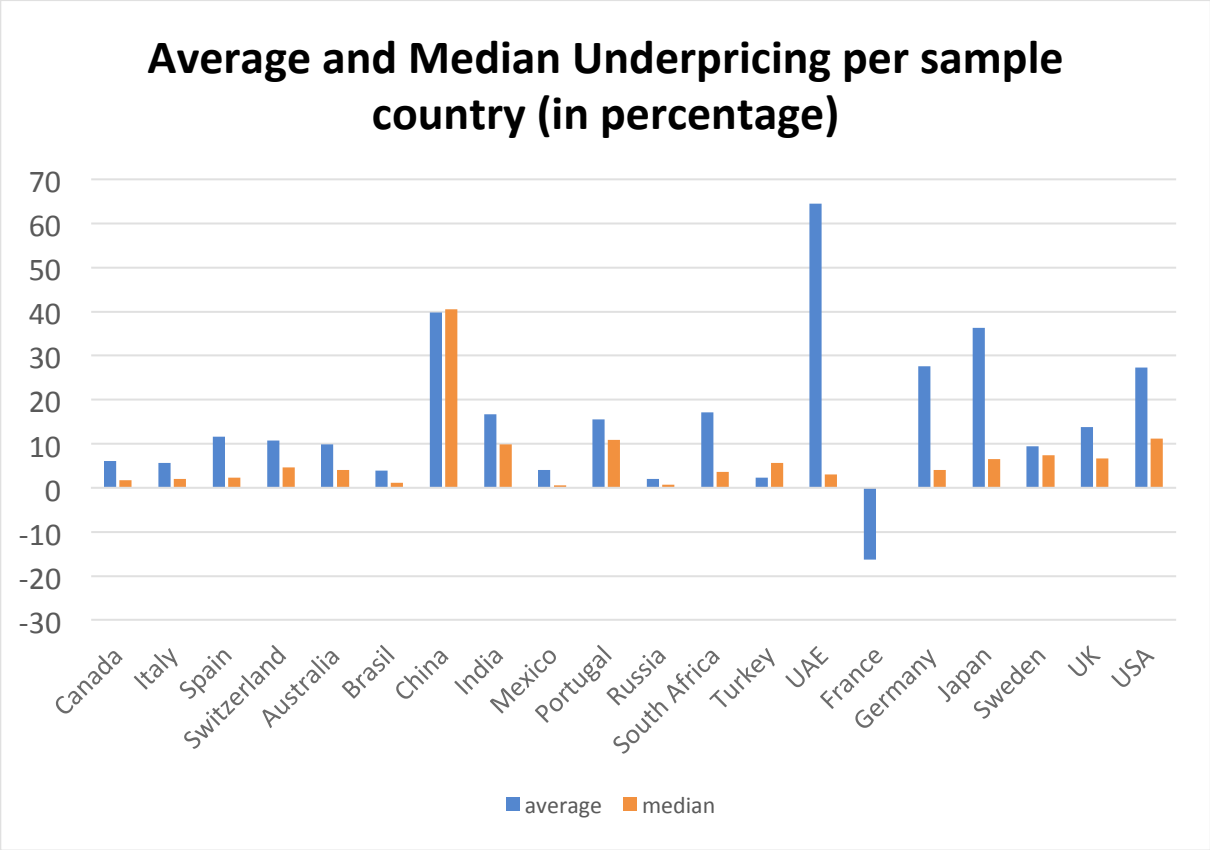

Figure 6 Average and Median Underpricing per sample country (in percentage)

In the graph, it's evident that underpricing is greater in UAE, China and Japan. In the majority of the countries it is on average below 15%.

Afterwards the analysis focuses on the five most represented countries: USA, China, United Kingdom, Japan and Germany.

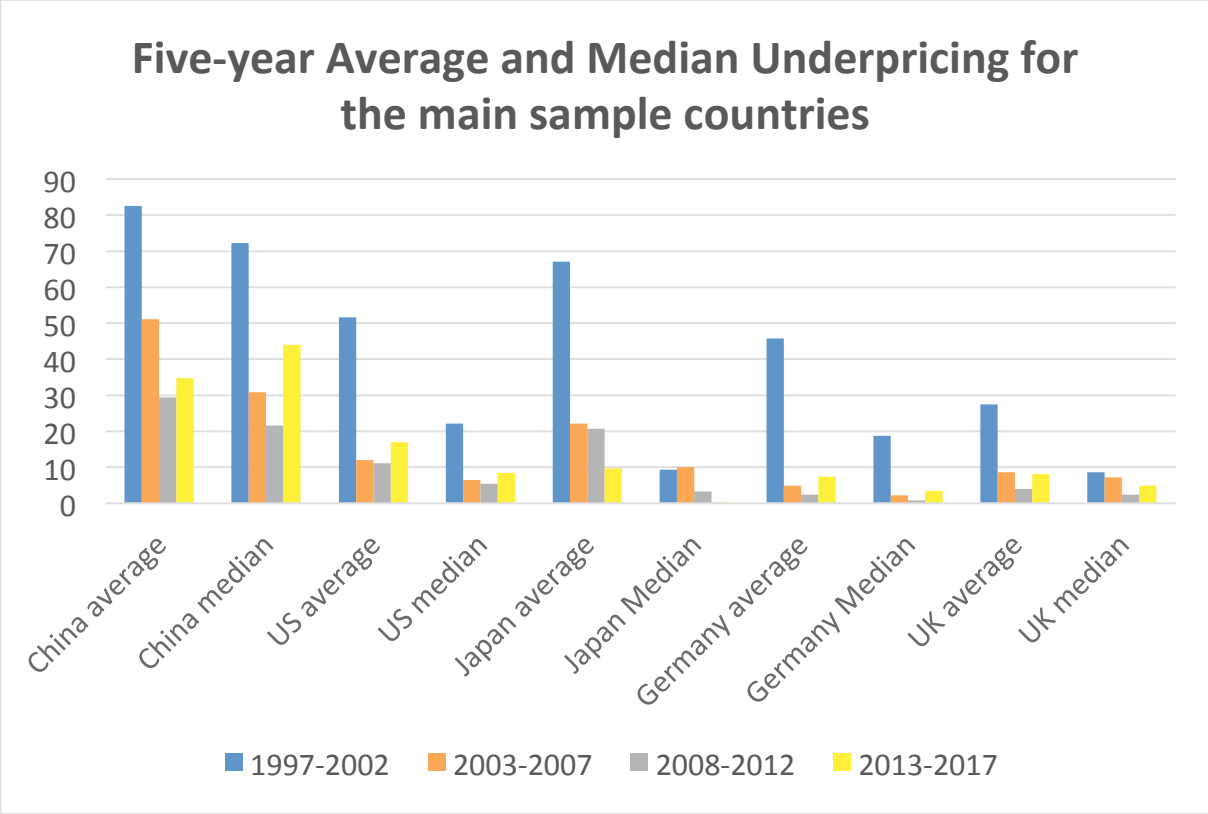

Figure 7 Five-year Average and Median Underpricing for the main sample countries

There are clear differences in underpricing across countries, even if there are similar trends. China has during the whole period the highest underpricing, but it shows a decreasing trend. US underpricing in the period 1997 - 1998 was above 50 %. A similar result was found in the study of Loughran and Ritter (2004). Afterwards it decreased and remained in a range of 10 % - 20 %. An akin trend is evident for Japan, Germany and United Kingdom. In the last two countries, underpricing dropped below 10 % after the peak between 1997 - 2002. In all countries, except China, average underpricing is always greater than median underpricing. Median underpricing also seems to be less volatile as highlighted in the analysis of the complete sample. On the contrary median underpricing in China in the period 2013 - 2017 is greater than the average underpricing. This unusual result can be explained by very negative first day return for many stocks in this five-year period.

4.5 Dependent variable

The dependent variable in the regression is underpricing. Underpricing is defined as:

$$\frac{first\ day\ closing\ price - offering\ price}{offering\ price}$$

The aim of this research is to determine the factors that influence underpricing. There is underpricing when the first-day return is positive; otherwise, there is so called overpricing. As one can see from the graphs in the previous section, on average, IPO stocks are underpriced.

However, as demonstrated for the first time by Logue (1973), underpricing is influenced by the daily return of the market portfolio. For this reason, first-day return should be adjusted for the daily return of the market (MAIR). The daily return of the market is used as a proxy, explicitly the daily return of the MSCI World Index. As the work uses a large cross-sectional sample of countries, the MSCI World Index return can be seen as a good proxy for the market portfolio. This index is a worldwide index and it is probably the most representative index of the return of worldwide markets. Given the large number of data in the sample, it was not possible to subtract each IPOs first day return with the respective MSCI world index daily return. Instead, the thesis has had to approximate the value to average daily return for each year.

4.6 Independent variables and hypothesis tested

In the following part of the research, the explanatory variables of the model are described and hypothesis on the sign of the variables are formulated at the end of each section.

4.6.1 Offer size

Offer size is in general related with the dimension of the firm. Bigger firms usually offer more shares during an IPO. As discussed in the previous section, firm size is usually related to the risk of a firm. The smaller a firm, the higher the risk connected to the company. Following the method of Ljungqvist and Ritter (2002) and of Cassia et al. (2004), the variable offer size is scaled using the natural logarithm. This transformation allows to consider the effect of percentage increase of the offer size on the level of adjusted underpricing.

Hypothesis 1: offer size is negative related to IPO underpricing

4.6.2 Asset size and revenue

The literature generally agrees that the asset size of a firm is generally related with ex-ante risk and smaller firms are more risky than bigger companies (Ritter (1984) and Beatty and Ritter (1986), Miller et al. (1987), Loughran and Ritter (2002) and Cassia et al. (2004)). The variable asset size, which is equal to total asset reported in the financial statement for the year of the IPO, is transformed using the natural logarithm. The variable is transformed, because asset size is positive skewed and the level of underpricing is logically more related to a percentage variation of the asset size, instead of a marginal variation (it's natural to think that the increase of 1 unit of the asset size of an already big firm has a negligible effect on underpricing. On the contrary an increase of 1% of asset size should have a more significant effect).

The already cited literature found that revenue, like asset size, can be used as a proxy for ex-ante risk of a firm. The variable revenue is also transformed using the natural logarithm for the same reasons of the transformation of asset size.

Hypothesis 2a: asset size is negative related to IPO underpricing

Hypothesis 2b: revenue is negative related to IPO underpricing

4.6.3 Net Income

Following the work of Cassia et al. (2004), in the model has been included a variable for net income. The variable is equal to net income as reported in the balance sheet the year of the IPO. However, it should be noticed that Cassia et al. (2004) constructed a similar variable using EBITDA instead of net income. Net income should be a proxy of firm risk, and negative net income should signal higher risk for a firm.

Hypothesis 3: net income is negative related to IPO underpricing

4.6.4 Certified advisors reputation

The variable certified advisors reputation is defined using a proxy dummy variable. The dummy variable is defined in the following way: the number of deals in which an advisor participated has been calculated for every year. Then, the dummy takes the value of 1 if the certified advisor participated in at least 10% of the IPOs during the year; otherwise, the dummy has a value of 0.

In general, the certified advisors that participate in at least 10% of the deals remain constant over time. With some exception, in more than two third of the years Bank of America, Citigroup, Credit Suisse, JP Morgan, Goldman Sachs and Morgan Stanley participate in at least 10% of the deals. It is interest to notice that, with the exception of Credit Suisse, the most reputable underwriters are American Investment Banks. After the 2007 Crisis, also Barclays and Deutsche Bank entered into the circle of the advisors that participate into at least 10% of the deals. Before the crisis Lehman Brothers and UBS were among the main certified advisors. The second thing that should be noticed is that no Chinese certified advisors are inside the group where the dummy is equal to 1. This can be explained by the fact that Chinese Investment Banks usually participate only in Chinese IPOs, while American Investment Banks work on global base.

As already discussed in the previous chapter, the effect of reputable certified advisors on underpricing is discussed by the literature: the work of Carter and Manaster (1990), Michaely and Shaw (1994), Megginson and Weiss (1991) and of Carter et al. (1998) found a significant negative relation between underpricing and reputation of certified advisors.

On the contrary the more recent works of Ljunqvist (1997), Loughran and Ritter (2002) and Ljungqvist and Wilhelm (2003) found a positive relation between undepricing and certified advisors reputation. Loughran and Ritter (2002) found that the relation changed during the '90s. The researcher explained the changed arguing that either certified advisors have increased their market share and they exploit their market power to increase underpricing or to the fact that more reputable underwriters have started to participate in more risky IPOs.

It's not an aim of this work to find the origin of this change. However, since the sample ranges from 1997 to 2017 it is plausible to hypothesize a positive relation between underpricing and underwriters reputation.

Hypothesis 4: Certified advisors reputation is positive related to underpricing

4.6.5 Industry sector

In the model used in this work, industry sector is defined with a dummy equals to 1 if the firm belongs to the technology industry and 0 if it belongs to another industrial sector. The dummy is based on the empirical finding that technology firms are more risky and that IPOs are on average more underpriced. A similar approach is used by Loughran and Ritter (2002) and

Cassia et al. (2004). For Loughran and Ritter (2002) the higher underpricing of the tech industry is justified by a more serious agency problem between underwriters and issuing firms.

Hypothesis 5: underpricing is higher in IPOs in the technology industry

4.6.6 Price revision

Following the work of Cassia et al. (2004), price revision is defined as the percentage difference between the midpoint bookbuilding price and the offer price. According to Loughran and Ritter (2002) and Cassia et al. (2004) price revision is negative related to underpricing. The authors argue that underwriters only partially adjust the offer price to positive information from investors. They don't completely adjust in order to compensate investors for the information provided. Hence, the higher the price revision, the higher the first day return.

The price revision effect was first theorized by Benveniste and Spindt (1989). They argued that a regression of underpricing on price revision could suffer of an endogeneity bias, caused by simultaneity. Price revision is determined at the same time of underpricing because "because the underwriter's pricing decision depends on how much money he has to leave on the table to ensure that investors truthfully reveal their demand for IPO shares during the premarket phase of the bookbuilding process". Moreover, Habib and Ljungqvist (2001) demonstrated that if price revision is endogenous, and it is treated as exogenous, it can change the sign of the relation between underpricing and certified advisor reputation.

Hypothesis 6: underpricing is positive related to price revision

4.6.7 Bubble effects

According to the work of Loughran and Ritter (2002), which is based on IPOs during the tech bubble, underwriters took advantage of higher price valuation, issuing firms of lower proceed. They argue that the consequence is that underpricing increases during the bubble for two main reasons: the ex-ante risk of issuing firms is higher and the agency problem between these more risky firms and the underwriters is more serious. In the model presented into this paper, the variable for bubble periods is defined using a dummy variable. The dummy is equal to 1 for the years 1999-2000 (tech bubble), 2006 (2007 crisis) and 2016-2017 (possible bubble on the stock market that ended at the beginning of the 2018.

Hypothesis 7: underpricing is higher during bubble periods

4.6.8 Variation of the forecasted real growth rate of the Gross Domestic Product (GDP)

This variable is defined in the following way: for every year and for every country it has been defined the average forecasted GDP growth rate. Afterwards, the past year forecasted GDP growth rate has been subtracted to the current year GDP growth rate.

The real forecasted GDP growth rate is based on OECD estimations, that are based on a mix of model-based analysis and expert judgement.

The choice of the forecasted real GDP growth rate instead of the real GDP growth rate is based on the fact that prices on the market are based on expectations and not on already determined values.

The choice of using the variation of the GDP growth rate instead of GDP growth rate is based on two main reasons:

1- growth rate is usually autocorrelated as a consequence of inertia of the GDP growth rate. The consequence of autocorrelation is that the OLS is not efficient even in large samples.

2- From a theoretical point of view underpricing should be correlated to the change in the growth rate instead on the level of growth rate, since growth rate tends to be constant in the medium term. Moreover, it is clear in the sample analyzed that countries with the highest growth rate (e.g. China) have also the highest underpricing. As a consequence, if GDP growth rate is used in the OLS regression, it could result in a spurious regression with serious consequences on the estimates of all parameters.

It can be argued that when the variation of GDP growth rate is positive related to underpricing. A positive variation of GDP growth rate is associated with "hot" markets. As discussed in chapter 2, underpricing is higher in "hot" market periods.

Hypothesis 8: underpricing is positive related to positive variation of forecasted real GDP growth rate

4.6.9 Interest rate

The variable interest rate is defined for each country on a yearly base. Interest rate are defined as the yearly average short-term interest rate in each country. Short-term interest rates are derived from the price of short-term government papers. The data on short-term interest rates are collected from the OECD database. The already cited studies of Chowdhry and Sherman (1996), and Fung and Che (2009) suggest a positive relation between underpricing and inter-

est rates: when interest rates are high, stocks should pay more in order to induce investors to buy them instead of risk-free government bond. The consequence on the IPO market is that underpricing increases.

However, the study of Bordo and Landon-Lane (2013) on unconventional monetary price and stock prices demonstrates that low interest rates create a sort of bubble effect on the stock market. As already discussed in the previous sections, bubbles on the stock market increase underpricing.

Hypothesis 9a: underpricing is positive related with interest rates

Hypothesis 9b: during period of unconventional monetary, when interest rates are close to zero or negative, there is a negative relation between underpricing and interest rates

4.6.10 Oil price

The literature didn't find a significant relation between underpricing and oil price and in general between oil price and stock price. However, the work of Sim and Zhou (2015) found that stock prices increase as a consequence of negative variations of oil price, while positive variations don't influence the stock price. Güntürkün et al. (2012) found that the oil price does not affect underpricing over their total evaluation period. But if the sample just considers the time after the financial crises, the oil price is a determinant of IPO underpricing.

From the work of Sim and Zhou (2015) the variable oil price is defined using a dummy variable as follow: the dummy assumes a value of 1 in the years 2009 and 2015. During those years the average price of oil dropped of around 50%., from an average of $95 in 2008 to $58 in 2009 and from $89 in 2014 to $49 in 2015. (data from OECD database on import price of oil).

However, it is difficult to make hypothesis on the effect of oil price on underpricing. From one hand, the decrease of oil price can cause a bubble on the stock market. On the other hand, it could decrease the risk of all firms, since a percentage variation of the same amount on oil price has a lower impact on oil price, when price are low.

In the first hypothesis underpricing should increase, while in the second it should decrease.

Hypothesis 10: negative variations of oil price have a significant impact on underpricing. However, the impact on underpricing could be either negative or positive, depending if the bubble or the low-risk effect prevails.

4.6.11 Consumer confidence Index (CCI) variation

The variable consumer confidence index variation is defined on a yearly base for every country as it has been defined the variables for GDP growth and for interest rates. The data for the Consumer Confidence Index are from the OECD database.

Güntürkün et. al. 2012 found that CCI is weakly and positive correlated with underpricing. When CCI is high, the economy is usually close to a peak of the business cycle and markets are "hot". As already extensively discussed underpricing is higher during periods of "hot" markets. firms tend to get underpriced as they receive higher than expected valuation for their stocks due to higher investor demand.

Hypothesis 11: CCI variation is positive related with underpricing

4.7 The multivariate model

In order to investigate the effect of all the variables describe above on the market adjusted first-day return (MAIR), a multiple regression model is performed. The multiple regression is performed using the Ordinary Least Square (OLS) technique. The data are treated as cross-sectional data. It is impossible to treat the data as normal panel data, since there are more than one observation for each countries in all years. However, a dummy variable for each country has been added to the model, in order to control for countries specific institutional factors. The analysis of institutional factors is outside the scope of this work: however, since they are dependent on legislative setting and economic development, they are quite stable over time. Therefore, the use of those dummy variables should be sufficient to control for country-specific effects.

It is also tested a model with both country and time fixed effects. Time fixed effects are created using a dummy variable for each year in the regression analysis. The reasoning behind the use of time fixed effects is to take into consideration the fact that underpricing varies through time as discussed in the previous sections. However, when time-fixed effects are added to the model the dummy variables for the momentum on the stock market and the oil dummy must be dropped for perfect multicollinearity.

A second problem, the variation of underpricing through time could be linked to the business cycle. Therefore, the previous findings that underpricing varies through time could be a spurious result, determined by the fact the researchers weren't able to control for the effect of mac-

roeconomic variables on underpricing. As a consequence, there could be a problem of near multicollinearity between the time dummy and the macroeconomic variables.

A more general problem linked to the use of a dummy variable for each country (and each year) is the lost of a big number of degrees of freedom. When degrees of freedom are lost, the standard deviation of all parameters increase and as a consequence the power of hypothesis testing reduces. However, that shouldn't be a relevant issue in this study, since the sample is composed of more than 7000 observations.

The structural form of the model tested is the following:

$$\begin{aligned} MAIR_i = {} & \ln(asset\ size_i) + net\ income_i \\ & + \ln(offer\ size_i) + technology\ dummy_i + bubble\ dummy_i \\ & + cetrified\ advisor\ reputation_i + price\ revision_i \\ & + variation\ GDP\ growth_i + CCI_i + interest\ rate_i + oil\ price\ dummy_i \\ & + \sum country\ fixed\ effects + \varepsilon_i \end{aligned}$$

The analysis of the above described model is performed using the econometric software EViews.

4.8 Econometric issues

Several econometric technical issues are presented in this model. In the following sections the main econometrics issues are discussed and possible solutions are discussed. Econometric issues can lead to either biased estimates of parameters, wrong calculation of the standard errors or inappropriate choice of the distribution of the test statistics.

4.8.1 Heteroscedasticity

The assumption of homoscedasticity is violated when the variance of the error term is not constant across different observations. The consequence of the violation of this assumption is that the standard errors of all parameters is wrong. Heteroscedasticity is a common problem in all econometric studies. White-robust Standard Errors are applied in the regression model.

4.8.2 Non-normality

The normality assumption is violated when error terms are not normally distributed. This assumption is tested using the Jarque-Bera Test. The violation of this hypothesis should lead to

wrong choice of the statistic distribution in hypothesis test. The normality hypothesis is usually violated in econometric models. However, the violation is not a problem if the sample size is large enough, because according to the Central Limit Theorem all distributions converge to the normal distribution. The JB test result for the whole sample can be found in the appendix.

4.8.3 Non-linearity

The hypothesis of linearity affirms that the regressors explain the dependent variable with a linear function. This hypothesis is tested using the Ramsey RESET test. If the test rejects the hypothesis of linearity, the functional form of the model is misspecified. A remedy to this problem, is to include in the model the variable(s) that causes non-linearity at a higher power.

4.8.4 Multicollinearity

Multicollinearity happens when two or more variables are correlated with each other. Multicollinearity doesn't violate OLS assumptions (parameters are "BLUE"). However, the regression coefficients can be very sensitive to small changes in the model, they can have unexpected signs or they can have very large standard error, because it is difficult to disentangle the individual effect of each highly correlated regressor on the dependent variable.

Multicollinearity is a common problem, especially with macroeconomic variables, that are driven by the same factors.

In this work, two variables are considered highly correlated when the correlation coefficient is greater than 0.8. The most common remedy to a problem of multicollinearity is to drop one of the highly correlated variables.

4.8.5 Endogeneity

Endogeneity happens when the error term is correlated with one of the dependent variables. Endogeneity has serious consequences on the model, because all the estimates of the parameters are biased and inconsistent. As highlighted by Benveniste and Spindt (1989), the variable price revision could suffer of endogeneity bias, since it is simultaneously determined with underpricing.

However, we didn't identify a valid instrument for price revision and we are not able to test endogeneity of this variable. Therefore, we assume that price revision is exogenous in the following sections of the work.

5.0 Research validity and reliability

In order to be a good research, the thesis needs to be valid and reliable. Validity refers to the extent to which the results are right and generalizable. Reliability refers to the repeatability of the study by other researchers with different datasets.

In the next sections the validity and the reliability of this study will be discussed.

5.1 Validity

Validity can be divided into internal and external validity. For internal validity the work produces right results from both a theoretical and a technical point of view. External validity is related to the possibility to generalize the results beyond the aim of the study. The design of the model used in the study is similar to previous works about underpricing. So it utilizes well proven research approaches and thus it is expected that the model measures correctly. For instance Ritter (1984), Lucas and McDonald (1990), Ritter and Rydqvist (1994) or Loughran and Ritter (2002) described similar approaches to measure the effects of underpricing. variables themselves like underwriter reputation, asset size or offer volume are also well examined and used by previous studies. Thus, a high internal validity can be assigned to the thesis. The new part added in this work is the effect of macroeconomic variables on underpricing. The authors believe that these variables are useful to explain underpricing and therefore they are considered as valid.

The general control variables as discussed earlier also fulfil the external validity. Extensive research has been done on the firm specific factors in different countries with different sample firms. So for these variables it is easy to generalize the results. Unfortunately, there has not been done a lot of work on macroeconomic variables. Güntürkün et al. (2012) made the only comprehensive study on the influence of macroeconomic factors that could be found. Nevertheless, as the authors are using a wide sample and standard econometric analysis tools, additional research can be conducted in a straightforward way on other countries that are not part of the sample. Thus also the macroeconomic variables fulfil the requirements of external validity.

From a technical point of view, the authors think of having considered all the econometric issue related with the model and to have applied remedies that provide valid estimates of the parameters.

5.2 Reliability

Reliability is primarily related to the trustworthiness of the sources of data. This means that the data and methodology will always lead to the same result. The data used in this research was mainly collected from Bloomberg and OECD databases, which are considered reliable after sample cross checking with company financial statements and other databases like the IMF and the World Bank. the exclusion of data is strictly based on missing information or the theoretical definition of the sample. Since the sample size is large, it is possible that there are human errors in the data processed manually. However, the authors believe that eventual human errors are negligible and they don't reduce the quality of the dataset used.

The research approach itself has been outlined in detail in the previous sections and is thus easy to replicate. In addition the authors just used standard software, namely EViews and Microsoft Office Excel, to derive at their results. This also enables replication of the derived results.

Therefore, the study is considered reliable and it can be repeated by other researchers as well.

6.0 EMPIRICAL FINDING

In this chapter the data will be visualized via descriptive statistics to make any interpretation more intuitive. These statistics and the results of the econometric regressions will be presented and analyzed in the following chapters.

6.1 Descriptive statistics

The table above reports the main statistics of the variables used into the model. It can be found in the appendix.

The mean of Adjusted underpricing is 23.69%, with strong variations from -100% to 697%. D_CAR is the dummy for certified advisors reputation. Advisors with high reputation participated in 51,4% of the deals in the sample.

Net Income measures the accounting value of net income in the IPO year. In the sample the average net income is 912 million US$.

Variation of GDP Growth is the second difference of the GDP. It measures the variation of the GDP growth. On average it is positive and equal to 0.27%.

Log(asset) and Log(revenue) are the logarithm of the revenue and the asset the year of the IPO. The first is equal on average to 6,81 and the second to 5,98.

Interesting to notice that 31% of the observations are during bubble years and that more than 12% of the firms are classified as technology firms.

On the contrary, only 8% of the observations belong to the years in which oil dropped of around 50%.

CCI variation is on average positive and equal to 0,55%, while interest rate are on average equal to 3,51%, but with a maximum close to 40% and a minimum with negative interest rates.

6.2 Correlation Matrix

A correlation matrix is produced to analyze eventual multicollinearity among independent variables. Also the matrix can be found in the appendix.

Apart from log(asset) and log(revenue) no variables show multicollinearity problems. The high correlation between the two mentioned variables (0.87) is probably due to the fact that high revenue is strongly correlated with high value of asset.

After having tested the correlation with the Variance Inflation Factor (VIF) between the two variables, it has been found a value of 8,68, below the value of 10, that is considered the value above which there is a problem of multicollinearity.

However, since the two variables measure the same source of risk, determined by the size of the firm, we don't think necessary to include both variables contemporarily. Therefore, in the following models we only include the variable Log(asset).

6.3 Regression results

There are four types of models tested in this part. A basic model that includes all variables for the full-time span from 1997 to 2017 over all G20 countries. The second model divides the total sample in two subsamples. The first time span ranges from 1997 to 2007 and the second from 2008 to 2017. The third model excludes the IPO observations from China on the whole sample. Finally, a model that divides the sample in developed and developing countries is run. To visualize the regression results the thesis presents regression results for each subsection.

The regressions tested exhibit the typical statistically issues of heteroscedasticity and non-normality. The classic Jarque-Bera (JB) tests for skewness and excess kurtosis. the normal distribution has zero skewness and zero excess kurtosis. The test shows a skewness of 3,77 and kurtosis 27,62. Therefore, the null hypothesis of the JB test can be rejected. Many empirical researches like Cont (2001) found the "stylized fact" that financial returns are not normal distributed. A basic shortfall of the JB test is that it works poorly in small samples. As the thesis uses more than 7 000 observations, it does not exhibit this problem and the JB test can be seen as valuable.

If the distribution exhibits heteroscedasticity, the variance of the variables is not constant. While this still produces unbiased results, the standard errors are wrong and thus hypothesis testing will be meaningless. Correcting this can be done by using so called robust standard errors. A method to detect heteroscedasticity is the Breusch-Pagan-Godfrey or the White test. As the White test is more general than the Breusch-Pagan-Godfrey test, it allows different functional forms. The thesis is thus using the White test for checking for heteroskedasticity. The null hypothesis of the test is homoscedasticity or constant variance of the residuals. The White test is just performed one time on the whole sample (similar to the basic model) of observations to check for heteroscedasticity. The p-value of the null hypothesis is 0,0000 and thus it is rejected on the 1 % significance level. As the data is heteroscedastic, the standard errors need to be adjusted. Therefore, the authors are using the White-Huber adjusted standard errors to correct this. With adjusted standard errors normal hypothesis testing can be conducted on the data.

6.3.1 Model 1: basic model

The first regression takes into account the whole sample of IPOs over the full time span. In the first specification only country fixed effects are considered

Nearly all variables are statistically significant on the 1 % level. In this basic model the sign of the interest rate variable is positive and significant on the 1 % level. This result confirms the finding of Chowdhry and Sherman (1996), and Fung and Che (2009), which found similar results in their studies on the relationship between interest rates and IPO underpricing. On the contrary, the dummy for the oil price is insignificant. Our results confirm the earlier mentioned study from Güntürkün et al. (2012) that oil prices do not affect IPO underpricing. A possible explanation for this can be that the oil price is set on an international level and thus

does not replicate the economic conditions in the individual countries. Thus it has no explanatory power on the individual underpricing in different countries.

The CCI variable is positive and weakly significant on the 10 % level. Thus it can be confirmed that a better consumer climate (a higher CCI score) leads to more investment demand and therefore to higher underpricing. But it needs to be pointed out that the increased willingness to invest in IPOs is just a indirect effect of underpricing which would explain the low significance level.

The dummy for momentum effects is positive and significant at the 1 % level. This result was expected as the momentum variable measures the effect of stock market bubbles on IPO underpricing. During stock market sustained growth the variable is one and during normal stock market periods the variable is zero. So, if there is a stock market bubble, underpricing tends to be greater. This result is in line with the work of Loughran and Ritter (2002).

Log(asset) variable is negative and strongly significant and the variable net income is positive and significant at the 1% level. These results are generally common to all research on IPO underpricing.

Tech dummy is positive and significant at the 1% level. Also this result is in line with the previous research, as discussed in the theoretical section.

Finally, the dummy underwriters reputation is positive and significant at the 5% level, as found by Loughran and Ritter (2002).

When time fixed effects are added the results of the regression are similar, except for interest rate. The parameter of interest rate becomes negative and significant at the 1% level. This result is surprising and it must be further analyzed using the model discussed in the following section.

6.3.2 Model 2: two-period model

The second model divides the initial cross section (observation window 1997 - 2017) into two sub samples. The first sample ranges from 1997 - 2007 and the second from 2008 to 2017. The idea behind this step is to observe whether the influence of the model specific macroeconomic variables has changed after the financial crisis of 2007. Specifically, with this model the thesis wants to examine whether the cut in interest rates after the financial crisis has influenced IPO underpricing. The approach follows a finding from Bordo and Landon-Lane (2013)

who found that a low interest rate can lead to stock overvaluation and eventually to a higher underpricing.

From an econometric point of view, the stability of parameters is tested with the Chow test. If the residual sum of square of the model the covers the entire period is much higher than the sum of the residual sum of square of the two sub samples, then parameters are not stable and it is better to split the entire sample in two sub-samples. The Chow test is distributed according to an F-distribution and the null hypothesis is that parameters are stable.

When performed the Chow test with the sample here examined on the model with only country fixed effects, one obtains a test statistic equal to 7,1. The associated critical value at alpha=1% is 2,006. Therefore, the null hypothesis of stability of parameters is rejected at the 1% level. As the test is replicated on the model with both time and country fixed effects (not reported), the result are equivalent and the null hypothesis of the Chow test is rejected at the 1% level.

In the first subsample, when only country fixed effect are used, the momentum effect, dummy for technology industry, log of assets and revenues are significant at the 1 % level and in the line with the results of the previous model and the previous research. In the observation window the interest rate variable has a positive sign: thus underpricing will be higher if interest rates are higher. This result is in line with several studies, for instance Chowdhry and Sherman (1996). The dummy for technology stocks also exhibits a positive sign and thus confirms the thesis from Loughran and Ritter (2002) and Giudici et al. (2002).

On the contrary, the variable for GDP growth becomes insignificant.

The table also displays that the CCI is statistically significant on the 1 % level. The sign of the CCI variable is positive, therefore, higher consumer confidence leads to higher underpricing.

The underwriter reputation is only weakly significant, but still positive. However, the fact that in our sample, the underwriters' name was missing for many observations in the period 1997-2007, could be a determinant for the weak significance of this variable.

As time fixed effects are added to the model, there are no significant variations in the results. It should be noticed, that the effects of consumer confidence index and of interest rates on underpricing become stronger and that the variable for GDP growth becomes negative, even if insignificant.

The model for the second subsample (2008-2017) exhibits a different behaviour. The momentum effect is just significant at the 10 % level, but still positive. On the contrary interest rate is statistically significant at the 1 % level and has a negative sign. Therefore, a lower interest rate will lead to higher underpricing. The result confirms the side effect discovered by Bordo and Landon-Lane (2013) during their studies of unconventional monetary policy. The dummy for technology industry is still significant on the 1 % level as expected. Another interesting result is that the oil price variable is significant on the 1 % level. This result was not expected but is in line with the research results of Güntürkün et al. (2012) who came to the conclusion that after the crisis investors took the world economic more into account for their investment decisions.

CCI is weakly significant at the 10 % level and negative. One could argue that the consumer confidence after the crisis was lower due to the negative experiences of the private investors while there was investment demand due to relatively reasonable stock prices from the institutional investors. Thus during the post crisis horizon CCI is not a good measure of underpricing.

The variable for GDP growth is negative and strongly significant. Therefore, it seems that underpricing reduces when economy growth more than in the previous period after the economic crisis.

Underwriter reputation is still insignificant and the explanation can be found in the low quality of this variable in the sample analyzed.

As time fixed effect are added, there are no important changes in the results and the results with only country fixed effects are confirmed.

6.3.3 Model 3: basic model without China observations

The third regression uses the whole sample from 1997 to 2017 but excludes all IPO observations from China. The Chinese stock market was and is still highly regulated and thus market forces were not able to determine the IPO prices correctly. The Chinese regulators control the IPO process completely as they control IPO qualifications and IPO pricing (Song et al., 2014). Furthermore Song et al. (2014) conclude that the primary market efficiency is relatively low compared to developed countries like the US and the secondary market is not competitive. Therefore, excluding the China observations should increase the power of the overall sample to investigate the macroeconomic impacts of underpricing.

The regression results confirm this argument even more. Underwriter reputation, momentum effects, offer size, dummy for negative returns, price deviation, interest rate, dummy for technology stocks, CCI, log of assets, log of revenues are all significant on the 1 % level, when Chinese observations are excluded.

The dummy for underwriter reputation is positive and thus a better reputation leads to higher underpricing.

CCI has a positive sign and thus a higher CCI leads to a better consumer climate and thus to a higher willingness to invest in stocks. This affects underpricing positively. The result was expected and strengthen the hypothesis of Güntürkün et al. (2012).

The dummy for tech firms is also positive, which was also expected since for example, Guidici and Paleari (2000), Loughran and Ritter (2004), Daily, Certo and Dalton (2005) found similar results.

All in all it can be concluded that excluding China from the sample lead to an overall improvement of the data quality and confirms the findings from Song et al. (2014). As most of the other countries have fully developed capital markets, it can be shown that macroeconomic forces are strong to affect underpricing.

However, the second difference of GDP is not more significance. This could lead to think that in the first model the strong significance was driven by a spurious regression. In the all sample, the second difference of China GDP tends to be negative and also underpricing in China tends to reduce over time. Since China accounts for more than 30% of the observations of the whole sample, a spurious regression could theoretically explain the strong significance in the first two models. When time fixed effects are added to the model, the main findings do not change and they are confirmed.

6.3.4 Model 4: Developed/Developing country model

Following the results form model 3, the authors want to further prove whether macro economic forces influence developed markets in a stronger sense than developing markets due to imperfect capital market surroundings. The model runs two separate regressions on the two subsamples. The idea is derived from study from Song et al. (2014) on China and its imperfect capital markets development. The first sample uses the following developing countries: China, India, Mexico, Russia, South Africa, Turkey, United Arab Emirates (UAE). The second

subsample uses the following countries: Canada, France, Germany, Italy, Japan, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States. The model uses the already used macroeconomic variables from the other three models.

For the developed countries the regression results are in line with the other models. All variables, except the variation of growth, are significant on the 1 % level. Underwriter reputation is positive as expected. Also offer size, momentum effects (booms), interest rate level and technology industry dummy are positive. This was also found in the previous models and will not be discussed anymore. Surprisingly the oil price dummy is significant at the 1 % level and has a positive sign. Beside Pescatori (2008) or Güntürkün (2012), who did not find a significant relationship between underpricing and the oil price level, the sample for the developed world shows a strong positive relation between the oil price level and the level of underpricing. This also proves the thesis that the macroeconomic forces can deploy their power in a better way as there are better developed markets. The variable for GDP growth is still insignificant and it confirms that its significance in the first model could have been lead by a spurious correlation. Time-fixed effects do not change results.

For the developing countries the regression shows the following behaviour. The CCI is negative and significant on the 1 % significance level. Furthermore, variation in growth and underwriter reputation are also significant on the 1 % level. It is interesting to notice that underwriter reputation seems to have a certification effect on the emerging markets, as it was in the developed world before the ‘90.

On the other hand, the momentum effects variable for booms and the interest rate variable are insignificant. These results are not in line with the previous conclusions of the work. Nevertheless, it be argued that there are different business cycles in the developing world than in the developed. Thus, the chosen variables are not suitable to explain the variation in underpricing in the developing world. Also Rand and Tarp (2002) found that business cycles in the developing world are shorter than in the developed world and that the turning points of the economy vary from the ones in the developed world.

Indeed, when time fixed effect are added, variation of GDP growth becomes insignificant, interest rate and CCI become positive and significant as in the previous models. The topic should be analyzed further in future research focused on emerging markets.

In summary, model four shows that macroeconomic variables have a stronger influence on underpricing in countries with functioning capital market mechanism and fully developed capital markets.

6.4 Limitations

The analysis conducted so far suffers some limitations, that could affect the results that were obtained. In this section those limitations are discussed, in order that future research could overcome it.

One limitation is that in the dataset it was impossible to divide in different industries the companies analyzed. It was only possible to have information of companies that are part of the tech industry. A dataset with more information on this aspect should improve the quality of the results of the regressions. Another limitation is the use of macroeconomic variables at an annual frequency. In the dataset used was indicated only the year of the IPO and not the exact day. Therefore, it was impossible to use macroeconomic variables at a monthly or quarterly frequency. Future research should try to overcome this issue. In addition, the authors were not able to find an instrument variable for the regressor price deviation. As discussed in the previous sections, price deviation could be endogenous, however it was considered exogenous by the authors due to missing research on that topic. Thus, it could cause biases in the estimates of all parameters.

A last limitation is caused by the fact that for IPOs in China, India, Turkey and other less developed countries, the number of missing information is higher than for European countries and US. Many of the less developed countries do not or just on an annual frequency publish economic data and indices. Further research should try to find more data on less developed countries.

7.0 Conclusions

The work was conducted to identify the effect of macroeconomic variables of IPO underpricing, on a sample of 20 countries for a period over 20 years. The wide sample allowed a more objective view on the influence of macroeconomic variables as country specific economic effects could be eliminated. The thesis proved that IPO underpricing is to some extent influenced by macroeconomic variables.

Furthermore it tried to investigate the effect of unconventional monetary policy on underpricing. Model 2 shows that if unconventional monetary policy is applied, the relation between interest rate and underpricing changes sign and negative interest rates increase IPO underpricing. Thus, it can be concluded, that the monetary policy of the world central banks influenced the degree of IPO underpricing.

In addition, the thesis demonstrated that macroeconomic variables have a stronger effect on countries with more efficient capital markets. It was shown that countries that have more developed capital markets are also countries that are in the first world. The explanation for this can be that in countries with developed and free capital markets, the market price of the IPO is determined by the market forces which are themselves determined by macroeconomic variables. However, this was not a central question of the thesis and it is recommended to continue the research on this subject.

Summing the results up, the thesis found that interest rate and CCI are positive and significantly associated with underpricing. If a sample of only developed countries is analysed, also oil price becomes significant and once it is considered the time period after the 2007 economic crisis, the sign of the parameter of interest rate changes its sign. Another finding is that CCI and interest rate are significant on the 1 % significance level in the sample of developed countries. The finding on the variable of GDP growth are mixed and its significance in some models could be lead by a spurious relation between underpricing in China and variation of growth.

Finally it can be stated that macroeconomic forces influence IPO underpricing. The effect of this phenomenon is more prevailing in developed countries as these exhibit more efficient capital markets. Further research should try to determine how the effect of macroeconomic variable changes over time and it should try to analyze the effect of other macro variables that are not considered into this work.

Appendix

The table below shows the descriptive statistics of the initial sample (base model) used in this thesis. The sample consists of all IPOs over 50 million issuing volume and all SEOs, Real Estate Funds and Financial Vehicles (REITS) have been excluded – Data collection from Bloomberg – timeframe lasts form 1997 to 2017. This timeframe gives a total of 7 608 IPO observations. The descriptive statistics for the IPO data is represented as follows

	Adjusted under-pricing	CCI Varia-tion	Log(a sset)	Log(rev enue)	Bub-ble D.	Net In-come	Log(off er size)	Oil Dum-my	Price deviation	Tech In-dustry D.	Variation GDP Gr.	Interest rate
Mean	26,80	0,56	6,81	5,98	0,31	911,88	342,81	0,08	262,44	0.120190	0,12	0,27
Median	11,89	0,73	6,47	5,81	0,00	15,33	123,93	0,00	0,07	0,00	0,30	3,51
Maximum	4412,82	42,63	19,51	16,47	1,00	482682,00	17976,50	1,00	1157894,00	1,00	13,70	39,96
Minimum	-100,00	-57,10	0,06	-4,20	0,00	-433089,00	32,35	0,00	0,00	0,00	-13,00	-0,78
Std. Dev.	71,88	9,06	2,36	2,57	0,46	12707,80	897,19	0,27	17420,31	0,33	1,79	3,02
Skewness	31,66	-0,28	0,83	0,21	0,84	10,58	9,74	3,09	66,45	2,34	1,83	1,75
Kurtosis	1837,78	5,20	3,99	3,54	1,70	954,20	133,89	10,57	4415,99	4,46	15,24	11,80

Table 1 Main statistics sample variables

Table 2 correlation matrix

Variable	*CCI Variation*	*Asset*	*Revenue*	*Bubble Dummy*	*Net Income*	*Offer size*	*Oil Dummy*	*Price Dummy*	*Tech Industry Dummy*	*Variation of GDP Growth*	*Interest Rate*
CCI Variation	1	-0,015839	-0,036288	0,145469	0,0185	-0,005032	0,034576	-0,005588	-0,014978	0,366539	-0,106435
Asset		1	0,866027	-0,158063	0,228478	0,40791	0,097574	0,00073	-0,215294	0,022729	-0,033533
Revenue			1	-0,181492	0,187259	0,347457	0,084077	0,007823	-0,148334	0,012493	-0,042662
Bubble Dummy				1	-0,030916	-0,006505	-0,196509	0,022621	0,106981	-0,000199	0,23444
Net Income					1	0,238757	0,051617	-0,000753	-0,018738	0,012995	-0,025986
Offer size						1	0,015521	-0,004804	-0,067354	0,008695	-0,013964
Oil Dummy							1	-0,004445	-0,032169	-0,092796	-0,181168
Price Dummy								1	0,040704	0,02381	-0,016991
Tech Industry D.									1	-0,006849	-0,005229
Variation of GDP Growth										1	-0,055278
Interest Rate											1

The figure below shows the result of the Jarque-Bera test that was run on the basic model. The test uses the whole sample of IPO observations of 7.608 IPO events. The sample period lasts from 1997 to 2017. A normal distributed sample would have a skewness of 0 and an excess kurtosis of 0. The null hypothesis of normality is thus rejected on the 1 % significance level. The sample is right skewed and leptokurtic.

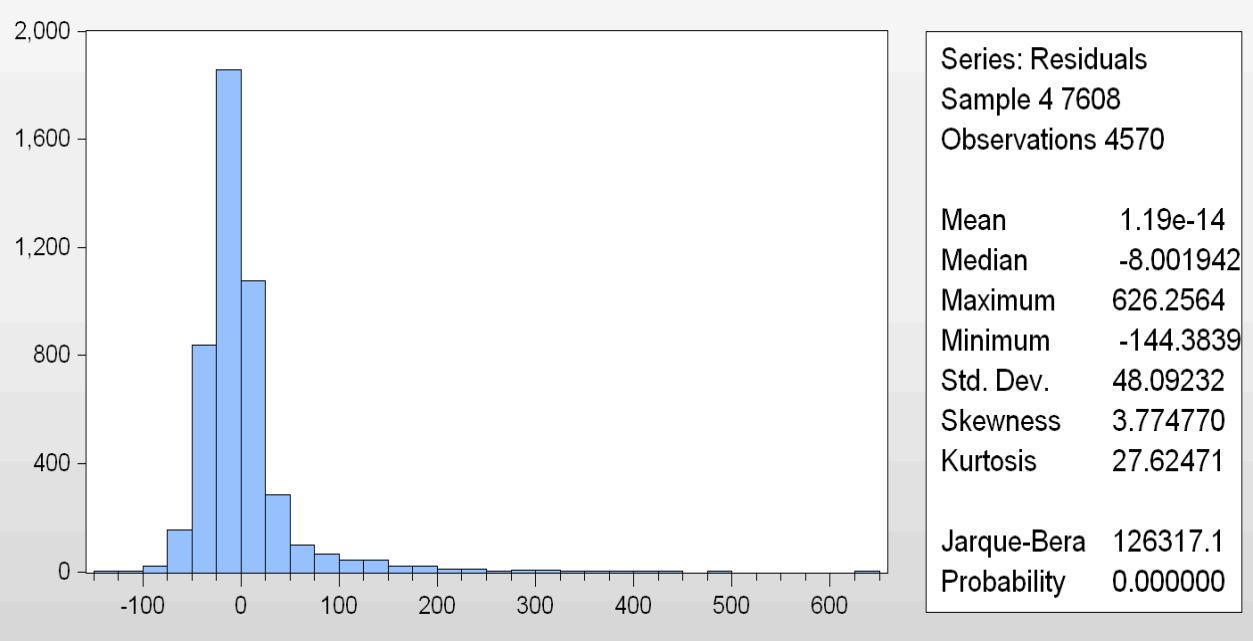

Figure 8 Jarque-Bera test for normality

The regression results of model 1 are present in the following table. The regression used below consists out of the independent variable $MAIR_i$ (market adjusted first day return) and the dependent variables certified advisor reputation, net income, variation of growth, bubble dummy, log of offer size, oil price dummy, price deviation, interest rate, technology industry dummy, log of assets and CCI variation. The method applied is the ordinary least squares (OLS) approach for a sample time frame from 1997 to 2017. The cross-section approach includes 7.608 IPO observations in an unbalanced sample. In order to account for the observed heteroscedasticity, White-Huber standard errors and covariance (number of degree of freedom correction) are used as a covariance method.

Model 1-Base Model

Effect specification		
Country Fixed effects	yes	yes
Time fixed effects	no	yes
Variables	**Coefficient**	**Coefficient**
Constant	12,8081** (4,42)	35,9547*** (6,09)
Certified Advisor Reputation	3,8825*** (1,42)	3,49** (1,50)
Net Income	0,0001*** (0,0000)	0,0001* (0,0000)
Variation of GDP Growth	0,9319*** (0,30)	0,9702** (0,39)
Bubble Dummy	19,7465*** (1,78)	-
Log(Offer Size)	2,1489* (1,15)	1,2784 (1,09)
Oil Dummy	0,2794*** (1,70)	-
Price Deviation	-0,0000*** (0,0000)	-0,0001*** (0,0000)
Interest rate	2,0041*** (0,33)	1,6977*** (0,41)
Tech Industry Dummy	11,9709*** (3,30)	10,5465*** (3,13)
Log(Asset)	-4,8439*** (0,74)	-3,697238*** (0,67)
CCI Variation	0,1252* (0,07)	0,233038*** (0,08)
R^2	0,123	0,21
Adjusted R^2	0,117	0,20
Observations	7608	7608

Dependent variable is adjusted underpricing. Standard error is in parenthesis. *** significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 3 base model regression results

The regression results of model 2 are present in the following table. The regression used below consists out of the independent variable $MAIR_i$ (market adjusted first day return) and the dependent variables certified advisor reputation, net income, variation of growth, bubble dummy, log of offer size, oil price dummy, price deviation, interest rate, technology industry dummy, log of assets and CCI variation. The method applied is the ordinary least squares (OLS) approach for a sample time frame from 1997 to 2007. The cross-section approach includes 3.801 IPO observations in an unbalanced sample. In order to account for the observed heteroscedasticity, White-Huber standard errors and covariance (number of degree of freedom correction) are used as a covariance method.

Model 2-IPO 1997-2007

Effect specification		
Country Fixed effects	yes	yes
Time fixed effects	no	yes
Variables	**Coefficient**	**Coefficient**
Constant	16,0079** (6,79)	19,2401** (7,53)
Certified Advisor Reputation	3,7598* (2,18)	6,675*** (2,26)
Net Income	0,0001 (0,0001)	0,0001 (0,0001)
Variation of GDP Growth	0,6139 (1,00)	-0,3265 (1,10)
Bubble Dummy	20,6896*** (2,32)	-
Log(Offer Size)	2,6286 (1,87)	3,2353* (1,89)
Oil Dummy	-	-
Price Deviation	-0,0001*** (0,0000)	-0,0000*** (0,0000)
Interest rate	2,6665*** (0,61)	4,661*** (0,68)
Tech Industry Dummy	14,0175*** (4,57)	15,9268*** (4,60)
Log(Asset)	-6,4127*** (1,24)	-7,181*** (1,26)
CCI Variation	0,5815*** (0,14)	0,991*** (0,15)
R^2	0,147	0,142
Adjusted R^2	0,138	0,13
Observations	3801	3801

Dependent variable is adjusted underpricing. Standard error is in parenthesis. *** significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 4 Two Step model part 1 regression results

The regression results of model 3 are present in the following table. The regression used below consists out of the independent variable $MAIR_i$ (market adjusted first day return) and the dependent variables certified advisor reputation, net income, variation of growth, bubble dummy, log of offer size, oil price dummy, price deviation, interest rate, technology industry dummy, log of assets and CCI variation. The method applied is the ordinary least squares (OLS) approach for a sample time frame from 2008 to 2017. The cross-section approach includes 3.810 IPO observations in an unbalanced sample. In order to account for the observed heteroscedasticity, White-Huber standard errors and covariance (number of degree of freedom correction) are used as a covariance method.

Model 3-IPO 2008-2017

Effect specification		
Country Fixed effects	yes	yes
Time fixed effects	no	yes
Variables	**Coefficient**	**Coefficient**
Constant	17,9217*** (4,84)	12,3779*** (4,22)
Certified Advisor Reputation	1,8256 (1,32)	1,1191 (1,36)
Net Income	0,0000* (0,0000)	0,0000* (0,0000)
Variation of GDP Growth	-1,141*** (0,28)	-0,6977** (0,28)
Bubble Dummy	-3,6002** (1,82)	-
Log(Offer Size)	2,0545** (0,89)	2,1936*** (0,85)
Oil Dummy	-3,9113** (1,75)	-
Price Deviation	-0,1886*** (0,07)	-0,1613** (0,07)
Interest rate	-3,0369*** (0,64)	-1,7966** (0,58)
Tech Industry Dummy	7,3411** (3,40)	7,6052** (3,41)
Log(Asset)	-2,5469*** (0,51)	-2,561*** (0,49)
CCI Variation	-0,1203* (0,07)	-0,1334* (0,07)
R^2	0,065	0,08
Adjusted R^2	0,05	0,061
Observations	3810	3810

Dependent variable is adjusted underpricing. Standard error is in parenthesis. *** significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 5 Two Step model part 2 regression results

The regression results of model 4 are present in the following table. The regression used below consists out of the independent variable $MAIR_i$ (market adjusted first day return) and the dependent variables certified advisor reputation, net income, variation of growth, bubble dummy, log of offer size, oil price dummy, price deviation, interest rate, technology industry dummy, log of assets and CCI variation. The method applied is the ordinary least squares (OLS) approach for a sample time frame from 1997 to 2017. The cross-section approach includes 5.192 IPO observations in an unbalanced sample. All observations with the country dummy China are excluded from the sample. In order to account for the observed heteroscedasticity, White-Huber standard errors and covariance (number of degree of freedom correction) are used as a covariance method.

Model 4- China Excluded

Effect specification		
Country Fixed effects	yes	yes
Time fixed effects	no	yes
Variables	**Coefficient**	**Coefficient**
Constant	2,7957 (4,46)	9,9289 (6,65)
Certified Advisor Reputation	7,9716*** (1,55)	7,9959*** (5,03)
Net Income	0,0001* (0,0000)	0,0000** (0,0000)
Variation of GDP Growth	0,2787 (0,27)	0,0532 (0,43)
Bubble Dummy	19,8434*** (1,85)	-
Log(Offer Size)	4,5541*** (1,20)	3,7085*** (1,13)
Oil Dummy	5,1174*** (1,85)	-
Price Deviation	-0,0000*** (0,0000)	-0,0000** (0,0000)
Interest rate	2,4311*** (0,36)	0,9972* (0,53)
Tech Industry Dummy	12,2753*** (3,30)	10,6571*** (3,14)
Log(Asset)	-6,1872*** (0,83)	-5,1127*** (0,75)
CCI Variation	0,462*** (0,07)	0,3357*** (0,08)
R^2	0,162	0,246
Adjusted R^2	0,155	0,236
Observations	5192	5192

Dependent variable is adjusted underpricing. Standard error is in parenthesis. *** significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 6 model without China regression results

The regression results of model 5 are present in the following table. The regression used below consists out of the independent variable $MAIR_i$ (market adjusted first day return) and the dependent variables certified advisor reputation, net income, variation of growth, bubble dummy, log of offer size, oil price dummy, price deviation, interest rate, technology industry dummy, log of assets and CCI variation. The method applied is the ordinary least squares (OLS) approach for a sample time frame from 1997 to 2017. The cross-section approach includes 3.453 IPO observations in an unbalanced sample. Only variables with country dummies from: Canada, France, Germany, Italy, Japan, Portugal, Spain, Sweden, Switzerland, United Kingdom and United States have been included in this sample. In order to account for the observed heteroscedasticity, White-Huber standard errors and covariance (number of degree of freedom correction) are used as a covariance method.

Model 5- Developed Countries

Effect specification		
Country Fixed effects	yes	yes
Time fixed effects	no	yes
Variables	**Coefficient**	**Coefficient**
Constant	-2,2538 (4,76)	-13,8806 (10,99)
Certified Advisor Reputation	9,60*** (1,73)	9,2305*** (1,79)
Net Income	0,0001*** (0,0000)	0,0000** (0,0000)
Variation of GDP Growth	0,4676 (0,34)	1,0783 (0,90)
Bubble Dummy	19,6291*** (1,99)	-
Log(Offer Size)	5,5042*** (1,38)	4,4304*** (1,29)
Oil Dummy	6,5447*** 2,06)	-
Price Deviation	-0,0000*** (0.0001)	-0,0000** (0,0000)
Interest rate	3,2799*** (0,39)	3,9051*** (1,15)
Tech Industry Dummy	12,1401*** (3,38)	10,4873*** (3,24)
Log(Asset)	-6,9744*** (0,95)	-5,7893*** (0,86)
CCI Variation	0,5724*** (0,08)	0,3912*** (0,12)
R^2	0,166	0,25
Adjusted R^2	0,16	0,24
Observations	3453	3453

Dependent variable is adjusted underpricing. Standard error is in parenthesis. *** significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 7 Developed Countries regression results

The regression results of model 5 are present in the following table. The regression used below consists out of the independent variable $MAIR_i$ (market adjusted first day return) and the dependent variables certified advisor reputation, net income, variation of growth, bubble dummy, log of offer size, oil price dummy, price deviation, interest rate, technology industry dummy, log of assets and CCI variation. The method applied is the ordinary least squares (OLS) approach for a sample time frame from 1997 to 2017. The cross-section approach includes 1.116 IPO observations in an unbalanced sample. Only variables with country dummies: China, India, Mexico, Russia, South Africa, Turkey and United Arab Emirates have been included in this sample. In order to account for the observed heteroscedasticity, White-Huber standard errors and covariance (number of degree of freedom correction) are used as a covariance method.

Model 6-Emerging Countries

Effect specification		
Country Fixed effects	yes	yes
Time fixed effects	no	yes
Variables	**Coefficient**	**Coefficient**
Constant	43,7254*** (8,55)	30,8897*** (10,65)
Certified Advisor Reputation	-9,0182*** (2,51)	-120,667*** (6,86)
Net Income	0,0002 (0,0001)	0,0003** (0,0001)
Variation of GDP Growth	1,5841*** (0,47)	1,0885*** (0,59)
Bubble Dummy	5,1715 (3,20)	-
Log(Offer Size)	-5,507*** (2,02)	-6,4027*** (2,00)
Oil Dummy	-15,9377*** (2,78)	-
Price Deviation	0,2174*** (0,08)	0,4497*** (0,08)
Interest rate	-0,3333 (0,28)	-1,1799*** (0,44)
Tech Industry Dummy	3,5729 (10,36)	5,0045 (9,51)
Log(Asset)	-0,1309 (1,03)	0,2106 (1,01)
CCI Variation	-0,3961*** (0,11)	-0,4288*** (0,12)
R^2	0,095	0,24
Adjusted R^2	0,08	0,21
Observations	1116	1116

Dependent variable is adjusted underpricing. Standard error is in parenthesis. *** significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 8 Emerging Countries regression results

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We hereby declare to be the sole authors of the present essay and not have received any assistance or contribution of others in this regard. Any source or aid used is stated and all quotations made, in writing or in spirit from published or unpublished sources, are marked as such.

Furthermore, this work has not been submitted, either in part or whole to this or any other examination authorities.

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