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NE PROFESIONALIŲ (MAŽMENINIŲ) IPO INVESTUOTOJŲ PELNĄ MAKSIMIZUOJANČIŲ PASITRAUKIMO STRATEGIJŲ TYRIMAS	AN EXPLORATION OF PROFIT-MAXIMIZING EXIT STRATEGIES FOR NON-PROFESSIONAL (RETAIL) IPO INVESTORS

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1. INTRODUCTION

While there is substantial research exploring certain Initial Public Offering (IPO) characteristics and phenomena such as the commonly observed underpricing or long-run underperformance, there seems to be a gap in the literature providing comprehensive evaluation of possible exit scenarios, including benchmark adjusted performance and concrete recommendations, specifically for non-professional (retail) investors.

The problem that arises here is the difficulty in navigating the IPO market faced by retail investors, who are already the less knowledgeable and more inexperienced party in a market that is characterised by information asymmetry & general uncertainty, one which has been historically dominated by large scale financial institutions with heightened access to quality information and preferential treatment from the underwriters.

The aim of this paper is to fill that gap and attempt to alleviate the problem laid out above by analysing the performance of IPOs available to retail investors, examining differences in initial returns across different sectors, underwriters, issue sizes, hot & cold markets and other factors, as well as short, medium and long-term IPO returns in the aftermarket. Several investment approaches will be tested, including both investors who are able to subscribe to the issuance and buy in at the offer price, and those who are not. Drawing from this, the goal is to provide clear insights and potential strategies that retail investors may be able to employ to optimise their exit strategies when participating in the IPO market.

For the empirical study, a sample of 2229 IPOs between 2000 and 2023 is chosen, focusing only on the US equity market. While there is no true direct indicator of the level of retail access or subscription to any particular issuance, since underwriters tend not to disclose this, the study will be focused on larger issues ($75m+), common shares & ADRs (American Depository Receipts) only, aiming to increase the probability that retail investors would have been able to subscribe to the issuance. Other IPO types, such as closed-end funds, REITs, special purpose entities and special purpose acquisition companies will also be excluded due to their different structures and characteristics. To address the impact of market movements during the study period, the vast majority of analysis will be performed on benchmark-adjusted returns. For the purposes of the study, the benchmark index is the S&P 500.

The data is to be cleaned up and processed using a mixture of Excel, Python and R. Regressions analysing various market, issuer, issuance and underwriter characteristics will be run, analysing the main drivers of IPO returns. Said findings will then be compared to the observations made by researchers in earlier works (reviewed as part of the literary overview) and synthesized to provide

clear conclusions and recommendations which could benefit retail investors in deciding on investment and exit strategies in the IPO market.

Research objectives:

1. To examine the level of underpricing in the selected sample.
2. To investigate the key drivers of underpricing, evaluating the impact of issue size, underwriter quality, issuer domicile, industry and market conditions.
3. To explore IPO performance after issuance, up to 1-year post IPO.
4. To evaluate the impact of the lock-up expiry on abnormal returns within the event window.
5. To provide clear insights and recommendations for the retail investor.

The primary scenario focus of the research is the case of a retail investor who is able to subscribe to an IPO before it hits the market, so the empirical review will consist mostly of analysis of the initial returns, defined as the benchmark-adjusted return from the IPO offer price to the closing price on the first day of trading. The empirical analysis will then examine the price movements post-issuance, capturing cumulative abnormal returns for various event windows within 2-5 days, 1-4 weeks and 1-12 months.

A retail investor may not always be able to obtain the opportunity to subscribe to an upcoming offering, especially in the cases of popular, oversubscribed IPOs. Because of this, the paper will also explore post-issuance trading opportunities, taking the first-day open price as the point of reference in order to evaluate buying during the first trading day and holding for a fixed period of time, or perhaps short-selling the stock (though this also may not always be an option) if abnormal negative returns are identified. Here, post-issuance cumulative abnormal returns ranging from 2 days to 12 months will also be covered.

The thesis will be composed in the following structure: Chapter 2 will cover the available literature on general IPO theory, recurring phenomena and the drivers of short, medium and long-term performance. Chapter 3 will establish the data selection and collection approach, as well as the wider empirical research methodology for the study, the results of which will be covered in Chapter 4. Conclusions drawn from the study and recommendations for the average retail investor looking to partake in IPO investing in the US market will be laid out in Chapter 5.

2. EXAMINING THE THEORETICAL FRAMEWORK AND CHARACTERISTICS OF THE IPO MARKET

2.1 What is an IPO?

An Initial Public Offering (IPO) is the act of transforming the ownership and control structure of a privately held company, opening up shares to a wider range of investors in the open market. Going public is among the most noteworthy events that a corporation may undertake within its lifecycle. Apart from opening up a broader avenue for new funding, the transition from private to public ownership brings with it wider market visibility, (potentially) improved public perception and additional governance, disclosure and regulatory concerns. It also acts as a an exit mechanism for existing shareholders, should they wish to diversify and realise some or all of their return on investment (Zingales, 1995). For new investors buying into such issuances of public equity, there is an opportunity be among the first of the wider public to access potentially lucrative growth-stage firms. However, there cannot be opportunity without risk, and the commonly observed characteristics within the IPO market are ones of uncertainty, volatility and information asymmetry (Li et al., 2005), especially in the case of non-professional retail investors, all of which contribute to persistent anomalies in their pricing and performance.

With thousands of IPOs being brought to market during the 21st century in the US alone (Ritter, 2015), numerous studies have been performed on the typical characteristics, risk and return profile, and observable phenomena/anomalies within the IPO market. The subsequent sub-chapters will review and synthesise the available research, focusing on topics such as the theoretical foundations of IPO markets, IPO pricing dynamics, bookbuilding and allocation mechanisms, investor sentiment and retail investor participation, behavioural aspects, post-IPO performance, hot and cold markets, lock-up agreements, media influence, investor demographics and the determinants of optimal exit timing, with the main findings of each summarized in tabular format at the end of the chapter.

2.2 Foundational IPO Underpricing Theory

One of the most frequently observed characteristics of IPO issuance is the tendency of the newly listed stocks to exhibit significant underpricing on the first day of trading, meaning that the offer price available to investors who are able to subscribe to the issuance is below the closing price of the stock on the first day of trading. yielding abnormal initial returns for investors who are able to secure shares at said offer price (Loughran & Ritter, 2002). Within their study, Loughran and Ritter also find growing underpricing in the US from the 80s to the 90s, and to an especially high degree of 65% during the dotcom bubble of the late 1990s/early 2000s. This may again prove to be highly relevant, with the Tech/AI industry receiving ever more attention and investment, P/E valuations soaring and bubble-like characteristics beginning to form (Basele et al., 2025).

These findings have also been consistently supported across different markets & time periods. Looking across sectors, the existence of underpricing, albeit smaller, in mature, long-standing industries such as shipping suggests that underpricing isn't just a characteristic of new popular sectors or trends, though it still indicates that when hoping to maximise exit profit, the selection of sector may still very much matter (Merikas et al., 2010). Evaluating cross-border listings, Francis et al. (2001) find that foreign issuers pursuing IPOs within US markets also experience similar abnormal returns, even outpacing their domestic counterparts due to the added uncertainties and informational gaps that arise from cross-border listings. Even in experimental markets, where IPOs are merely simulated using optimal conditions, market participants still demand discounts and are reluctant to sell shares in the aftermarket at prices below the offer price, suggesting that even without the influence of real-world institutions, behavioural bias and uncertainty drive some degree of underpricing (Füllbrunn et al., 2020).

Studies into the IPO market in Europe also find persistent, significant underpricing in new issuance, averaging as high as 38% (Giudici & Roosenboom, 2002). Gajewski & Gresse (2006) support these findings, identifying varying extremities across borders, but still averaging 22%. Even broader research, collated from other studies by Ritter (2003), finds underpricing in all 38 reviewed markets. The level of underpricing identified somewhat correlates with the economic maturity and investor confidence within any particular market, with some Nordic countries experiencing only mid-single digit average underpricing, but the most noteworthy finding here is the extreme level of underpricing within the Chinese market, also observed in subsequent studies (Chi & Padgett, 2005; Xu & Zhao, 2014). In this case, researchers attribute their findings mostly to the uniqueness of the substantial government participation within the market, but also general uncertainty and risk factors.

Together, this literature strongly supports the general theory that underpricing is a widespread and persistent characteristic of the IPO, market rather than a short-term anomaly, that has clear drivers and determinants beyond just risk and uncertainty, more of which will be covered in the chapters to come.

2.3 Information Asymmetry, Allocation & Bookbuilding

Traditional theory primarily attributes informational asymmetry, whether that be between issuers, underwriters or investors, as the driving factor for underpricing. An early study by Rock (1986) proposes that there are two types of investor – informed and uninformed. The investors with access to larger quantities of information and valuation modelling participate only in the high-quality issuances, which they expect to be profitable, pushing the uninformed investors out and largely leaving them with poorer quality, worse performing IPOs. Therefore, the argument is that underpricing exists to keep the uninformed (often retail) investor active in the market. According to this framework, the greater the level of asymmetry and uncertainty around a particular issuance, the greater the underpricing should be to compensate.

Later work by Benveniste & Wilhelm (1997) builds upon this, examining the bookbuilding process. This involves the underwriter collecting information from potential investors on what they are willing to pay and how many shares they would like to purchase in the upcoming issuance, thus gauging demand and setting a final price point. Here, the authors make the case that underwriters utilise deliberate underpricing and discretionary allocations to favoured clients in order to entice institutional investors to reveal their valuations and demand preferences, rewarding those willing to participate. Leite (2007) expands further on the information asymmetry and 'uninformed investor' outlined in Rock's (1986) early work, noting that the average uninformed market participant return is zero or negative. A subsequent study (Reber & Vencappa, 2016) also highlights information asymmetry between market participants and influence of financial institutions, noting that deliberate underpricing is the prevailing driver of initial returns, rather than aftermarket price adjustments.

In a study covering the allocation of public offerings and flipping activity, Aggarwal (2003) finds that underwriters maintain a record of subscribers' trading activity and may act to limit access to future IPOs, hoping to stabilise post-issuances prices on subsequent IPOs in the case of flipping – immediately selling shares purchased at the offer price in the aftermarket. Interestingly, flipping is found to be more common among institutional investors than retail market participants. Flipping activity is also observed to be more common in hot IPOs with stronger trading volumes than in cold ones, indicating a higher willingness to hold and await

longer-term returns. Globally, there is conflicting evidence on the reallocation principles and favouritism of underwriters, with Bertoni & Giudici (2014) finding that when positive information is collected during the bookbuilding process, reallocation tends to shift more towards the institutional investor, reducing the retail availability. Contrasting this Wadhwa & Syamala (2018) observe that underwriters actually reward the retail investor in periods of high demand.

2.4 Post-IPO Performance

Trading of the stock post-IPO is also referred to as the aftermarket. Here, an early study by Barry & Jennings (1993) suggests that at least within their relatively short sample (1988-1990), most of the underpricing is realised in the increased opening price (relative to the offer price) on the first day of trading. This suggests that the only real pathway to capitalizing on the underpricing phenomenon is getting access to the issue at the offer price, as transaction and other costs effectively outweigh the small level of positive returns observed in the study. Further examination (Bradley et al., 2009) over a later sample (1993-2003) actually finds positive average first day open returns of 2.3%. While first day returns are highest during the dotcom bubble build-up of 1999-2000, they persist even in the lower issuance period of 2002-2003, increasing as a percentage of total underpricing. The authors propose that these excess returns accumulate mostly due to IPOs with greater information asymmetry and related uncertainty. While these findings consistently show that the majority of the underpricing is realised almost immediately upon open, there may still be opportunity for investors who were not able to access the offering to make short-term financial gains.

Conversely to the previously discussed short-term underpricing and abnormal gains, the long-term performance of IPOs has been observed to be weaker than that of comparable non-issuing firms over a 3 year horizon, especially during periods of high activity (Ritter, 1991). Carter et al. (1998) provide further evidence to support these findings while also exploring the impact that underwriter quality has on both short and long-term performance, highlighting both lower underpricing and less negative performance over a 3-year holding period for top tier underwriters, marking another consideration in the optimization of exit strategy. Repeated study in this area continues to echo the same findings, signalling that underwriter quality is a predictor of long-run performance (Dong et al., 2010).

Performing similar research as the previously discussed insights into foreign domiciled issuance in the US markets (Francis et al., 2001), Killins & Egly (2018) focus more on the long-term performance of the reverse scenario, where US firms avoid the domestic capital markets and

seek listing elsewhere. They find that in the case of long run performance, issuances of US firms in foreign markets exhibit significant underperformance when comparing to peer companies issuing strictly in the domestic market.

Looking more broadly across industries, whereas underpricing in the shipping market had been less significant than in most others, the long-term returns within the same period still fell below comparable market return rates, especially in the case of the 3-year holding period (Merikas et al., 2010).

Focusing on issuances involving venture capital (VC) investment, Michel (2014) notes substantial underperformance of firms with recent high VC investment in comparison to those with lower rates of VC involvement in the long-term, citing investor over-optimism or lack of understanding as key factors.

Another type of IPO issuance is that of the closed end fund, however here too there is little positive evidence on long run returns. In fact, it is characterised by low levels of underpricing and poor performance in the aftermarket (Shao & Ritter, 2018).

2.5 Retail Participation and Investor Sentiment

While conventional theories on information asymmetry, uncertainty and underwriter influence provide strong explanatory power on the observed underpricing and subsequent price correction/underperformance of IPOs, a lot of research is also available on the behavioural side of things, covering the impact of investor sentiment and retail participation in general.

Ljungqvist et al. (2003) suggest that the main IPO related 'anomalies' of underpricing and long-run underperformance can be traced back to "a class of irrationally exuberant investors" as another driving factor. Chan (2010) investigates the proportion of individual and institutional investor trading in the US markets within the first days of issuance, noting that short-term, and open to close window returns are positively impacted by small investor participation in the aftermarket for the case of hot issuances, while prices in cold and neutral IPOs is driven more by the actions of the institutional investor, who is less likely to be as affected by sentiment. Tying back to other findings of short-term gains (Bradley et al., 2009), it may make sense to focus specifically on hot IPOs, attempting to capitalise on the attention, optimism of other investors and overall momentum of the stock when hoping to realise short-term gains. Further empirical analysis here could provide insight into how long it would be rational to hold such investment in recent years.

Diving deeper into internet bubble period sentiment, participation and returns, Chan (2014) finds a positive relationship between the sentiment and volatility of new issuance. Overoptimism during the bubble also creates a degree of overpricing in the short term, as the momentum and bullishness push fresh issuance stock prices higher. Said underpricing is of course subject to later correction, with greater overpricing leading to weaker subsequent long-term performance. If trends have not shifted too far, these findings are particularly relevant in today's context of growing AI 'hotness' and potential of a new market bubble (Basele et al., 2025).

Further evidence from the US market, using Google search volume as a proxy for retail attention, also indicates the statistically significant role that retail investor attention and participation make in the early IPO valuation stages (Colaco et al., 2016). An overall review of public US equity transaction data also finds positive correlation between stocks with net-positive retail investor purchases to following week returns, when compared to stocks which are net-sold (Boehmer et al., 2021) .

Examining the effects in the German markets, Dorn (2003) suggests that retail investors are more willing to subscribe to IPOs following periods of high returns in recent issuance, even being willing to overpay to get access. This creates a disconnect between the expectations of the investors and the true fundamentals of the issuer, highlighting that investor sentiment makes meaningful impact on returns. High retail participation often yields higher initial returns, but lower aftermarket returns. Also within the European markets, Ljungqvist et al. (2005) evaluate investor sentiment in the grey market (unregulated trading of allocations prior to IPO issuance date), finding that high investor optimism (and high grey market prices) is a good predictor of initial returns, while the opposite is not. Tying back into the information asymmetry aspect, they also note that retail investors occasionally push the aftermarket prices upwards, but never down, attributing this to the well-informed institutional investor offloading their allocations to excessively overoptimistic investors, and holding on to their shares when retail sentiment is overly pessimistic.

Looking at an example of these effects in an emerging market economy, Neupane et al. (2012) show that investor sentiment heavily influences retail activity in India, even in transparent markets with accessible data, while institutional investors rely almost exclusively on the fundamentals and overall quality of the target firm.

2.6 Hot Markets & IPO waves

Numerous works investigating the observed clustering of IPO issuance in particular time periods also exist. These result in what is referred to as 'hot markets', when IPO issuance is abnormally high compared to the average sample, and also 'cold markets', when issuance is abnormally low. Characterisations and thresholds for classifying a market as 'hot' or 'cold' vary. Some studies group issuance levels by month (Pastor & Veronesi, 2005), some by quarter (Yung et al., 2007), and others even on an annual basis (Bustamante, 2008). Despite varying methods, all reviewed research exhibits matching evidence of 'IPO waves', cycling between high (hot) and low (cold) periods of issuance.

(Pastor & Veronesi, 2005) find that IPO waves are typically preceded by high stock market returns and followed by low market returns. When economic activity, returns and valuations of IPOs are high, younger, lower quality firms also flock to the markets, hoping to capitalise on the heightened attention and improved financing opportunities. The worse the quality of the firm, the more incentive it has to seek valuation during 'hot' periods, given that sentiment and momentum alone can push the valuations, and therefore returns to existing shareholders, higher than they would achieve in average or cold market conditions. With the cyclical nature of the waves and their relation to general stock market activity, subsequent downturns and long-term poor fundamentals of issuers who rushed IPOs become driving factors in long-run outperformance. Such findings are also consistent with research into the impact of IPO timing on capital structure and the proportions of equity issued in hot markets (Alti, 2006), during which firms issue substantially more equity, initially decreasing their leverage ratios, but subsequently taking on more risk and issuing additional debt.

Building on this, Yung et al. (2007) find underpricing in hot markets to be greater, citing a wider dispersion in firm quality and hence higher information asymmetry and uncertainty during such times. They also find the proportion of IPOs issued during hot markets that subsequently delist to be much greater than those issued in cold markets. This is consistent with higher underpricing observed in this and other studies and reflects the altered levels of risk and opportunity during such periods. To the retail investor, this acts also acts as evidence against employing a long-term buy and hold strategy.

Similar patterns arise in the UK market, which exhibits cyclical IPO characteristics akin to the US market (Banerjee et al., 2013). The research also points to the strong relationship between IPO volume and the market's historical price to book ratio present in their sample, noting potential investor sentiment and timing effects. Consistent with earlier research (Alti,

2006), the paper finds UK firms to raise substantially higher proceeds from IPOs in hot market conditions.

2.7 Lock-up Agreements

A lock-up agreement is the prohibition of company insiders (managers) and pre-IPO investors to sell their own shares for a set period of time, until the agreed upon 'lock-up expiry' date. It is a very common feature of IPO issuance and acts as a signal that the firm will remain a going concern and that insiders are not just trying to cash out before the announcement of upcoming bad news (Field & Hanka, 2000). Over the period of 1988-1997, Jordan et al. (2000) find significant negative abnormal returns on the expiry dates of the lockup agreements. More so than others, the biggest drops in their sample are observed for VC-backed firms, which lose around 3-4% of their value, with firms not backed by VC losing out less, marking an important consideration regarding the funding and ownership structure of any prospective IPO, especially if planning to hold longer-term.

Linking lock-up agreements back to the theme of underpricing, Aggarwal et al. (2001) suggest that managers strategically underprice new issues to create positive momentum for the stock, hoping that will drive higher stock valuations at the time of lock-up expiry, when they can unload their own shares. Findings on positive correlation between managerial stock holdings and higher underpricing support their theory.

A more recent study investigating the impact of large and influential shareholder activity around the lock-up expiry date (Ertimur et al., 2013) also suggests that another driver of the negative post-lock-up returns may be the postponement of publishing of bad news past the lock-up period expiry window, as well as informational influence enacted on the smaller shareholder by the large ones, enabling pre-IPO shareholders to sell at higher prices, leaving all new (and remaining) shareholders worse off in the future.

For additional interesting insight, Gao et al., (2017) investigate a regulatory change in the Chinese market which removed the imposition of a mandatory lock-up period for institutional investors that had previously been in place. Following the shift, evidence shows that institutional investors bid the offer price higher, since they are then able to realise the returns on any underpricing sooner and with less timing risk. Consequently, the overall underpricing and 1st day returns of the IPO also shrink. Although not directly applicable to the US context, the findings are consistent with aspects of strategic underpricing (R. K. Aggarwal et al., 2001). If insiders were not subject to lock-up agreements, the dynamics of deliberate underpricing to drive momentum, as well as investor sentiment and perceived risk levels may shift.

2.8 Pricing, Marketing and Media Attention

The role of the underwriter, as well as the overall interest and attention an IPO receives has already been discussed in prior chapters, however it is also worth briefly touching upon the specific impact of media attention and IPO marketing,

Here, an early study by Pollock & Rindova (2003) finds a negative, diminishing relationship between the general volume of media provided information and underpricing, as well as a positive, diminishing relationship with the volume of trading right after issuance. This is consistent with the findings of information asymmetry (Leite, 2007; Li et al., 2005; Rock, 1986) discussed in earlier chapters. As investors become more informed about the IPO, and since media coverage may present both the issuer and issuance as more trustworthy, the level of information asymmetry declines, also lowering the underpricing in the process. Additionally, Pollock & Rindova (2003) find that the positivity of the media coverage has a positive relationship with underpricing, which is in line with the importance of investor sentiment and overoptimism (Chan, 2014; Neupane et al., 2012). Results of subsequent studies support and expand on these findings, with Liu et al. (2007) showing positive media coverage drives higher underpricing, but finding no evidence of the inverse effect, proposing that negative media coverage does not affect the level of underpricing. A more recent study into media attention in the form of social media analyst articles, Han & Zhang (2025) also note the same – only bullish articles may drive up underpricing, while bearish articles have no effect.

Discussing marketing of IPOs, Cook et al. (2006) highlight the benefits for underwriters to market IPO issuances, building especially on appealing to the "class of irrationally exuberant investors" (Ljungqvist et al., 2003), suggesting that this brings liquidity to the market, improved valuations for the issuers and momentum in the stock price, as well as increased underwriter compensation. Subsequent studies also find reduced underpricing and increased volumes for heavily marketed issuances (Luo, 2008), as well as a positive correlation between pre-IPO marketing spending and short-term aftermarket performance, despite no persistent effects on the long run (Fine et al., 2017).

2.9 Changing Investor Demographics

A final avenue of literature to touch on before closing remarks for the chapter is the recent IPO market developments and changes to investor demographics. While not all of these will be relevant to or correlated with the findings of this study, they may help interpret its findings in the context of evolving market conditions.

Discussing the impact of the digital age on investment decisions, Briere (2023) notes that technological developments have reduced the barriers to entry in some investment areas, driving increased investor attention, especially when it comes to the younger generation. The overall effects of this have been mixed, but some digital services have had negative impact on rational investor behaviour, amplifying biases and increasing turnover. In the context of IPOs, such shifts may push pricing anomalies further, as investors notice soaring initial returns and pile into the markets to capitalise. This can be profitable, but the only challenge is not being left holding the stock when the readjustment of prices back towards fundamentals begins.

This increased access and interest also translates into social media, with a recent study citing social media forums as discussion grounds for extremely risky stock market activity, often leading to significant losses for the retail investors who partake in them (Warkulat & Pelster, 2024). This is highlighted further by D. Aggarwal et al. (2024), who analyse how the reduction in online brokerage fees, coupled with the rise of social media and general shift to more online activity during and after the COVID-19 pandemic lead to the creation of online communities centred around particular (often non-performing) stocks, creating huge swings in demand and consequently prices, completely devoid of any fundamental backing.

Last, Gempesaw et al. (2025) conduct an empirical review a newly available type of 'Retail Access' IPOs, which are run through the online brokerages of Robinhood and SoFi Technologies and are specifically marketed towards retail investors. Despite the enticing premise of easier access, Gempesaw et al. find that these underperform tradition issuances by around 20% during the first year, so may not be worth paying much attention to as of yet.

2.10 Summary

The literature examined in the sub-chapters above creates a solid overall basis for building an understanding of the theoretical IPO framework.

Figure 1 shows a high-level overview of the said framework. It notes the move from initial underpricing to short-term momentum driven gains, followed by long-run underperformance. It also highlights some of the most prominent linkages between the driving factors of IPO returns. Table 1 synthesizes the main findings of previous studies and analyses their implications for this one.

Figure 1
The Linkages Between the Drivers of IPO Returns
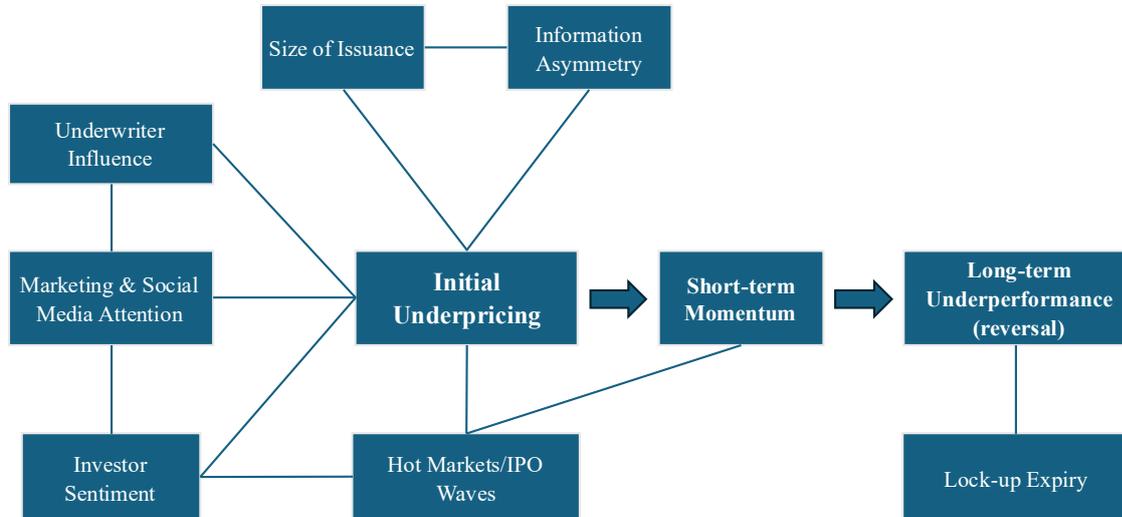
Source: Created by Author, 2025.

Table 1

Literature Summary

Characteristic	Findings/Implications	Notable Papers
Initial Underpricing and long-term Underperformance	Studies consistently find that IPO issuance exhibits initial abnormal positive returns but tends to perform poorly in the medium to long-term. This is persistent across regions, markets & sectors, though the severity of each does vary.	Carter et al., 1998; Francis et al., 2001; Michel, 2014; Ritter, 1991
Underwriter Influence	Underwriters exert a high degree of influence over the market, often build-in underpricing to attract a wider scope (especially those less informed) of investors. Preferential treatment for large institutional clients has also been observed.	B. Boehmer et al., 2006; Carter et al., 1998; Dong et al., 2010
Information Asymmetry & Market Uncertainty	Information asymmetry between market participants and general market uncertainty towards new unestablished issuance is also a key driver of initial underpricing, as investors demand excess returns for taking on higher levels of risk.	Leite, 2007; Li et al., 2005; Reber & Vencappa, 2016

Continuation of Table 1

Investor Sentiment	Investor sentiment and overoptimism, especially in bullish markets, may over inflate stock prices in the short term, leading to greater underpricing and short-term momentum, but also contributing to long-run underperformance, as excitement and prices subside. Retail investors tend to be more susceptible to behavioural biases and sentiment-based trades, and therefore risk being left the ones holding the falling shares as institutional investors sell.	Colaco et al., 2016; Ljungqvist et al., 2005; Neupane et al., 2012
Hot Markets & IPO Waves	Building on sentiment and market conditions, studies have shown IPOs to follow cyclical patterns and cluster in high issuance periods referred to as 'Hot Markets' or 'IPO Waves'. Underpricing tends to be greater in hot markets, with a wider dispersion in firm quality and greater degree of information asymmetry. The proportion of IPOs issued during hot markets that subsequently delist has also been observed to be much greater than those issued during low activity periods.	Banerjee et al., 2013; Helwege & Liang, 2004; Pastor & Veronesi, 2005
Lock-up Agreements	The expiration of lock-up agreements, whereby inside investors become able to sell their shares in the open market, exhibits varying levels of impact from one study to another, with the most sizable negative effect on returns observed upon lock-up expiry being in VC backed IPO issuance.	Ertimur et al., 2013; Field & Hanka, 2000; Gao et al., 2017

Continuation of Table 1

Media Attention	Supplementing the findings on information asymmetry and investor optimism, studies find correlation between the volume and sentiment of media coverage. An overall increase in volume of media is observed to be correlated with a decrease in the underpricing, consistent with reduced information asymmetry, while positive media sentiment is correlated positively with underpricing, given the excitement and momentum it may help build. Conversely, negative media sentiment is found not to have a statistically significant impact on returns.	Cook et al., 2006; Fine et al., 2017; Liu et al., 2007; Pollock & Rindova, 2003
Changing Investor Demographics & Social Media Influence	In more recent times, key considerations include the growing role of social media and changing investor demographics. Digitalization has opened up the possibility of IPO investment to a wider, younger audience of investors. This increased access to issuance and the development of online discussion forums, especially post-covid, have been noted to play a role in potentially exacerbating some of the behavioural and sentiment effects discussed in earlier chapters, leading to greater market anomalies.	D. Aggarwal et al., 2024; Gempesaw et al., 2025; Tütüncü, 2022

Source: Author, synthesized literature review, 2025

While the overall literature is broad, there is little recent work aimed specifically at the non-professional (retail) investor, offering synthesised review and guidance. This is the niche that the paper will aim to fill, evaluating both long-term and short-term holding and exit strategies, adjusting scenarios for instances where direct access to the IPO at offer price is simply not possible, testing the impacts of factors such as industry, market conditions or issuance size on returns, collating everything into applicable concepts to guide investment strategy.

3. METHODOLOGICAL APPROACH

Answering the broad research question of when a retail investor should close out their positions when participating in IPO investing presents many avenues and market characteristics to explore, as seen from the literature in the previous section. The following sections will outline the specific research hypotheses to be considered within the study, as well as the sample selection, data collection and data processing approaches.

3.1 Variables

The below sections will cover the key notation, relevant terms and definitions which will be referenced when setting out the research hypotheses.

Figure 2
Overview of Key Variables
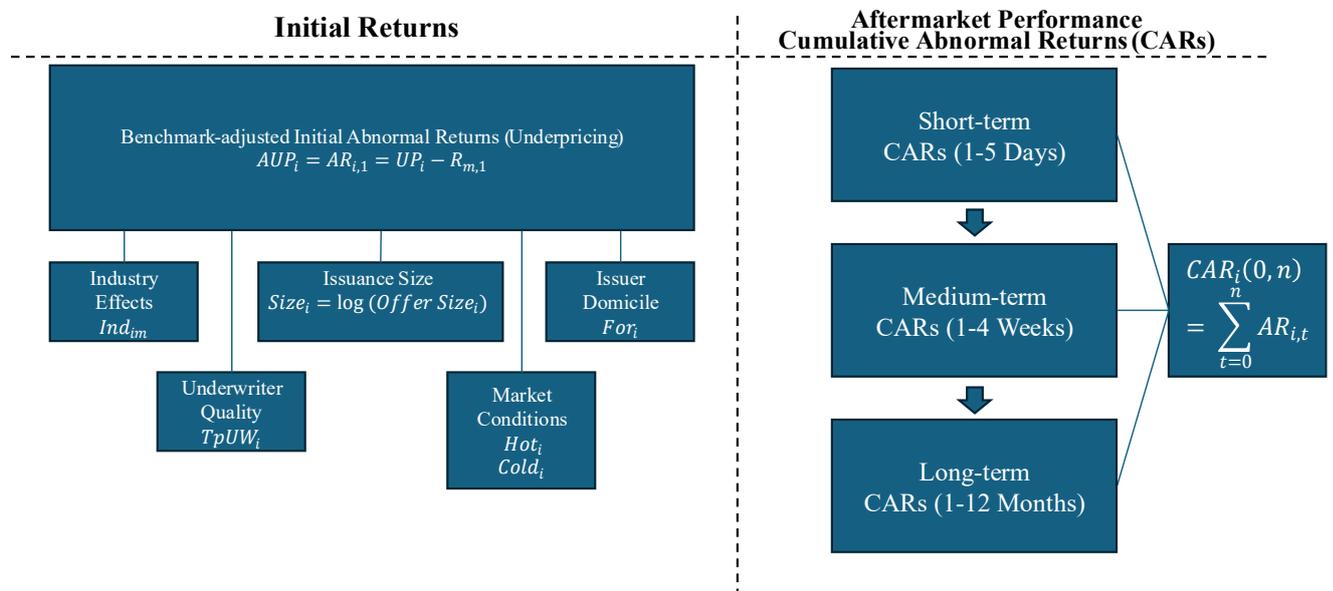
Source: Created by Author, 2025.

Figure 2 shows the linkage between the key variables to be used and analysed within the study. Further details and the rationale for their selection is presented below and in the next sections.

$i = 1, 2, \dots, N - index\ of\ the\ IPO\ (in\ no\ particular\ order)$

$t = 1, 2 \dots, 252 - number\ of\ trading\ days\ from\ IPO$

$n = 1, 2, \dots, 252 - holding\ period/investment\ horizon\ in\ trading\ days$

$l = -N, \dots, N - number\ of\ trading\ days\ from\ the\ lockup\ expiry$

$V_m = Market\ volume\ of\ IPOs, measured\ as\ number\ of\ IPOs\ per\ Quarter$

$\varepsilon = Zero\ mean\ error\ term$

$P_{i,0} = Offer\ price\ of\ IPO\ i$

$P_{i,t} = Closing\ price\ of\ IPO\ i\ on\ day\ t$

Underpricing observed on the first day of trading, measured as the return between the offer price and closing price on the first day:

$$UP_i = \frac{P_{i,1} - P_{i,0}}{P_{i,0}}$$

$R_{i,t} = Return\ of\ IPO\ on\ day\ t\ (in\ trading\ days\ from\ the\ IPO\ date)$

$R_{m,t} = (Daily)\ Return\ of\ benchmark\ index\ on\ day\ t$

$AR_{i,t} = R_{i,t} - R_{m,t} = Abnormal\ return\ of\ IPO\ i\ on\ day\ t\ over\ the\ benchmark\ index$

Benchmark adjusted underpricing on the first day of trading:

$$AUP_i = AR_{i,1} = UP_i - R_{m,1}$$

Cumulative abnormal returns (CAR), calculated as the sum of abnormal returns between the offer price and returns from desired holding period (n) in trading days:

$$CAR_i(0, n) = \sum_{t=0}^{n} AR_{i,t}$$

Size factor:

$$Size_i = \log(Offer\ Size_i)$$

Top underwriter dummy:

$$TpUW_i = \begin{cases} 1: Lead\ underwriter\ is\ in\ the\ top\ 5\ by\ total\ IPO\ issuance\ size \\ 0: Lead\ underwriter\ is\ not\ in\ the\ top\ 5\ by\ total\ IPO\ issuance\ size \end{cases}$$

Hot market dummy:

$$Hot_i = \begin{cases} 1: V_m\ is\ in\ the\ top\ quartile\ of\ the\ sample \\ 0: V_m\ is\ not\ in\ the\ top\ quartile\ of\ the\ sample \end{cases}$$

Cold market dummy:

$$Cold_i = \begin{cases} 1: V_m\ is\ in\ the\ bottom\ quartile\ of\ the\ sample \\ 0: V_m\ is\ not\ in\ the\ bottom\ quartile\ of\ the\ sample \end{cases}$$

Industry dummies (1 always dropped to avoid perfect multicollinearity):

$$Ind_{im} = \begin{cases} 1: IPO\ i\ belongs\ to\ industry\ m \\ 0: IPO\ i\ does\ not\ belong\ to\ industry\ m \end{cases}$$

Foreign Issue Dummy:

$$For_i = \begin{cases} 1: Issuer\ of\ IPO\ i\ is\ not\ domiciled\ in\ the\ US \\ 0:\ Issuer\ of\ IPO\ i\ is\ domiciled\ in\ the\ US \end{cases}$$

3.2 Research Hypotheses

The below sections will outline all hypotheses, models and regressions to be computed in the study. In addition to this, the regressions will be tested for heteroscedasticity using the Breusch-Pagan test and adjusted accordingly (via the HC1 adjustment in R) should the null hypothesis of homoscedasticity be rejected. The regressors will also be evaluated for potential multicollinearity using the Variance Inflation Factor (VIF) test.

3.2.1 Initial Underpricing

With the high levels of underpricing highlighted in the literature, the very first alternative hypothesis to be tested is that the expected underpricing exhibited by the average IPO is positive, generating corresponding excess returns for the investor:

Intercept-only Model:

$$UP_i = \alpha + \varepsilon_i$$

Null and Alternative Hypotheses:

$H_0: E(UP_i) = 0$ – On average, IPOs are fairly priced with no systemic underpricing.

$H_A: E(UP_i) > 0$ – On average, IPOs are underpriced and generate positive returns.

3.2.2 Size

Looking at the effect that uncertainty has on initial returns (Aissia, 2014), the next hypothesis to be tested is the impact of issuance size on initial returns. Here, one would expect that firms with larger IPOs are better established, well covered and less shrouded in uncertainty, and would therefore demand lower rates of underpricing, however another consideration is the media coverage and overall attention the large issuance is likely to bring, putting upward pressure on underpricing. The following will be evaluated to determine what, if any, effect the issuance size has on 1st day (benchmark-adjusted) underpricing:

Regression:

$$AUP_i = \alpha + \beta_1 Size_i + \varepsilon_i$$

Null and Alternative Hypotheses:

$H_0: \beta_1 = 0$ – On average, the size of the issuance will have no effect on the level of underpricing.

$H_A: \beta_1 < 0$ – On average, larger issuances will have lower levels of underpricing.

3.2.3 Underwriter Quality

With the heavy involvement of underwriters in the IPO process, the impact of lead underwriter 'quality' will also be assessed. Here, cumulative issuance volumes for distinct lead underwriters/bookrunners will be calculated and a ranking formed. The top 5 from this list will make up the 'Top' underwriter tier, the next 10 – the 'Middle', with the rest categorized as 'others'. Issuances with no underwriter datapoints will be grouped into the 'None' category. For the purposes of the regression analysis, the effect of the 'Top' quality underwriters will be considered:

Regression:

$$AUP_i = \alpha + \delta_1 TpUW_i + \varepsilon_i$$

Null and Alternative Hypotheses:

$H_0: \delta_1 = 0$ – On average, the quality of the underwriter will have no effect on benchmark adjusted underpricing

$H_A: \delta_1 \neq 0$ – On average, the quality of the underwriter will have an effect on benchmark adjusted underpricing

3.1.4 Foreign Domiciled Issuance

Building on the findings of outperformance of foreign domiciled issuance in US markets (Francis et al., 2001), the following regression is set out. If the patterns observed in the research have stayed intact, the expectation would be that foreign domiciled issuances will exhibit greater levels of underpricing, due to increased uncertainty and other cross-border listing implications.

Regression:

$$AUP_i = \alpha + \delta_1 For_i + \varepsilon_i$$

Null and Alternative Hypotheses:

$H_0: \delta_1 = 0$ – On average, foreign domiciled issuances will exhibit no underpricing.

$H_A: \delta_1 > 0$ – On average, foreign domiciled issuances will exhibit higher levels of underpricing.

3.2.5 Industry Effects

There are 9 broad industries within the sample. Previous research has indicated differences in returns between sectors and markets, therefore it would be reasonable to assume that the sample for this study will exhibit similar behaviour.

Dummy variables will be created for each industry (using built-in R functionality), evaluating the potential impact of each on the level of underpricing (and potentially CAR), helping retail investors make informed decisions when subscribing to IPOs.

Regression:

$$AUP_i = \alpha + \sum_{m=1}^{M-1} \delta_m \ Ind_{im} + \varepsilon_i$$

Null and Alternative Hypotheses:

$H_0: \delta_1 = \delta_2 = \cdots \delta_m = 0$ – On average, the industry type will have no impact on the level of underpricing.

$H_A: \delta_1 \neq \delta_2 \neq \cdots \delta_m \neq 0$ – On average, IPOs within different industries will exhibit different levels of underpricing.

3.2.6 Hot & Cold Markets

Hot and cold markets, or rather the varying level of issuance from year to year has been observed not only in the literature review but the dataset of this paper. Therefore, this section aims to evaluate both the effects of hot and cold markets on the level of (benchmark-adjusted) underpricing for any given IPO, expecting to observe greater levels of underpricing in hot markets and lower levels during cold ones:

Regression:

$$AUP_i = \alpha + \delta_1 Hot_i + \delta_2 Cold_i + \varepsilon_i$$

Null and Alternative Hypotheses:

$H_0: \beta_1 = 0$ – On average, the perceived state and 'hotness' of the market will have no effect on the level of underpricing.

$H_{1A}: \delta_1 > 0$ – On average, hot markets will exhibit higher levels of underpricing.

$H_{2A}: \delta_2 < 0$ – On average, cold markets will exhibit lower levels of underpricing.

3.2.7 Short-term Performance

The paper will subsequently move to testing post-IPO performance in the aftermarket, first looking at the short-term performance within the first week of trading. CARs will be calculated for each day in the event window, and two separate cases, dependent on the level of potential access to IPO issuance, will be considered. The first will evaluate the cumulative abnormal returns taking the offer price as the reference point, while the other will take the first day (open market) open price as the starting point for calculating subsequent returns.

Intercept-only Model (Scenario 1 – with subscription to issue):

$$CAR_i^{1,n} = \alpha_n + \varepsilon_{i,n}$$

Null and Alternative Hypotheses (Scenario 1):

$H_0: \alpha_n = 0$ – On average, there will be no abnormal returns relative to the market

$H_{1A}: \alpha_5 > \alpha_4 > \alpha_3 > \alpha_2 > \alpha_1$ – Short-term returns will grow during the first week of trading.

$H_{2A}: \alpha_5 > 0$ – Stemming mostly from the presence of underpricing, 1-week CARs should be positive and significant.

Intercept-only Model (Scenario 2 – without subscription to issue):

$$CAR_i^{2,n} = \alpha_n + \varepsilon_{i,n}$$

Null and Alternative Hypotheses (Scenario 2):

$H_0: \alpha_n = 0$ – On average, there will be no abnormal returns relative to the market

$H_A: \alpha_5 > \alpha_4 > \alpha_3 > \alpha_2 > \alpha_1$ – Abnormal returns will be positive during the first event window.

$H_{2A}: \alpha_5 > 0$ – Stemming mostly investor sentiment and momentum, 1-week CARs should be positive.

3.2.8 Medium-term Performance

Looking further to the medium-term, the 1-week, 2-week, 3-week and 4-week CARs of both scenarios outlined in section 3.2.7 will be calculated and analysed, with both expected to grow slightly.

Intercept-only Model (Scenario 1 – with subscription to issue):

$$CAR_i^{1,n} = \alpha_n + \varepsilon_{i,n}$$

Null and Alternative Hypotheses (Scenario 1):

$H_0: \alpha_n = 0$ – On average, there will be no abnormal returns relative to the market.

$H_A: \alpha_{15} > \alpha_{10} > \alpha_5$ – Initial returns should be sustained and may continue to experience momentum and sentiment driven growth.

$H_{2A}\alpha_{20} > 0$ – Barring any fundamental IPO market shifts, 1-month CARs should on average, be positive and significant.

Intercept-only Model (Scenario 2 – without subscription to issue):

$$CAR_i^{2,n} = \alpha_n + \varepsilon_{i,n}$$

Null and Alternative Hypotheses (Scenario 2):

$H_0: \alpha_n = 0$ – On average, there will be no abnormal returns relative to the market.

$H_{1A}: \alpha_{15} > \alpha_{10} > \alpha_5$ – Initial returns should be sustained and may continue to experience momentum and sentiment driven growth.

$H_{2A}: \alpha_{20} > 0$ – Given the aforementioned pricing support factors in the early market, 1-month CARs are expected to be positive (albeit slightly), with reversal following later on.

3.2.9 Long-term Performance

Looking finally at the long-term, a wide sample of CARs will be calculated, spanning monthly intervals between 1-12 months. Some form of reversal and correction of overpricing is expected (Killins & Egly, 2018; Michel, 2014), leading to long-term underperformance. Looking at the data month to month will hopefully aid in capturing when this happens and what the key drivers may be.

Intercept-only Model (Scenario 1 – with subscription to issue):

$$CAR_i^{1,n} = \alpha_n + \varepsilon_{i,n}$$

Null and Alternative Hypotheses (Scenario 1):

$H_0: \alpha_n = 0$ – On average, there will be no abnormal returns relative to the market.

$H_{1A}: \alpha_{42} > \alpha_{21} > \alpha_{252}$ – On average, initial returns may be high or at least stable and may continue to experience momentum and sentiment driven growth, but it is unclear when a reversal may occur, hence the one or two-month returns should exceed those seen after a full year.

$H_{2A}: \alpha_{252} > 0$ – Even with any potential shocks or price adjustments, the substantial first day returns yielded from underpricing should keep CARs positive through the whole first year.

Intercept-only Model (Scenario 2 – without subscription to issue):

$$CAR_i^{2,n} = \alpha_n + \varepsilon_{i,n}$$

Null and Alternative Hypotheses (Scenario 2):

$H_0: \alpha_n = 0$ – On average, there will be no abnormal returns relative to the market.

$H_{1A}: \alpha_{42} > \alpha_{21} > \alpha_{252}$ – Initial returns may be high and could continue to experience momentum driven growth, but it is unclear when a reversal may occur, hence the one or two-month returns should exceed those seen after a full year.

$H_{2A}: \alpha_{252} < 0$ – Without the large-scale 1st day returns propping up the CARs for the year, it is very possible that these will turn negative at some point as the reversal kicks in and the overpricing begins to correct.

3.2.10 Lock-up Expiry

Also using the CAR approach, this section will test the abnormal returns of the stock price at 3 intervals around the lock-up expiry date:

a. -1, +1 Trading Days
b. -3, +3 Trading Days
c. -5, +5 Trading Days

Given the large increase in supply that can become available upon lock-up expiry, it is expected that CAR will be negative within the event windows, as is consistent with past observations (R. K. Aggarwal et al., 2001; Field & Hanka, 2000).

With by far the most common within being the 180-day window. The analysis will be limited to the 360-calendar day option, as there are only a few within the sample with lockup periods greater than that – at 365 and 540 days. These fall outside of the calculated return

windows and will therefore be excluded for this part of the empirical research. Also excluded are the IPOs with no lock-up date.

Intercept-only Model:

$$CAR_i^{2,n} = CAR_i^{l-x,l+x} + \varepsilon_{i,n}$$

Null and Alternative Hypotheses:

$$H_0: CAR_i^{l-x,l+x} = 0$$

$$H_A: CAR_i^{l-x,l+x} < 0$$

Where x = desired number of trading days to be included on either side of the lock-up window.

3.3 Determining the Sample

Given its size, depth, international and retail attention, the market selected for this study is the US Equity Market. While various limitations arise, the large dataset spanning over a 20+ year period should allow for robust analysis and meaningful findings. The below section outlines the various criteria determined for the sample construction, along with the rationale of why such selections were made, as well as what the key limitations were and what efforts were made to reduce their impact on the empirical results of the paper.

3.3.1 Sample Criteria

Date range – 2000-01-01 to 2023-12-31 (pricing data up to 2024-12-31): This encompasses nearly all available data within the 21st century, covering various market conditions, financial crises, extraordinary boom markets, and the recent developments of the post-covid shift in the world.

Offer size – $75m+: A larger offer size increases the likelihood of some degree of retail investor access and participation, as well as subsequent volumes to drive meaningful price movements in the aftermarket.

Security type – Only the following two are included in the sample:

a. Common Stock: These are more likely to be relevant and available to retail investors in comparison to other security types (such as class A shares, which come with enhanced voting rights)
b. American Depository Receipts (ADRs): This is how foreign domesticated issuance in the US markets is typically denominated. Availability to retail varies but larger issuance attracts investor attention. Included to re-examine findings of Francis et al. (2001).

Exclusion list – below is the list of subsequent exclusions made when composing the sample and cleaning the file:

a. Closed-end funds, REITs, special purpose entities and special-purpose acquisition companies: These exhibit different characteristics from the standard IPO and have also shown poor performance in past studies (in the case of closed-end funds for example) (Shao & Ritter, 2018).

b. Any IPO that was withdrawn before the IPO date and never listed, as in cases like these money is returned and no returns can be calculated. It is worth noting that the risk of this happening poses a certain opportunity cost of IPO investment, as the funds briefly tied up in the subscription could be employed elsewhere.

c. Several datapoints containing inconsistencies within the offer date in Bloomberg and availability of historical pricing for the same issuer.

3.3.2 Potential Limitations

The main limitation of concern is the lack of ability to determine the level of retail investor access and participation to any given issuance historically speaking, since specific data on this does not exist. To reduce the impact of this, only large issuances and selected security types (as laid out in the section above) are included, however this does not completely eliminate the problem. Due to this, alternative investment options, focusing on aftermarket trading will also be examined.

The second is determining the exchange the IPO was listed on. It might have made sense to only include issuances on the New York & Nasdaq stock exchanges, as these would once again be most accessible to retail investors, however look-back data for this in the case of most delisted IPOs is not available on Bloomberg, hence filtering on 'Primary Exchange' would be opening the study up to survivorship bias. Given that the large majority of large issuances would still be expected to take place in a reputable exchange, no additional filtering in this category is made.

3.4 Data Collection

The collection of the data is performed using the Bloomberg Terminal, using the following methods:

1. The IPO screening tool is used to filter and create the sample, based on the parameters laid out in section 3.3.1.

2. Additional columns are added to the standard 'Deal List' view that is available in the terminal, resulting in the following data points:

   a. 'Issuer Ticker' and 'Issuer Name': needed for subsequent extraction of historical data & review of inconsistencies.

   b. 'Offer Size ($ million)': used to both narrow down the sample and test size effects on returns.

   c. 'Offer Price ($)': Used as the base of most underpricing and cumulative returns calculations, except for purchases made in the aftermarket.

   d. 'Industry': a broad Bloomberg classification (e.g. 'Consumer', 'Technology' 'Financial', etc.), which will be used to compare returns and potential strategies between sectors.

   e. 'Security Type', which indicates whether the IPO was a common stock issuance or an ADR (as mentioned below these are the only two types included in the study).

   f. 'Bookrunner' and 'Left Lead Bookrunner', which will be used to evaluate the effect of the number of bookrunners and reputation of the lead bookrunner on the performance of the IPO.

   g. 'First Lock-Up Period' (where available): the exact date (and required amount of wait) after which insiders can sell their shares in the open market. Returns around this date will be tested to evaluate what impact the potential offloading of manager held securities has on returns.

   h. 'Country/Region', which, in conjunction with the 'ADR' security type, will be used to differentiate foreign and domestic issuers, building on the findings of past research (Francis et al., 2001).

3. Data is then exported in simple form into Excel format

4. The 'Spreadsheet Builder' tool, available in Excel, is used to gather:

   a. Daily opening/closing price data on all exported stocks, for the period of 2000-01-01 to 2024-12-31, to ensure that sufficient aftermarket data is collected even for IPOs in late 2023.

   b. Corresponding data for the SPX (S&P 500) index, which will be used as the benchmark when calculating abnormal returns over the market, and as a general passive investment alternative for the average retail investor.

3.5 Data Processing

Performing the data collection yields an Excel file with two sheets:

1. The first of which contains all of the IPO data as outlined in the 2nd point of the above section.
2. The second contains complete daily trading data extending just beyond the sample period, as outlined in the 4th point of the data collection sub-chapter.

From these two sheets, a mixture of Excel transformations and some Python code are used to create a master file with panel style data, which can be easily interpreted by R. It contains a consolidated version of the aforementioned data, with prices and returns displayed as one row per issuer per trading day, spanning an event window of 365 calendar days (roughly 261 or 262 trading days). Said data is then imported into R for further processing and regression analysis. Figure 2 provides a high-level overview of the steps outlined above.

Figure 3
Overview of the Data Collection & Processing Approach
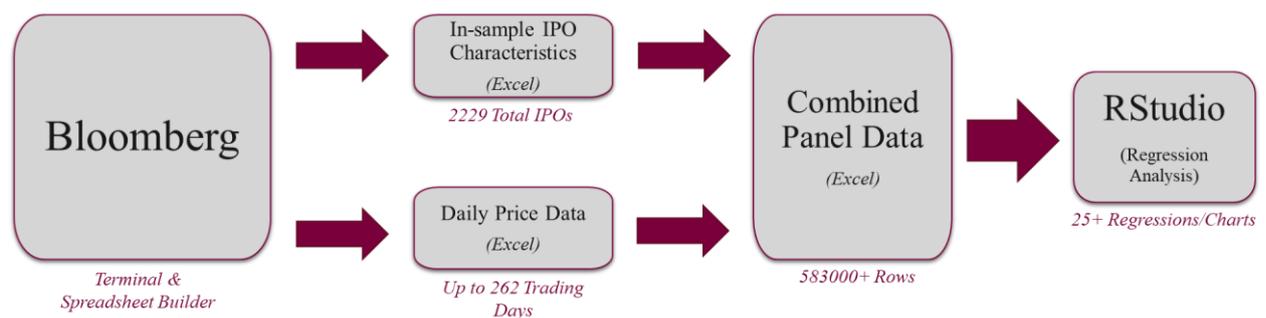
Source: Created by Author, 2025.

4. AN EMPIRICAL REVIEW OF IPO RETURNS AND KEY DRIVERS

4.1 Overview of the Data

The constructed sample, ranging from the start of 2000 until the end of 2023, Contains a total of 2229 IPOs. The below chart shows the annual level of activity throughout the study period:

Figure 4

Number of in-sample IPOs by Year
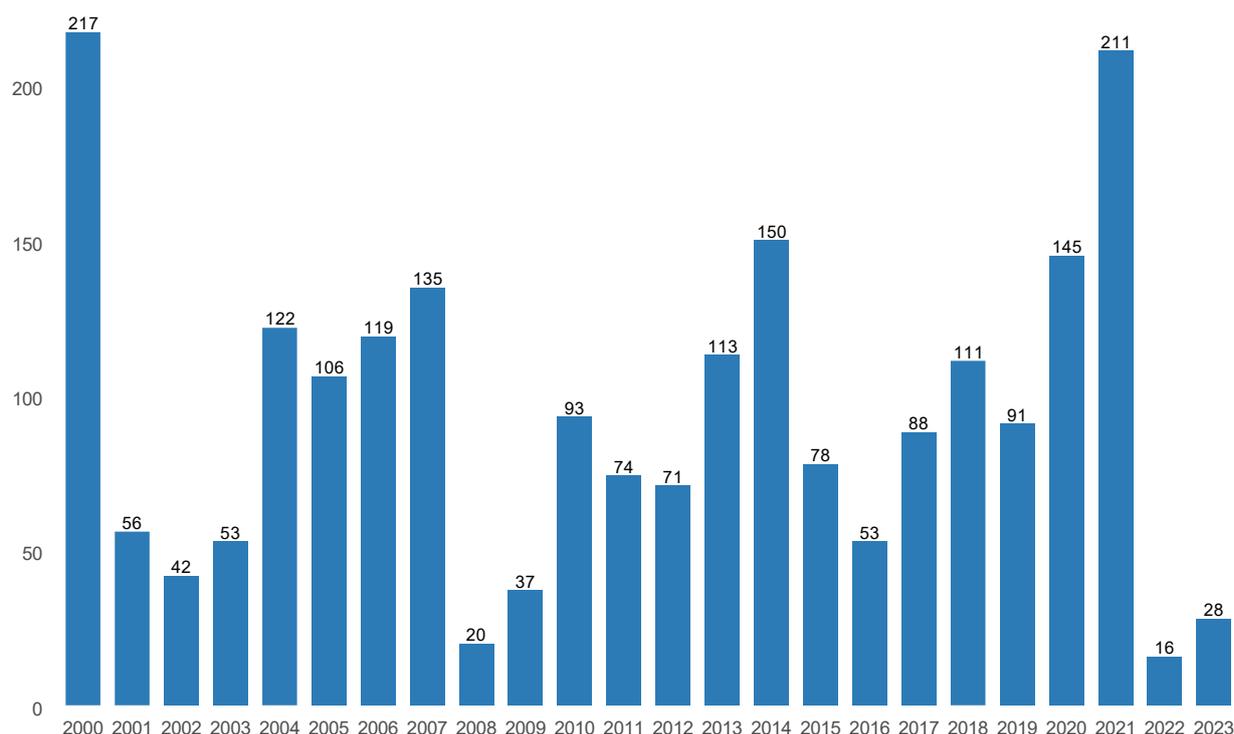
Source: Generated in R by author, from Bloomberg Data, 2025.

As can be seen above, there are very wide swings in the levels of IPO activity from year to year. These findings are consistent with prior research into market patterns and volumes both in the US and abroad (Banerjee et al., 2013; Loughran & Ritter, 2002), and supports the existence of 'hot markets', when issuers flock to the markets, be it for favourable valuation conditions or other factors, pushing issuance to greater highs. The data also suggests the existence of the opposite, cold markets when issuance is way down. Research and the data collected within the study shows that these coincide quite strongly with economic downturns and market turmoil. Relative to the prior year, the number of IPOs drops by a factor of 4 during the dotcom bubble crash of 2001, by nearly 7 times during the financial crisis of 2008-09, and well over 10-fold in 2022. The latter is the most interesting here, since, despite global turmoil, the markets did not fall nearly as strongly as in the first 2 observed instances and had already recovered by 2023. Further research into the determinants of this, and whether it marks a long-

term shift in IPO issuance in general would greatly supplement the findings of this paper and insights for the retail investor.

Figure 5

Number of in-sample IPO Issuances by Sector
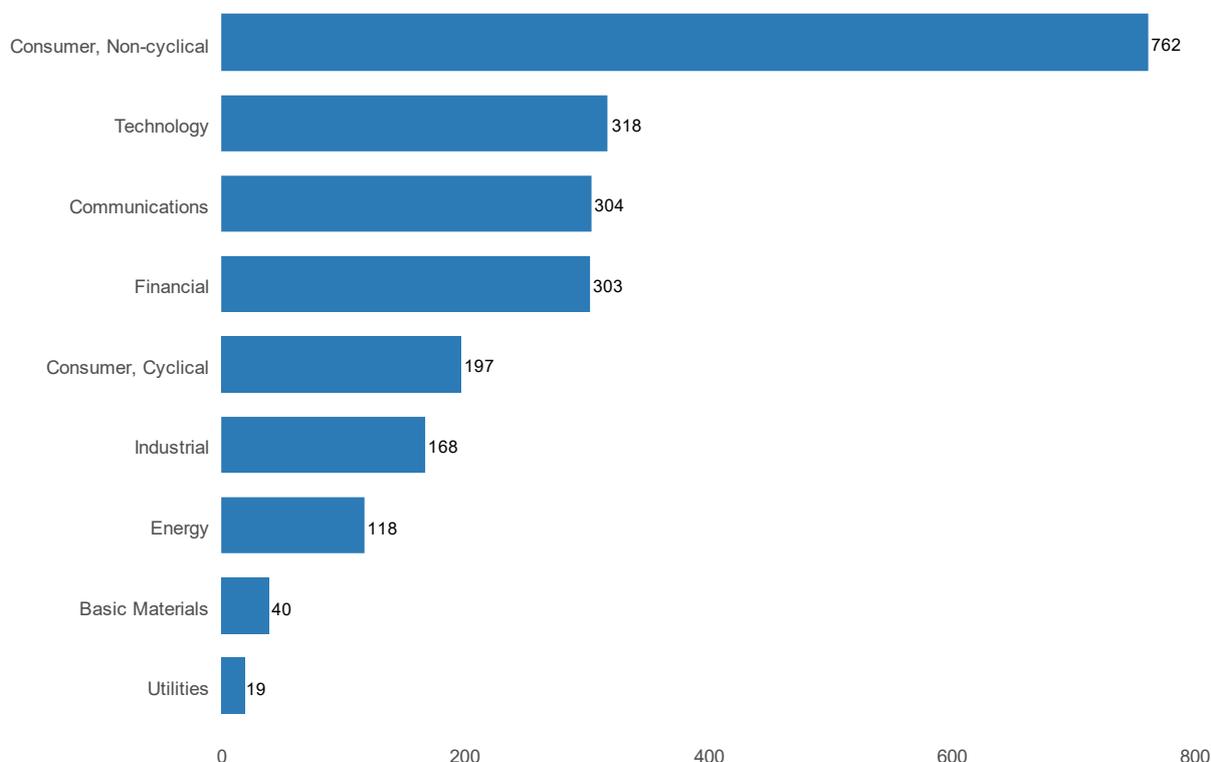
Source: Generated in R by author, from Bloomberg Data, 2025.

A large portion of IPOs falls into the consumer sector, with 762 in the non-cyclical category and another 197 in the cyclical. This is followed by a fairly even number of issuances within the technology (318), communications (304) and financial (303), dropping off in the industrial (168) and energy (118) sectors. Lastly, there was considerably lower quantity of basic materials (40) and utilities (19) sector issuance within the parameters of the sample. Based on examined research, it would also be fair to expect the levels of underpricing of these less "popular" sectors to be lower (Merikas et al., 2010).

The study will focus on the analysis of each distinct hypothesis and thus will be dominated by single variable regressions or intercept-only models, with additional tests being run to improve the robustness of the results. The Breusch-Pagan test will also be run for each regression to test for heteroscedasticity. Where homoscedasticity can be rejected (p-value <0.05), heteroscedasticity-consistent (HC1 in R) standard errors will be used, adjusting for non-constant residual variance. The Variance Inflation Factor (VIF) is also run to evaluate the level of

multicollinearity between the regressors, yielding values between 1.05 and 1.25, indicating a light degree of multicollinearity at most, with no specific adjustments to the analysis arising from this.

4.2 Simple Underpricing

To evaluate the level of underpricing found in within the sample, the following intercept-only equation is evaluated: $UP_i = \alpha + \varepsilon_i$

Table 2

Intercept-Only Model of Simple IPO Underpricing

Term	Estimate	Std. Error	t value	p value	CI Lower 95%	CI Upper 95%
α	0.1973	0.0076	25.8543	0.0000	0.1823	0.2123

Source: Bloomberg Database/R, 2025.

The results of the model show an intercept (α) of 0.1973, and p-value of nearly 0, indicating a statistically significant level of underpricing within the sample under all confidence levels. Based on these findings, the null hypothesis (H_0) of no systemic underpricing is rejected, in favour of positive 1st day returns (underpricing). On average, new issuances returned 19.73% on the first day of trading, with the 95% confidence intervals placing returns in a range between 18.23% and 21.23%, consistent with the findings from previous studies (Loughran & Ritter, 2002; Rock, 1986).

Below is a table detailing some additional statistics of the above model. The highest the 1st day return with within the 2229 observations of the sample was 414.29%, highlighting the possibility for truly extraordinary gains. It must be noted that this is counteracted by a first day loss of 37.2%, which indicates that although average returns are high, they do not come without risk.

Table 3

Summary Statistics (Simple Underpricing)

Statistic	Value
Number of Observations	2229
Mean underpricing	0.1973
Lowest 1st day return	-0.3720
Highest 1st day return	4.1429

Source: Bloomberg Database/R, 2025.

4.3 Benchmark-Adjusted Underpricing

Next, a model testing the benchmark-adjusted underpricing is run, to evaluate the impact of market returns on the day of issuance: $AUP_i = \alpha + \varepsilon_i$

Table 4

Intercept-Only Model of Benchmark-Adjusted IPO Underpricing

Term	Estimate	Std. Error	t value	p value	CI Lower 95%	CI Upper 95%
α	0.1971	0.0076	25.8256	0.0000	0.1822	0.2121

Source: Bloomberg Database/R, 2025.

Much like in the model in the previous sub-chapter, the results here show a positive intercept (α) of 0.1971, and p-value of nearly 0, indicating a statistically significant level of underpricing within the sample under all confidence levels. Based on these findings, the null hypothesis (H_0) of no systemic underpricing is also rejected in favour of positive 1st day abnormal returns. On average, new issuances yielded abnormal returns of 19.71% (once again consistent with earlier research findings on underpricing) only a very minor decrease of 0.02% in comparison to the simple underpricing observed before. While this suggests no market movement impacts on the underpricing observed, the benchmark adjusted returns will be used throughout the rest of the study to ensure consistency and evaluation of real-world conditions.

Below is a table detailing some additional statistics of the above model, once again painting a nearly identical picture to the one in Table 3. While the overall mean returns shrink by just under 0.02%, the extremities appear to both have taken place on days with positive market movement.

Table 5

Summary Statistics (Benchmark-Adjusted Underpricing)

Statistic	Value
Number of Observations	2229
Mean benchmark-adjusted underpricing	0.1971
Lowest benchmark-adjusted 1st day return	-0.3742
Highest benchmark-adjusted 1st day return	4.1347

Source: Bloomberg Database/R, 2025.

4.4 Size Effect

To test the impact that the size of the issuance has on the benchmark-adjusted level of underpricing, the following regression is run: $AUP_i = \alpha + \beta_1 Size_i + \varepsilon_i$

Table 6

Benchmark-Adjusted Regression (Underpricing vs Size)

Term	Estimate	Std. Error	t value	p value	CI Lower 95%	CI Upper 95%
α	0.1971	0.0076	25.8245	0.0000	0.1822	0.2121
β_1	-0.0084	0.0093	-0.9015	0.3674	-0.0267	0.0099

Source: Bloomberg Database/R, 2025.

Given that it is not possible for the issue size to be $0, the regression is log-centered to ensure consistency of the intercept. A Breusch-Pagan p-value of 0.09 indicates that the null hypothesis of homoscedasticity cannot be rejected and no additional adjustment needs to be made. The β_1 of -0.0084 generated by the regression in this case indicates a very small, negative relationship between the benchmark adjusted underpricing and size of the issuance. Despite this, the value of the p-value is too high, meaning that the null hypothesis of no issue size effect on the level of underpricing cannot be rejected and the conclusion that size has no effect on the benchmark-adjusted level of underpricing could be drawn. However, an important point to consider here is the sample selection. Perhaps the offer size filter of $75m+ is substantial enough to completely eliminate the effects that uncertainty around smaller issuance would be expected to bring. Further testing with a wider set of even smaller IPOs could be done, but this would likely not have drastic implications for the retail investor, who would be less likely to have access.

Looking at the sample split into the bottom, middle and top terciles of issue size, the largest observed underpricing is within the 'Medium' issue classification, ranging from $120m to $230m. Additionally, underpricing of the bottom tercile ($75m to $120m) is actually the lowest in the sample, at just 17.39%, compared to 19.52% observed in the largest issuances ($230m+)

Table 7

Split Sample Overview (Underpricing vs Size)

Issue Size	N_IPOs	Min Issue Size ($M)	Max Issue Size ($M)	Average Observed underpricing
Small	743	75	120	0.1739
Medium	743	120.141	230	0.2223
Large	743	230	25032.3	0.1952

Source: Bloomberg Database/R, 2025.

4.5 Underwriter Quality Effect

As outlined in the methodological approach, the underwriter plays a very important role in the IPO process. The following regression is run to determine the impact that underwriter quality has on benchmark-adjusted underpricing:

$$AUP_i = \alpha + \delta TpUW_i + \varepsilon_i$$

Table 8

Benchmark-Adjusted Regression (Underpricing vs Underwriter Quality)

Term	Estimate	Std. Error	t value	p value	CI Lower 95%	CI Upper 95%
α	0.1650	0.0166	9.9527	7.31E-23	0.1325	0.1975
δ_1	0.0408	0.0187	2.1868	0.0289	0.0042	0.0774

Source: Bloomberg Database/R, 2025.

Here, the p-value of the Breusch-Pagan test is 0.45, once not rejecting the null of homoscedasticity. The result of the regression (δ_1 of 0.0408) suggests a positive correlation between the quality of the underwriter and adjusted underpricing. Due to a p-value of 0.0289, the figure is not significant at the 1% significance level but is significant at the 5% and 10% levels.

Consequently, the null hypothesis of no underwriter quality effect on underpricing can be rejected. A two-sided hypothesis alternative hypothesis was set out as it was not immediately clear which way the influence of underwriter quality would swing the level of underpricing. On one hand, it can be argued that top tier underwriters should have more experience and be able to price issues more accurately, reducing the amount of underpricing. On the other, and as the findings of this study suggest, these underwriters may be deliberately underpricing in the hopes of attracting greater investor attention (Benveniste & Wilhelm, 1997; Ljungqvist et al., 2003, 2005).

The sample is subsequently split into performance by underwriter tiers (summarised in Table 9 below), based on a ranking of total IPO issuance underwritten (as lead). This data highlights just how much IPO activity flows through the top 5 underwriters, with close to 80% of the number in-sample IPOs, and even greater proportion of issuance volume lead by one of the top tier players. Somewhat surprisingly, the highest average benchmark-adjusted underpricing of 20.58% is observed within the top underwriter category, compared to just 17.74% of mid-tier underwriters and 10.85% of the lower bunch. The top tier also consists of IPOs which, on average, are over $100m larger than those in the mid-tier and almost $200m larger than the rest of the bunch.

Table 9

Benchmark-Adjusted Split Sample (Underpricing vs Underwriter Quality)

Underwriter Tier	Number of IPOs	Average Issue Size ($M) (underwritten as lead)	Mean Adjusted Underpricing
Top (rank 1 to 5)	1757	337.7	0.2058
Mid (rank 6 to 15)	118	233.5	0.1774
Other (rank 15+)	83	143.8	0.1085
None/Missing	271	389.9	0.1769

Source: Bloomberg Database/R, 2025.

As a supplement, below are the 5 underwriters with the highest adjusted underpricing within IPOs they facilitate. While 3 out of 5 spots are filled by top tier underwriters, the highest abnormal underpricing is actually observed within the mid-tier, with TD Securities taking the top spot (34.83%) and Jefferies coming in second (29.67%). While trends may change over time, it could be worth checking back in on this in the future to see any movements within the table. If stable, it could form a partial basis for IPO investment selection.

Table 10

Top 5 Underwriters by Mean Adjusted Underpricing

Underwriter	Num. of IPOs	Total Issuance Proceeds ($M)	Mean Adj. Underpricing	Biggest day-1 Winner	Biggest day-1 Loser	Rank (by Proceeds)
TD Securities	25	3211.7	0.3483	1.6506	-0.3387	14
Jefferies	75	10644.0	0.2967	2.0554	-0.2314	9
Goldman Sachs	348	143434.1	0.2612	3.5459	-0.3099	1
Morgan Stanley	323	136222.5	0.2112	4.1347	-0.3624	2
JP Morgan	287	72932.0	0.2094	1.9722	-0.2883	4

Source: Bloomberg Database/R, 2025.

4.6 Foreign Issuance Effect

As discussed in the methodological approach, this section builds on the work of Francis et al. (2001), aiming to test if the phenomenon of underpriced foreign issuance in the US market still holds. To assess this, the following regression is run:

$$AUP_i = \alpha + \delta_1 For_i + \varepsilon_i$$

Table 11

Benchmark-Adjusted Regression (Underpricing vs Domicile)

Term	Estimate	Std. Error	t value	p value	CI Lower 95%	CI Upper 95%
α	0.1992	0.0081	24.6434	0.0000	0.1821	0.2163
δ_1	-0.0087	0.0207	-0.4202	0.6743	-0.0441	0.0267

Source: Bloomberg Database/R, 2025.

With a p-value of 0.009 from the Brausch-Pagan test, homoscedasticity is rejected in favour of heteroscedasticity, therefore the HC1 model adjustment discussed earlier is made (and shown in Table 11).

Contrary to the findings Francis et al., the foreign issuance coefficient (δ_1=0.0087) is found to be negative and statistically insignificant at all confidence levels, therefore, the null hypothesis stating that there is no foreign issuance effect cannot be rejected. The below highlights the slightly lower mean adjusted underpricing for non-US firms within the sample, as well as a higher average issue size, but not many other conclusions or recommendations for investors can be drawn from this.

Table 12

Benchmark-Adjusted Split Sample (Underpricing vs Domicile)

Issuer Domicile	Num. of IPOS	Average Issue Size ($M)	Mean Adj. Underpricing
US	1708	294.8	0.1992
Non-US	521	451.1	0.1905

Source: Bloomberg Database/R, 2025.

4.7 Industry Effect

As outlined in the methodology, the following regression on a panel of industry dummies is run on the sample:

$$AUP_i = \alpha + \sum_{m}^{M-1} \delta_m \ Ind_{im} + \varepsilon_i$$

First, the ANOVA (Analysis of Variance) test is run to check for statistically significant differences in variance in the group of industry dummy variables, yielding an F statistic of 11.2175 and p-value close to zero, meaning that there are significant differences between the industries and that the null hypothesis of no industry effect can be rejected.

Table 13

ANOVA (Analysis of Variance) Test (Underpricing vs Industry)

Source	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Ind	8	11.2442	1.4055	11.2175	1.13E-15
Residuals	2220	278.1598	0.1253	NA	NA

Source: Bloomberg Database/R, 2025.

Next, the effects of each industry are assessed individually and presented in Table 14 below. For the purposes of this regression, the intercept (α) is the dummy for Basic Materials (auto computed by R to avoid perfect multicollinearity). Here once again, a very low p-value in the Breusch-Pagan test indicates potential heteroscedasticity and leads to the application of the HC1 adjustment to the data.

Table 14

Benchmark-Adjusted Regression (Underpricing vs Industry)

Term	Estimate	Std. Error	t value	p value	CI Lower 95%	CI Upper 95%
α	0.0444	0.0184	2.4105	0.0160	-0.0654	0.1541
δ_1(Communications)	0.2234	0.0347	6.4383	0.0000	0.1067	0.3402
δ_2(Consumer, Cyclical)	0.1278	0.0253	5.0607	0.0000	0.0074	0.2482
δ_3(Consumer, Non-cyclical)	0.1836	0.0222	8.2653	0.0000	0.0710	0.2962
δ_4(Energy)	0.0175	0.0231	0.7586	0.4482	-0.1095	0.1445
δ_5(Financial)	0.0604	0.0214	2.8298	0.0047	-0.0563	0.1772
δ_6(Industrial)	0.0764	0.0308	2.4820	0.0131	-0.0457	0.1985
δ_7(Technology)	0.2315	0.0316	7.3316	0.0000	0.1151	0.3480
δ_8(Utilities)	0.0376	0.0318	1.1835	0.2367	-0.1558	0.2310

Source: Bloomberg Database/R, 2025.

Out of the 9 industries present in the sample, 7 have a statistically significant impact on the benchmark adjusted underpricing. The communications, consumer non-cyclical, consumer cyclical, technology, financial sector impacts are significant at the 1% confidence level, while the impact of the industrial and basic materials industries is only statistically significant at the 5% confidence level.

The largest level of underpricing is observed within the technology and communications sectors (23.15% and 22.34%, respectively), while the lowest is observed within the energy (1.75%), utilities (3.76%) and basic materials sectors (4.44%), which is in line with previous researcher findings, such as the study on the shipping industry (Merikas et al., 2010). Mature,

less covered and larger issuances, tend to be more entrenched in fundamentals rather than investor sentiment, and consequently seem to exhibit less underpricing, despite the lack of statistical significance within the dummy variables.

Table 15

Benchmark-Adjusted Split Sample (Underpricing vs Underwriter Quality)

Industry	Num. of IPOS	Average Issue Size ($M)	Mean Adj. Underpricing
Consumer, Non-cyclical	762	241.5	0.1836
Technology	318	288.8	0.2315
Communications	304	457.9	0.2234
Financial	303	379.1	0.0604
Consumer, Cyclical	197	409.9	0.1278
Industrial	168	285.1	0.0764
Energy	118	455.9	0.0175
Basic Materials	40	415.3	0.0444
Utilities	19	503.9	0.0376

Source: Bloomberg Database/R, 2025.

4.8 Hot & Cold Markets

Up next, the below is regressed:

$$AUP_i = \alpha + \delta_1 Hot_i + \delta_2 Cold_i + \varepsilon_i$$

Table 16

Benchmark-Adjusted Regression (Underpricing vs Hot/Cold Market)

Term	Estimate	Std. Error	t value	p value	CI Lower 95%	CI Upper 95%
α	0.1520	0.0077	19.8349	0.0000	0.1293	0.1748
δ_1	0.0954	0.0154	6.2169	0.0000	0.0646	0.1263
δ_2	-0.0440	0.0184	-2.3967	0.0166	-0.1045	0.0165

Source: Bloomberg Database/R, 2025.

As in the prior 2 sections, the Breusch-Pagan test again leads to the rejection of homoscedasticity and the robust standard errors adjustment to the regression. Table 16 represents the regression analysing underpricing variability within hot and cold markets and showcases the statistically significant and positive hot market dummy coefficient of 0.954, indicating that issuances in hot markets tend be underpriced by 9.54% in relation to normal markets. The finding is significant at the 1% confidence level. IPOs issued in cold markets appear to have lower levels and a negative effect on underpricing, however this is only significant at the 5% confidence level. Overall, these results are consistent with previous papers on IPO waves, hot

markets and investor sentiment (Banerjee et al., 2013; Helwege & Liang, 2004; Ljungqvist et al., 2003).

Table 17 also showcases the volume and underpricing differences between the three market types side by side. One thing of note here is the larger issuance size during cold markets, which contradicts earlier studies' evidence on increased issue proceeds generated during hot markets (Alti, 2006; Banerjee et al., 2013).

Table 17

Benchmark-Adjusted Split Sample (Underpricing vs Hot/Cold Market)

State of the Market	Number of IPOs	Average Issue Size ($M)	Mean Adj. Underpricing
Cold	156	390.6	0.1080
Normal	947	312.2	0.1520
Hot	1126	339.2	0.2475

Source: Bloomberg Database/R, 2025.

4.9 Short-term (up to 1 week) CARs

Moving onto the short-term cumulative abnormal returns over the market index, both the scenarios of getting access to the IPO at the offer price and not getting an allotment and analysed. For the latter, an alternative strategy of buying on the open of the first trading day post-IPO is proposed.

Very similar models are run for both scenarios, with the only difference being the purchase date (at offer price vs 1st day open price):

Model 1:   Model 2:

$$CAR_i^{1,n} = \alpha_n + \varepsilon_n \qquad\qquad CAR_i^{2,n} = \alpha_n + \varepsilon_n$$

Looking first at the scenario where the investor is able to access the issue at the offer price, Table 18 Shows that while returns in the opening day are greatest (19.71%), as expected from all past literature (R. K. Aggarwal et al., 2001; Rock, 1986), the market continues to climb in the days following IPO issuance. The largest (non-1st day underpricing) jump is observed from day one to day two, during which IPOs seemingly generate excess abnormal returns of nearly 5% (4.85% to be precise), subsequently peaking at a total CAR of 24.73% on day 3, then falling slightly on days 4 and 5, closing out at a sizable 24.39%, still nearly 5% up on first day returns. All findings are significant at the 1% confidence level, leading to the rejection of the null hypothesis of no significant post-IPO movements, in favour of a momentum, sentiment, or other factor driven upswing during the first week of trading.

Table 18

Cumulative Abnormal Returns – 1 week horizon

Horizon	Estimate	Std. Error	t value	p value	CI Lower 95%	CI Upper 95%
$CAR_i^{1,1}$	0.1971	0.0076	25.8256	7.14E-129	0.1822	0.2121
$CAR_i^{1,2}$	0.2456	0.0098	25.0703	2.14E-122	0.2264	0.2648
$CAR_i^{1,3}$	0.2473	0.0098	25.2775	3.67E-124	0.2281	0.2665
$CAR_i^{1,4}$	0.2469	0.0098	25.1460	4.86E-123	0.2277	0.2662
$CAR_i^{1,5}$	0.2439	0.0099	24.6800	4.32E-119	0.2246	0.2633

Source: Bloomberg Database/R, 2025.

Despite previous evidence arguing that nearly all of the initial gains are realized on the jump from offer price to open trading (Barry & Jennings, 1993; Bradley et al., 2009), the below analysis of the alternative scenario, where the purchase is made on the open of the 1st trading day, clearly indicates the presence of statistically significant, positive abnormal returns in the short-term. Based on the below, returns seem to peak at 3 days after the IPO, supporting evidence of short-term momentum and investor sentiment driving stock valuations further up, consistent with previous findings (Chan, 2010; Dorn, 2003; Reber & Vencappa, 2016).

Table 19

Cumulative Abnormal Returns – 1 week horizon (buying at the start of the 1st day)

Horizon	Estimate	Std. Error	t value	p value	CI Lower 95%	CI Upper 95%
$CAR_i^{2,2}$	0.0485	0.0063	7.6372	3.27E-14	0.0360	0.0609
$CAR_i^{2,3}$	0.0502	0.0064	7.7979	9.59E-15	0.0376	0.0628
$CAR_i^{2,4}$	0.0498	0.0065	7.6740	2.48E-14	0.0371	0.0625
$CAR_i^{2,5}$	0.0468	0.0065	7.1489	1.18E-12	0.0340	0.0596

Source: Bloomberg Database/R, 2025.

4.10 Medium-term (1-4 week) CARs

Exactly as before, very similar models are run for both scenarios, with the only difference being the purchase date (at offer price vs 1st day open price):

Model 1:   Model 2:

$$CAR_i^{1,n} = \alpha_n + \varepsilon_n \qquad\qquad CAR_i^{2,n} = \alpha_n + \varepsilon_n$$

In the medium-term, returns continue on the initial upward trajectory observed during days 2 & 3, consistently growing each week for a month. All results are statistically significant,

so the null hypothesis is rejected. Behaving as theorised, there is not yet any sign of reversal and end the of month returns of 26.27% are over 5% higher than the initial underpricing returns.

Table 20

Cumulative Abnormal Returns – 1 month horizon

Horizon	Estimate	Std. Error	t value	p value	CI Lower 95%	CI Upper 95%
$CAR_i^{1,5}$	0.2439	0.0099	24.6800	4.32E-119	0.2246	0.2633
$CAR_i^{1,10}$	0.2491	0.0103	24.1819	6.48E-115	0.2289	0.2693
$CAR_i^{1,15}$	0.2548	0.0109	23.2807	1.73E-107	0.2333	0.2762
$CAR_i^{1,20}$	0.2627	0.0109	24.1996	4.61E-115	0.2414	0.2840

Source: Bloomberg Database/R, 2025.

Even without the initial underpricing bump in returns, the sustained, statistically significant growth of CARs leads to the rejection of the null hypothesis in favour of both alternatives, as results are positive and higher at the end of the month than at the start. From this, the argument for retail investors to achieve profitability can be made, without the need of trying to get allocations within new issuances directly from the underwriters or their brokers. That being said, should they be able to, it is still by far the better strategy, yielding a return nearly 20% higher than that of the open market purchase strategy.

Table 21

Cumulative Abnormal Returns – 1 month horizon (buying at the start of the 1st day)

Horizon	Estimate	Std. Error	t value	p value	CI Lower 95%	CI Upper 95%
$CAR_i^{2,5}$	0.0468	0.0065	7.1489	1.18E-12	0.0340	0.0596
$CAR_i^{2,10}$	0.0519	0.0071	7.3258	3.30E-13	0.0380	0.0658
$CAR_i^{2,15}$	0.0576	0.0078	7.3940	2.01E-13	0.0423	0.0729
$CAR_i^{2,20}$	0.0656	0.0078	8.3591	1.10E-16	0.0502	0.0809

Source: Bloomberg Database/R, 2025.

4.11 Long-term (1-12 month) CARs

Once more, very similar models are run for both scenarios, with the only difference being the purchase date (at offer price vs 1st day open price):

Model 1:

Model 2:

$$CAR_i^{1,n} = \alpha_n + \varepsilon_n$$

$$CAR_i^{2,n} = \alpha_n + \varepsilon_n$$

All returns are positive and statistically significant, leading to the rejection of the null hypothesis in favour of the alternative (H_{2A} in this case). Despite a small uptick in month 3, the

findings show that any previously observed positive momentum quickly fizzles out and leaves abnormal returns declining quite steadily, down to just 15.72% by the end of the year (over 10% down from the early market gains). As theorised, the 1-month and 2-month abnormal return is greater than that of the 1-year.

Table 22

Cumulative Abnormal Returns – 1 year horizon

Horizon	Estimate	Std. Error	t value	p value	CI Lower 95%	CI Upper 95%
$CAR_i^{1,21}$ (1 month)	0.2634	0.0109	24.2255	2.80E-115	0.242	0.2847
$CAR_i^{1,42}$ (2 months)	0.2524	0.0111	22.6775	1.30E-102	0.2306	0.2742
$CAR_i^{1,63}$ (3 months)	0.2571	0.0118	21.8393	5.69E-96	0.234	0.2802
$CAR_i^{1,84}$ (4 months)	0.2475	0.0123	20.1477	4.54E-83	0.2234	0.2716
$CAR_i^{1,105}$ (5 months)	0.2374	0.0129	18.4687	5.60E-71	0.2122	0.2626
$CAR_i^{1,126}$ (6 months)	0.2139	0.0132	16.2182	5.32E-56	0.188	0.2397
$CAR_i^{1,147}$ (7 months)	0.2041	0.0134	15.2081	9.02E-50	0.1778	0.2304
$CAR_i^{1,168}$ (8 months)	0.1911	0.014	13.6401	9.55E-41	0.1637	0.2186
$CAR_i^{1,189}$ (9 months)	0.1832	0.0145	12.6171	2.66E-35	0.1548	0.2117
$CAR_i^{1,210}$ (10 months)	0.175	0.0151	11.5871	3.45E-30	0.1454	0.2047
$CAR_i^{1,231}$ (11 months)	0.1654	0.016	10.3062	2.31E-24	0.1339	0.1968
$CAR_i^{1,252}$ (12 months)	0.1572	0.0165	9.5205	4.31E-21	0.1248	0.1896

Source: Bloomberg Database/R, 2025.

The inability to get access to IPO issuance presents an even more negative picture of long-run returns. Whereas the other scenario at least maintains positive overall CARs, this one experiences the reversal and dip into negative returns, as laid out in the alternative hypothesis, by month 8 of the study (though the figure is not statistically significant until month 11). A lack of

meaningful long-run performance, especially past month 3 is a strong signal confirming the previously observed underperformance (Dong et al., 2010; Ritter, 1991) and a solid piece of evidence against holding long positions, or potentially taking short ones, in fresh IPO issuances.

Table 23

Cumulative Abnormal Returns – 1 year horizon (buying at the start of the 1st day)

Horizon	Estimate	Std. Error	t value	p value	CI Lower 95%	CI Upper 95%
$CAR_i^{2,21}$ (1 month)	0.0662	0.0079	8.4094	7.25E-17	0.0508	0.0816
$CAR_i^{2,42}$ (2 months)	0.0553	0.0083	6.6482	3.72E-11	0.0390	0.0716
$CAR_i^{2,63}$ (3 months)	0.0599	0.0093	6.4697	1.20E-10	0.0418	0.0781
$CAR_i^{2,84}$ (4 months)	0.0503	0.0101	4.9780	6.92E-07	0.0305	0.0702
$CAR_i^{2,105}$ (5 months)	0.0402	0.0110	3.6504	2.68E-04	0.0186	0.0618
$CAR_i^{2,126}$ (6 months)	0.0167	0.0115	1.4585	0.144852	-0.0058	0.0392
$CAR_i^{2,147}$ (7 months)	0.0069	0.0121	0.5742	0.565858	-0.0167	0.0306
$CAR_i^{2,168}$ (8 months)	-0.0060	0.0129	-0.4677	0.640022	-0.0312	0.0192
$CAR_i^{2,189}$ (9 months)	-0.0139	0.0134	-1.0365	0.300085	-0.0402	0.0124
$CAR_i^{2,210}$ (10 months)	-0.0221	0.0140	-1.5786	0.11456	-0.0496	0.0054
$CAR_i^{2,231}$ (11 months)	-0.0318	0.0151	-2.1090	0.035057	-0.0613	-0.0022
$CAR_i^{2,252}$ (12 months)	-0.0400	0.0156	-2.5597	0.010543	-0.0706	-0.0093

Source: Bloomberg Database/R, 2025.

Putting everything together, Figure 5 combines the above three models and shows a 1-year window of the average cumulative abnormal returns of all IPOs within the sample. In this case, it is the scenario where the purchase is made on the open of the first trading day, with the chart showing returns from day 2 onwards. As has been discussed, returns shoot up during the first day and continue to climb up to over 6% throughout the first month post-IPO, then level off until

roughly the end of the 3rd month, after which all momentum appears to be lost, with the average IPO stock losing close to 1% when compared to the benchmark index, further supporting the short-term holding strategy.

Figure 6

Average Cumulative Abnormal 1ˢᵗ Year Returns of All in-sample IPOs
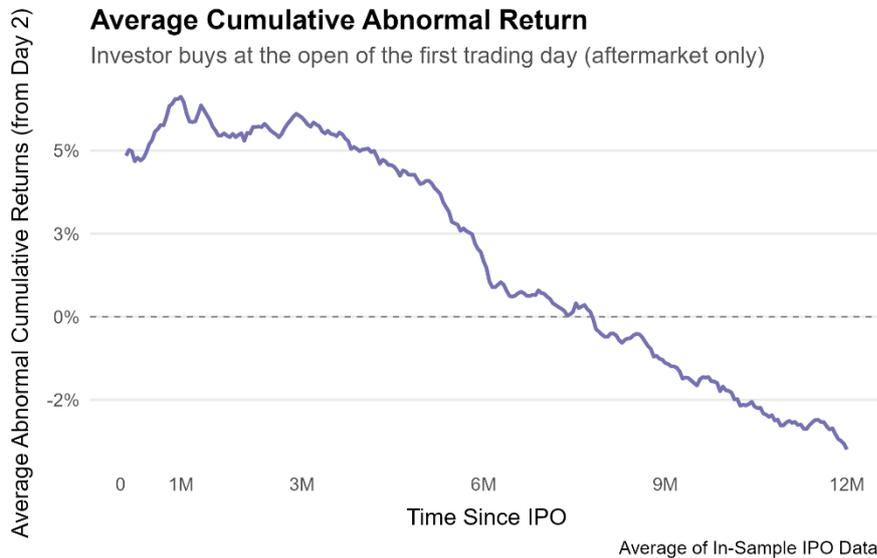
Source: Author generated in R, data from Bloomberg Database, 2025.

4.12 Lock-up Expiry Effect

Finally, a study on the lock-up expiry event window is also conducted based on the following equation:

$$CAR_i^{2,n} = CAR_i^{l-x,l+x} + \varepsilon_{i,n}$$

Table 24 (below) shows the mean CARs for three event windows around the lock-up expiry date. The most immediate {-1, +1} window appears to exhibit a fairly minor (-0.5%) negative abnormal return over the market. This finding is statistically significant at the 5% confidence level but not at the 1%. The longest investigated event window of {-5, +5} days exhibits a slightly more negative result of -0.8%, which is also significant at the 5% confidence level. Despite its positioning between the other two event windows, the {-3, +3} event window exhibits the lowest level of underperformance, which is also not significant even at the 10% confidence interval.

This observed level of underperformance is below that of some other studies (Michel, 2014), which may be a factor of changing market conditions or specifics of the sample, as some lower quality issuances may have not met the $75m issuance size threshold.

Table 24

Cumulative Abnormal Returns – Lock-up Expiry

Horizon	Estimate	Std. Error	t value	p value	CI Lower 95%	CI Upper 95%
$CAR_i^{-1,1}$ (-1 to +1 day)	-0.005	0.002	-2.036	0.042	-0.009	0.000
$CAR_i^{-3,3}$ (-3 to +3 day)	-0.004	0.003	-1.413	0.158	-0.009	0.002
$CAR_i^{-5,5}$ (-5 to +5 day)	-0.008	0.003	-2.479	0.013	-0.014	-0.002

Source: Bloomberg Database/R, 2025.

5. CONCLUSIONS & RECOMMENDATIONS

The following subsections will summarize the findings of the empirical analysis, lay out recommendations for the non-professional (retail) investor and make suggestions for further avenues of research to enhance the findings of this paper.

5.1 Empirical Analysis Outcome Summary

Looking back on the first four objectives set out in the introduction, the study finds:

1. Statistically significant positive abnormal regular and benchmark-adjusted returns for those able to buy in at the offer price and sell at the start of the first day of trading, confirming earlier findings of underpricing in IPO issuance (Loughran & Ritter, 2002; Rock, 1986).

2. No statistically significant effect of the size of the issuance on benchmark-adjusted initial returns, though this may have been influenced by the large issuance filter set out when collating the sample for the study.

3. A statistically significant positive effect on abnormal initial underpricing for IPOs underwritten by top tier financial institutions such as Golman Sachs, Morgan Stanley and JP Morgan.

4. No statistically significant effect of the domicile of the IPO issuing firm on benchmark-adjusted initial returns, failing to provide supporting evidence to earlier work (Francis et al., 2001).

5. A statistically significant industry effect, although not all examined industries were found to meaningfully impact initial returns. The communications, consumer non-cyclical, consumer cyclical, technology, financial sector impacts are significant at the 1% confidence level, while the impact of the industrial and basic materials industries is only statistically significant at the 5% confidence level. The findings show no statistically significant impact within the utilities and energy sectors. The greatest level of underpricing is observed within the technology and communications sectors.

6. Periods of IPO issuance clustering in 'hot' markets, and a statistically significant positive correlation between initial underpricing and issuance in hot markets, consistent with findings of earlier work (Banerjee et al., 2013; Helwege & Liang, 2004; Ljungqvist et al., 2003), and a statistically significant negative correlation for issuance in cold markets.

7. Statistically significant positive benchmark-adjusted short-term CARs (2-5 trading days post-IPO) both with direct access to the IPO at offer price and without, peaking on day three after the release of the IPO. This indicates that not all of the gains left on the table

are realised immediately on open, and that there is growth in returns within the first few days, also confirming results seen in the literature (R. K. Aggarwal et al., 2001; Rock, 1986).

8. Statistically significant positive benchmark-adjusted medium-term CARs spanning 1-4 weeks post-IPO both with direct access to the IPO at offer price and without, with the highest returns observed at the end of the first month period event study window. This continues to indicate initial optimism and positive momentum effect, consistent with earlier findings of positive short-run performance.

9. Statistically significant positive benchmark-adjusted long-term CARs (1-12 months) spanning the full first year for those able to subscribe to the IPO, but negative abnormal returns towards the end of the 1-year event window for those who are not. The first negative CARs are observed at the 8-month mark, but they do not become statistically significant until month 11. In both scenarios, CARs trend almost exclusively downward from month-to-month, and never reach the returns observed during the first month post-IPO, which once again conforms to earlier findings of initial positive returns, followed by long-run underperformance (Dong et al., 2010; Ritter, 1991).

10. Statistically significant slightly negative CARs in the [-1, +1] and [-5, +5] trading day event windows around the lock-up expiration date, though this observed level of underperformance is below that of some other studies (Michel, 2014) and may not be large enough to impact proposed trading strategies much, other than acting as another indicator against long-term buy and hold strategies.

5.2 Recommendations for the Retail Investor

Drawing on the findings discussed above, below is a short list of key considerations to shape potential exit strategies for the retail investor participating in the IPO market:

1. When aiming to maximise initial returns and if able to gain access to the IPO at the offer price, carefully consider the key characteristics of the issuing and underwriting firms, as well as the prevailing market conditions, identifying IPO issuances which are:
   a. Underwritten by one of the top-tier underwriting firms. While not in the top 5 by issuance and variety of IPOs, also consider those underwritten by TD Securities and Jefferies, as these showed the greatest level of first day underpricing within the split sample.
   b. In contemporary, growing industries with sufficient investor attention and media coverage, such as Technology and Communications. Avoid less covered and size dominated fields such as Energy and Utilities.

c. Issued during 'hot' markets if willing to take on increased levels of risk in the pursuit of abnormal returns, or during 'normal' markets if aiming for a slightly more balanced approach.

2. Despite the significant average levels of underpricing, the data indicates that immediately selling on the first day of trading does not maximise returns. Instead, it is optimal to aim for a holding period of around 3 days if focusing on the very short-term, or to extend it up to a month in the medium-term. Holding until the end of the first month (20 trading days) yields the best results, at least in the sample reviewed, however an earlier sale could be justified if an additional investment opportunity into an IPO matching the selection criteria arises, since most of the gains are likely to be generated in the opening window.

3. Even if access to the IPO at the offer price is impossible, it can still be profitable to buy-in at the start of the first trading day. Once again, the optimal holding observed is 20 trading days, though opportunity cost once again plays a role. It is also worth noting that in this scenario, the difference between the initial returns and 1-month CARs is lower, given that a large portion of underpricing is realized before the 1st day close, especially when factoring in transaction costs and time constrains that a retail investor may face.

4. Avoid the long-term investment horizon, especially beyond three months, as positive abnormal returns become much less likely. An alternative strategy that could be feasible here is the short-sale of recent IPO stocks 3 months after their release, followed by maintaining the position for an additional 9 months until the 1-year mark, capitalising on the significant underperformance exhibited on average. Executing short sales, however, presents a heightened risk for theoretically unlimited losses, and may not fit the risk appetite or tolerance of the average retail investor, so is definitely not something for all.

5. If willing to take on considerable levels of risk and leverage to outweigh transaction costs, the approach of short selling right before lock-up expiry and closing out the position on the day after could also be explored. Both in this case and the prior one, it would be advisable to ensure the short sale is hedged against larger market movements, isolating the expected abnormal returns in the IPO stock.

5.3 Recommendations for Further Research

To expand on the findings of the study and increase the comprehensiveness of the set of recommendations for non-professional investors, the following extensions could be considered for future papers in this field:

1. Expand the study to other markets, comparing younger emerging markets with other mature, well-established markets.

2. Explore the effects of the drivers reviewed in this study on the level of aftermarket returns, up to and including 1-year cumulative abnormal returns.

3. Explore additional determinants of both short and long-term performance, such as managerial shareholding positions pre-IPO, retail attention and the effects of initial performance (and underpricing) on long-run returns.

4. Revisit the current study with an extended time frame to evaluate how the covid tech and current AI boom have affected long-term IPO performance and issuance trends. Has the cold market observed in 2022 and 2023 continued or has IPO activity picked back up in a meaningful manner? Has the attention to these markets created more volatility or growth prospects?

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AN EXPLORATION OF PROFIT-MAXIMIZING EXIT STRATEGIES FOR NON-PROFESSIONAL (RETAIL) IPO INVESTORS

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Master thesis

Finance and Banking (Hyb)

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Vilnius, 2026

SUMMARY

53 pages, 24 charts, 6 figures, 60 references.

The primary aim of the master thesis is to perform an exploration of Initial Public Offering (IPO) investment returns in order to provide clear and concise profit maximising exit strategy recommendations for the non-professional (retail) investor. To achieve this, the following objectives are set: to investigate the level of underpricing and its determinants, to examine long-term post-IPO returns (1 day – 1 year) and evaluate the influence of lock-up expiry on cumulative abnormal returns (CARs) in the event window.

The thesis is split up into several sections, the first of which tackles the theoretical framework of the IPO market and synthesizes the available literature, covering topics such as the role and influence of the underwriter, bookbuilding and allocation, informational asymmetry, investor sentiment, IPO clustering, and other factors affecting the persistently observed underpricing phenomenon, as well as post-IPO performance.

Focusing on a sample of 2229 US market IPOs from the 21st century, a combination of intercept-only models, linear panel regressions and cumulative abnormal returns (CARs) are computed, tested, and adjusted accordingly. The empirical review finds statistically significant positive benchmark adjusted initial returns (underpricing), short-term positive momentum up to around 1-month post IPO, followed by a subsequent decline compared to the benchmark index for the next 11 months of the event study window. A statistically significant negative lock-up expiry effect is also observed. The data shows a statistically significant effect on Underpricing by the underwriter quality, industry and IPO clustering (hot and cold markets), while size factor and issuer domicile exhibit no statistically significant impact within the sample.

Apart from a detailed summary of the above findings, the final chapter of the thesis also contains practical takeaways and recommendations for non-professional investors regarding profit maximising exit strategies in the IPO market, suggesting a focus on short-term investment

horizons of no longer than one month, even for those who are not able to get access to the IPO at the offer price and instead purchase at the opening price on the day of the IPO. Recommendations for further potential extensions to the study are also made.

NE PROFESIONALIŲ (MAŽMENINIŲ) IPO INVESTUOTOJŲ PELNĄ MAKSIMIZUOJANČIŲ PASITRAUKIMO STRATEGIJŲ TYRIMAS

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Vilnius, 2026

SANTRAUKA

53 puslapiai, 24 lentelės, 6 paveikslėliai, 60 literatūros šaltinių.

Pagrindinis šio magistro baigiamojo darbo tikslas – ištirti pirminio viešo akcijų platinimo (IPO) investicijų grąžą, siekiant pateikti aiškias ir glaustas pelną maksimizuojančių pasitraukimo strategijų rekomendacijas neprofesionaliems (mažmeniniams) investuotojams. Siekiant šio tikslo, tyrime numatoma ištirti neįprastai aukštą pirmosios dienos grąžos lygį IPO rinkoje ir jo veiksnius, išnagrinėti ilgalaikę akcijų grąžą po IPO išleidimo (tarp 1 dienos ir 1 metų) ir įvertinti ,lock-up' periodo pabaigos įtaką kaupiamajam nenormaliam pelnui.

Darbas sudarytas iš keleto skyrių, iš kurių pirmasis skirtas IPO rinkos teorinio pagrindo ir esamos literatūros apibendrinimui. Ši apima investicinių bankų rolę ir įtaką, informacinę asimetriją, investuotojų nuotaikas ir kitus veiksnius, turinčius įtakos pasikartojančiam aukštos pradinės grąžos reiškiniui, bei IPO akcijų ilgalaikiams rezultatams.

Remiantis 2229 JAV rinkos IPO pavyzdžiais iš XXI a., apskaičiuojami įvairūs modeliai, linijinės panelinės regresijos ir kaupiamieji nenormalaus pelno rodikliai. Empirinėje apžvalgoje identifikuojamas statistiškai reikšmingas teigiamas nenormalus pirmosios dienos pelnas, teigiamas trumpalaikis impulsas, kuris stumią akcijų kainas aukštyn ir tęsiasi truputį ilgiau nei mėnesį po IPO paviešinimo datos. Vėliau pastebimas kainos nuosmukis, per sekančius 11 mėnesiu iki tyrimo lango pabaigos bendra grąža yra silpnesnė nei lyginamojo indekso. Taip pat pastebimas statistiškai reikšmingas neigiamas ,lock-up' galiojimo pabaigos poveikis. Duomenys rodo statistiškai reikšmingą poveikį nepakankamai įvertintoms kainoms pagal investicinio banko, padedančio rengti IPO, pramonės šakos ir IPO susitelkimo į vieną laikotarpi (karštos rinkos) poveikį pirmos dienos grąžai. Iš taip pat tyrinėtų veiksnių, IPO piniginis dydis bei įmonės buveinė statistiškai reikšmingo poveikio neparodo.

Be išsamios viršuje minėtų išvadų santraukos, paskutinis darbo skyrius taip pat pateikia praktines išvadas ir rekomendacijas neprofesionaliems investuotojams dėl pelno maksimizavimo

išėjimo strategijų IPO rinkoje, siūlo sutelkti dėmesį į trumpalaikius investavimo horizontus, ne ilgesnių nei vieno mėnesio trukmės, net ir tiems, kurie negali įsigyti IPO už siūlomą pradinę kainą. Taip pat pateikiamos rekomendacijos ir dėl tolesnių tyrimo plėtros galimybių.

7. ANNEXES

Annex 1: VIF Test of the regressors

```
                   GVIF Df GVIF^(1/(2*Df))
log_offer_size_c 1.077220  1        1.037892
top_uw           1.094051  1        1.045969
foreign_dummy    1.055419  1        1.027336
Hot              1.232744  1        1.110290
Cold             1.237942  1        1.112628
Industry         1.177640  8        1.010272
```

Annex 2: Size Regression Breusch-Pagan Test & Standard OLS Regression

```
        studentized Breusch-Pagan test

data:  model
BP = 2.8173, df = 1, p-value = 0.09325



Coefficients:
                 Estimate Std. Error t value Pr(>|t|)
(Intercept)      0.197147   0.007634  25.824   <2e-16 ***
log_offer_size_c -0.008407   0.009325  -0.902    0.367
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Annex 3: Underwriter Quality Regression Breusch-Pagan Test & Standard OLS Regression

```
        studentized Breusch-Pagan test

data:  model
BP = 0.56984, df = 1, p-value = 0.4503



Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.16497    0.01658   9.953   <2e-16 ***
top_uw       0.04083    0.01867   2.187   0.0289 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Annex 4: Foreign Issuance Regression Breusch-Pagan Test & Adjusted Regression

```
        studentized Breusch-Pagan test

data:  model
BP = 6.687, df = 1, p-value = 0.009712
```

```
t test of coefficients:

              Estimate Std. Error t value Pr(>|t|)
(Intercept)    0.1991842  0.0080827 24.6434   <2e-16 ***
foreign_dummy -0.0087169  0.0207421 -0.4202    0.6743
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Annex 5: Industry Regression Breusch-Pagan Test & Adjusted Regression

```
        studentized Breusch-Pagan test

data:  model
BP = 39.918, df = 8, p-value = 3.319e-06
```

```
t test of coefficients:

                            Estimate Std. Error t value  Pr(>|t|)
(Intercept)                 0.044371   0.018407  2.4105   0.01601 *
IndustryCommunications      0.223435   0.034704  6.4383 1.476e-10 ***
IndustryConsumer, Cyclical  0.127805   0.025254  5.0607 4.520e-07 ***
IndustryConsumer, Non-cyclical 0.183563 0.022209  8.2653 2.368e-16 ***
IndustryEnergy              0.017495   0.023061  0.7586   0.44816
IndustryFinancial           0.060450   0.021362  2.8298   0.00470 **
IndustryIndustrial          0.076395   0.030780  2.4820   0.01314 *
IndustryTechnology          0.231546   0.031582  7.3316 3.169e-13 ***
IndustryUtilities           0.037580   0.031753  1.1835   0.23674
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Annex 6: Hot & Cold Market Regression Breusch-Pagan Test & Adjusted Regression

```
        studentized Breusch-Pagan test

data:  model
BP = 34.689, df = 2, p-value = 2.933e-08
```

```
t test of coefficients:

            Estimate Std. Error t value  Pr(>|t|)
(Intercept)  0.152016   0.013166 11.5458 < 2.2e-16 ***
Hot          0.095437   0.029613  3.2228  0.001288 **
Cold        -0.044008   0.022336 -1.9703  0.048933 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```