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Shift in IPO market dynamics following the financial crisis of 2008: increased focus on recession-proof companies

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Abstract

The financial crisis of 2008 marks one of the most significant and longest IPO market droughts. There has been an open debate over the years of whether this economic recession has brought about structural changes in the IPO market dynamics, the type of firms that tend to go public and their respective underpricing levels when subject to fluctuating economic uncertainty levels. Several calls for increased regulations and transparency have been made following this infamous recession. This paper evaluates the first day returns in U.S. IPO market, during a period of economic instability and compares it to periods preceding and succeeding this recession, comprising years from 2007 to 2014. There is substantial evidence to conclude that periods of very high uncertainty led to higher underpricing, even during cold markets. Additionally, the number of smaller-sized firms going public has drastically decreased and instability levels differentially impacted U.S.'s industries, highlighting exploitable discrepancies.

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1. Introduction

During the last decades, there has been extensive media coverage of firms deciding to go public, especially during the dot come bubble and the recent technology bubble. Given the extensive literature conducted on the topic, it results of relevant importance to investigate further the anomalies in the IPO market. The IPO anomaly is subdivided into two anomalies: the first-day underpricing and the long-run underperformance of IPOs. However, only the former will be scrutinized in this paper. Additionally, it is of interest to exploit the findings to provide room for potential policy implications to re-energize the IPO market or create new second-tier exchanges as a response to economic downturns. Second-tier exchanges, which comprise those stocks that investors tend to favor less, could be made more accessible and provide room for going public for those firms that during economic crises are either deterred or not capable of bearing the costs of going public. Whilst the market could be re-energized by increasing incentives to pursue auctions rather than book-building practices when going public as costs would be significantly lowered (Ritter, 2012).

The vibrancy of the IPO market has been significantly affected by business-cycle fluctuations, as by Ritter and Welch (2002); thus, it has been considered strongly cyclical, reflected in the highly varying frequency and type of IPOs pursued. In addition, the impact of information asymmetry on the IPO underpricing anomaly has been a widely discussed topic over the years. However, despite the abundant previously conducted literature, there is still room for further research to provide a more satisfactory explanation for the latter phenomena.

Previous research has already been conducted on the impact of economic and political uncertainty on IPO underpricing in Kesten and Mungan (2015). Accordingly, the authors predict that increases in political uncertainty decrease the frequency of IPOs as it pushes up costs of going public and that IPOs during these periods tend to be of higher quality, generating higher returns. Related to the latter, they also predict that underpricing is less pronounced during periods of economic uncertainty. Given the strong cyclicality of the IPO market, the IPO decision appears to be substantially affected by investor sentiment and asymmetric information in the market.

Furthermore, some argue that the commonality of recessions is a positive factor in the economy: Eichengreen (1996) argues that economic recessions caused by crises increase the recovery pace of an economy, while Caballero and Hammour (1991) argue that periods of economic recession are necessary for development. Therefore, it is interesting to study pre-/during/post-crisis IPO underpricing, potentially leaving room for more practical policy implications and a call for increased transparency in the IPO market. In this paper, I aim at adding to existing research conducted on the topic by investigating the effect of economic instability following the financial crisis on the U.S. IPO industry and analyze how determinants of IPO underpricing are eventually affected. Hence I formulate the following research question:

What was the impact of the economic uncertainty caused by the financial crisis on IPO underpricing in the U.S.: structural or behavioral consequence?

The above research question aims at understanding whether the financial crisis has had permanent structural effect on the dynamics of the IPO market as well as on the type and size of firms that tend to dominate it during and post-recession periods, or whether changes occurred where only a temporarily behavioral response of issuers and investors that over-/under-reacted to an uncertain economy. The research question also sheds light on the interesting implications that different underpricing levels have on the type of firms that tend to dominate the IPO market, as we see increased participation of these so-called Special Purpose Acquisitions Companies (SPACs).

Understanding what drives underpricing anomaly and evaluating the effect of periods of uncertainty on the latter is socially relevant as going public entails both advantages and disadvantages. Besides the advantage of raising capital and awareness in the market, there are several disadvantages, such as the obligation to comply with strict regulations and disclosure requirements which results costly, especially to smaller firms. The latter disadvantage is why in this paper, I will be scrutinizing the differential effect during recessions on the extent of underpricing on different-sized firms. Moreover, the study of this paper adds to the existing literature on scientific relevance grounds as it focuses on the impact that information asymmetry and economic uncertainty caused by the Financial crisis of 2008 had on IPO underpricing levels, which is an area that, to the best of my knowledge, has not been thoroughly scrutinized yet. By having a better picture of the advantages and disadvantages of an IPO, investors and issuers can make better informed decisions, improving their strategy regarding

the most effective funding type to speed a product in the market, and minimize their investment risks during recession periods.

The scope of this paper is to deepen existing knowledge on the dynamics of the IPO market and its sensitivity to changes in economic uncertainty. More specifically, it focuses on the impact that the financial crisis had on IPO underpricing and its determinants to be able to conclude whether over the years following this recession, structural changes in the market have occurred and potentially providing a guideline for the evaluation of the market following the recent economic recession caused by the pandemic. Contrasting research done by Ritter and Welch (2002), this paper focuses on the short-term performance of initial issuance of stock; therefore, looking at first-day return, market capitalization, and the number of IPOs.

Based on the results of this paper, I was able to make some significant inferences on the IPO market. I found that during the crisis, from 2008 to 2009, the overall level of underpricing had surprisingly increased. Additionally, I observed a substantial decrease in small firms going public during the crisis followed by a more pronounced decrease after the crisis, indicating a potential change in the type of firms dominating the IPO market. Moreover, small firms also a were subject to a larger fall in their respective underpricing compared to larger firms. Finally, I also observe how IPOs seem to be clustered by industry: having industries with inelastic demands dominating the market and observing higher underpricing levels.

This paper is subdivided in the following sections. Section 2 introduces the hypotheses based on a thorough analysis of previously conducted literature, touching upon four concepts affecting initial returns. Section 3 comprises the data retrieval process and the methodology used to reach results allowing me to make significant inferences. Then Section 4 presents the descriptive statistics of the dataset as well as the results of my regressions. Finally, Sections 5 and 6 report the conclusion and discussion of this thesis.

2. Theoretical framework

In this theoretical framework, I report previously conducted literature that will lead me to the formulations of several hypotheses. This section is subdivided into four subsections. The first

one aims at providing a thorough explanation of the IPO underpricing anomaly. Secondly, the efficient market hypothesis is discussed. Thirdly, an evaluation of economic circumstances' effect on the IPO anomaly is analyzed. Finally, I conclude with an elaboration on firm characteristics' impact on underpricing.

2.1 IPO underpricing anomaly and Ex-ante uncertainty

As findings by Clarkson and Merkley (1994) prove, IPOs in the U.S. tend to be underpriced. Likewise, Loughran and Ritter (2002) found that during the period of economic downturn between the 1990s and 1998, underpricing levels were at 15 percent. During the dot-com bubble in 1999 and 2000, U.S. IPOs experienced an average initial return of around 65 percent and finally, from 2000 after, it stabilized at 12 percent roughly (Ritter, 2014). All the above shows how IPO underpricing has greatly fluctuated over the years.

Diving deeper into this phenomenon, Rock (1986) introduces the *Winner's Curse* problem in which he identifies three parties participating in an IPO: the issuer and investors classified as informed and uninformed individuals. In this setting, uninformed investors are subject to higher levels of ex-ante uncertainty on the stock's intrinsic value. This leads to informed investors only buying shares if they are priced below their fair value and uninformed investors getting all shares in case the offer price is set higher than their expected fair value, resulting in an adverse selection problem (Fabrizio, 2000). To ensure uninformed investors' participation, issuers tend to underprice their offers.

Concerning the popularity of underwriters and its effect on initial returns of IPOs, it is essential to note that investors are not homogenous. Therefore, driving a wedge in monitoring skills between large and smaller investors as the formers usually benefit from better institutional mechanisms. The latter wedge is reflected thereafter in their differential impact on a firm's IPO valuations. Stoughton and Zechner (1998) emphasize the relevance of share allocations in the determination of underpricing level: specifically, they argue how pro-rata allocation decreases the level of underpricing. Likewise, Loughran et al. (1994) provide evidence for lower underpricing levels in countries with less strategic rationing. The latter findings lead us to question the impact that institutions and regulations could have on the type of allocation pursued during periods of uncertainty, as I expect that firms in countries with regulations requiring higher participation from small investors are more likely to face higher underpricing,

accordingly to the *Winner's Curse*. Consequently, as Doidge et al. (2013) confirms, the U.S. is characterized by high quality institutions with regulations targeting the protection of all investors, making it more likely to observe higher underpricing in its IPO market.

Related to the latter idea, Beatty and Ritter (1986) would argue that higher ex-ante uncertainty among investors tends to increase the level of underpricing. Ritter (1984) explains Rock's *Winner's Curse* by stating that the reason for observing first-day underpricing is because it acts as compensation for uninformed investors that have to incur costs to access information on the actual value of shares. Consequently, the higher the uncertainty among these investors will be, the higher compensation is needed, which is followed by higher levels of underpricing. Adjacently, Michaely and Shaw (1994) conclude that by relaxing the assumption that the market for IPOs comprises heterogenetic investors, informed and uninformed, all having equal information levels, then the *Winner's Curse* disappears along with the associated underpricing. Besides, I also consider the finding by Doidge et al. (2013) that with increases in financial globalization, the role that institutions have on the IPO market weakens, consequently possibly resulting in lower underpricing.

2.2 Market efficiency psychological bias theory

The ex-ante uncertainty preceding an IPO raises the concern of whether markets are as efficient as depicted. The Efficient Market Hypothesis introduced by Fama (1970) entails the idea that prices in the market always reflect all available information regarding securities and the market. Malkiel (2003) argues that behind this hypothesis lies the concept of "random walk"; meaning that the prices reflected in tomorrow's market are independent of today's changes in prices. Hence information flow is not hindered. Therefore, the theoretical view believes that the stock market reaches an efficient equilibrium; however, the latter is nearly never the case. There are persistent behavioral finance biases that lead investors to overreact or underreact to the availability or lack of specific information. Purnanandam and Swaminathan (2004) argue that issuers tend to set their offer price equal to the actual firm value. The reason for this deduction is the observation of the poor long-run performance of these firms compared to a market benchmark. Irrational investors' temporary overreaction purely drives the initial market return in excess of the offer price to information. The authors attach this observed poor long-run performance to the idea of IPOs being overpriced rather than underpriced, as they end up performing much worse than what the market had valued them after a period of three to five

years post IPO. To further prove Purnanandam and Swaminathan's argument, Ritter (1991) shows how in the long run, namely after 36 months, IPOs significantly underperform the market by roughly 30 percent. Likewise, Bloomfield et al. (2000) discuss how investors tend to overreact to unreliable news and underreact to significantly relevant news, which is why the continuous underpricing persists over the years. The period of the economic recession of 2008 was flooded by a substantial amount of reliable and unreliable news due to the high level of uncertainty about the near future, which could potentially be a reason for observing sudden spikes in underpricing followed by sudden droughts.

2.3 Financial crisis

As Schumpeter (1939) once said: “History is a record of “effects” the vast majority of which nobody intended to produce". The Great Financial depression of 2008 began in the late summer of 2007. It was adequately visible following the fall of the Lehman Brothers, succeeded by the American International Group’s (AIG) liquidity crisis, which was caused by a fall in their credit ratings. Consequently, many more institutions started to collapse, and it was clear that government intervention was needed to maintain the economy afloat. When stock prices started to fall, this period of the economic downturn was then defined as an economic recession. Briefly, the reason for such a significant rise in liquidity issues was because, during the years before the crisis, there had been an excessive build-up of precarious bad mortgages that were not sustainable anymore as borrowers had no liquidity at hand to repay them. This period of economic recession was the biggest following the Great Depression of 1929. Besides leading to the bankruptcy of several institutions, the financial crisis further added to the already existing market information asymmetry that had led to this downturn. Thence, we see that there has been a thorough increase in regulations for increased transparency and disclosure of information ever since the crisis. It is, therefore, interesting to evaluate the effect that this crisis has had on IPO underpricing and scrutinize how an increase in regulations has influenced the level of underpricing during the post-crisis period. On a more general note, developing countries encounter an average level of underpricing of around 60 percent while developed countries of only 15 percent. There is, therefore, a substantial difference in the effect of information asymmetry between emerging markets and developed ones; in this paper, I will focus on the impact that the crisis has had on IPO underpricing in the developed market of the U.S.

The conventional view is that information uncertainty before an IPO tends to increase the level of underpricing. On this matter, Ritter (1987) argues that an increase in disclosed information, hence an increase in regulation, could potentially reduce the costs for the U.S. stock market associated with capital funding. Likewise, Ang and Brau (2002) found a negative relationship between the transparency of information and the level of costs associated with IPOs. Lastly, the economic uncertainty caused by the recession likely decreased more smoothly, hence enabling us to still observe relatively high uncertainty levels in the years following the crisis. This residual uncertainty drives the IPO post-crisis market, more specifically by positively influencing their respective underpricing.

A distinction should be made between hot and cold markets and their influence on the IPO market-timing. A paper by Ibbotson and Jaffe (1975) defines a hot issue as an IPO with a return significantly above the offer price and higher than the average market return, providing implications on market-timing. Furthermore, already in the model illustrated in Rock (1986), there is the expectation that in hot markets with favorable conditions, higher-risk IPOs tend to be more underpriced than less risky ones as they are more difficult to value. Adjacently, Ritter (1984) builds on Rock's model and finds that changing the composition of risk fails to explain the observed higher returns of such IPOs; nevertheless, he argues that an accurate proxy for risk considering ex-ante uncertainty needs to be accounted for. On the other hand, cold markets act conversely to hot markets as they are associated with droughts, and underpricing seems less pronounced. A study by Fauzi, Wellalage, and Locke (2012), who looked at a set of New Zeeland IPOs, found that during the financial crisis of 2008, the short-term performance of these IPOs was less favorable. Previous literature indicates that market uncertainty tends to push down the issuers' offer price to enable informed and uninformed investors participation, assuming that market valuations do not fluctuate much. However, in practice, markets are characterized by hot and cold periods that greatly influence both the frequency and valuations of IPOs. Given that the scope of this paper is to evaluate the effect of the crisis, considered a period of cold market with significantly high levels of economic uncertainty, I formulate the following hypotheses:

H1. During the financial crisis, lower levels of underpricing were observed compared to periods of economic stability.

2.4 Firm characteristics

2.4.1 Firm size

A paper by Doidge et al. (2013) investigates the abnormally low small-firm activity that the US IPO market has experienced over the last decade. Their study aims at explaining what could have caused the latter phenomena by focusing on the impact of changes in regulations in the early 2000s and potential changes in the ecosystem of small firms' competitiveness. They conclude that financial globalization had greatly benefitted small-firm IPO activity outside the U.S. but not in the U.S. potentially due to the financial globalization being correlated with other factors (Doidge et al., 2013). Additionally, they also concluded that the implementation of regulations, such as the Sarbanes-Oxley act which aims at protecting investors from corporations' fraudulent behavior, had occurred only after the U.S. small-firm activity started to decline so no causal relation could have been drawn. Bernstein, Dev, and Lerner (2020) argue that the risk of expropriation from entrepreneur to the investor is reduced when the quality of minority shareholders' protection is higher, stimulating more investments in smaller firms that face low listing requirements. Also, Bell, Moore, and Al-Shammari (2008) argue how firms from countries having efficient governmental policies and better-quality institutions experience lower IPO underpricing; additionally, firms from countries that have lower quality institutions can avoid the adverse effects of their home country's regulations by borrowing those of foreign countries when global market integration is high.

Based on these findings, this paper will compare periods of economic recession to periods of economic stability to evaluate differences in underpricing levels and look at how determinants of this anomaly are differentially affected for different-sized firms. Additionally, I expect that during periods of economic downturn, in countries with good legal protection, investments in smaller firms decrease even more but underpricing is less pronounced.

Thus, it interesting to look at whether the costs related to uncertainty in the market, such as delayed investment and the benefits, both reflected in underpricing, offset each other and whether they are more prominent for smaller and younger firms, decreasing their likelihood of going public. All the above leads to the formulation of the following hypothesis:

H2. Recessions tend to decrease the frequency of small firms going public as costs are more pronounced.

It is known that high-quality institutions and country-level solid governance characterize the U.S. . Thence, I expect that in countries with robust systems to empower outside investors, IPO underpricing is more accentuated by issuers who aim at creating excess demand for IPO shares and therefore increase the dispersion of ownership to maintain their control. The latest thinking raises the question of whether recession recovery periods tend to decrease the level of underpricing, especially for smaller firms, that could potentially benefit more by reducing the extent of ownership dispersion at the cost of retaining less control. The latter depends on a fundamental aspect of the IPO market entailing the idea that investors aim at minimizing the downside risks associated with their investments. Thence, they tend to target recession-proof companies that have inelastic demands. I therefore, formulate the following hypothesis:

H3. During post-crisis periods, IPO underpricing decreases more for small firms compared to large firms.

2.4.2 Industry-specific characteristics

This paper will emphasize the effect of industry-specific characteristics influencing levels of IPO underpricing in the U.S. . A study by Lerner (1994), focusing on the biotechnology industry, finds evidence that industry market-to-book ratio significantly influences the decision of IPO compared to the decision to acquire venture capital funding. The limitation in the existing literature on underpricing is that usually, the researcher only observes the IPO that succeeds and does not observe the firms planning to go public. On this matter, Pagano, Panetta, and Zingales (1998) were able to analyze a set of Italian firms avoiding this limitation and found that larger companies in industries with high market-to-book ratios are more likely to go public. Additionally, Lowry (2003) determines that industry growth opportunities, investor sentiments, and IPO volume are all factors that affect initial returns. By now, it is clear that the more transparent an industry is regarding the information on quantity and quality of firms, the less underpricing there is. Moreover, a paper by Guo, Lev, and Shi (2006) finds evidence that R&D is actually related to information asymmetry, supported by Aboody and Lev (2000), and that companies engaging in R&D tend to be significantly undervalued (Chan et al. , 2001). The macroeconomic industries that are more likely to engage in R&D are healthcare,

specifically the biotechnology microeconomic industry and the technology industry. Consequently, the lack of information on the nature and progress of R&D activities available to investors, that try to retain as much proprietary information as possible, positively influences the underpricing levels of IPOs (Eberhart et al. 2004). Following the above literature, I expect to observe higher levels of underpricing in the healthcare and high technology industries. All of this indicates how it is of particular interest to dive deeper into the macroeconomic industries' characteristics that drive IPOs occurring in the same market, hence being subject to the same regulations, formulating the following hypothesis:

H4. The financial crisis differentially affected the extent of IPO underpricing and its determinants across industries.

3. Data and Methodology

3.1 Data sources

In order to address the research question, I will retrieve data for IPOs in the U.S. from various databases. Firstly, the sample period will range from 2007 to 2015. The reason to include this period is that this paper aims at analyzing the immediate impact that the financial crisis has had on IPO underpricing of firms in the U.S. . Therefore, starting from a period of economic stability, in 2007, jumping to a two-year period of economic instability, namely from 2008-2009, and including a period of economic recovery and stableness until 2014. These pre-/during/post-crisis periods are determined by the economic policy uncertainty index for the U.S. (USEPUINDXD) retrieved from FRED, Federal Reserve Bank of St. Louis, which will be later described. Secondly, concerning data on IPO firms, industry, and offer prices, I will be using the Thomson One database. Moreover, to acquire respective data on closing prices, I will be using Datastream. To benchmark the initial return of all IPOs, I retrieved data on the daily and one-month prior IPO monthly returns on S&P 500 from the CRSP database. Additionally, I retrieved the issue size of the IPO from the Bloomberg database. Finally, I will be computing the initial returns, representing the IPO underpricing of each firm, using the offer and closing price.

3.2 Data Transformation

The initial sample consisted of 3247 IPOs of different firms, with the target issuer being the United States of America. However, the database used to retrieve the offer prices of companies between 2007 and 2014, namely Thomson One, did not have all information for all IPOs in this period. Therefore, I removed all missing observations, reducing my sample to 1496 IPOs. Additionally, several companies did not have a matching ISIN nor a 9-digit CUSIP code, essential to pull other respective information from other databases. Hence, I removed all missing observations reaching a sample size of 1263 IPOs. Moreover, Bloomberg had missing data concerning the issue size of specific firms, which reduced the sample to 1134. Finally, after removing missing observations for each company's IPO closing prices, the sample was reduced to 925 IPO observations.

Subsequently, the IPO market is known for its extreme positive outliers. This phenomenon is that issuers tend to extremely underprice their offer to observe excessive abnormal returns on the first day. For this, I remove all observations that have an offer price below 3$. The industries in which these outliers are observed are financials, high technology, industrials, retail, energy and power, consumer products and services, and healthcare. In conclusion, removing these observations leads to a final sample size comprising 895 observations that I will use to assess the financial crisis's impact on IPO underpricing.

3.3 Methodology

In order to address the research question, I will be conducting both univariate and multivariate regressions. When treating the data as cross-sectional, I will be conducting univariate Ordinary Least Squared Regressions (from now on OLS). When conducting multivariate regressions, data will be transformed into panel data. Firstly, the dependent variable of these regressions will indicate the underpricing on the first day of IPO, using the formula reported in Ljungqvist (2007), as a percentage difference between the closing price and the offer price as follows:

$$\boldsymbol{Initial\ return_i} = \frac{Closing\ price_i - Offer\ price_i}{Offer\ price_i} \qquad (1)$$

Theoretically, the dataset is panel data, given that there are different observations corresponding to different firms over seven years. To conduct the univariate regressions, I will be treating this dataset as cross-sectional since there is only one observation per firm over time, namely the IPO. Consequently, to account for the time factor, I will be using three time dummies to account for economic stability and instability periods.

The dependent variable will be regressed with OLS regressions on a series of explanatory variables determined by a thorough evaluation of previous literature. The basic regression model is reported here below:

$$\boldsymbol{Initial\ return_i} = \alpha + \beta_1 x_{1_i} \ldots + \beta_{ni} x_{ni} + \varepsilon_i \qquad (2)$$

In equation 2, the dependent variable Y_i denotes the initial return or underpricing of each company that went public in the U.S. from 2007 and 2014. Furthermore, the x_{1i} + … + x_{ni} represent all the independent variables that will be used in the regressions, where *I* indicate each firm in the sample. The β_{1i} + …+ β_{ni} represent the coefficients of each independent variable. Lastly, α is the intercept between the regression and the y-axis, hence the constant of the regression — Table 1 below reports all variables used in the regressions, their respective type, and measurement.

Table 1*. List of variables used, their respective variable type and measurement*

Variable	Type of variable	Measurement
Initial return	Y_i = Dependent variable	Percentage change between closing and offer price of IPO
Offer Price	X_{1i}= Independent variable	Initial price of a share at IPO
Issue size	X_{2i}= Independent variable	Total equity gained from IPO measured by

		multiplying offer price by shares issued
Economic uncertainty	X_{3i}= Independent variable	News-based economic policy uncertainty index based on newspapers in U.S.
Daily return on S&P500	X_{4i}= Control variable	Return stated in absolute terms measured by taking the natural logarithm of the current closing price divided by yesterday's closing price of index
Monthly return on S&P500	X_{5i}= Control variable	Return stated in absolute terms measured by taking the natural logarithm of the current month closing price divided by last month's closing price of index
Recession	X_{6i}= Dummy variable	Lead dummy variable that takes value one when economic uncertainty is higher than 90, and zero otherwise
Small firm	X_{7i}= Dummy variable	Dummy that takes value one if market capitalization is less than $50 m
Pre-crisis	X_{8i}= Dummy variable	Time dummy with value one if IPO occurs in 2007
Crisis	X_{9i}= Dummy variable	Time dummy with value one if IPO occurs between 2008 and 2009

Post-crisis	X_{10i}= Dummy variable	Time dummy with value one if IPO occurs between 2010 and 2014
$\boldsymbol{\alpha}$	Constant	-

Notes: The sample consists of observations for the following variables: Initial return, Offer price, issue size, Economic uncertainty, a daily and monthly return on S&P500. Additionally, five dummies are created to account for different time periods and firm size, namely: recession, Small firm, pre-crisis, crisis and post-crisis. All these variables are reported in this table along with their description and measurement

The variables reported in Table 1 are expected to significantly impact underpricing levels. Firstly, market capitalization for each firm is measured by multiplying the shares issued by the market price of each share, reported in millions of U.S. dollars. Subsequently, a firm size dummy will be generated following Gao, Ritter, and Zhu (2012), who considered small a firm being valued at less than $50 million in 2009 dollars. Secondly, issue size will account for the size of the offering, and a recession dummy will be generated to account for the financial crisis period. The recession dummy takes value one if the economic uncertainty index was higher than 90 and zero otherwise. The construction of this dummy was based on an evaluation of the development of the uncertainty index based on Figure 1: at the beginning of the crisis, it suddenly spiked to levels close to 90 and fluctuated at high levels thereafter, which is why I assumed it to accurately reflect the recession period. The economic policy uncertainty index is constructed with three components. The first component is a quantitative measure of policies' uncertainty coverage on daily newspapers; the second comprises federal tax code provisions with a future expiring date and the third reports the wedge created by economic forecasters' disagreements. Then, given the fact that the economic uncertainty index adjusted more slowly after the crisis, which is why we still observe high uncertainty in Figure 1 between 2010 and 2013, three dummies will be generated that subdivide the sample into three periods: pre-crisis in 2007, crisis from 2008 to 2009 and post-crisis from 2010 to 2014. The latter subdivision will allow to specifically scrutinize the impact on underpricing in those two years, 2008-2009, that define the financial crisis period. Additionally, accounting for these dummies rather than only the index itself prevents me from making inaccurate inferences on the effect that the financial crisis had on underpricing as I specifically focus on the IPOs in those years for comparison with periods of non-crisis. Finally, to benchmark returns, the Initial return will be regressed on two control variables being daily returns on S&P500, and monthly S&P 500 returns of the previous month to each IPO, expressed as percentages of S&P 500.

Furthermore, Ritter and Welch (2002) find that industries have a significant impact on the level of underpricing. For this matter, I will be conducting multivariate regressions by transforming the data into panel data and accounting for fixed industry effects. The latter, as well as reducing the respective standard error, will also help further reducing the omitted variable bias, from now on OVB. The expanded model specification is reported in equation 3 below.

$$\begin{aligned} \boldsymbol{Initial\ return_i} &= \alpha + \beta_1 OfferPrice_i + \beta_2 IssueSize_i + \beta_3 EconUncertainty_i \\ &+ \beta_4 DailyreturnS\&P500_i + \beta_5 MonthlyreturnS\&P500_i \\ &+ \beta_6 Recession_i + \beta_7 SmallFirm_i + \beta_8 Precrisis_i + \beta_9 Crisis_i \\ &+ \beta_{10} Postcrisis_i + \varepsilon_i \end{aligned} \quad (3)$$

3.4 Validity

To be able to base accurate inferences, it is crucial to make sure that results are valid and that they comply with the OLS assumptions. Hence, I will mention the primary concerns and how they will be addressed to ensure a sound empirical research.

3.4.1 Heteroskedasticity

Firstly, one of the assumptions of the CLRM model requires homoskedasticity, meaning that the variance of errors should be the same for all observations. This assumption is necessary for OLS to be BLUE: best linear unbiased estimator. However, this assumption is often violated in practice. In fact, heteroskedasticity is one of the most probable violations of OLS assumptions to occur when working with IPO samples, especially during highly cyclical periods like the financial crisis. Thus, I will be performing a White-test introduced by White (1980), and in case of rejection of the null hypothesis of homoscedastic error terms, I will be using robust standard errors. The White test showed that there is significant evidence of heteroskedasticity, so the null is rejected, and robust standard errors need to be used.

Before conducting any regression, I also investigated the validity of the third assumption requiring no correlation between residuals for all observations. In this dataset, there are most

probably industry-specific effects that are not being modeled, leading to white standard errors being no longer valid. Detecting correlated errors in cross-sectional data is nearly impossible; however, there is substantial evidence to believe that IPOs in the same industry have correlated errors. The latter is deduced by observing the means of residuals for each industry, which switch signs: some being positive, some negative, and having the total residual average significantly different from zero, further proving the presence of correlated errors. To address this issue, clustered standard errors, allowing for correlation within groups but not across, will be used in the univariate regressions as they are robust to both heteroskedasticity and correlated errors.

Additionally, conducting multivariate regressions with the data set as panel data will allow to account for clustered standard errors by the industry as well as the potential presence of omitted variable biases given the nature of the model. A paper by Cameron and Miller (2015) indicates that cluster-specific fixed effects should be used when there is substantial reason to believe that the errors are independent across clusters but dependent within. They also add that in the latter situation, using default standard errors potentially leads to an overstatement of estimators' precision that could invalidate results.

To conclude, accounting for clustered errors allows adjusting for observations that are not independent and identically distributed and considers unexplained variation across time that fixed effects are unable to capture. Whilst by using fixed effects, unobserved heterogeneity between different industries is removed. Besides, only controlling for a substantial list of control variables is not enough to have a robust model specification; hence fixed effects also account for the remaining OVB.

3.4.2 Endogeneity

Moreover, the most crucial assumption for OLS to hold, namely exogeneity, will most likely be violated. Endogeneity coming in the form of OVB or reverse causality is a common issue when researching IPOs. The latter could be a cause of either mechanical relations in the market or correlations of variables between the underwriter reputation of private firms going public. Hence why, to address potential mechanical relations that could influence the underpricing in the market, I will include two control variables indicating the daily return on the S&P500 and the monthly return on the S&P500 before each IPO. The reason for including returns on this

index is because it has been considered the best indicator for U.S. stock exchange fluctuations. Jamaani and Ahmed (2020) argue how the underwriter reputation in the underpricing relationship is a potential endogenous variable. However, finding an instrumental variable that is both relevant and exogenous is challenging and it will not be considered, highlighting one of this paper's limitations.

4. Results

4.1 Descriptive statistics

4.1.1 Economic Uncertainty

Before scrutinizing the IPO sample data, it is crucial to look at how the level of economic uncertainty has evolved over the years of the sample period, namely between 2007 and 2014. As mentioned earlier, to account for the stability of the economic situation, an index indicating the uncertainty level is used as a regressor. In Figure 1, this index is reported. It can be observed that the level of uncertainty suddenly increases around December 2007 and peaks in January 2008. This coincides with the start of the economic recession. The level of uncertainty then suddenly drops and rises again to reach its peak in December 2008 of roughly 230. In the following years, the level of uncertainty remains relatively high, however still at lower levels than that of the first peak until it reaches its second-highest peak at the end of 2011 of around 250. Towards the end of the sample, the level of uncertainty smoothens and reaches levels similar to those observed at the beginning of around 70, highlighting the economy's recovery stage.

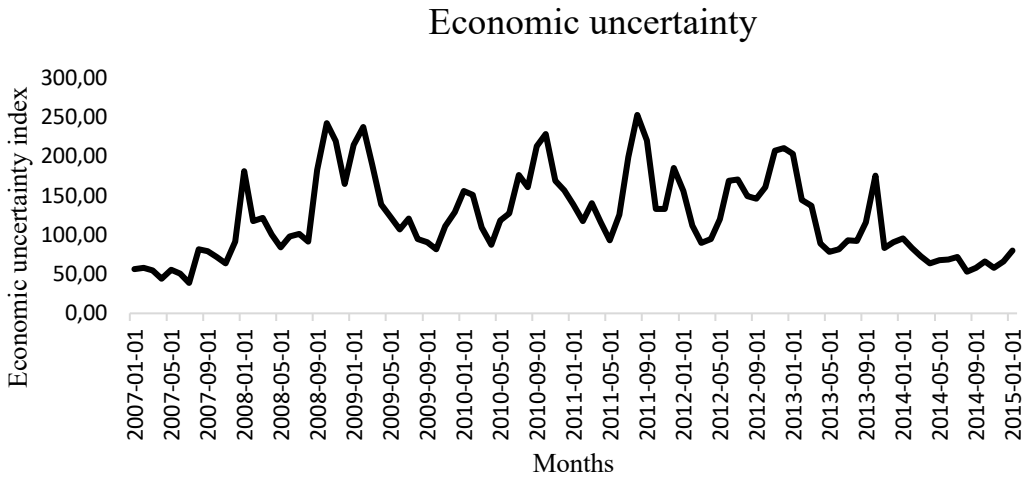

Figure 1. *Monthly economic uncertainty index for the U.S. from 2007 till 2014*

In order to have a clearer view of the level of uncertainty in each sample year, Table 12 reported in the Appendix reports the mean, standard deviation, and frequency of IPOs in that specific year. The level of uncertainty drastically increases from 2007 to 2008, staying relatively high until 2013, to fall again to similar initial values in 2014. The above analysis on the development of economic uncertainty is used in determining periods of the average economic situation and of recession. It is to be noted that despite the level of economic uncertainty still being high in the years from 2010 to 2013 due to slower adjustment to changes, they are considered as a post-crisis period since the economy is already in a recovery stage.

4.1.2 S&P500 returns

It is interesting to look at how monthly returns on the S&P500 have developed over the sample period to evaluate how they have affected IPO underpricing. A striking phenomenon is a sudden drop in the return, coinciding with the financial crisis period. Despite the ongoing crisis, the return quickly regains its previous pace reaching even higher returns than before the crisis and remaining stable after that. The inclusion of the returns on S&P500 in the previous month relative to the IPO issue date is of particular interest to account for market mechanisms that drive closing prices of specific IPOs in specific industries. Next to acting as a benchmark to control from market mechanisms that affect initial returns, the index is expected to influence the initial returns of IPOs and their frequency. As can be observed in Figure 2, in the months prior to the crisis, the return on the S&P 500 seems stable and highlights a market favorable to new issues. During the crisis, between 2008 and 2009, the return suddenly drops to negative

values, reaching a return of around -0,17 in September 2008, which highlights a cold market where we expect to see very few IPOs. Nevertheless, the IPO observed during cold markets are expected to be of high quality. In January 2009, a sudden spike of the return reaches levels even higher than those observed at the beginning of the sample of around 0,1, which would suggest a fast recovery in the stock market. It is, therefore, relevant to observe in the following sections whether there was a similar increase in the frequency of IPOs and respective initial returns corresponding to the same period.

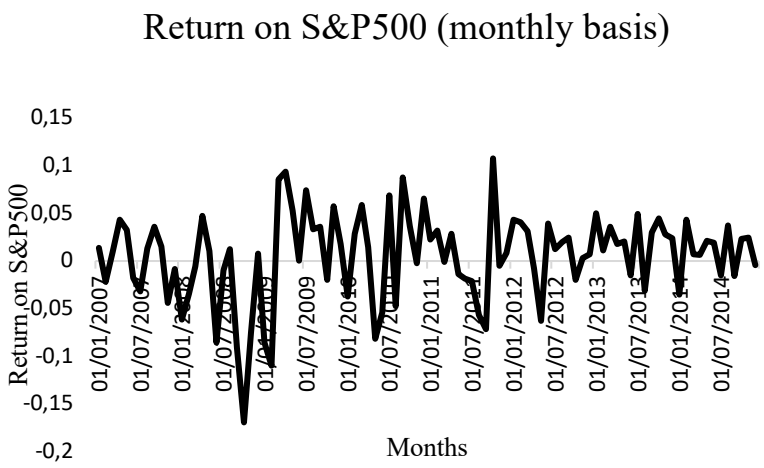

***Figure 2**. Monthly returns on S&P500 from 2007 to 2014*

4.1.3 US IPO activity and macroeconomic industries over the sample period

This section will describe the trend in IPO frequency over the years, taking a closer look at three periods separately: pre-crisis, crisis, and post-crisis. Subsequently, I will analyze how all 895 IPOs are spread across different industries in the market.

Table 2 reports the number of IPOs and the respective average offer price, closing price, and initial return for each year in the sample. In 2007, the number of IPOs represented roughly 20 percent of the whole sample with an average initial return of 14.02 percent, similar to the findings of Ibbotson et al. (1994) of short-run IPOs' underpricing in the U.S. of 10-15 percent. In the subsequent year, at the start of the financial crisis, we observe a drop of roughly 85 percent in terms of the number of IPOs of the previous year, explicitly dropping to 26 IPOs. In contrast, we observe the opposite happening to the average initial return for those IPOs, as it rises to around 56 percent. The latter phenomenon goes against the expectations that we tend to observe lower underpricing levels during periods of economic uncertainty. However, our

predictions seem to hold in the year after where the economy is in full recession, as we see a drop of the average initial return to 4.27 percent, with a slightly higher number of IPOs. Consequently, in the years after the crisis till the end of the sample, the number of IPOs gradually increases, reaching the highest average initial return in 2012, possibly indicating an economically favorable situation for new IPO issues. Between 2010 and 2014, IPOs seem to gradually rise again, except in 2011 where a slowdown in the number of IPOs is observed. This could have been due to periods of economic downturn resulting from the debt ceiling crisis. The latter initiated an economic and political debate on whether to increase the limit at which the U.S. Federal government could borrow.

Table 2. *Total IPOs, average offer price, closing price and initial return by year of sample period in the U.S.*

Year	Total IPOs	Average Offer price ($)	Average Closing price ($)	Average Initial return (%)
2007	180	14.52$	15.48$	14.02%
2008	26	16.04$	33.33$	55.76%
2009	52	16.13$	16.67$	4.27%
2010	100	14.34$	14.63$	8.22%
2011	97	16.36$	17.39$	11.86%
2012	120	15.56$	30.83$	81.89%
2013	152	46.33$	19.62$	26.22%
2014	168	26.33$	31.04$	21.39%
Total	895	22.59$	21.86$	26.34%

Notes: This table reports the total IPOs, the average offer and closing price and the average initial return for every year in the sample. The total IPOs are stated in number of IPO per year, the average offer and closing prices are stated as dollar amounts. Finally, the average initial return is expressed as percentages.

Moreover, I performed an analysis on the distribution of the entire sample and during periods of economic stability and instability, subdivided into three periods. The tables can be found in the Appendix. Tables 13, 14, 15, 16 show the distribution during the pre-crisis, crisis, and post-crisis periods, respectively. It can be observed that the frequency of IPOs during pre-crisis and post-crisis periods, hence periods of normal economic stability, significantly differ from the

IPO frequency during economic instability. More specifically, there is a significant drop in the frequency of IPOs in 2008, persisting in 2009, only to start catching up to previous numbers in 2010. Controversially, we observe an opposite reaction to initial returns: during the crisis, average underpricing increases, and so does the issue size. One thing to note is that the average firm size of IPOs during the crisis is substantially larger than during the pre-crisis period. The latter supports the hypothesis that IPOs tend to come from larger firms during periods of high economic uncertainty, potentially in a more mature stage, rather than small start-ups. This result is likely due to investor sentiment phenomena playing a considerable role in the stock market, especially during crises. The risk of investing in a smaller, younger firm with little information on past market performance deters investors from participating in the initial public offering, which ex-ante deters smaller firms from going public during unstable periods. Additionally, the conventional view is that IPOs during crises are usually of high quality, signaling potentially successful IPOs.

4.1.4 Large versus small firms

This section will briefly analyze the pattern of IPO frequency, offer price, closing price, and initial returns for large and small firms separately over the sample period, reported in Tables 3 and 4. By skimming through the tables, it can be immediately observed that the frequency of IPOs logically falls for both type-sized firms during 2008 and 2009. However, the frequency decreases by more for smaller firms. Another striking result is the persistent negative initial return of smaller firms over the years. This unusual return indicates that there is a tendency of overpricing for smaller firms in the U.S. IPO market. In Table 3 it can be observed how in 2008 the average return of 59.77 percent was the second highest during the whole sample period, with the first highest occurring in 2012 of 94.58 percent. The latter observations indicate severe levels of underpricing, supporting the expectation of observing, during periods of recession, higher underpricing for large firms compared to smaller firms. A possible explanation for higher returns for larger IPOs is that high-quality firms tend to signal their quality by excessively lowering their offer price.

Table 3. *Total IPOs, average offer price, closing price and initial return for each year in sample period for large firms*

Year	Total IPOs	Average Offer Price ($)	Average Closing Price ($)	Average Initial return (%)
2007	158	14.55$	16.30$	17.31%
2008	24	16.48$	35.14$	59.77%
2009	45	16.38$	17.44$	7.71%
2010	83	15.38$	15.98$	11.49%
2011	83	16.60$	18.88$	18.56%
2012	105	16.12$	33.94$	94.58%
2013	134	50.44$	20.74$	32.29%
2014	139	28.77$	35.45$	27.86%
Total	771	24.04$	23.82$	32.61%

Notes: This table reports the total IPOs, the average offer and closing price, and the average initial return for large firms every year in the sample. The total IPOs are stated in the number of IPO per year, the average offer and closing prices are stated as dollar amounts. Finally, the average initial return is expressed as percentages.

Table 4. *Total IPOs, average offer price, closing price and initial return for each year in sample period for small firms*

Year	Total IPOs	Average Offer Price ($)	Average Closing Price ($)	Average Initial return (%)
2007	22	14.26$	9.59$	-9.63%
2008	2	10.75$	11.68$	7.60%
2009	7	14.57$	11.71$	-17.86%
2010	17	9.27$	8.03$	-7.74%
2011	14	14.93$	8.53$	-27.86%
2012	15	11.65$	9.052$	-6.96%
2013	18	15.69$	11.24$	-18.95%
2014	29	14.64$	9.94$	-9.61%

Total	124	13.59$	9.67$	-12.64%

Notes: This table reports the total IPOs, the average offer and closing price, and the average initial return for small firms every year in the sample. The total IPOs are stated in the number of IPO per year, the average offer and closing prices are stated as dollar amounts. Finally, the average initial return is expressed as percentages.

4.1.5 Industry-specific descriptive statistics

In this section, the industries in which all 895 IPOs have occurred from 2007 to 2014 will be analyzed. The detailed analysis of industry-specific factors is crucial in individuating patterns in underpricing of several sectors and how they behave during periods of crises. For example, a study by Chen, Chen, and Lee (2013) found evidence for increases in the local sentiment of investors, significantly increasing returns of three specific industries: basic materials, telecommunications, and utility industries.

Figure 3 reports a general overview of the percentage portions of each industry in which IPOs have occurred over the sample period. The sectors with the highest number of IPOs are the financials' sector accounting for 31 percent, then the healthcare and high technology industries with 16 percent each, and the energy and power industry accounting for 10 percent. All other industries account for negligible fractions in the U.S. IPO market. A more precise representation of the distribution of IPOs per industry is reported in Figure 4, which can be found in the Appendix.

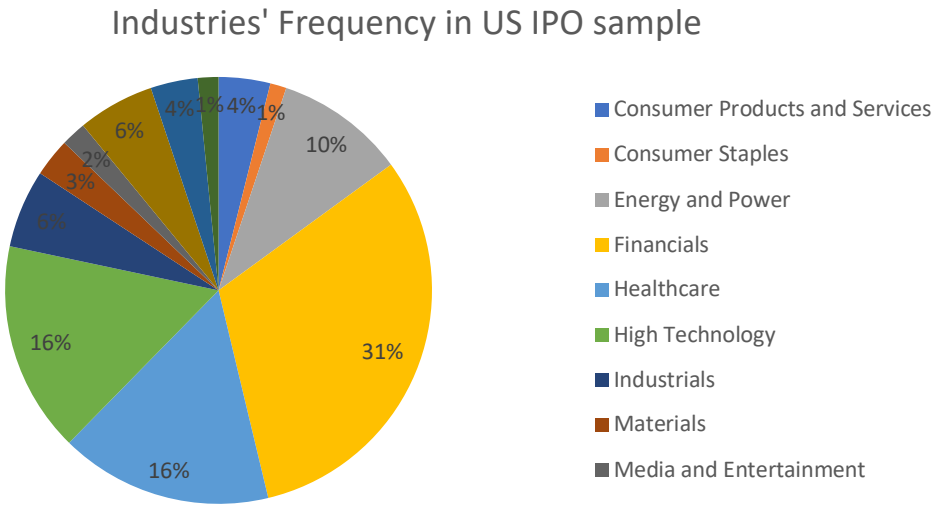

Figure 3. *Pie chart with industries' portions in the U.S. market during 2007 to 2014*

Table 5 reports the average offer and closing prices and respective initial returns for each industry. As previously observed in Figure 3, the industries with the most IPOs are financials, healthcare, high technology and energy, and power. These industries, however, report average initial returns that are very similar to other industries that are under-represented in the sample like industrials, materials, retail, and telecommunications.

Table 17, which can be found in the Appendix, depicts the total IPOs and medians for each industry's respective offer, closing prices, and initial returns. It can be immediately observed how the median initial returns are substantially lower than the average initial returns, indicating that the initial returns of each industry are heavily skewed. This phenomenon could be since initial returns can be higher than 100 percent, but since a stock cannot have a negative valuation, it cannot be lower than negative 100 percent. Besides this observation, median offer and closing prices follow the same pattern as the averages.

Table 5. *Total IPOs, average offer, closing price and average initial return by macro industry in the U.S. (over entire sample)*

Macroeconomic industry	**Total IPOs**	**Average Offer price ($)**	**Average Closing price ($)**	**Average Initial return (%)**
Consumer Products & Services	35	16.23$	15.30$	-1.30%
Consumer Staples	11	15.41$	16.94$	9.06%
Energy and Power	88	18.97$	18.12$	-2.49%
Financials	280	16.33$	21.93$	33.16%
Healthcare	144	55.90$	32.46$	44.99%
High Technology	143	14.99$	18.58$	24.82%
Industrials	53	14.84$	16.85$	23.41%
Materials	26	16.46$	32.20$	54.59%
Media & Entertainment	17	15.86$	18.77$	22.45%
Real estate	52	16.78$	16.11$	1.90%
Retail	32	15.44$	20.06$	29.83%

Telecommunications	14	14.21$	17.69$	23.66%
Total	895	22.59$	21.86$	26.34%

Notes: This table reports the frequency of IPOs, the respective average offer and closing prices of these IPOS and the Initial average returns by macroeconomic industry. The total IPOs are stated in the number of IPO per year, the average offer and closing prices are stated as dollar amounts. Finally, the average initial return is expressed as percentages.

Finally, Table 6 reports the same values as Table 5, however, filtered by the economic period situation, hence focusing on these values during the financial crisis. It can be immediately observed how the frequency drastically decreases for all industries, with the financial sector remaining the dominant one with 24 IPOs. The average initial returns seem to be lower during economic recession periods than periods of economic stability, which supports the hypothesis of economic crisis decreasing the level of underpricing. The significant change in average returns and frequency of IPOs between Tables 5 and 6 can be explained by a finding of Helwege and Liang (2004). They argue how favorable markets are driven by investor sentiments rather than the pace of innovation. The latter can be applied to cold markets as well, indicating the significant and immediate effect of the crisis uncertainty on the IPO market.

Table 6. *Total IPOs, average offer price, closing price and initial return by industry during recession in the U.S.*

Macroeconomic Industry	**Total IPOs**	**Average Offer price ($)**	**Average Closing price ($)**	**Average Initial return (%)**
Consumer Products & Services	5	16.80$	19.28$	12.39%
Consumer Staples	2	18.25$	19.36$	4.18%
Energy and Power	6	18.08$	18.63$	4.48%
Financials	24	16.04$	15.24$	0.48%
Healthcare	7	12.93$	14.07$	10.07%
High Technology	10	14.55$	16.72$	12.74%
Industrials	7	13.50$	15.21$	13.90%
Materials	4	18.12$	135.15$	361.40%

Media & Entertainment	2	19.50$	13.85$	-23.39%
Real Estate	6	19.83$	18.51$	-6.80%
Retail	4	15.50$	11.95$	-25.87%
Telecommunications	1	19.00$	21.5$	13.16%
Total	78	16.10$	22.23$	21.43%

Notes: This table reports the frequency of IPOs, the respective average offer and closing prices of these IPOS and the Initial average returns by macroeconomic industry during the Financial Crisis. The total IPOs are stated in the number of IPO per year, the average offer and closing prices are stated as dollar amounts. Finally, the average initial return is expressed as percentages.

4.2 Regressions

In this section, the univariate and multivariate regressions are reported with an attempt to reject or not reject the hypotheses previously formulated. Recapitulating, these regressions are based on a sample comprising 895 U.S. IPOs. Firstly, univariate OLS regressions are reported analyzing individual effects of each IPO underpricing determinant. The independent variables are the offer price, economic uncertainty, issue size, firms size dummy, three time dummies and a recession dummy being the variable of interest. Additionally, the dependent variable, initial return, is also separately regressed on two control variables: monthly and daily returns on the S&P 500 index. Secondly, multivariate regressions are depicted to check for industry-specific fixed effects on initial returns.

4.2.1 Univariate regressions

Firstly, it is crucial to observe the sign of the constant when no control variables are added to acquire an idea of how the market acts per se. I observe that indeed the constant of the regression is positive and significant at a one percent meaning that there is already significant underpricing in the market. In fact, the average underpricing in the market stands at 26.34 percent, which corresponds to the total average in Table 2.

Table 7 reports the univariate regressions modeling initial returns of ten different variables. It can be immediately observed that there are a couple of significant results at univariate levels. Starting with the offer price, which logically has a negative coefficient significant at a 1 percent level, which means that a 1$ increase in the offer price significantly decreases the level of

underpricing by 0.026 percent. Moreover, the economic uncertainty index seems to be positively significant at a 10 percent level; hence an increase in the index of uncertainty results in a 0.184 percent increase in initial returns. Surprisingly, the two control variables representing returns on the index are both insignificant in determining the level of underpricing. We can see that increases in monthly returns prior to each IPO tend to decrease levels of underpricing. However, we do not have enough evidence to prove this. On the other hand, the coefficient of the issue size of the offering is positive and significant at 1 percent, meaning that a million dollars higher issue size increases underpricing by a tiny fraction.

Table 7. *Univariate regressions of Initial returns on US IPOs*

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Offer Price	-.00026*** (.0019)				
Econ uncertainty		.00184* (.0016)			
S&P500previous month			-.27255 (1.2309)		
Daily S&P500				.77189 (145.745)	
Issue size					-0.000*** (0.000)
Constant	26.921*** (5.3775)	.0667 (.0761)	.2674*** (.0562)	.2636*** (.0528)	.2698*** (.0541)

Notes: The table reports the regression results when modeling the Initial returns of each firm on the offer price of the IPO, economic uncertainty levels, daily and monthly returns on S&P 500, issue size . The model is estimated using Ordinary Least Squares (OLS) Analysis. Meanwhile, standard Errors are reported in parentheses while asterisks represent the significance level of the coefficients.

*Significant at the 10% level | **Significant at the 5% level | ***Significant at the 1% level

Below, in Table 8, the continuation of Table 7 is reported. The coefficient of the dummy, taking value one if the firm is considered small, is significant at a 1 percent level: being a smaller firm significantly decreases initial returns compared to being a more prominent firm by 45 percent roughly. Therefore, we fail to reject the second hypothesis and can conclude that during the crisis, both the frequency and initial returns of small firms tend to be lower than larger firms.

Furthermore, initial returns are regressed on three time dummies, out of which the only significant one is taking value one if IPO occurred before the crisis in 2007. The coefficient of the pre-crisis variable indicates that, at a 1 percent level, IPOs before the crisis had lower underpricing than those after this period. Despite not being significant, the dummy for crisis shows that during the recession, IPO underpricing decreases, but this cannot be proved. Adjacently, the post-crisis dummy has a positive coefficient indicating that IPO underpricing increased after the crisis. The latter also cannot be proved due to the insignificance of the coefficient barely short of being significant at a 10 percent level as having a p-value of 0.135. Finally, the dependent is regressed on a dummy taking value one if the level of economic uncertainty was more than 90. The recession dummy results to be positive and significant at five percent, meaning that being in a recession significantly increases the level of underpricing. More specifically, the p-value corresponding to this coefficient was 0.107. Hence its significance is on edge and potentially weakens inferences made on this result. The latter result enables us to conclude that the first hypothesis is rejected as underpricing results higher with economic instability.

Table 8. *(table seven continued) Univariate regressions of Initial returns on US IPOs*

	Model 6	**Model 7**	**Model 8**	**Model 9**	**Model**	**10**
Small Firm	-.45249*** (5.6864)					
Pre-crisis		-.15425*** (.0445)				
Crisis			-0.05279 (.2223)			
Post-crisis				0.141685 (.0878)		
Recession					.20195** (.0722)	
Constant	0.3261*** (.6420)	0.2944*** (.0590)	0.2681*** (.0597)	0.1626** (.0619)	.1519*** (.0493)	

Notes: The table reports univariate regression results when modelling Initial returns of each firm on the offer price of the IPO, economic uncertainty levels, daily and monthly returns on S&P 500, issue size . The model is estimated using Ordinary Least Squares (OLS) Analysis. Meanwhile, standard Errors are reported in parentheses while asterisks represent the significance level of the coefficients.

*Significant at the 10% level | **Significant at the 5% level | ***Significant at the 1% level

To scrutinize more efficiently the effect of the financial crisis, whose results are ambiguous, I performed additional univariate regressions modeling initial returns on the level of economic uncertainty filtered by pre, during and post-crisis dummies. These results are reported in Table 9. We can observe how Model 12, with the independent variable being the level of economic uncertainty during the financial crisis, reports a negative coefficient, meaning that periods of recession decrease the level of underpricing in theory. However, this cannot be proved due to the insignificance of the coefficient. The negative coefficient in Model 12 and the positive coefficient of the recession dummy in Model 10, raise doubts regarding the validity of the non-rejection of the first hypothesis, as the dummy crisis represents the financial crisis while the recession represents the general level of uncertainty. Therefore, indicating that there are likely other factors that have not been considered affecting underpricing during economic instability and stability periods.

The ambiguity in the effect of the economic uncertainty variable could be explained by the fact that the uncertainty is correlated with the period it occurs in hence, resulting in multicollinearity. The reason for observing this ambiguous significance is also because the index of economic uncertainty that I have used is potentially not an accurate indication for ex-ante ex-post uncertainty nor an accurate reflection of investor sentiment, which has been proved to greatly move underpricing fluctuations over the years. As mentioned in section 3.3, economic uncertainty doesn't account for a wide range of macro and micro factors that are likely to affect offer prices and investor reactions. For instance, it is highly likely that investors' reactions to market uncertainty, which is reflected in initial returns of IPOs, are greatly influenced by levels of inflation. Meaning that when inflation is stable, the underpricing should be less pronounced as compared to highly fluctuating price levels. This phenomenon is not taken into account in the uncertainty index used, which can be an immediate consequence of observing the sudden insignificance of its coefficients under the specifications here below.

Table 9. *Regressions of Initial returns on Economic uncertainty during three periods*

	Model 11	**Model 12**	**Model 13**
Economic uncertainty (pre-crisis)	.00201 (.0023)		
Economic uncertainty (crisis)		-.0020671 (.0025)	

Economic uncertainty (post-crisis)			.0018797 (.0018
Constant	.01813 (.1528)	.4605 (.4842)	.0818 (.1374)

Notes: This table reports univariate regressions modelling Initial return on three separate periods of the sample, namely pre-crisis (2007), crisis (2008-2009) and post-crisis (2010-2014). The model is estimated using Ordinary Least Squares (OLS) Analysis. Meanwhile, standard Errors are reported in parentheses while asterisks represent the significance level of the coefficients.

*Significant at the 10% level | **Significant at the 5% level | ***Significant at the 1% level

4.2.2 Multivariate regressions

In this section, multivariate regressions are reported, with data being transformed into panel data to reduce standard errors and account for remaining omitted variable biases. Rather than focusing on individual firms, the IPOs are grouped by industries, which are observed at several points in time, and their fixed effects are estimated on initial returns. This panel data error term consists of time-variant and invariant factors. The advantage of using this data set is that it allows getting rid of OVB that we do not observe. However, the disadvantage lies in the fact that time-invariant variables that are observable also drop out. Additionally, it makes a relatively strong assumption that time difference in errors should be unrelated to time differences in time-varying regressors and that coefficients are constant over time.

Table 18, which can be found in the Appendix, reports the multivariate pooled OLS estimator regression, which captures around 42.6 percent of the variation in returns. For this regression, errors were also clustered by industry to account for unexplained variation across time that fixed effects fail to capture. Contrarily, to the univariate regression in Section 4.2.1, the coefficient of the daily returns on the index is positive and significant at a 10 percent level, meaning a 100 percent increase in the index return increases underpricing of IPO. Moreover, the monthly index returns and economic uncertainty index show no significant effect on initial returns. Then, being a smaller firm significantly decreases the initial returns of the IPO compared to being a large firm. The issue size and the offer price both remain significant when correcting for fixed effects. More specifically, an increase in one million dollars of issue size positively increases the initial return by a negligible fraction. On the other hand, the offer price significantly decreases the level of underpricing.

Table 10 below reports the multivariate regression modeling initial return by industry fixed effects. This regression has not been filtered by the business cycle yet. The latter will be evaluated in Table 11. Table 10 reports very few significant results, and the model explains roughly 38 percent of the between-estimator variation in initial returns. It can be observed that only the offer price, the small firm dummy and the issue size are significantly influencing initial returns. In more detail, being a smaller firm significantly decreases the initial returns of the IPO compared to being a large firm. An increase in one million dollars of issue size positively increases the initial return by a negligible fraction and, on the other hand, the offer price significantly decreases the level of underpricing. The returns on the S&P 500, both short of being significant, have positive coefficients, but there is not enough evidence to conclude that with an increase in the index return, the underpricing level increases as well. Most importantly, the recession dummy seems to increase underpricing, but this cannot be proved due to insignificance.

Table 10. *Fixed effects United states panel data regression of initial returns*

	Panel regression fixed effects United states
Daily S&P500	4.5880 (5.3725)
S&P500previous month	.5956 (1.5539)
Econ uncertainty	.0015 (.0011)
Small Firm	-.8079*** (.1564)
Issue size	0.000*** (0.000)
Offer Price	-.0237*** (.0018)
Recession	.0460 (.1624)
Constant	.9678*** (.1489)

Notes: This table reports the fixed effects panel data regression modelling initial returns. The underpricing level is regressed on the following variables: daily and monthly returns on the S&P500 index, economic

uncertainty, small firm dummy, issue size, offer price and recession dummy. Meanwhile, standard Errors are reported in parentheses while asterisks represent the significance level of the coefficients.
*Significant at the 10% level | **Significant at the 5% level | ***Significant at the 1% level

To be able to determine whether it is more appropriate to use fixed or random industry effects, I performed a Hausman test to check whether the beta coefficients were similar. However, the p-value of 0.063 indicated a rejection at a 10 percent of the null hypothesis of similar coefficients. Hence, meaning they differ, and fixed effects must be used.

As a result, Table 11 reports the most interesting results. Here I compare multivariate regressions filtered by business cycle to address the research question adequately. The R-squared of the three models explains: 12.19 percent, 14.5 percent, and 13 percent of the variation in returns, respectively. The second column reports the multivariate regression prior to the crisis, the third during and the last after the crisis. It can be immediately observed how being a small firm significantly decreases underpricing more during the crisis than before the crisis. The latter seems to persist during post-crisis years with an even lower coefficient. The coefficient's significance of this dummy increases over the years, implying that the crisis could have potentially led to a structural change in the stock market relative to how smaller firms are priced. Thence, I fail to reject the fourth hypothesis. The offer price seems to significantly influence the initial returns over the years, with the coefficient becoming slightly more negative during the crisis. The variable of interest, namely the recession dummy, results significant only during the financial crisis: the coefficient is positive, meaning being in an economic downturn increases the level of underpricing. This result seems to be persistent in the final years of the sample as well; however, it cannot be proved. The reason we might observe a positive coefficient for periods after the crisis is that the economic uncertainty level remained relatively high between 2010 and 2013. The control variable representing the index returns on the previous month of the IPO results positive and significant at a 10 percent level, meaning higher returns on the index positively influence the underpricing levels of IPOs occurring the subsequent month. This can be explained by the presence of positive information and investor sentiment that induces higher stock valuations of IPOs.

Finally, to observe how levels of economic uncertainty have influenced different industries' IPO underpricing levels, I run a test indicating which industry incurred smaller returns than those predicted by the model. The industries with lower returns than the model were consumer product & services and consumer staples – which are less sensitive to business cycles and represent the industry for non-durable goods – energy power, high technology, industrials, materials, real estate, and retail. Those with higher returns than the model predictions were the financial, healthcare, media and entertainment and telecommunications sectors. The latter finding highlights the presence of higher underpricing among industries that tend to be easily affected by economic fluctuations. We can conclude that there is clearly a differential effect of periods of recessions on the first day returns among industries. However, there is a clash in the results. In the descriptive statistics in Table 6, we observe that both the technology and healthcare industries experience higher returns during the crisis. Whilst the above finding indicates that the technology industry actually incurred lower levels of returns than expected during the crisis. This creates ambiguity in my results which does not allow me to confirm my expectation of higher underpricing in both the healthcare and high technology industry. Despite the latter ambiguity, there is enough evidence to support the fourth hypothesis. Thence, concluding that the financial crisis differentially affected determinants of IPO underpricing across macroeconomic industries.

Table 11. *Panel data regression of initial returns during normal economic times and crisis (by industry)*

	Panel regression during fixed effects during precrisis	**Panel regression during fixed effects during crisis**	**Panel regression during fixed effects during postcrisis**
Daily S&P500	-2.1713 (3.2382)	-.4209 (1.8229)	11.6136 (8.1041)
S&P500previous month	1.8003 (1.1759)	1.1953* (.6638)	1.0120 (2.1394)
Econ uncertainty	.0018 (.0022)	.0014 (.0009)	.00209 (.0015)
Small Firm	-.1959** (.0947)	-.2944*** (.0989)	-.9740*** (.2046)
Issue size	0.000*** (0.000)	0.000 (0.000)	0.000*** (0.000)
Offer Price	-.0271*** (.0060)	-.0336*** (.0084)	-.0309*** (.0023)
Recession	-.0273	.1852**	.1477

	(.1652)	(.0874)	(.2111)
Constant	.3892**	.3931**	1.188***
	(.1773)	(.1808)	(.2164)

Notes: This table reports the multivariate regressions, considering industry fixed effects, modelling initial returns. the first column reports the regressions filtered by the period prior to the crisis, during and after the crisis. The initial returns of each firm are regressed on the following variables: daily and monthly returns on the S&P500 index, economic uncertainty, small firm dummy, issue size, offer price and recession dummy. Meanwhile, standard Errors are reported in parentheses while asterisks represent the significance level of the coefficients.
*Significant at the 10% level | **Significant at the 5% level | ***Significant at the 1% level

5. Conclusion

The scope of this thesis was to observe and interpret the effect the financial crisis of 2008 had on the US IPO market, and the research question was as follows: What was the impact of the economic uncertainty caused by the financial crisis on IPO underpricing in the U.S.: structural or behavioral consequence? To address this question, I used a sample of 895 IPOs occurring in the U.S. market from 2007 until 2014. In order to assess the impact of the financial crisis, I used a set of variables related to the initial public offering of a firm that I expected to be significantly affected by business-cycle fluctuations, as well as including a variable indicating the level of uncertainty in the U.S. economy. In general, I found sufficient evidence to conclude that the economic uncertainty caused by the financial crisis significantly altered the extent to which specific determinants affected IPO underpricing. Below I will briefly go over the hypotheses and summarize the main findings of this thesis to answer the research question.

The first hypothesis, stating that lower IPO underpricing was observed during the financial crisis, is rejected as results show that the recession positively influenced initial returns. This result is similar to findings of Li, Wang and Wang (2019) who evaluate a set of Chinese IPOs. They found that firms that are subject to higher information asymmetry experience higher underpricing levels. Accordingly, Ljungqvist, Nanda and Sigh (2006) determine that in hot markets, investor sentiment is more pronounced, and the highest number of IPOs observed is when the market is optimist (Loughran, Ritter and Rydqvist, 1994). The financial crisis can be seen as a cold market period combined with a high level of economic uncertainty. Despite knowing the fact that cold markets result in a period of IPO droughts and lower underpricing, the more substantial effect of economic uncertainty seems to offset this and is reflected in higher levels of underpricing during 2008 and 2009 compared to previous years. The results of

this paper are opposite to those found in Sohail et al. (2010), who find lower levels of underpricing during the recession of 2008. This conclusion raises interest in the implications that could be made on today's IPO market following the great level of economic uncertainty caused by the outbreak of COVID -19, also considered as a period of economic recession. In general, the extent to which different IPO markets are affected by economic crises, and uncertainty highly depends on the respective countries' financial systems; hence it is difficult to make general implications on IPO markets outside of the U.S.

Moreover, we fail to reject the second hypothesis as smaller firms are less present in IPO markets during periods of recessions since firms with less well-defined and established revenue records find it more challenging to execute a successful IPO. Additionally, smaller firms seem to be more exposed to fluctuations in uncertainty as their frequency in IPO markets significantly moves with changes in market conditions. Loughran and Ritter (2004) proved that larger offers tend to be more underpriced than smaller offers. Accordingly, Gao et al. (2013) introduce the economic scope argument indicating that decreases in IPOs tend to be more concentrated in small firm industries as they cannot keep pace with the rapidly changing economic environment. Besides, Helewage and Liang (2004) found that firms who base their valuations on innovation levels enter IPO market during cold periods, suggesting that these firms tend to be larger in size, to be able to carry a successful IPO that can cheaply avoid or easily bear costs involved.

Related to the second hypothesis is the third one stating that during post-crisis, the underpricing of smaller firms decreases by more than for larger firms. There is not enough evidence to reject this hypothesis. The fact that smaller firms experience lower levels of underpricing could be since, after the crisis, they were subject to stricter regulations to increase transparency, which also deterred smaller firms from growing through IPOs. Furthermore, the remaining small firm going public could have experienced lower initial returns since investor sentiment was worse concerning the potential survival of these firms in unstable economic conditions. Simultaneously, these firms could have purposely overpriced their offer on the first day in order to signal quality; however, investors were instead deterred due to uncertainty about the success of smaller firms with limited revenue prospects. The latter results suggest that there might have been a structural change in the nature of IPO markets. These findings are like those of Li, Liu, Liu and Tsai (2018) of smaller firms' issues being less underpriced than larger issues. In general, these markets now exhibit significantly larger-sized issues combined with higher

levels of uncertainty and therefore also higher underpricing due to investors perceiving higher risks and evaluating IPOs with much more scrutiny compared to before the crisis. Some ambiguity in the results was observed as after the crisis, there were still high levels of uncertainty, which can be justified by the fact that after 2009 the economy was characterized by both hot and cold periods. However, this makes it challenging to make implications on the quality and type of IPOs dominating the market.

Finally, the fourth hypothesis is also not rejected as, firstly, IPOs appear to be clustered in certain industries, namely financials, healthcare, and high technology. In more detail, the frequency and extent of underpricing significantly differs across industries, highlighting a discrepancy in the U.S. IPO market. This result suggests that to stabilize the IPO market across industries, increased regulations arguing for transparency in the market are needed. However, there is a risk that increased transparency will deter firms from innovating or participating in IPOs due to higher costs therefore, increasing incentives to look for alternative funding methods to grow or speed products into markets by selling to larger companies with broader networks.

6. Discussion

In conclusion, the results of this paper suggest that the financial crisis evidently altered the IPO market along with determinants of underpricing and that there are various anomalies concerning the aspect of firms going public (Ritter and Welch, 2002). These consequences can be considered as structural rather than solely behavioral, as the immediate changes persist throughout the years following the crisis. More specifically, smaller firms either wait before going public until they have reached a certain size or resort to alternative funding methods such as crowdfunding, venture capital, or even engage in acquisitions by larger firms. On this matter, both Ritter (2014) and Gao et al. (2012) argue that changes in benefits and costs affect the number of firms going public. Likewise, Lowry et al. (2017) argue that these costs are usually associated with managers' objective pursuing short-run performance over the long-run. Consequently, this can add to implications concerning regulations to be taken, such as directing manager’s objectives and how it could potentially decrease ex-ante uncertainty as well as underpricing.

Concerning the level of underpricing, results seem to stay high even after a crisis but whether this is a structural or behavioral consequence remains an open question for further literature. This paper contributes to existing literature by providing significant information on so-called recession-proof industries for more efficient and adequate investment strategies during economic recessions. More specifically, these industries tend to be characterized by inelastic demands and relatively stable cash flows such as: consumer staples, consumer repair services, government mandated services and other necessities not affected by downturns.

Despite being able to address the research question on a general note, this paper is characterized by several limitations. Firstly, the sample size only comprises one recession period which greatly reduced the number of IPOs observed, especially during the recession. Hence, including a larger sample characterized by more crises might enable us to infer more precise conclusions regarding the structural consequence of economic uncertainty. Besides, subdividing the sample into three periods comprising a different number of years, might cause problems regarding the validity of my inferences in comparing these periods as the number of IPOs varies significantly. Secondly, the firm size dummy is likely a noisy proxy for information asymmetry that can raise questions on the validity of conclusions made on smaller firms in the IPO market. Lastly, there is a limitation concerning the fact that this thesis places on the same level all industries, albeit their core products greatly differ. For instance, the healthcare industry has a prevalence of tangible assets offered in the market whilst the high technology sector prevails in the services industry, hence intangible assets. As a result, in order to compare underpricing between industries, strong assumptions regarding their core products and characteristics are necessary. This limitation doesn't allow to me to conclude that uncertainty impacts to the same extent all industries as some may be more exposed to investor sentiment than others.

All the above provides great room for further literature to be conducted on the topic. With this, I provide some suggestions. Firstly, this paper provides a good base to closely evaluate the immediate behavioral consequences that economic uncertainty has had on IPO markets. However, the variations of underpricing determinants are not entirely captured by the independent variables I include in my regressions thence, more attention can be drawn to the extent that underwriters' reputation affects first-day returns during the economic sink. Chen and Wilhelm (2008) also argue that the timeframe in which IPOs are priced is too narrow; meaning that relevant info is not yet reflected in the market valuations, which could be a significant reason for observing high underpricing levels. Hence why, introducing relevant and

exogenous instrumental variables to my regression can significantly increase inferences' precision. Moreover, the scope of this paper could be extended in terms of predicting which industry is most likely to dominate the market following the recovery of the economy after the pandemic, by establishing homogenous characteristics of the macro industries and enabling a comparison between them. Additionally, further literature could focus on an evaluation on long-run performance following crises and frame the reasons for uneven distribution in the U.S. market of IPOs across industries, being more pronounced during recessions, enabling a better understanding of the structural consequences on the IPO market.

In the first quarter of 2020, the stock market experienced a sudden crush as it became sure that the world was experiencing a global pandemic known as Covid-19. According to Farmer (2012), observing a drop in the stock market exchange of 30 percent, experienced at the start of 2020, can be considered a period of economic recession. All the above raises interest in comparing the economic impact that the pandemic has had on the IPO market along with previous economic recessions. Hence, it is interesting to look at this new wave of economic uncertainty, shedding light on the type of firm that tends to dominate this market during these periods. However, it is difficult to determine the duration of economic crises, whether the stagnation will prolong, and which companies tend to go out of business. Consequently, one can only conclude which industries and company types tend to dominate the market once recession period is over. Therefore, further literature could provide implications on the future nature of the IPO market once the COVID-19 downturn will have fully terminated, by using this paper as guideline.

Appendix

Table 12. *Summary of Economic Uncertainty level per year of sample period*

Year	Mean	S.D.	Frequency
2007	60.66	13.58	180
2008	128.95	41.64	26
2009	114.19	36.60	52
2010	156.20	41.56	100
2011	140.36	40.17	97
2012	138.67	38.42	120
2013	115.83	40.85	152
2014	70.80	10.37	168
Total	106.80	47.54	895

Notes: in this table, the mean, standard deviation of economic uncertainty as well as the frequency of IPOs are reported for each year in the sample. The means are expressed in index value, the S.D. is stated as the average distance from the mean of all values in the dataset in each sample year. Finally, the frequency reports the number of IPOs per year.

Table 13. *US IPOs during all sample period 2007-2014*

Variable	N	Mean	S.D	Min	Max	25% percentile	Median	75% percentile
Initial return	895	.2634047	2.055674	-.997776	56.6	-.0381818	.01875	.275
Offer Price	895	22.59496	161.412	3.25	4500	10	15	20
Closing Price	895	21.86119	90.56558	.33	2255	11.14	15.5	20.5
Shares Issued (mln)	895	15.4	29.7	1	478	5.75	8.993	1.58
IssueSize ($mln)	895	391	2930	40	81000	75	128	260
FirmSize ($mln)	895	353	1290	12.6	20700	74.5	145	288

Notes: in this table the number of observations (i.e. number of IPOs in entire sample), the mean, standard deviation (S.D.), minimum and maximum value observed, 25, 75 percentile and median of the following variables are reported: Initial return, offer price, closing price, shares issued, issue size, firm size. The initial return, offer price,

closing price, issue size and firm size are all expressed in dollar amounts; whilst the shares issued are expressed as a number. This table reports the above descriptive statistics for the entire sample period.

Table 14. *US IPOs during pre-crisis period 2007*

Variable	N	Mean	S.D	Min	Max	25% percentile	Median	75% percentile
Initial return	180	.1401794	.5014016	-.922381	2.592	-.0435	.0103333	.2606696
Offer Price	180	14.51883	6.657867	3.25	65	10	14	19
Closing Price	180	15.47727	7.322141	1.63	42.3669	9.35015	14.525	20.005
Shares Issued (mln)	180	15	15.8	408095	131	6	10	16.9
IssueSize ($mln)	180	233	346	4080950	3280	75.1	126	246
FirmSize ($mln)	180	248	329	3227010	2620	65.7	144	272

Notes: in this table the number of observations (i.e. number of IPOs in entire sample), the mean, standard deviation (S.D.), minimum and maximum value observed, 25, 75 percentile and median of the following variables are reported: Initial return, offer price, closing price, shares issued, issue size, firm size. The initial return, offer price, closing price, issue size and firm size are all expressed in dollar amounts; whilst the shares issued are expressed as a number. This table reports the above descriptive statistics for the pre-crisis period (2007)

Table 15. *US IPOs during crisis period 2008-2009 (Descriptive statistics)*

Variable	N	Mean	S.D.	Min	Max	25% percentile	Median	75% percentile
Initial return	78	.2143032	1.691092	-.8	14.74999	-.047	.0006667	.10125
Offer Price	78	16.10256	5.654764	8.5	44	12	15	20
Closing Price	78	22.2254	55.56198	3	503.9998	11.49	15	20

Shares Issued (mln)	78	21.8	47.3	1100000	406	6.82	11.3	188
IssueSize ($mln)	78	498	2020	1.11	17900	91	171	309
FirmSize ($mln)	78	538	1820	3300000	15100	103	165	333

Notes: in this table the number of observations (i.e. number of IPOs in entire sample), the mean, standard deviation (S.D.), minimum and maximum value observed, 25, 75 percentile and median of the following variables are reported: Initial return, offer price, closing price, shares issued, issue size, firm size. The initial return, offer price, closing price, issue size and firm size are all expressed in dollar amounts; whilst the shares issued are expressed as a number. This table reports the above descriptive statistics for the crisis period (2008-2009)

Table 16. *US IPOs during post-crisis period 2010-2014 (Descriptive statistics)*

Variable	N	Mean	S.D	Min	Max	25% percentile	Median	75% percentile
Initial return	637	.3042374	2.348782	-.9977756	56.6	-.034	.0366667	.2890323
Offer Price	637	25.67206	191.2417	3.75	4500	11	15	20
Closing Price	637	23.62053	105.4794	.33	2255	11.75	16.01	21
Shares Issued (mln)	637	14.8	29.8	1	478	5.5	8.4	15
IssueSize ($mln)	637	423	3390	40	81000	72	125	257
FirmSize ($mln)	637	360	1380	12.6	20700	75	143	288

Notes: in this table the number of observations (i.e. number of IPOs in entire sample), the mean, standard deviation (S.D.), minimum and maximum value observed, 25, 75 percentile and median of the following variables are reported: Initial return, offer price, closing price, shares issued, issue size, firm size. The initial return, offer price, closing price, issue size and firm size are all expressed in dollar amounts; whilst the shares issued are expressed as a number. This table reports the above descriptive statistics for the post-crisis period (2010-2014)

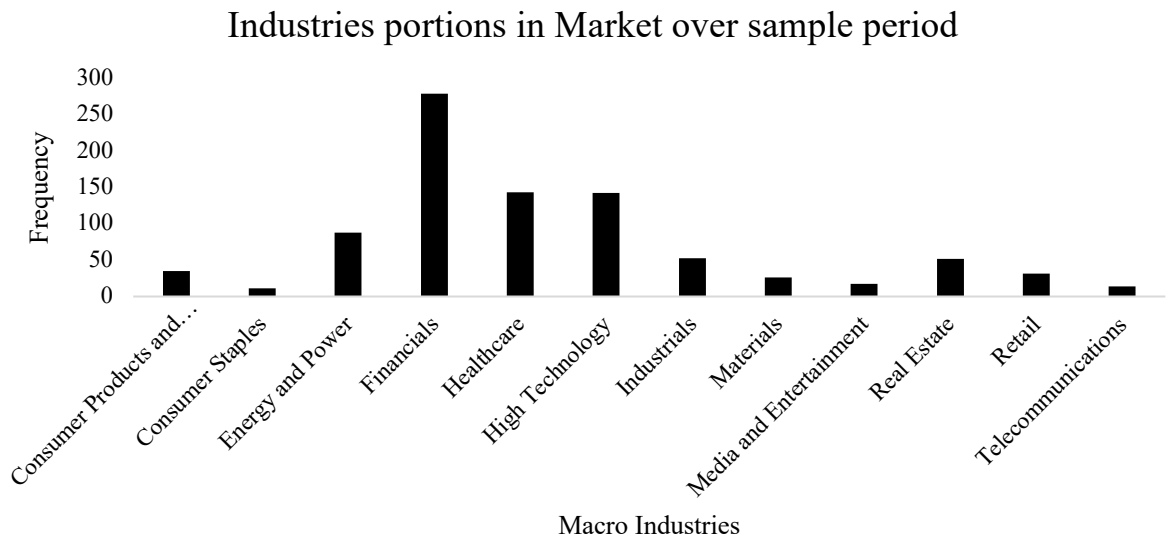

Figure 4. *Histogram with industries' portions in the U.S. market during 2007 to 2014*

Table 17. *Total IPOs, median offer, closing price and median initial return by macro industry in the U.S. (over entire sample)*

Macroeconomic industry	**Total IPOs**	**Median Offer price ($)**	**Median Closing price ($)**	**Median Initial return (%)**
Consumer Products & Services	35	16$	14,27$	-1.4%
Consumer Staples	11	16$	17,5$	10.13%
Energy and Power	88	20$	18,74$	0%
Financials	280	15$	16,53$	0%
Healthcare	144	12$	14,85$	12.35%
High Technology	143	14$	15,3$	17.5%
Industrials	53	15$	15,42$	8.82%
Materials	26	13$	13,29$	-6.65%
Media & Entertainment	17	14$	14,2$	0.28%
Real estate	52	18$	16,72$	-0.31%

Retail	32	16$	21.03$	9.03%
Telecommunications	14	15$	15,87$	14.47 %
Total	895	14.5$	15.36$	13.16%

Notes: this table report the total number of ipos, the median offer price, closing price and initial return for each macroeconomic industry: consumer products & services, consumer staples, energy and power, financials, healthcare, high technology, industrials, materials, media & entertainment, real estate, retail and telecommunications. The total ipos in each industry are expressed in numbers, the median offer and closing price are expressed in dollar amounts while the median initial return is expressed as a percentage.

Table 18. *Panel data regression*

	Panel regression (pooled OLS estimator)
Daily S&P500	5.4499* (3.0795)
S&P500previous month	.6781 (.8897)
Econ uncertainty	.0014 (.0011)
Small Firm	-.7436*** (.1549)
Issue size	0.000** (0.000)
Offer Price	-.0233*** (.01086)
Recession	-.0098 (.1053)
Constant	.9614 ** (.3156)

Notes: this table reports the fixed effects panel data regression modelling initial returns. The underpricing level is regressed on the following variables: daily and monthly returns on the S&P500 index, economic uncertainty, small firm dummy, issue size, offer price and recession dummy. Meanwhile, standard Errors are reported in parentheses while asterisks represent the significance level of the coefficients.

*Significant at the 10% level | **Significant at the 5% level | ***Significant at the 1% level

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