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UNLOCKING THE PUZZLE: ASSESSING UNDERPRICING AND LONG-TERM
PERFORMANCE OF FOREIGN IPOS ON US STOCK EXCHANGES

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Abstract

This thesis examines underpricing and long-term performance of foreign IPOs listed on US stock exchanges and domestic US IPOs. Additionally, it investigates the impact of home country economic freedom on IPO performance, finding that this factor is only in the short-term significant. Using a Bloomberg dataset covering IPOs from 2000 to 2020, the study reveals that foreign IPOs experience slightly lower levels of underpricing than domestic IPOs (11.47% vs. 13.11%). In the long-run, both significantly underperform the market, but international IPOs (-39.70%) by a greater margin than domestic ones (-21.60%). These findings offer insights into home bias and market efficiency.

Keywords: IPO, Underpricing, Long-run Performance, Foreign Company

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1 Introduction

The globalization of economies has introduced new strategic opportunities for companies, including the possibility to go public on a foreign stock exchange due to the internationalization of capital markets. Such practices of listing outside the home country have become increasingly common, and US financial markets positioned themselves as a popular destination. While domestic Initial Public Offerings (IPOs) in the US market have been extensively studied, there is only a limited amount of comprehensive research on the performance of foreign IPOs listed on US stock exchanges (Chemmanur and Fulghieri 2006, 456; Wu 2012, 939; Yang and Lau 2010, 352). This thesis aims to address this gap by examining the stock market performance of foreign companies that go public in the USA and comparing their performance to domestic US IPOs. Understanding the dynamics of foreign IPO performance is crucial for investors, as it sheds light on the influence of home bias and the challenges faced by these firms in the US market.

Foreign companies that decide to list abroad not only experience advantages, but also face challenges, compared to their domestic peers. This thesis investigates whether there is a significant difference in the initial underpricing and long-term stock performance between foreign and domestic IPOs in the US market. Additionally, it also aims to determine if home bias exists, favoring domestic over international companies.

To achieve this, the thesis addresses the following three key research questions:

- I) What differences exist in the initial underpricing between IPOs of domestic and foreign companies that go public on a US stock exchange?
- II) How does the long-term stock performance of foreign companies that conduct their IPO in the USA compare to domestic US IPOs over a three-year period?
- III) What is the effect of the home country's economic freedom, as determined by the Index of Economic Freedom, on the stock performance of an IPO in the USA?

To answer these questions, the thesis is divided into a qualitative part, where IPO literature is discussed, and a quantitative section, which presents the results of the empirical analysis. The research methodology for the empirical section includes the analysis of a Bloomberg dataset, consisting of IPOs on US stock exchanges from the year 2000 to 2020 and their subsequent three-year post-IPO performance. Additionally, a regression analysis is conducted for initial returns and the long-run performance to identify factors influencing IPO performance. The long-run performance results have been adjusted for market performance, which is measured using the Russell 3000 index. Finally, all results have been transformed using the natural logarithm to address the heavy skewness in the data.

The structure of this thesis is outlined in the following manner. Chapter 2 begins with an introduction to IPOs, including a clear definition and a concise analysis of the key motivations behind companies' decisions to go public. Chapter 3 conducts a comprehensive literature review, focusing on existing research related to IPOs, particularly underpricing and long-term performance. The chapter also includes a section about market efficiency and concludes with a discussion of research on foreign IPOs. Chapter 4 presents an analysis of the raw data, outlines the data cleaning process, introduces the Index of Economic Freedom, and provides an overview of the cleaned dataset. Chapter 5 explains the underlying methodological approach used in Chapter 6. The sixth chapter presents the results of the empirical analysis and discusses their implications. Finally, Chapter 7 summarizes the key findings, acknowledges the limitations of the study, and suggests areas for future research.

2 Definition and Motivation

This chapter offers a clear definition of IPOs and examines the primary motivations behind a company's decision to go public. It begins by defining IPOs, followed by an exploration of the general reasons for pursuing a public listing, as well as the specific considerations for listing on foreign exchanges. The chapter also addresses the challenges associated with foreign IPOs, providing a comprehensive overview of the factors that influence a company's decision to undertake an international listing.

2.1 Definition of Initial Public Offering

An IPO represents the first instance where a private company offers its shares to the public and lists them on a stock exchange. This is a milestone in a company's lifecycle because the IPO transforms a private entity into a public one. Going public involves assessing the costs and benefits to determine whether the advantages of public ownership, such as easier access to capital, outweigh the benefits of remaining private, like less strict disclosure requirements. The primary objective of an IPO is to maximize the total value derived from the proceeds, the anticipated future returns, and any private gains accrued by the company's insiders (Blass and Yafeh 2001, 557; Iannotta 2010, 45, 50; Kesten 2018, 28).

A successful listing is characterized by an offering that sells rapidly, often being oversubscribed, and experiencing a price increase shortly after the initial sale. Both the underwriters, who manage the sale and stabilization of the share price, and the shareholders, who see an increase in the value of their holdings, benefit from this outcome. Underwriters, regulated by the US Securities and Exchange Commission, are allowed to engage in stabilizing actions to prevent volatility, although a successful IPO minimizes the need for such interventions (Reilly and Hatfield 1969, 73).

Since there is not a singular definition, the term IPO is somewhat generic. There are various

forms of going public depending on the nature of the shares being sold, the location of the listing, and the targeted investors. Therefore, in this thesis, the term IPO is defined as the process through which a company goes public on a stock exchange, involving both a primary offering (new shares issued to raise capital) and a secondary offering (sale of existing shares). This approach is the most common type of IPO (Iannotta 2010, 45-47).

2.2 Reasons to Go Public

The following chapter explores the motivations behind companies' decisions to go public. It begins with a general overview of reasons to list a company's shares. Following that, the focus is on foreign companies, presenting why firms may choose to list their shares abroad and the obstacles they face.

2.2.1 General Motives to Go Public

According to Iannotta (2010, 46), there are cash and non-cash reasons to list a company's shares on a stock exchange. However, the motives can differ from the company's perspective versus the shareholder's perspective, which is particularly the case for cash reasons.

From the company's perspective, gaining access to a new source of financing is a primary motivation for going public, as it enhances financial independence and strengthens its bargaining power with credit institutions. Access to public markets for funding is particularly attractive for companies with major current and future investment needs, high level of debt, and rapid growth. These factors are capital intensive, therefore, the equity market may be the more efficient alternative (Pagano, Panetta, and Zingales 1998, 38-39).

From the shareholder's perspective, cash is also a key consideration. An IPO enables shareholders to exit their investment effortlessly and receive liquidity. Additionally, an IPO can serve as a mechanism to address succession issues within the management. Even the latter argument is considered a way to sell the investment, making it a cash motive (Iannotta 2010, 46).

On the other hand, Iannotta (2010, 46) highlights that the main non-cash motivations for going public include obtaining an acquisition currency, enhancing reputation, and providing additional instruments for management compensation and incentives.

Firstly, an IPO allows a company to use its shares as a form of currency for an acquisition. In the case of an acquisition of another company, the shareholders of the acquired firm can be compensated either in cash or with stocks. For the latter option to be viable, the acquiring company's shares must be publicly listed. The listing of the shares provides a public valuation and ensures that they are easily convertible into cash, enhancing their appeal as a payment method. Therefore, companies looking to grow through mergers and acquisitions (M&A), often pursue an IPO to broaden their payment options (Iannotta 2010, 46).

Secondly, listing on the stock exchange raises the company's profile and reputation. Many investors build portfolios that include only a fraction of available securities, typically because they are unaware of certain alternatives. Being listed on a major exchange is considered as a form of advertisement, increasing the company's visibility to potential investors and thereby attracting more attention and investment (Pagano, Panetta, and Zingales 1998, 40).

Lastly, an IPO serves as a managerial discipline device and a tool for designing more efficient compensation schemes. On the one hand, the threat of a hostile takeover and the public assessment of managerial decisions via stock market performance can lead to better management practices. On the other hand, shareholders can utilize stock price information to create more effective compensation packages for the management team. For example, tying the salaries of top management to the company's stock price development aligns their interests with those of the shareholders (Pagano, Panetta, and Zingales 1998, 40).

2.2.2 Reasons to List Abroad

Companies may choose to list their business abroad for various strategic reasons. The primary advantages include easier access to cheaper capital, a strengthened reputation and visibility within the domestic and home country investor community, and the potential for a higher valuation (Liu, Tang, Yang, and Arthurs 2019, 144-145; Wu 2012, 940-941).

Moreover, strategic corporate actions, especially M&A, play a crucial role in the decision to list abroad. Local shares may be more appealing to the target's investors if the company decides to use its shares as acquisition currency. For example, European firms have traditionally listed their shares in the USA to facilitate stock acquisitions in the American market (Iannotta 2010, 49).

Another important motivation is market dynamics. Companies operating within a specific niche may find it beneficial to list in a market where their competitors are already established. For example, many high-tech firms find it preferable to list their shares on NASDAQ because of the focused investor and analyst attention and the resulting increase in liquidity (Iannotta 2010, 49).

Moreover, companies from smaller or less credible domestic markets often seek foreign listings to enhance their trustworthiness. Although this trend was more prominent in the past, it remains relevant for firms from developing economies that list in established financial centers like London or New York. These markets offer access to a more robust investor base and better market conditions (Blass and Yafeh 2001, 558; Iannotta 2010, 49).

Finally, a company can also decide to list abroad because it does not meet the listing requirements of its home market (Iannotta 2010, 49).

2.2.3 Challenges When Listing Abroad

Companies that go public on foreign stock exchanges encounter numerous obstacles that impact the success of their IPO. These challenges are commonly referred to as the liability of foreignness or home bias and arise from a variety of institutional, informational, and cultural barriers (Bell & Rasheed 2016, 107; Zaheer 1995, 343).

One of the primary challenges is the institutional distance that exists between the company's home country and the host market. This distance includes differences in minority investor protection and varying disclosure requirements. Such disparities may complicate compliance and increase the costs associated with meeting the host market's regulatory standards (Bell and Rasheed 2016, 107).

Moreover, information asymmetry poses a significant problem. Investors often find it more difficult to obtain reliable information about foreign firms compared to domestic ones, making foreign investments less attractive (Bell and Rasheed 2016, 107). On top of that, companies face unfamiliarity costs. Even when investors have similar information about two companies, they tend to prefer investing in domestic firms with which they are more familiar. This preference is based on prior dealings and a perceived sense of reliability and comfort with domestic companies. Cultural distance further exacerbates this issue, as investors may be reluctant or more hesitant to invest in firms from culturally distant regions (Bell & Rasheed 2016, 107; Zaheer 1995, 343). For instance, investors were more at ease with the regulatory aspects of the home country environments when firms such as Lululemon from Canada or Manchester United from the United Kingdom went public in the USA. These firms' legal and governmental institutions are very similar to those in the USA, reducing cultural and institutional barriers. In contrast, companies like Alibaba from China face greater scrutiny and resistance because of the more culturally distant environment (Liu et al. 2019, 145).

These drawbacks lead to a strong preference for domestic equities among investors, leading to less efficient asset allocation due to less diversification in their investment portfolios (Coval and Moskowitz 1999, 2045).

3 Literature Review and Previous Research

The literature review is divided into four sections. The first part provides an overview of the Efficient Market Hypothesis (EMH), providing a theoretical foundation for the subsequent discussions. The second part discusses the IPO underpricing phenomenon, while the third part examines the long-run performance of IPOs. It makes sense to discuss these topics separately because they have different root causes, and according to Ritter and Welch (2002, 1822), there is no reliable relationship between these two IPO-related phenomena. The final section explores research on companies that go public abroad.

3.1 The Efficient Market Hypothesis in the Context of IPOs

Underpricing and the IPO long-run performance may be analyzed separately due to their different root causes, but one of their commonalities is that both contradict the EMH. Therefore, it is relevant to briefly introduce the EMH and keep it in mind while reading the literature review.

The EMH assumes that asset prices in efficient markets “fully reflect all available information” at any point in time (Fama, 1970, 383). Consequently, it should be impossible to consistently experience abnormal risk-adjusted returns, whether positive or negative, because prices should only react to new information released into the market. Fama categorizes market efficiency into a weak form, semi-strong form and a strong form. Each form varies in the degree of information reflected in prices and their implications (Fama, 1970, 383-384). A brief summary can be found in Table 1 in the appendix.

The EMH would suggest that, when a company goes public, the initial offer price of its shares accurately reflects the fair market value, based on all information available. However, the literature review will prove that this is not the case. Companies that go public typically experience a significant outperformance on their IPO day and a substantial underperformance versus the market in the long-run. This implies that the initial pricing does not incorporate all relevant information. As Ibbotson (1975, 262) states, “If a security were issued in an unregulated competitive market, it would be sold to investors for whatever price it could fetch.” This inconsistency challenges the EMH and suggests the presence of market inefficiencies (Ritter 1991, 3-5).

3.2 Literature Review: IPO Underpricing

The study of IPO underpricing started to gain momentum in the early 1970s. Logue (1973) and Ibbotson (1975) are often referenced as the pioneers of underpricing literature because they were among the first to rigorously attempt to investigate and explain this phenomenon. Underpricing refers to the situation where equity in an IPO is sold at a price lower than the fair value, leading to a substantial price jump on the first trading day. It is measured as the difference between the offer price and the subsequent market price (Ljungqvist 2007, 376, 381).

The underpricing literature review is divided into the four common schools of thought, Asymmetric Information, Institutional Explanations, Ownership and Control, and Behavioral Theories that aim to explain underpricing (Ljungqvist 2007, 376). In those subchapters, the most promising theories will be discussed.

3.2.1 Asymmetric Information Models

Asymmetric information models assume that one of the involved parties possesses more information than the others. Such information friction eventually results in underpricing in the equilibrium state (Ljungqvist 2007, 376). The following chapter discusses the Winner’s Curse

model and the Principal-Agent theory as an explanation approach.

3.2.1.1 The Winner's Curse

Rock's (1986) Winner's Curse model assumes the existence of two investor groups, an informed and an uninformed one. It is crucial to mention that new issues are not adjustable, meaning that when the quantity and price of the shares are set, they cannot be changed anymore. This setup leads to rationing of the share allocation, in case of excess demand. Moreover, informed investors are able to assess the true value of a new issue. Hence, they can distinguish between attractively priced IPOs and overpriced new issues. Consequently, they only participate in profitable new issues and abstain from investing if the IPO is overpriced. In contrast, uninformed investors participate in every IPO since they cannot distinguish between good and bad ones. Hence, informed investors crowd out the uninformed investors from the market because they are rationed in the successful IPOs and receive their full allocation in the unattractive ones, resulting in a scenario where uninformed investors have to bear all the losses in the market. To ensure full subscription of their IPOs, companies must price their shares at a discount, so that uninformed investors earn at least the risk-free rate and remain in the market for new issues (Rock 1986, 187-188, 205-206). The Winner's Curse model can be seen as an application of Akerlof's (1970, 489-490) "Lemons" problem, which leads to adverse selection due to the uncertainty of quality, similar to the information asymmetry in Rock's (1986) model.

Testing the Winner's Curse in major stock markets, such as the USA, is difficult due to a lack of data availability. However, Koh and Walter (1989, 251-253) identified Singapore as a unique market, that must make the rationing process publicly observable, allowing for a direct application of Rock's (1986) model in the Singaporean IPO market. A crucial characteristic of this market is also that all market participants have the same probability of receiving their allocation since the ballot decides about the allocation, making it a fair game. The empirical analysis of Koh and Walter (1989) supports the model's predictions, showing that when the rationing

associated with new issues is taken into account, underpricing diminishes. In fact, the expected return of an uninformed investor, as described in Rock's (1986) model, comes close to the risk-free rate, allowing a clear observation of the Winner's Curse.

Empirical evidence from Amihud, Hauser, and Kirsh (2003, 137-138) provides contradicting evidence from the Israeli stock exchange, where all subscribers receive their share allocation by equal proration if a new issuance is oversubscribed. The allocation rate is disclosed publicly, whereas in the USA the rationing decision is at the underwriter's discretion and not publicly announced. Their study aligns with Rock (1986) in finding that uninformed investors are allocated larger shares in poor-performing IPOs and smaller shares in successful ones, thereby supporting the idea of adverse selection. However, they also show that uninformed investors lose money on average, when participating in every IPO. This finding contradicts a key assumption in the Winner's Curse model because uninformed investors would leave the new issue market, if they would not earn at least the risk-free rate.

3.2.1.2 Principal-Agent Theory

Baron (1982, 955-957, 975) explores principal-agent conflicts in the IPO market, where the issuer acts as the principal and the underwriting investment bank serves as the agent. The model assumes that bankers are better informed about the market environment and issuers are not able to observe the bank's distribution efforts, creating information asymmetry. This setup leads to a combination of adverse selection and moral hazard problems. Adverse selection occurs when bankers misrepresent information to secure favorable contract terms, while moral hazard arises when bankers do not exert optimal effort in distribution due to the issuer's inability to effectively monitor the bank's actions. In an optimal state of the world, the investment bank would only be responsible for the distribution of the shares through a fixed-price offering. However, the information asymmetry requires the issuer to choose a contractual setup that aligns the interests of the investment bank with its own. The key to a successful alignment of interests is risk

sharing. Therefore, the optimal contract requires the investment bank to be responsible for setting the offer price and, within a fixed-price offering framework, handling the distribution, so that the bank's earnings depend on both the issue price and the success of the distribution. However, this is not a pareto efficient solution because the underwriter will underprice the new issue, compared to the optimal contract, to maximize its distribution success. Such contracts are particularly valuable under high market uncertainty, as they align the interests of issuers and bankers and mitigate informational asymmetry problems.

Ljungqvist (2003, 1-3) supports Baron's model, demonstrating that increasing the bank's pay-for-performance sensitivity through higher commissions can mitigate these conflicts and reduce underpricing. He uses a sample of IPOs that go public in the UK and finds that higher commissions align the interests of banks and issuers, resulting in significantly lower initial returns. This evidence confirms that the design of the contract influences the pricing behavior of IPO underwriters, impacting the extent of underpricing.

Moreover, Ljungqvist and Wilhelm's (2003, 723-724, 750-751) analysis highlights how the principal-agent framework explains the increased IPO underpricing observed during periods of significant market uncertainty, such as the dot-com bubble. They argue that changes in ownership structure and insider selling behavior during this period reduced the incentives for key decision-makers to control and monitor underpricing, thereby amplifying the effects predicted by Baron's (1982) model.

Muscarella and Vetsuypens's (1989, 125-126, 133) empirical analysis looks at self-marketed IPOs, which means IPOs of investment banks that conduct their own IPOs. This implies that there is no information asymmetry between the issuer and underwriter because they are the same entity. Following Baron's (1982) logic, there should not be underpricing because it is an optimal contract without asymmetric information. However, their findings contradict Baron's

(1982) model, showing that these self-marketed IPOs also experience statistically significant underpricing, similar to other companies that go public. In fact, if the investment bank acts as the lead manager in its own IPO, underpricing is even higher. This suggests that factors other than information asymmetry between issuer and underwriter contribute to IPO underpricing. Nevertheless, one could argue that the sample size with only 38 observations is relatively small, which is why these results should be interpreted with caution.

3.2.2 Institutional Explanations

Institutional explanations for IPO underpricing emphasize two key aspects of the marketplace, namely litigation risks and tax considerations (Ljungqvist 2007, 376). The theories of Hensler (1995) and Rydqvist (1997) are discussed. However, institutional explanations tend to be country specific, limiting their general applicability. Therefore, there is relatively little literature to discuss them broadly. Nevertheless, they are included to provide a comprehensive overview of the factors influencing IPO underpricing.

3.2.2.1 Legal Liability

According to Hensler (1995, 111) IPOs are underpriced as a measure to mitigate litigation risk due to poor post-IPO performance. This model is based on one of Ibbotson's (1975, 264) hypotheses for underpricing, when he describes underpricing as insurance against legal action for companies that go public and for their underwriters. Hensler (1995, 111, 113) postulates that companies face a trade-off between reducing potential future litigation expenses and "leaving money on the table" on the IPO day by accepting a lower valuation. For instance, in the USA, the Securities Act of 1933 is the legal basis for investors to file a lawsuit due to a deceptive registration statement and the resulting poor post-IPO performance. The maximum compensation courts can grant to investors is the difference between the current market price and the issue price. Therefore, underpricing minimizes the potential damages to be paid.

Tiniç (1988, 789-790, 818-819) provides supporting evidence for the legal liability explanation approach. Issuers and investment banks both benefit from implicit insurance that comes with underpricing. By pricing IPOs below their true market value, they can lower the risk of legal action against them as well as the associated costs. Tiniç (1988) compares IPOs pre- and post-enactment of the Securities Act of 1933. His empirical findings show that IPOs issued post-1933 experienced significantly higher initial returns compared to those issued pre-1933, indicating that underpricing serves as a protective measure against potential legal repercussions. One could argue that Tiniç's (1988) data set is quite old, and the post-1933 data could be chosen arbitrarily. For instance, Lowry and Schwert (2002, 1171-1172) demonstrate that the level of underpricing fluctuates from month to month and can even be negative, suggesting that the selected timeframe can significantly influence the results.

However, Lowry and Shu (2002, 309-310) explain that approximately 6% of the companies in their sample faced a lawsuit related to their IPO in the USA. Moreover, they provide evidence supporting the legal liability theory, as their empirical findings show that companies more at risk of facing IPO-related lawsuits experience higher levels of underpricing. On top of that, they also reveal that underpricing negatively correlates with expected litigation costs.

On the other hand, contradicting evidence is not difficult to find outside the USA. For example, Jenkinson (1990, 447) explains that there are barely any UK listings that faced IPO related lawsuits. On top of that, Ljungqvist (2007, 402) stresses that underpricing is a global phenomenon, but IPO related lawsuits are not a frequent problem in many countries in Asia and Europe, for instance. Concluding from that, the legal liability theory is at best an amplifier of underpricing in the USA, but definitely not the root cause of it.

3.2.2.2 Tax Considerations

Rydqvist's (1997, 295-296) theory looks at the different treatment of capital gains and ordinary income from a tax perspective, particularly in the Swedish market before 1990. A key aspect is that in Swedish IPOs certain investors such as employees of the company, customers, or any other party with a relationship with the company or the investment bank can be favored in the allocation of shares. This setup makes it attractive for these investors to participate in the IPO and benefit from lower capital gains taxes.

Rydqvist (1997, 296) provides empirical evidence to support this hypothesis, showing that the average initial returns of Swedish IPOs plummeted from 41% before 1990 to 8% after a regulatory change that reclassified underpriced shares as ordinary income for tax purposes. This regulatory change eliminated the tax advantage associated with underpricing, leading to a significant reduction in initial returns. Therefore, Rydqvist's (1997) findings highlight how tax considerations can drive underpricing.

Rydqvist (1997, 312) further emphasizes that tax considerations only influence underpricing in jurisdictions where gains from underpricing are taxed differently. He makes it clear that his theory shows that there must be non-tax reasons that cause underpricing because even after the change in Swedish tax law, underpricing persisted, but on a much lower level.

3.2.3 Ownership and Control

Ownership and control theories suggest that underpricing is used as a strategic tool to shape the ownership structure of a company, thereby minimizing the likelihood of intervention by outside shareholders post-IPO (Ljungqvist 2007, 376). The two studies discussed, Brennan and Franks (1997) and Stoughton and Zechner (1998), offer contrasting perspectives.

3.2.3.1 Underpricing as a Means to Retain Control

Brennan and Franks (1997, 391-393) propose that underpricing is caused by the desire of directors to remain in charge and minimize the risk of a hostile takeover, which effectively equals a hostile change of power. According to their theory, underpricing serves as a mechanism to ensure oversubscription in the IPO, thereby enabling to discriminate against applicants of large stakes in the company. This leads to a more dispersed ownership structure, reducing the incentives for external investors to monitor the company and challenge its management team. Using underpricing for the directors' power considerations is advantageous for them because the majority of the costs associated with underpricing are borne by non-director shareholders.

Booth and Chua (1996, 291) argue that IPO underpricing is driven by the issuer's desire for ownership dispersion. Their model posits that the oversubscription, caused by the underpricing, leads to a more diversified ownership structure at the time of the IPO. On top of that, the broader ownership structure also enhances liquidity in the secondary market. Nevertheless, the more diversified investor base increases information costs for investors, requiring compensation through underpriced shares. Booth and Chua's (1996) empirical results support the idea that underpricing is positively related to ownership dispersion, aligning with Brennan and Franks' (1997) model.

Field and Karpoff (2002, 1884-1885) provide additional supporting evidence by examining the role of takeover defenses in IPO firms. They find that takeover defenses installed by companies that go public are most likely to be found in firms that have a management with high compensation, a small stake in the company, and a low level of oversight. This finding is consistent with Brennan and Franks' (1997) because they show that especially when managers benefit personally from a dispersed ownership structure and bear only a fraction of the costs to achieve that goal, their companies are more likely to try to defend themselves from a change in control.

Field and Sheehan (2004, 279-280) provide evidence that underpricing is not a major factor that prevents large investors from becoming block holders. Variables that effectively influence block building are the size of the company, how many shares are being sold in the IPO process, and the involvement of venture capitalists in the company. Additionally, Field and Sheehan's (2004) results also show that there is a negative relationship between block building and underpricing, aligning with Brennan and Frank's (1997) theory. However, this effect is economically minor. They also highlight that 83% of companies that go public already have a large outside block holder before the IPO, and almost all of them have representation on the board level. Therefore, Brennan and Frank's (1997) block building concerns seem exaggerated, as management is likely already dealing with the monitoring of a large existing shareholder.

3.2.3.2 Underpricing as a Means to Reduce Agency Costs

Stoughton and Zechner's (1998, 45, 74-75) theory assumes that the valuation of a company that goes public is heavily influenced by its ownership structure, which results from the share allocation process in the IPO. They emphasize that small and large investors do not have the same monitoring capabilities. In fact, large shareholder groups are the only shareholders that can effectively monitor the company. This inequality results in a free rider problem, where small investors benefit without contributing anything, thereby creating an agency problem.

Stoughton and Zechner (1998, 48, 74-75) postulate that underpricing is linked to strategic rationing, targeted to encourage block building by large investors. Those investors' monitoring activities generate positive externalities, increasing the IPO's intrinsic valuation. Since all shareholders benefit from these positive externalities, this free rider problem is addressed in the IPO process through strategic rationing. In practice, this means preferential allocation of shares to large investors. Consequently, if local laws limit or forbid such favoritism, IPOs are less underpriced, which is the case in France, for instance.

Mello and Parsons (1998, 79-80) emphasize that ownership structure significantly affects the value of a company, highlighting that large investors play a crucial role in monitoring management and enhancing efficiency. They argue that when structuring an IPO, it should be designed around the optimal shareholder base to maximize firm value. This aligns with Stoughton and Zechner's (1998) theory that underpricing is a strategic tool to shape the ownership structure advantageously.

Cornelli and Goldreich (2001, 2339, 2368) received insight into the allocation of shares in the bookbuilding process of a major bank. Their empirical findings provide supporting evidence for Stoughton and Zechner (1998) because they show that investment bankers favor investors who want to build up large stakes in companies that go public.

As already pointed out, Field and Sheehan's (2004, 279-280) findings show that a substantial number of IPOs already have a large outside shareholder with board representation before the IPO. Therefore, underpricing is often unnecessary to attract a large block holder for monitoring purposes when such an investor is already in place before the IPO.

Hill (2006, 117) presents further contradictory evidence from her empirical analysis. She demonstrates that only 23 out of 502 IPOs in her dataset gained a new shareholder, holding at least 3% of the company during the IPO process. This finding suggests that Stoughton and Zechner's (1998) rationale fails to explain underpricing.

3.2.4 Behavioral Theories

Behavioral theories highlight the influence of psychological factors on market participants. This means that either 'irrational' investors drive up the price of IPO shares beyond their intrinsic value or that behavioral biases come into play (Ljungqvist 2007, 412). In the following two subchapters Welch's (1992) Cascade Effects model and Loughran and Ritter's (2002) Prospect Theory and Mental Accounting explanation approach are presented.

3.2.4.1 Cascade Effects

Welch (1992, 695-696) explains IPO underpricing with informational cascades and investor behavior. He argues that the sequential nature of investor decisions leads to cascades, where early investors influence later ones. If early investors find the IPO undervalued and buy shares, a positive cascade follows, ensuring the IPO's success. Conversely, if early investors abstain, a negative cascade occurs, leading to failure. A cascade can be convincing enough for subsequent investors to ignore their private information and follow earlier investor behavior. To mitigate the risk of an unsuccessful IPO, issuers strategically underprice their IPO to attract investors, who subsequently trigger a cascade effect, attracting even more investors. Therefore, underpricing acts as a positive catalyst to ensure early participation in the IPO and kicks off a positive feedback loop to increase the likelihood of a full subscription.

Cipriani and Guarino (2005, 1427-1428) argue that verifying empirically a theory such as Welch's (1992) is enormously challenging because investors' thoughts, rationales, and private information are not observable. Consequently, there is limited literature to discuss this model.

Nevertheless, Cipriani and Guarino (2005, 1428, 1434) conducted an experimental study. Their experiment shows that herd behavior, where participants disregard their private information and follow previous actions, can occur under fixed prices. This finding aligns with Welch's (1992) idea that early trades impact later investors' decisions. Therefore, it seems reasonable that if an IPO is underpriced and a group of investors discovers this, more investors will follow suit.

Amihud, Hauser, and Kirsh's (2003, 148, 157) findings are also consistent with Welch's (1992) cascade model. They point out that underpricing is used to stimulate excess demand. Additionally, they observed in their dataset that demand for IPOs follows a U-shape, meaning that IPOs are either heavily over- or undersubscribed with only a few cases in between. This pattern indicates herd behavior, which is what Welch (1992) describes in his cascade model.

Finally, Ljungqvist (2007, 413) argues that while cascades can explain IPO underpricing, they are avoidable. For instance, bookbuilding is usually a discrete and secret process. Therefore, the underwriter and the issuer are in a position to prevent a cascade from happening. Additionally, bookbuilding also provides the issuer with some flexibility in terms of the offer size. If there is strong demand for the IPO, it is possible to adjust the offer size upward, either by issuing more shares or through an overallotment option.

3.2.4.2 Prospect Theory and Mental Accounting

Loughran and Ritter (2002, 414-415, 425, 437-438) aim to answer the question why issuers are comfortable with leaving substantial amounts of money on the table during the IPO process. They argue that prospect theory explains this seemingly irrational behavior. They base their explanation on how issuers perceive wealth changes rather than absolute wealth levels. In an IPO, this results in a situation where issuers add up their opportunity costs, meaning losses caused by underpricing, with their gains from the price increase in their retained shares. Issuers generally view opportunity costs of underpricing as less critical than equivalent direct costs and underwriters take advantage of this behavioral bias to maximize their earnings. They underprice IPOs and seek quid pro quo arrangements from investors in exchange for favorable share allocations. Such arrangements are easier to realize and more lucrative for underwriters, instead of negotiating higher fees. Since the direct gains of issuers are typically higher than the losses, they are happy and consider the IPO a success.

Ljungqvist and Wilhelm (2005, 1787-1789) find supporting evidence through a proxy they develop to measure the satisfaction of the CEO with the IPO. This proxy assesses the CEO's net wealth change on the IPO day to derive the CEO's satisfaction level. They find that companies with the same CEO as on their IPO day are significantly more likely to change their investment bank for their first seasoned equity offering if the proxy indicates that the CEO was not satisfied with the outcome of the IPO. This finding holds true even when the proxy is calculated for the

senior management team. Ljungqvist and Wilhelm (2005) also explain that the results are most significant among inexperienced CEOs. However, the satisfaction of venture capitalists, who also hold a stake in the company, does not impact the decision to switch underwriters, which is likely due to their experience and more frequent participation in IPOs.

Even after intense research, the author of this thesis could not find any contradictory evidence to discuss Loughran and Ritter's (2002) model further. This may be due to the nature of behavioral theories and the fact that those kinds of models are difficult to verify empirically because of the behavioral data needed (Cipriani and Guarino 2005, 1427-1428).

3.3 Literature Review: Long-run Performance

Understanding the post-IPO performance is crucial for all stakeholders, such as investors, management, and policymakers. While underpricing has been extensively explored and discussed, the long-run performance of IPOs is considerably more complex due to the multitude of factors that can influence the stock's price in the long-run. This section aims to review the existing literature on IPO long-run performance, evaluate theoretical frameworks, and discuss the factors influencing post-IPO performance.

3.3.1 Empirical Findings and Explanations of IPO Long-run Performance

The long-run performance of IPOs, which is typically measured as the buy-and-hold return over three years, is widely considered and accepted to be negative when market-adjusted (Lin, Yu, and Lin 2021, 1; Ljungqvist 2007, 414; Ritter 1991, 4). Ritter (2024b, 21) has been updating Table 1 of Ritter and Welch (2002, 1797), where he shows that the (raw) average three-year buy-and-hold return of IPOs from 1980-2022 is 19.6%, which becomes (-19.5%), if market-adjusted. It is important to note that this is not a US market-specific phenomenon. Long-run underperformance also occurs in other major markets such as the United Kingdom or China (Goergen, Khurshed, Mudambi, 2007, 402, 408, Luo, Fang, and Esqueda 2012, 202).

Given the uniformity of these findings across different markets, it is more interesting to look into the underlying reasons for this persistent underperformance. Several theories attempt to explain this phenomenon, though Ritter and Welch (2002, 1821) argue that only a couple of these explanations are somewhat reasonable. Ritter and Welch (2002, 1820) also stress that long-run returns are noisy, which makes it difficult to work with them because there may be plenty of other factors that are unrelated to the company's market debut. Ritter (1991, 4) points out that even bad luck may be a reason for the poor post-IPO performance, highlighting that it is difficult to pin down a good explanation. On top of that, Purnanandam and Swaminathan (2004, 828) stress that the results of long-run IPO studies should be interpreted with caution due to several measurement issues and disagreements in the proper methodology. Therefore, the following section will only explore the most credible theories.

3.3.1.1 Constraints on Short Selling and Heterogeneous Expectations

Miller (1977, 1151) provides a model in which the constraints on short selling and the heterogeneous expectations of investors interact and influence IPO performance negatively in the long-run.

In a market with restricted short selling, the price of a security tends to be set by the most optimistic investors. This occurs because pessimistic investors are unable to short sell securities they consider overvalued. As a result, the security prices are pushed above their intrinsic value, leading to the valuation of the optimistic investors instead of the average market consensus (Miller 1977, 1151-1163). This model can be applied when analyzing the share price performance of companies after they went public because uncertainty is typically high and opinions often vary at the time of issuance. Initially, the most optimistic investors drive the share price up. However, as the market gains more information and the differences in opinions narrow, the share price tends to fall to a more realistic and moderate level. This gradual process contributes to the observed long-run underperformance of IPOs (Miller 1977, 1160-1161).

Empirical studies from Bradley, Jordan, and Ritter (2003, 5), Brav and Gompers (2002, 2), and Field and Hanka (2001, 479-480, 484-486) support this theory. They report increased trading volumes and significant drops in share prices following the expiration of lock-up periods, when insiders are allowed to sell their shares. This increase in supply generally leads to a price decline. On top of that, Field and Hanka (2001, 479-480, 484-486) document that the decrease in the stock price and the increase in trading volume around the lockup expiration are much larger for venture-capital-backed firms compared to non-venture-backed companies. They find that venture capitalists sell their shares more aggressively, leading to a bigger drop in share prices.

The author of this thesis could not find any research paper that directly contradicts Miller's model. This suggests that this approach is generally supported in academia.

3.3.1.2 IPO Volume Cycles

The IPO Volume Cycles theory, based on Schultz (2003), suggests that the timing and clustering of IPOs are the key factors that contribute to their long-run underperformance. The theory proposes that successful IPOs create a favorable market sentiment, which encourages more firms to go public. This phenomenon results in periods of high IPO issuance. This period is often referred to as "hot issue" market. As a consequence of the increasingly positive market sentiment, the average quality of new offerings decreases. In such a hot issue environment, the high volume of IPOs eventually saturates the market. Therefore, the last wave of IPOs issued during these high-volume periods tends to underperform significantly. This underperformance lowers the average returns of all IPOs. The theory suggests that underperformance is partly due to the cooling down of these hot markets as the initial enthusiasm fades and more realistic valuations set in (Schultz 2003, 496-501).

The assumptions of the IPO Volume Cycles theory regarding clustering and market saturation during hot issue periods are supported by other studies, such as Ritter (1984, 238-239) or Lowry

and Schwert (2002, 1171, 1188-1191). They reinforce that high issuance volumes are followed by poorer long-term performance. These studies imply that inflated valuations, driven by investor sentiment and market conditions during such periods, are corrected over time.

However, there is also literature that concludes that alternative viewpoints explain the phenomenon better. Fama and French (2004, 266-268) argue that the fundamental characteristics and inherent riskiness of IPO firms are more significant factors in explaining long-run underperformance. Pástor and Veronesi (2005, 1713-1717, 1747) do not disprove the IPO Volume Cycles theory, but their findings also suggest that factors related to IPO pricing rather than volume cycles, influence post-IPO performance. This assumption also explains IPO waves within a specific industry without causing a general positive IPO market sentiment.

3.3.1.3 Overoptimism and Overinvestment by Managers

A third explanation focuses on managerial behavior and overoptimism. Heaton (2002, 33-35) argues that many managers overinvest when they get access to capital. This overinvestment is often driven by their overoptimistic projections about the company's future. The model can be applied to IPOs because many investors like hearing an attractive growth story. In such a case, managers are tempted to overpromise but may eventually not deliver on their promises, which leads to the underperformance in the long-run.

Empirical evidence by Teoh, Welch, and Wong (1998, 1935-1937) supports this view. They show that many companies, before they go public, engage in aggressive earnings management to inflate their initial valuations. As the market corrects these inflated expectations over time, the stock price decreases, contributing to the long-term underperformance.

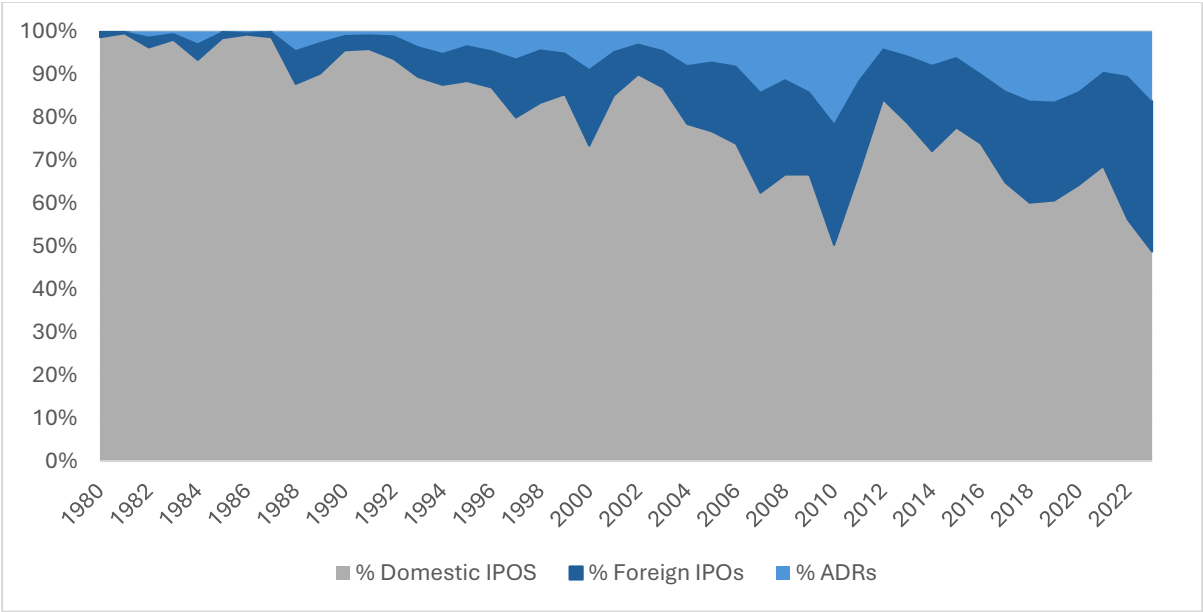
However, alternative explanations challenge this theory. Carter, Dark, and Singh (1998, 285-287, 296) found that companies that went public with reputable underwriters experienced less long-run underperformance. A reason for this finding could be that prestigious underwriters are

known for conducting strict due diligence, which reduces the likelihood of overoptimistic projections and overinvestment. Additionally, Chemmanur and Paeglis (2005, 331-333) argue that the success of a company depends on the credibility and reputation of the firm's management. Therefore, companies with a strong management team perform better in the long-run because they are more likely to select better and profitable projects. Hence, there is no or only limited overoptimism. This approach aligns closely with the methods used by practitioners like venture capitalists when evaluating the potential success of an investment.

3.4 Research on Foreign IPOs

Literature on international IPOs on foreign exchanges, even in the USA, is limited. Although some research exists on companies listing abroad, many of these studies focus on international cross-listings, where companies already listed on domestic exchanges seek additional listings abroad. Studies examining IPOs that initially list only abroad are less common, because this has been a rather modern trend (Yang and Lau 2010, 351-352). Figure 1 illustrates the development of the shares of domestic and foreign IPOs as well as American Depositary Receipts (ADRs). The figure shows a significant increase in the share of foreign IPOs, rising from 1.4% in 1980 to 35% in 2023. When ADRs, an equity instrument utilized by foreign companies, are included, the share of foreign listings further increases to 51.3% in 2023. This sharp rise in foreign listings over the past few decades reinforces that the trend is a modern phenomenon, as postulated by Yang and Lau (2010).

Figure 1: Share of Domestic IPOs, Foreign IPOs, and ADRs in the US Equity Market



Source: Own illustration, based on Ritter (2024a, 3)

Furthermore, while existing research has provided valuable insights into various aspects of IPOs, the understanding of the factors influencing the performance of foreign IPOs is still limited (Liu et al. 2019, 144). Therefore, this chapter has to reference some studies that use data from cross-listings or listings of ADRs to fulfill the author’s aim to provide the reader with a general understanding of international IPOs on US stock exchanges.

As already mentioned in Chapter 2.2.3 international IPOs face a home bias, which favors domestic firms over foreign ones. For instance, this is reflected in lower amounts of capital raised by foreign IPOs compared to their domestic peers (Çolak, Jens, Knill, and Syvrud 2014, 2). Contrary to what one would expect in the presence of a home bias, Brunner, Chaplinsky, and Ramchand (2004, 39, 41) demonstrate that the average level of underpricing is very similar between foreign and domestic companies. However, when comparing international IPOs with IPOs from their home countries, the home bias becomes evident. Blass and Yafeh (2001, 565) show in their empirical study that Israeli companies going public in the USA experience significantly higher levels of underpricing compared to their peers listing in Israel. Factors such as

institutional distance, asymmetric information, and investor unfamiliarity, as discussed in Chapter 2.2.3, are all reasonable explanations for the IPO home bias.

One aspect that has not yet been addressed is the viewpoint of investors. These obstacles faced by companies are commonly referred to as country risks, and according to economic theory, investors demand compensation for taking on additional risks. Therefore, country risk affects a company's IPO valuation (Brunner, Chaplinsky, Ramchand 2004, 39; Wu 2012, 940). Wu (2012, 955) showed that especially the economic freedom in a given country, the level of corruption, and, to a lesser extent, the legal system are good proxies for country risk.

It is particularly interesting to understand why a foreign company would undergo this scrutiny and accept the liability of foreignness, especially if it would "leave less money on the table" in a listing at home. The reason lies in their long-term strategy. According to Yang and Lau (2010, 369) they want to signal their quality and growth potential by going public abroad, which would be an asymmetric explanatory approach. For example, Blass and Yafeh (2001, 564-567) found in their empirical study that the median Israeli company that listed in the US market experienced almost 55% revenue growth compared to approximately 15% of the home country median peers after the first year of going public. Moreover, and more importantly, companies that decided to go public in the USA instead of at home, experienced significantly better stock market performance than their home country peers three years after their IPO. This finding holds true even if the first day returns are excluded, proving their good quality compared to their home country peers. Especially IPOs from countries with weak investor protection benefit from listing abroad in the USA (Yang and Lau 2010, 369).

However, the long-run share price performance in comparison to domestic peers, that are headquartered in the USA, is unclear. For instance, Luo, Fang, and Esqueda (2012, 208) find in their study with Chinese companies, that list in the USA, significant long-run underperformance

versus US peers, whereas Yang and Lau (2010, 369) cannot detect a significant underperformance in their more diverse sample. Even though Luo, Fang, and Esqueda (2012, 201) only focus on Chinese stocks, their study seems more representative due to its larger dataset, which spans from 1993 to 2010. In contrast Luo, Fang, and Esqueda (2012, 353) examine issuers from different countries listing in the USA, but their data only covers the period from 1990 to 1999, which is somewhat outdated and likely less representative. Finally, Liu et al. (2019, 144, 149) stress the importance of the prospectus for foreign companies that go public abroad to convince investors of their quality and future prospects.

4 Data Description

This chapter provides a comprehensive overview of the data used in this thesis. It begins by presenting the sources and nature of the financial data, followed by an introduction to the Index of Economic Freedom, a key variable in the regression analysis. Subsequently, it describes the data cleaning procedures undertaken. Finally, an overview of the cleaned dataset is presented.

4.1 Financial Data

The financial data for the empirical analysis was sourced from Bloomberg (2024). The dataset contains all IPOs in the US market between the years 2000 and 2020, including the underpricing and the subsequent three-year post-IPO stock price performance. Each of these companies, while going public, conducted a primary and a secondary offering, as described in Chapter 2.1.

As a measure to control for overall market performance, the Russell 3000 index was employed. This index is the broadest in the US equity market and includes approximately 98% of all investable stocks in the USA, according to LSEG (n.d., 1). Those properties make the Russell 3000 the ideal benchmark because the composition of other indexes is much narrower. For instance, the S&P 500 is focused on US large cap stocks, according to S&P Global (n.d., 1), making it a less representative benchmark for the share price development of small IPOs. The

benchmark data was also obtained from Bloomberg (2024).

4.2 The Index of Economic Freedom

Economic theory suggests that economic freedom influences incentives, productive efforts, and the efficiency of resource utilization. Fundamentally, economic freedom represents the basic right of individuals to have control over their own labor and property (Wu 2012, 945). An important variable in the regression analysis is the Economic Freedom Index, which is used to control for country risk of foreign IPOs in the USA. This idea was inspired by Wu (2012, 946).

The Heritage Foundation (2023, 1) publishes annually the Index of Economic Freedom, which ranks the economies of 184 countries. Table 2 in the appendix provides an overview of the four categories Rule of Law, Government Size, Regulatory Efficiency, and Open Markets, that are divided into twelve assessment criteria that impact a country's score. Each of these factors is graded on a scale from 0 to 100, and a country's overall score is derived by averaging these scores equally.

4.3 Data Cleaning

One of the initial steps, when handling the data, was filtering the obtained dataset. The approach followed in this thesis is aligned with common practices among researchers analyzing IPO underpricing and IPO long-run performance, such as Ritter (2024b, 10) and Dong, Michel, and Pandes (2011, 227). Therefore, ADRs, SPACS, closed-end funds, real estate investment trusts, unit offers, and penny stocks, which are in this thesis defined as stocks with an issue price below USD 1, were removed from the dataset.

Additionally, N/A values required closer examination, which is why 24 IPOs were randomly chosen and analyzed. These IPOs can be categorized into two groups. There were companies that filed for bankruptcy and companies that were acquired. The situation was complicated by companies that were in the process of going bankrupt but were acquired beforehand, often at a

discount rather than a premium. To deal with the issue that some companies lost their value entirely and others were either taken over at a discount or at a premium, the method selected was to choose the last available data point in the dataset before the N/A value appeared and keeping it constant. This approach proved to be relatively accurate on average in the sample.

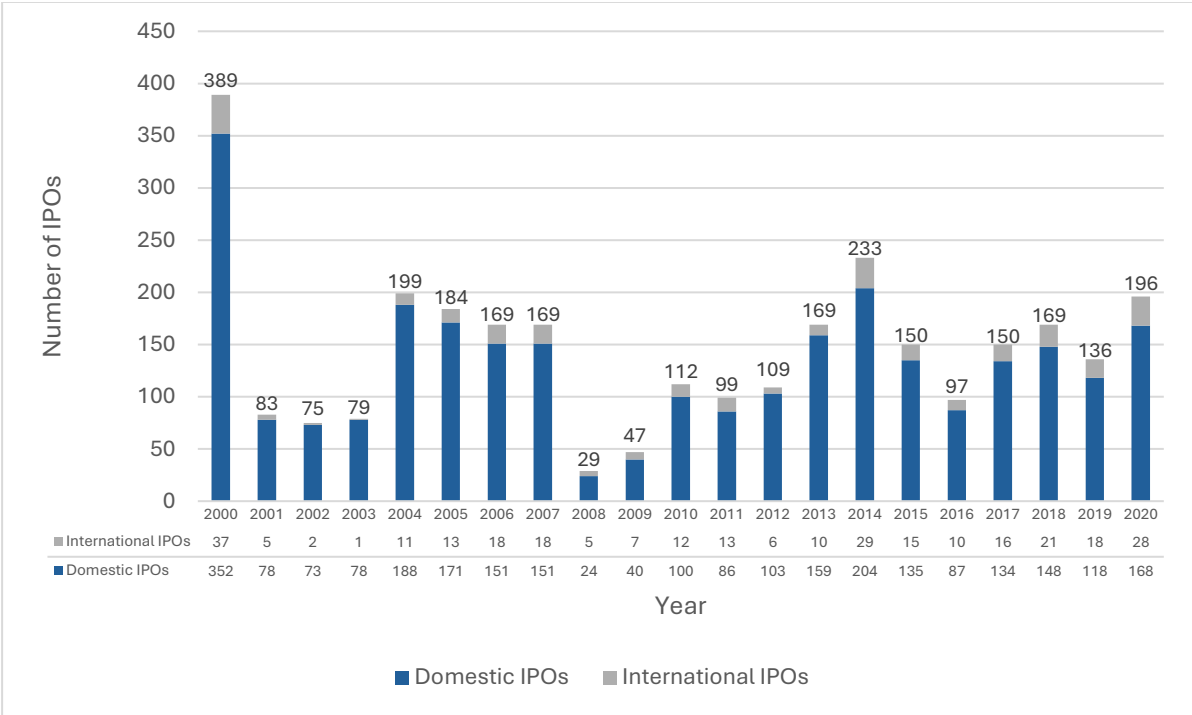
On top of that, IPOs from countries not included in the Economic Freedom Index were excluded as well. This affected only a few companies, which were headquartered on small islands such as the Cayman Islands or Jersey.

Finally, since the data was highly skewed to the right, the bottom and top 2% of the underpricing data and the long-term stock performance data were cut off, like in Carter, Dark, and Singh (1998, 298) and Baker, Boulton, Braga-Alves, and Morey (2021, 5). This measure allows for more normalized and robust results. Those filter criteria reduced the data set from originally 4893 IPOs down to 3043 data points.

4.4 Overview of the Dataset

The analysis covers the period from the first IPO on 13.01.2000, to the last IPO on 22.12.2020, and extends to the post-IPO performance three years later, ending on 22.12.2023. The empirical analysis includes 3043 data points, of which 295 IPOs are foreign and 2748 are domestic US IPOs. IPO activity appears to be highly cyclical because the number of total IPOs fluctuated in the analysis period between 29 during the global financial crisis in 2008 and 389 IPOs during the dotcom bubble in 2000, as illustrated in Figure 2.

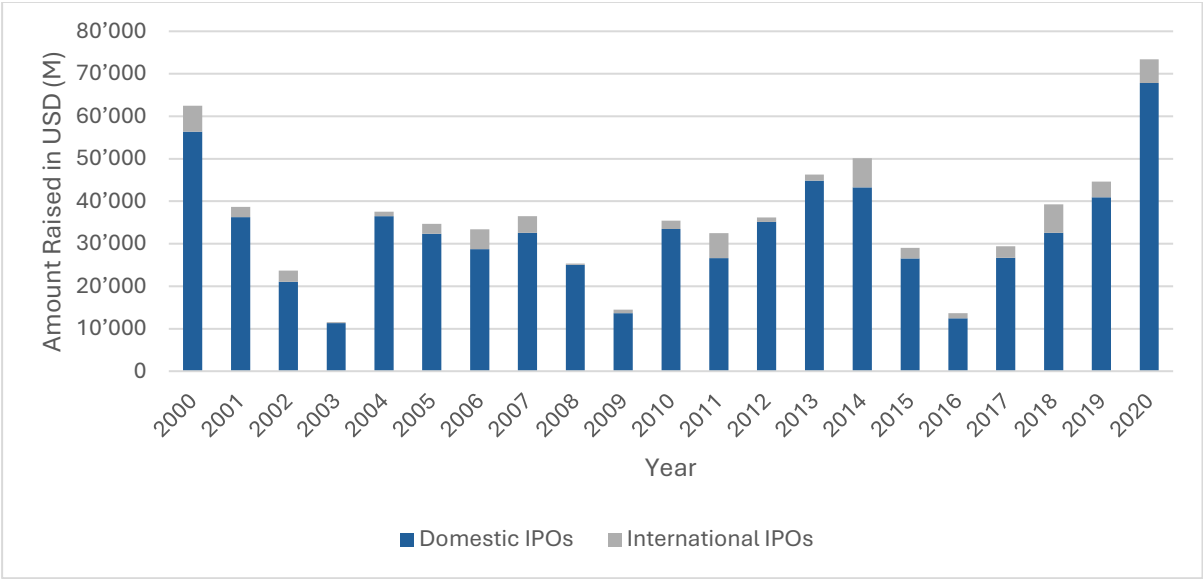
Figure 2: Number of IPOs per Year in the US Market from 2000 to 2020



Source: Own illustration, based on Bloomberg (2024)

Consequently, the cumulative offer size of IPOs is also cyclical, as illustrated in Figure 3. The lowest amount raised in a single year was USD 13.7 billion in 2016, while the highest amount raised was USD 73.4 billion in 2020. As illustrated in Table 3 in the appendix, the average offer size of an IPO in the US market is USD 246 million. For domestic IPOs, the average offer size slightly increases to USD 249 million, whereas for international IPOs, it decreases to USD 217 million. Notably, the median offer size is USD 104 million for domestic IPOs and USD 94 million for international IPOs. This indicates that a few large IPOs significantly influence the average, while the median offer size remains relatively consistent regardless of the company’s origin. The largest domestic IPO was Visa Inc. in 2008, raising USD 19.7 billion and the largest international IPO was the one of the Brazilian company Pageseguro Digital Ltd. in 2018, raising USD 2.6 billion.

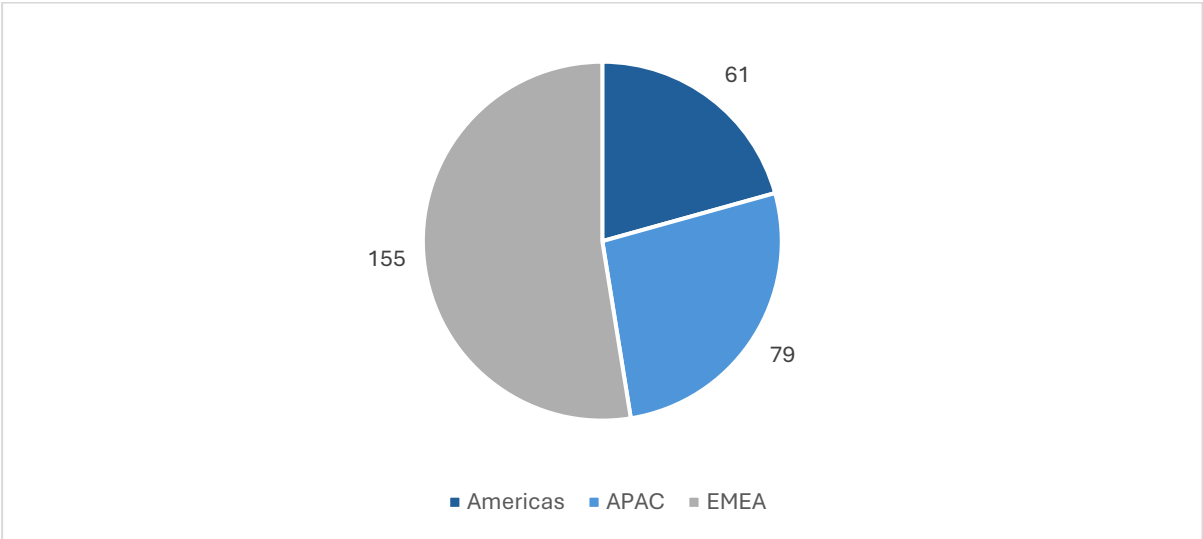
Figure 3: Offer Size of IPOs from 2000 until 2020



Source: Own illustration, based on Bloomberg (2024)

Finally, Figure 4 illustrates the origins of the 295 international IPOs by region. The majority of these IPOs are from the EMEA region. However, from a country perspective, China, which is located in APAC, leads with 64 IPOs, followed closely by Israel, an EMEA country, with 60 IPOs, and Canada, from the Americas region, accounts for 42 IPOs. The complete list of foreign IPOs on US stock exchanges by region and country can be found in Table 4 in the appendix.

Figure 4: Origin of International IPOs



Source: Own illustration, based on Bloomberg (2024)

5 Methodology

This chapter outlines the methodology for examining IPO underpricing and long-run performance. Given the right-skewed nature of the data, specific methodological adjustments are necessary. This thesis follows the approach of Kutsuna, Smith, and Smith (2009, 516). Therefore, price adjustments and returns are transformed using natural logarithms to mitigate skewness and improve data normality.

The computations were performed using Microsoft Excel for initial data handling and Python for the regression and statistical analyses. This combination ensures a thorough examination of IPO underpricing and long-run performance.

5.1 Underpricing Methodology

IPO underpricing can either be computed as the initial return of an investment in a company that goes public or as the amount of “money left on the table” (Ljungqvist 2007, 381). This thesis focuses on the return perspective and defines underpricing as the return generated between the issue price and the first opening price of the shares. No market-adjustment has been applied. The reason for this is that the primary driver of underpricing is the price change from the offer to the opening price and since the pricing of the IPO typically occurs just a few hours before the shares begin trading, there is no need for an adjustment (Bhagat, Lu, and Rangan 2018, 117; Ljungqvist 2007, 380). To maintain consistency with the long-run performance analysis and to address data skewness, the underpricing data, which was directly sourced from Bloomberg (2024), was transformed using the natural logarithm, following the approach of Baker et al. (2021, 5) and Chambers and Dimson (2009, 1435). The computation and transformation method is illustrated in Equation 1.

Equation 1: Underpricing (log transformed)

$$\text{Underpricing} = \ln \left(\frac{P_{open}}{P_{issue}} \right)$$

\ln = Natural logarithm

P_{open} = First opening price of the shares

P_{issue} = Issue price of the shares

Alternatively, the first closing price could be used instead of the first opening price to measure underpricing. However, the results show minimal differences (Ritter and Welch 2002, 1802).

5.2 Long-run Performance Methodology

The long-run performance of IPOs in this thesis is measured using buy-and-hold returns over a three-year period that are adjusted for market performance. This approach aligns with the methodology that Ritter (1991, 6-7) used. Additionally, to provide a more comprehensive analysis, buy-and-hold returns are also calculated for six months and one year. To correct for market performance, the return of the Russell 3000 in the same period is used. This approach reflects the perspective of a long-term investor who was allocated shares at the issue price and takes opportunity cost into account to measure the relative performance of their IPO investments.

To address the skewness issue of the data, the returns and adjustments of the IPO performances are transformed using the natural logarithm, as recommended by Carter, Dark, and Singh (1998, 298) and Purnanandam and Swaminathan (2004, 838). This leads to Equation 2.

Equation 2: Market-adjusted IPO Long-run Performance (log transformed)

$$\text{Market – adjusted IPO long – run performance} = \ln \left(\frac{P_t}{P_{\text{issue}}} \right) - \ln \left(\frac{M_t}{M_0} \right)$$

ln = Natural logarithm

P_t = Share price at time t (6 months, 12 months, and 36 months time interval)

P_{issue} = Share price at issuance

M_t = Market index points at time t (Russell 3000)

M_0 = Market index points at IPO day (Russell 3000)

Purnanandam and Swaminathan (2004, 838) point out that the log transformed returns lead to better distributional properties. This method provides a straightforward approach to account for the skewness issues encountered in the IPO dataset.

5.3 Regression Analysis Methodology

This thesis conducts a regression analysis for underpricing and IPO long-run performance. The regression model investigates whether a linear relationship can be identified between underpricing respectively the long-run performance of the IPOs and selected explanatory variables, which are listed in Table 5. The model used for this calculation is specified in Equation 3.

Equation 3: Regression Model for Underpricing and Long-Run Performance

$$Y = \beta_0 + \beta_1 * (\text{Pricing Year}) + \beta_2 * (\text{Domestic IPO Dummy}) + \beta_3 * (\text{Economic Freedom Index}) + \beta_4 * (\log (\text{Offer Size in USD (M)})) + \sum_{i=1}^{66} \beta_{4+i} * (\text{Industry}_i) + \varepsilon$$

Y = Dependent variable (Underpricing or long-run performance)

β_0 = Intercept

$\beta_1, \beta_2, \beta_3, \beta_4$ = Coefficients for the respective variables

$\sum_{i=1}^{66} \beta_{4+i} * (\text{Industry}_i)$ = Sum of the coefficients for the 66 industry dummy variables

ε = Error term

Table 5: Regressors of the Multiple Regression Analysis

Explanatory Variable	Description
Pricing Year	The year in which the IPO is priced.
Domestic IPO Dummy	A binary variable indicating whether the IPO is domestic, meaning headquartered in the USA (1), or not (0).
Index of Economic Freedom Rank	Economic Freedom Index rank of the home country of the company in the year of its IPO.
log Offer Size in USD (M)	The natural logarithm of the IPO offer size in million USD.
Industry	Industry classification of the IPO with 66 different industry categories.

Source: Own illustration

In the following section, the author explains his expectations regarding the influence of the individual explanatory variables on underpricing and IPO long-run performance.

Pricing Year

The pricing year captures specific market conditions and the overall economic environment. Therefore, it could be seen as a proxy to determine IPO waves, or “hot issue” markets, which might lead to higher levels of underpricing and poorer post-IPO performance after the market “cooled off” for certain pricing years.

Domestic IPO Dummy

The origin is a key variable in the regression analysis and the author expects that the distinction between domestic and international firms will likely have a major impact on the dependent variable. However, the specific impact on underpricing is unclear, prior to further analysis. Domestic firms might experience either lower or higher levels of underpricing, compared to international companies. One possible rationale for lower underpricing is that local investors may

be more familiar with them, which could reduce the perceived risk and, therefore, the need for underpricing. Conversely, the same familiarity could also lead to higher underpricing if it causes greater optimism about the company's future prospects, thereby driving up demand for shares on the IPO day, which results in a higher share price increase. On top of that, international firms might face a bias towards them when their value is being determined. This could lead to higher underpricing for domestic firms respectively lower underpricing for international firms, as the associated risk with being a foreign company may result in a lower initial valuation, thereby reducing the need for underpricing as a form of risk compensation. In the long-run, the author expects that the domestic IPO dummy will positively impact market performance relative to international peers.

Economic Freedom Index

Higher economic freedom is generally associated with more efficient markets and better investor protection. Therefore, the author expects lower levels of underpricing for IPOs from high-ranking countries and a better long-run performance for those companies.

Log Offer Size in USD (M)

The author considers the offer size as a proxy for risk of an IPO investment. Larger offer sizes might indicate more established and, hence, possibly lower-risk companies, potentially reducing underpricing. However, the long-run impact remains unclear. While lower-risk companies may experience a more moderate share price performance, smaller companies are more likely to have a more volatile share price development over three years. Therefore, the net effect is unclear.

Industry

The industry classification, with 66 different categories, is expected to capture sector-specific effects. Certain industries might have higher or lower levels of underpricing due to varying investor familiarity, investor preference, and market conditions. For the long-run performance,

industry factors such as growth prospects, regulatory environment, and competitive dynamics are expected to play a crucial role, leading to variations in performance across sectors. As a result, making generalizations about their impact is challenging.

6 Empirical Results and Discussion

This chapter presents and discusses the empirical findings from the conducted empirical analysis. The chapter is split into two parts. The first part looks into IPO underpricing, examining the extent and determinants of the initial returns observed in the sample. The second part evaluates the IPO long-run performance, aiming to provide an understanding of the empirical patterns and underlying factors influencing post-IPO performance.

6.1 Underpricing Results and Discussion

This subchapter first presents the results of the analysis of the data, followed by the discussion of the regression model. Where applicable, references to the literature and interpretations of the results are provided.

6.1.1 Underpricing Analysis Results

Table 6 in the appendix presents key statistical measures related to the underpricing of international IPOs. All figures are transformed with the natural logarithm. According to Table 6, international IPOs experience on average 11.47% underpricing, while the median is substantially smaller with 3.92%. Since the median is substantially smaller than the average, it can be concluded that there are a few IPOs with significantly higher levels of underpricing, skewing the results of the average. This can also be observed in the standard deviation of 0.18 and even more in the wide range of 91.17%, reflecting the log difference between the highest and lowest values observed. Moreover, this also means that the median international IPO only experiences minor levels of underpricing. However, a potential explanation for this finding may be the log transformation, which might skew the result towards 0. The conducted two-sided t-test results

in a p-value of 0, making the results statistically significant at the 1% significance level.

Table 7 in the appendix provides the same key statistical measures as Table 6 but for the underpricing of domestic US IPOs. These results are also expressed in log returns. The average underpricing for domestic IPOs is 13.11%, with a median of 7.56%. The standard deviation is 0.17 and the range of the observed levels of underpricing is 92.09%. These results allow the same conclusion for the domestic IPO data as for the international IPOs, that there are some outliers in the dataset, increasing the mean level of underpricing substantially. On top of that, the findings also confirm Brunner, Chaplinsky, and Ramchand (2004, 39, 41) who showed that the difference in underpricing between international and domestic IPOs is minimal, which is indeed the case with 11.47% of underpricing for international respectively 13.11% for domestic IPOs. The p-value of the two-sided t-test is 4.12E-261, indicating a high level of statistical significance at the 1% level of significance for the observed underpricing.

Both international and domestic IPOs experience significant levels of underpricing, but domestic companies face higher levels of underpricing. On top of that, the median underpricing for international IPOs is significantly lower than for domestic IPOs. This suggests that while both types of IPOs tend to be underpriced, domestic IPOs might be more consistently underpriced at a higher rate than international ones. Since the p-values are extremely low, it is reasonable to conclude that underpricing is a consistent and significant phenomenon in both international and domestic IPOs in the US market.

However, this conclusion conflicts with the EMH as the empirical findings imply that investors, who participated in every IPO from 2000 to 2020, were able to systematically generate abnormal returns. This is inconsistent with the notion that all available information is already factored into stock prices (Fama 1970, 383-384, 415). The deviation from expected efficiency indicates that the market does not always adjust accurately, which creates an opportunity for excess

returns. This challenges the validity of the EMH in the context of IPOs.

6.1.2 Underpricing Regression

Table 8 below presents a shortened version of the regression analysis, highlighting key variables, while the full results are available in Table 12 in the appendix. A discussion of the explanatory variables and the author's assumptions regarding their implications can be found in Chapter 5.3.

Table 8: Condensed Underpricing Regression Analysis Results

	<i>Dependent variable: log underpricing</i>
Const	-0.1247 (0.097)
Domestic IPO Dummy	0.0289** (0.014)
Economic Freedom Index Ranking	0.0004* (0.000)
Log Offer Size in USD (M)	0.0221*** (0.003)
Observations	2,922
R^2	0.170
Adjusted R^2	0.144
Residual Std. Error	0.161 (df = 2,832)
F Statistic	6.500*** (df = 89; 2,832)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

Source: Own illustration, based on Bloomberg (2024)

The intercept is -0.1247 and is not statistically significant (p-value = 0.197) at any common level of confidence. This means that the baseline underpricing when all other variables are held constant is not significantly different from zero.

The model reveals that a substantial number of industry dummies are either at the 5% level or at the 10% level statistically significant. This finding implies that there are sector-specific effects on IPO underpricing. A potential explanation may be that IPOs are associated with

different levels of investor enthusiasm or are perceived differently in terms of growth potential.

Additionally, all pricing year variables are statistically significant at the 5% confidence level, except for 2008 and 2020. The significant pricing year variables indicate lower levels of underpricing in those years compared to the reference year 2000. The impact of the year variable on underpricing varies from year-to-year. The two insignificant pricing years correspond to major economic events that triggered turmoil and uncertainty in the stock market. In 2008 the global financial crisis unfolded and in 2020 the outbreak of the COVID-19 pandemic led to global economic shutdowns. Both events caused significant uncertainty, likely complicating the assessment and valuation of IPOs during those periods.

Moreover, the log Offer Size in USD (M) variable is positive and statistically significant at the 5% level, suggesting that larger IPOs are an indicator for higher initial first day returns. This may reflect greater investor demand and long-term confidence in larger offerings, driving up the initial return.

When analyzing an IPO's origin respectively where the company is headquartered, the domestic IPO dummy and the Economic Freedom Index ranking are key variables to consider. Both are statistically significant. The coefficient for the domestic IPO dummy is positive and significant at the 5% level, suggesting that domestic IPOs tend to be slightly more underpriced compared to international IPOs. This finding provides clarity to the author's thoughts on the status of being a domestic or foreign company and its effect on underpricing, as elaborated in Chapter 5.3. However, it remains unclear if the difference in the level of underpricing can be related to greater investor optimism toward domestic stocks and hence increasing demand for the IPO, lower valuations for international firms due to their liability of foreignness, or a combination of these factors.

The coefficient for the economic freedom index ranking is slightly positive and only statistically

significant (p-value = 0.068) at the 10% level, which seems to be reasonable for this type of explanatory variable. While this finding might seem contradictory to the impact of the domestic IPO dummy, it should rather be interpreted as a relative measure among foreign IPOs from different jurisdictions and, therefore, different levels of economic freedom instead of a direct comparison to domestic IPOs. Therefore, this finding implies that IPOs from countries with a lower rank in the Economic Freedom Index experience higher levels of underpricing. Investors may perceive such IPOs as riskier and, therefore, demand a higher discount on the fair price of the IPO to be compensated for the additional risk taken.

Finally, the F-statistic of 6.500 (p-value = 1.02e-64) shows that the model is statistically significant. However, the model's R-squared value is 0.170. This suggests that approximately 17% of the variance in IPO underpricing is explained by the explanatory variables discussed. This implies that there are further factors affecting IPO underpricing that are not captured in this analysis.

6.2 Long-run Results and Discussion

This subchapter initially outlines the findings from the data analysis and following that presents the regression model. When possible, references to the literature and interpretations of the results are included.

6.2.1 Long-run Performance Analysis Results

Table 9 in the appendix presents the post-IPO share price performance of international IPOs. The results are market-adjusted and transformed with the natural logarithm. The long-run performance is measured with the three-year variable, but the table also includes a six and twelve months time horizon to show the initial stock market development within the first year. The mean steadily declines over time. After three years, the average foreign IPO underperforms the market by -39.70%. This underperformance begins rather quickly after going public because

the six months mean and median variables are already negative. Another interesting observation is the steep decline in performance from -7.14% to -29.75% in the period from six months to one year. This finding may be related to the end of lock-up periods for insiders, who sell some of their shares, creating over-proportionally high supply as discussed in Chapter 3.3.1.1. This explanation aligns with previous research and supports Miller's (1977) model of constraints on short selling and heterogeneous expectations.

Additionally, when comparing the median return to the mean return, the mean is more negative for six and twelve months than the median, indicating the presence of negative outliers that skew the mean downward. However, this trend reverses after three years, with the mean return surpassing the median. This reversal indicates a shift in the distribution of returns over the long-run. While most IPOs perform poorly, there are a few IPOs with exceptionally positive returns that skew the mean upward. This interpretation is further supported by the steadily growing standard deviation up to 1.31 and even more in the range after three years with 839.62%. All the results are statistically significant at the 1% level.

Table 10 in the appendix illustrates the post-IPO share price performance of domestic US American IPOs. The table is set up the same as Table 9 for international IPOs, which is why the results are also market-adjusted and transformed with the natural logarithm and discusses the same variables. Domestic IPOs experience the same share price deterioration trend as international ones. However, the magnitude is lower and the underperformance to the market begins later. Especially the difference in the three-year performance of domestic IPOs (-21.06%) versus international IPOs (-39.70%) highlights the likely presence of a home bias in favor of US American IPOs as described in Chapter 2.2.3 by Bell & Rasheed (2016, 107) and Zaheer (1995, 343). Moreover, the significant underperformance of international IPOs compared to domestic ones supports the findings of Luo, Fang, and Esqueda (2012, 208), who observed long-run underperformance of Chinese companies listed in the USA. Conversely, these results contradict

the findings of Yang and Lau (2010, 369), who did not detect significant underperformance in their sample of foreign companies.

At the six months mark, domestic IPOs still outperform the market with a mean return of 2.25% and a median of 6.41%. By the one year mark the IPO underperformance relative to the market had begun with an average return of -12.00% and a median return of -2.28%. This gap to the Russell 3000 widens over the three-year observation period on average to -21.06% and to -9.62% when looking at the median. Notably, the median performance is better at all three observation points, indicating that a few negative outliers skew the mean results downward. Moreover, the standard deviation of domestic IPOs is lower than for international ones. This is particularly notable for the first six months after going public, when domestic companies experience a standard deviation of 0.17, compared to 0.45 for international companies. This underlines the argument that domestic companies are perceived as less risky. Even though this observation can be made at all three time points, this effect diminishes rather quickly, becoming negligible after one year, with only a slight increase in the long-run. The performance range for domestic IPOs is higher at all three observation points compared to international IPOs. Due to the better overall performance of domestic IPOs, the wider ranges indicate that there are more positive outliers. The reason for this may be due to institutional, informational, and cultural advantages, as discussed by Bell and Rasheed (2016, 107) and Zaheer (1995, 343). All the results are statistically significant at the 1% level.

The illustrated findings in Tables 9 and 10 also make the significant performance gap over three years between domestic and international listings evident. An implication for foreign companies may be the need to adopt strategies to mitigate the disadvantages associated with listing abroad, such as improving transparency and investor relations to reduce information asymmetry. By enhancing investor confidence through such measures, foreign companies could potentially improve their post-IPO performance.

The observed negative mean and median returns across all three time horizons for international IPOs, and to a lesser extent for domestic IPOs, suggest that the market fails to fully and immediately incorporate all available information into the companies' share prices. This long-term underperformance implies that the market's initial pricing of IPOs is not efficient and that it gradually adjusts over time. This phenomenon is inconsistent with the rapid adjustment that Fama (1970, 383-384, 415) postulates in his EMH. Furthermore, the deviation between mean and median returns indicates the presence of skewed distributions with extreme outliers. This skewness suggests that certain IPOs perform significantly different than others, which could be due to factors that are not fully anticipated by the market. Although Fama (1970, 388) acknowledges that market efficiency is a radical hypothesis, the magnitude and persistence of IPO underperformance, as shown in the tables, present substantial evidence against the EMH, at least in the context of IPOs.

6.2.2 Long-run Regression

Table 11 below presents a condensed version of the regression analysis, highlighting the key variables. The full regression analysis can be found in Table 13 in the appendix. A discussion of the explanatory variables and the author's assumptions about their implications can be found in Chapter 5.3.

Table 11: Condensed Three-Year Regression Analysis Results

<i>Dependent variable: log 3y long-run performance (market adjusted)</i>	
Const	-1.6703** (0.725)
Domestic IPO Dummy	0.1020 (0.104)
Economic Freedom Index Ranking	-0.0003 (0.002)
Log Offer Size in USD (M)	0.0465** (0.021)
Observations	2,921
R^2	0.083
Adjusted R^2	0.055
Residual Std. Error	1.240 (df = 2,832)
F Statistic	2.931*** (df = 88; 2,832)

Note:

*p<0.1; **p<0.05; ***p<0.01

Source: Own illustration, based on Bloomberg (2024)

The long-run regression analysis shows that the intercept is substantially negative and statistically significant at the 5% confidence level. This indicates that the baseline market-adjusted three-year performance of IPOs is negative, when all other variables are held constant. The baseline likely reflects the inherent risks and market conditions faced by newly listed firms.

Moreover, most pricing year variables are statistically significant at the 5% level, with 2009 and 2011 being significant at the 10% level and 2003, 2006, and 2019 not being statistically significant at any common level of significance. This finding suggests that the IPO year has a notable impact on the long-run performance. Interestingly, every significant pricing year variable contributes positively to the stock market performance, compared to the reference year 2000, except the year 2020, which is highly negative, suggesting IPOs that were priced in 2020 had an extremely poor three-year post-IPO performance relative to IPOs of the other years. When trying to use Schultz's (2003) IPO Volume Cycle model to explain this finding, it is important to account for the number of companies that went public in the same year. In 2020, with 196 IPOs, the volume was relatively high. As shown in Figure 2, which was presented in Chapter 4.4, IPOs do indeed occur in waves, as proposed by the IPO Volume Cycles theory and

the observed pattern also holds true for the year 2000 with 398 IPOs. However, for instance, the model is completely off in the years 2007 and 2014/2015 at the end of those high-volume cycles. In those years the post-IPO performance was not significantly worse than in other years. Therefore, the data can only confirm that IPOs come in waves, as proposed by the IPO Volume Cycle theory, and at best somewhat impact the IPO long-run performance. An explanation that considers the specific economic circumstances and unique challenges seems more reasonable. In the year 2020 it was likely due to the COVID-19 pandemic, the associated market volatility, and uncertainty regarding the companies' futures, which probably impacted the pricing of IPOs. Therefore, it is only possible to conclude in general, that the significant year dummies indicate that external factors specific to certain years have a notable impact on the IPO long-run performance, irrespective of the number of IPOs, in a given year. Reasonable explanations are economic cycles, regulatory changes, or market conditions prevalent during those years.

On top of that, the log Offer Size in USD (M) variable is also statistically significant at the 5% level, which implies that larger IPOs are an indicator of better long-run IPO performance. Larger offerings may attract more investor interest and could be an indicator that the company that goes public is more established with a robust business model, which likely contributes to better long-term performance.

In contrast to the underpricing regression, there is barely any industry that is statistically significant, except for Housewares at the 5% level and Airlines as well as Engineering & Construction at the 10% level. The remaining 63 industries are not statistically significant, suggesting that industry is not a reliable predictor of long-run IPO performance, in contrast to its relevance in the underpricing analysis.

Additionally, origin, measured through the Domestic IPO Dummy and the Economic Freedom Index, lost its statistical significance compared to the underpricing regression. This indicates

that the effect of pure foreignness diminishes and potentially other factors that are not included in the regression analysis may explain the substantial difference in post-IPO stock market performance between domestic and international companies. This finding highlights the complexity of long-run performance data, as foreign companies perform much worse, as discussed in Chapter 6.2.1. While it might seem obvious to attribute this underperformance to a company's origin, the regression analysis indicates otherwise.

Finally, the F-statistic of 2.931 (p-value = 1.60e-17) indicates that the model is statistically significant. However, the R-squared value of 0.083 suggests that only 8.3% of the variance in long-term IPO performance is explained by the variables in the regression. This implies that there are additional factors affecting the IPO long-run performance that are not included in this analysis.

7 Conclusion

This thesis aimed to examine and contrast the stock market performance of both foreign and domestic US companies that go public on US stock exchanges. The primary objectives were to analyze the initial underpricing and long-term three-year post-IPO performance to identify differences in their stock market performance and potential explanations.

The literature review revealed insights about IPOs and discussed the most common models and theories related to IPO phenomena. It highlighted that IPO underpricing is driven by various factors including asymmetric information, institutional explanations, ownership and control matters, as well as behavioral theories (Ljungqvist 2007, 376). Additionally, the literature on long-term performance indicates a consistent underperformance of IPOs after their stock market debut (Lin, Yu, and Lin 2021, 1). However, explanation approaches for long-run underperformance should be interpreted with caution because of the noise in IPO datasets. There are many factors that are unrelated to the IPO that influence the post-IPO stock market performance

(Ritter and Welch 2002, 1820-1821). Moreover, literature specifically on foreign IPOs underscored the impact of the liability of foreignness due to institutional distance, information asymmetry, and unfamiliarity costs (Bell & Rasheed 2016, 107).

The empirical analysis has revealed that both foreign and domestic IPOs experience significant underpricing on average, with domestic IPOs (13.11%) showing slightly higher levels of underpricing than international ones (11.47%). The higher underpricing of domestic IPOs may be attributed to greater investor familiarity and optimism, driving up the initial return. Over the long-run, both foreign and domestic IPOs substantially underperformed relative to the market, but the underperformance was more pronounced for foreign IPOs (-39.70%) than for domestic ones (-21.06%). This supports the presence of a home bias in favor of domestic companies. On top of that, the regression analysis showed, among other things, that origin, measured as the economic freedom of the IPO's home country, only matters when analyzing first day returns. Origin variables lose their explanatory power in the long-run, indicating that other factors drive long-run performance. The most rational conclusion based on the regression analysis is that the pricing year and, therefore, economic cycles, regulatory changes, or market conditions affect post-IPO performance. However, this does not explain the significant performance difference between foreign and domestic IPOs in the long-run.

The findings of the empirical analysis come with both theoretical and practical implications. Theoretically, the results challenge the EMH in an IPO context by demonstrating systematic underpricing and long-term underperformance. This systematic aspect implies that the market fails to incorporate new information immediately and efficiently, which could allow traders to exploit these inefficiencies to generate consistent excess returns by applying appropriate investment strategies, provided they can buy at the issue price and short sell the stock. Practically, the findings suggest that foreign companies might need to adopt strategies to mitigate the disadvantages associated with listing abroad, such as improving transparency and investor relations

to reduce information asymmetry.

The main limitations were the scope of this thesis and the availability of necessary data to test the discussed models, particularly those related to IPO underpricing. The analysis was also influenced by the specific time frame, which may not fully reflect the current IPO market due to the changing and dynamic nature of markets. However, a shorter time frame would have reduced the sample size and would not have allowed to account for special circumstances, such as the dotcom bubble or the global financial crisis.

Future research should specifically focus on foreign listings in the USA, as there is still a lot to investigate in this field. While the long-run performance of IPOs remains somewhat of a black box, the substantial difference in performance between domestic and international IPOs is worth exploring further. This research has the potential to assist foreign companies, that list abroad, to identify strategies to mitigate or even overcome the liability of foreignness.

In conclusion, this thesis highlights the complex dynamics of IPO underpricing and long-term performance, emphasizing the role of home bias and its impact on foreign companies. The empirical findings contribute to a more profound understanding of the challenges faced by foreign companies going public in the USA, respectively by their shareholders who bear the costs. This underscores the necessity for further research to address the stock market performance gap between domestic and foreign IPOs, with the ultimate goal of enhancing market efficiency, improving investor confidence, and creating greater shareholder value.

8 Bibliography

- Akerlof, George A. 1970. "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism." *The Quarterly Journal of Economics* 84 (3): 488–500. <https://doi.org/10.2307/1879431>.
- Amihud, Yakov, Shmuel Hauser, and Amir Kirsh. 2003. "Allocations, Adverse Selection, and Cascades in IPOs: Evidence from the Tel Aviv Stock Exchange." *Journal of Financial Economics* 68 (1): 137–158. [https://doi.org/10.1016/S0304-405X\(02\)00251-9](https://doi.org/10.1016/S0304-405X(02)00251-9).
- Baker, Edward D., Thomas J. Boulton, Marcus V. Braga-Alves, and Matthew R. Morey. 2021. "ESG Government Risk and International IPO Underpricing." *Journal of Corporate Finance* 67 (April): 101913. <https://doi.org/10.1016/j.jcorpfin.2021.101913>.
- Baron, David P. 1982. "A Model of the Demand for Investment Banking Advising and Distribution Services for New Issues." *The Journal of Finance* 37 (4): 955–976. <https://doi.org/10.1111/j.1540-6261.1982.tb03591.x>.
- Bell, Greg, and Abdul A. Rasheed. 2016. "Seeking Capital Abroad: Motivations, Process, and Suggestions for Success." *Journal of Applied Corporate Finance* 28 (1): 104–113. <https://doi.org/10.1111/jacf.12163>.
- Bhagat, Sanjai, Jun Lu, and Srinivasan Rangan. 2018. "IPO Valuation: The International Evidence." In *The Oxford Handbook of IPOs*, edited by Douglas Cumming, 108–145. Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780190614577.013.9>.
- Blass, Asher, and Yishay Yafeh. 2001. "Vagabond Shoes Longing to Stray: Why Foreign Firms List in the United States." *Journal of Banking & Finance* 25 (3): 555–572. [https://doi.org/10.1016/S0378-4266\(00\)00090-X](https://doi.org/10.1016/S0378-4266(00)00090-X).
- Bloomberg, 2024. Accessed March 28, 2024.
- Booth, James R., and Lena Chua. 1996. "Ownership Dispersion, Costly Information, and IPO Underpricing." *Journal of Financial Economics* 41 (2): 291–310. [https://doi.org/10.1016/0304-405X\(95\)00862-9](https://doi.org/10.1016/0304-405X(95)00862-9).
- Bradley, Daniel J., Bradford D. Jordan, and Jay R. Ritter. 2003. "The Quiet Period Goes out with a Bang." *The Journal of Finance* 58 (1): 1–36. <https://doi.org/10.1111/1540-6261.00517>.
- Brav, Alon, and Paul A. Gompers. 2003. "The Role of Lockups in Initial Public Offerings." *The Review of Financial Studies* 16 (1): 1–29. <https://doi.org/10.1093/rfs/16.1.0001>.
- Brennan, M.J., and J. Franks. 1997. "Underpricing, Ownership and Control in Initial Public Offerings of Equity Securities in the UK." *Journal of Financial Economics* 45 (3): 391–413. [https://doi.org/10.1016/S0304-405X\(97\)00022-6](https://doi.org/10.1016/S0304-405X(97)00022-6).
- Bruner, Robert, Susan Chaplinsky, and Latha Ramchand. 2004. "US-Bound IPOs: Issue Costs and Selective Entry." *Financial Management* 33 (3): 39–60. <http://www.jstor.org/stable/3666263>.
- Carter, Richard B., Frederick H. Dark, and Ajai K. Singh. 1998. "Underwriter Reputation, Initial Returns, and the Long-Run Performance of IPO Stocks." *The Journal of Finance* 53 (1): 285–311. <https://doi.org/10.1111/0022-1082.104624>.
- Chambers, David, and Elroy Dimson. 2009. "IPO Underpricing over the Very Long Run." *The Journal of Finance* 64 (3): 1407–1443. <https://doi.org/10.1111/j.1540-6261.2009.01468.x>.
- Chemmanur, T, and P Fulghieri. 2006. "Competition and Cooperation among Exchanges: A Theory of Cross-Listing and Endogenous Listing Standards." *Journal of Financial Economics* 82 (2): 455–489. <https://doi.org/10.1016/j.jfineco.2005.06.008>.
- Chemmanur, Thomas J., and Imants Paeglis. "Management Quality, Certification, and Initial Public Offerings." *Journal of Financial Economics* 76, no. 2 (May 2005): 331–68. <https://doi.org/10.1016/j.jfineco.2004.10.001>.

- Cipriani, Marco, and Antonio Guarino. 2005. "Herd Behavior in a Laboratory Financial Market." *American Economic Review* 95 (5): 1427–1443. <https://doi.org/10.1257/000282805775014443>.
- Çolak, Gönül, April M. Knill, and Kelsey Syvrud. 2014. "International IPO Markets and a Foreign IPO Puzzle." *SSRN Electronic Journal*: 1–44. <https://doi.org/10.2139/ssrn.2446039>.
- Cornelli, Francesca, and David Goldreich. 2001. "Bookbuilding and Strategic Allocation." *The Journal of Finance* 56 (6): 2337–2369. <https://doi.org/10.1111/0022-1082.00407>.
- Coval, Joshua D., and Tobias J. Moskowitz. 1999. "Home Bias at Home: Local Equity Preference in Domestic Portfolios." *The Journal of Finance* 54 (6): 2045–2073.
- Dong, Ming, Jean-Sébastien Michel, and J. Ari Pandes. 2011. "Underwriter Quality and Long-Run IPO Performance." *Financial Management* 40 (1): 219–251. <https://doi.org/10.1111/j.1755-053X.2010.01140.x>.
- Fama, Eugene F. 1970. "Efficient Capital Markets: A Review of Theory and Empirical Work." *The Journal of Finance* 25 (2): 383–417. <https://doi.org/10.2307/2325486>.
- Fama, Eugene F., and Kenneth R French. 2004. "New Lists: Fundamentals and Survival Rates." *Journal of Financial Economics* 73 (2): 229–269. <https://doi.org/10.1016/j.jfineco.2003.04.001>.
- Field, Laura Casares, and Gordon Hanka. 2001. "The Expiration of IPO Share Lockups." *The Journal of Finance* 56 (2): 471–500. <https://doi.org/10.1111/0022-1082.00334>.
- Field, Laura Casares, and Jonathan M. Karpoff. 2002. "Takeover Defenses of IPO Firms." *The Journal of Finance* 57 (5): 1857–1889. <https://doi.org/10.1111/0022-1082.00482>.
- Field, Laura Casares, and Dennis P. Sheehan. 2004. "IPO Underpricing and Outside Blockholdings." *Journal of Corporate Finance* 10 (2): 263–280. [https://doi.org/10.1016/S0929-1199\(03\)00057-9](https://doi.org/10.1016/S0929-1199(03)00057-9).
- Goergen, Marc, Arif Khurshed, and Ram Mudambi. 2007. "The Long-run Performance of UK IPOs: Can It Be Predicted?" Edited by Arif Khurshed. *Managerial Finance* 33 (6): 401–419. <https://doi.org/10.1108/03074350710748759>.
- Heaton, J. B. 2002. "Managerial Optimism and Corporate Finance." *Financial Management* 31 (2): 33–45. <https://doi.org/10.2307/3666221>.
- Hensler, Douglas A. 1995. "Litigation Costs and the Underpricing of Initial Public Offerings." *Managerial and Decision Economics* 16 (2): 111–128. <https://doi.org/10.1002/mde.4090160203>.
- Heritage Foundation. 2023. "Index of Economic Freedom - Methodology." Heritage Foundation. Accessed July 5, 2024. <https://www.heritage.org/index/pages/about>.
- Hill, Paula. 2006. "Ownership Structure and IPO Underpricing." *Journal of Business Finance & Accounting* 33 (1–2): 102–126. <https://doi.org/10.1111/j.1468-5957.2006.01359.x>.
- Iannotta, Giuliano. 2010. *Investment Banking: A Guide to Underwriting and Advisory Services*. Berlin: Springer.
- Ibbotson, Roger G. 1975. "Price Performance of Common Stock New Issues." *Journal of Financial Economics* 2 (3): 235–272. [https://doi.org/10.1016/0304-405X\(75\)90015-X](https://doi.org/10.1016/0304-405X(75)90015-X).
- Jenkinson, T.J. 1990. "Initial Public Offerings in the United Kingdom, the United States, and Japan." *Journal of the Japanese and International Economies* 4 (4): 428–449. [https://doi.org/10.1016/0889-1583\(90\)90020-7](https://doi.org/10.1016/0889-1583(90)90020-7).
- Kesten, Jay B. 2018. "The Law and Economics of the Going-Public Decision." In *The Oxford Handbook of IPOs*, edited by Douglas Cumming, 26–51. Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780190614577.013.12>.
- Koh, Francis, and Terry Walter. 1989. "A Direct Test of Rock's Model of the Pricing of Unseasoned Issues." *Journal of Financial Economics* 23 (2): 251–272. [https://doi.org/10.1016/0304-405X\(89\)90058-5](https://doi.org/10.1016/0304-405X(89)90058-5).

- Kutsuna, Kenji, Janet Kiholm Smith, and Richard L. Smith. 2009. "Public Information, IPO Price Formation, and Long-Run Returns: Japanese Evidence." *The Journal of Finance* 64 (1): 505–546. <https://doi.org/10.1111/j.1540-6261.2008.01440.x>.
- Lin, Tsai-Yin, Jerry Yu, and Chia-Yi Lin. 2021. "IPO's Long-Run Performance: Hot Market versus Earnings Management." *Journal of Risk and Financial Management* 14 (3): 132. <https://doi.org/10.3390/jrfm14030132>.
- Liu, Kun, Jintong Tang, Kun (Michelle) Yang, and Jonathan Arthurs. 2019. "Foreign IPOs in the U.S.: When Entrepreneurial Orientation Meets Institutional Distance." *Journal of Business Research* 101 (August):144–151. <https://doi.org/10.1016/j.jbusres.2019.04.011>.
- Ljungqvist, Alexander. 2007. "IPO Underpricing." In *Handbook of Empirical Corporate Finance*, 375–422. Elsevier. <https://doi.org/10.1016/B978-0-444-53265-7.50021-4>.
- Ljungqvist, Alexander, and William J. Wilhelm. 2003. "IPO Pricing in the Dot-com Bubble." *The Journal of Finance* 58 (2): 723–752. <https://doi.org/10.1111/1540-6261.00543>.
- Ljungqvist, Alexander, and William J. Wilhelm. 2005. "Does Prospect Theory Explain IPO Market Behavior?" *The Journal of Finance* 60 (4): 1759–1790. <https://doi.org/10.1111/j.1540-6261.2005.00779.x>.
- Logue, Dennis E. 1973. "On the Pricing of Unseasoned Equity Issues: 1965-1969." *The Journal of Financial and Quantitative Analysis* 8 (1): 91–103. <https://doi.org/10.2307/2329751>.
- Loughran, Tim, and Jay R. Ritter. 2002. "Why Don't Issuers Get Upset About Leaving Money on the Table in IPOs?" *Review of Financial Studies* 15 (2): 413–444. <https://doi.org/10.1093/rfs/15.2.413>.
- Lowry, Michelle, and G. William Schwert. 2002. "IPO Market Cycles: Bubbles or Sequential Learning?" *The Journal of Finance* 57 (3): 1171–1200. <https://doi.org/10.1111/1540-6261.00458>.
- Lowry, Michelle, and Susan Shu. 2002. "Litigation Risk and IPO Underpricing." *Journal of Financial Economics* 65 (3): 309–335. [https://doi.org/10.1016/S0304-405X\(02\)00144-7](https://doi.org/10.1016/S0304-405X(02)00144-7).
- LSEG. n.d. "Russell US Indexes." LSEG. Accessed July 5, 2024. <https://www.lseg.com/en/ftse-russell/indices/russell-us#t-russell-3000>.
- Luo, Yongli, Fang Fang, and Omar A. Esqueda. 2012. "The Overseas Listing Puzzle: Post-IPO Performance of Chinese Stocks and ADRs in the U.S. Market." *Journal of Multinational Financial Management* 22 (5): 193–211. <https://doi.org/10.1016/j.mulfin.2012.06.008>.
- Mello, Antonio S., and John E. Parsons. 1998. "Going Public and the Ownership Structure of the Firm." *Journal of Financial Economics* 49 (1): 79–109. [https://doi.org/10.1016/S0304-405X\(98\)00018-X](https://doi.org/10.1016/S0304-405X(98)00018-X).
- Miller, Edward M. 1977. "Risk, Uncertainty, and Divergence of Opinion." *The Journal of Finance* 32 (4): 1151–1168. <https://doi.org/10.1111/j.1540-6261.1977.tb03317.x>.
- Muscarella, Chris J., and Michael R. Vetsuypens. 1989. "A Simple Test of Baron's Model of IPO Underpricing." *Journal of Financial Economics* 24 (1): 125–135. [https://doi.org/10.1016/0304-405X\(89\)90074-3](https://doi.org/10.1016/0304-405X(89)90074-3).
- Pagano, Marco, Fabio Panetta, and Luigi Zingales. 1998. "Why Do Companies Go Public? An Empirical Analysis." *The Journal of Finance* 53 (1): 27–64. <https://doi.org/10.1111/0022-1082.25448>.
- Pástor, Luboš, and Pietro Veronesi. 2005. "Rational IPO Waves." *The Journal of Finance* 60 (4): 1713–1757. <https://doi.org/10.1111/j.1540-6261.2005.00778.x>.
- Purnanandam, Amiyatosh K., and Bhaskaran Swaminathan. 2004. "Are IPOs Really Underpriced?" *Review of Financial Studies* 17 (3): 811–848. <https://doi.org/10.1093/rfs/hhg055>.
- Reilly, Frank K., and Kenneth Hatfield. 1969. "Investor Experience with New Stock Issues."

- Financial Analysts Journal* 25 (5): 73–80. <https://doi.org/10.2469/faj.v25.n5.73>.
- Ritter, Jay R. 1984. “The ‘Hot Issue’ Market of 1980.” *The Journal of Business* 57 (2): 215–240. <http://www.jstor.org/stable/2352736>.
- Ritter, Jay R. 1991. “The Long-Run Performance of Initial Public Offerings.” *The Journal of Finance* 46 (1): 3–27. <https://doi.org/10.1111/j.1540-6261.1991.tb03743.x>.
- Ritter, Jay R., and Ivo Welch. 2002. “A Review of IPO Activity, Pricing, and Allocations.” *The Journal of Finance* 57 (4): 1795–1828. <https://doi.org/10.1111/1540-6261.00478>.
- Ritter, Jay R. 2024a. “Initial Public Offerings: Foreign Companies Going Public in the U.S., 1980-2023” Warrington College of Business, University of Florida. Last modified January 19, 2024. Accessed August 31, 2024. <https://site.warrington.ufl.edu/ritter/ipo-data/>.
- Ritter, Jay R. 2024b. “IPO Long Run Returns: Initial Public Offerings: Updated Statistics.” Warrington College of Business, University of Florida. Last modified April 26, 2024. Accessed June 28, 2024. <https://site.warrington.ufl.edu/ritter/ipo-data/>.
- Rock, Kevin. “Why New Issues Are Underpriced.” *Journal of Financial Economics* 15, no. 1–2 (January 1986): 187–212. [https://doi.org/10.1016/0304-405X\(86\)90054-1](https://doi.org/10.1016/0304-405X(86)90054-1).
- Rydqvist, Kristian. 1997. “IPO Underpricing as Tax-Efficient Compensation.” *Journal of Banking & Finance* 21 (3): 295–313. [https://doi.org/10.1016/S0378-4266\(96\)00043-X](https://doi.org/10.1016/S0378-4266(96)00043-X).
- Schultz, Paul. 2003. “Pseudo Market Timing and the Long-Run Underperformance of IPOs.” *The Journal of Finance* 58 (2): 483–517. <https://doi.org/10.1111/1540-6261.00535>.
- S&P Global. n.d. “S&P 500.” S&P Global. Accessed July 5, 2024. <https://www.spglobal.com/spdji/en/indices/equity/sp-500/#overview>.
- Stoughton, Neal M, and Josef Zechner. 1998. “IPO-Mechanisms, Monitoring and Ownership Structure.” *Journal of Financial Economics* 49 (1): 45–77. [https://doi.org/10.1016/S0304-405X\(98\)00017-8](https://doi.org/10.1016/S0304-405X(98)00017-8).
- Teoh, Siew Hong, Ivo Welch, and T.J. Wong. 1998. “Earnings Management and the Long-Run Market Performance of Initial Public Offerings.” *The Journal of Finance* 53 (6): 1935–1974. <https://doi.org/10.1111/0022-1082.00079>.
- Tiniç, Seha M. 1988. “Anatomy of Initial Public Offerings of Common Stock.” *The Journal of Finance* 43 (4): 789–822. <https://doi.org/10.1111/j.1540-6261.1988.tb02606.x>.
- Welch, Ivo. 1992. “Sequential Sales, Learning, and Cascades.” *The Journal of Finance* 47 (2): 695–732. <https://doi.org/10.1111/j.1540-6261.1992.tb04406.x>.
- Wu, Congsheng. 2012. “Country Risk and Valuation of US-listed Foreign IPOs.” *Managerial Finance* 38 (10): 939–957. <https://doi.org/10.1108/03074351211255155>.
- Yang, Ting, and Sie Ting Lau. 2010. “An Empirical Investigation of Yankee Stock Offerings.” *Review of Quantitative Finance and Accounting* 34 (3): 351–370. <https://doi.org/10.1007/s11156-009-0135-x>.
- Zaheer, S. 1995. “Overcoming the Liability of Foreignness.” *Academy of Management Journal* 38 (2): 341–363. <https://doi.org/10.2307/256683>.

9 Appendix

Table 1: Forms of Market Efficiency

Form of Market Efficiency	Definition	Implications
Weak Form Efficiency	Prices reflect all past market data such as stock prices and volume.	Technical analysis (using past prices and volumes) cannot consistently achieve excess returns.
Semi-Strong Form Efficiency	Prices reflect all publicly available information, including past market data, financial statements, news, etc.	Fundamental analysis (using public information) cannot consistently achieve excess returns.
Strong Form Efficiency	Prices reflect all information, both public and private, including insider information.	Not even insider information can provide investors with an advantage to consistently achieve excess returns.

Source: Own illustration, based on Fama (1970, 383-391)

Table 2: Assessment Criteria of the Economic Freedom Index

Category	Assessment Factor	Description
Rule of Law	Property Rights	Evaluates the extent to which private property is protected by law.
	Judicial Effectiveness	Assesses the efficiency and independence of the judicial system.
	Government Integrity	Measures the level of corruption within the government.
Government Size	Tax Burden	Analyzes the tax rates and the overall tax burden on individuals and businesses.
	Government Spending	Examines the level of government expenditures as a percentage of GDP.
	Fiscal Health	Evaluates the sustainability of government debt and fiscal balance.
Regulatory Efficiency	Business Freedom	Measures the ease of starting, operating, and closing a business.
	Labor Freedom	Assesses the flexibility of the labor market, including regulations and practices.
	Monetary Freedom	Evaluates price stability and the absence of controls over prices and wages.

Category	Assessment Factor	Description
Open Markets	Trade Freedom	Measures the absence of tariffs and other barriers to the free flow of goods and services.
	Investment Freedom	Assesses the ability to freely invest and move capital, both domestically and internationally.
	Financial Freedom	Evaluates the efficiency and independence of the financial sector.

Source: Own illustration, based on Heritage Foundation (2023, 1)

Table 3: IPO Offer Sizes in USD (M)

Measure	Overall	Domestic	International
Maximum	19,650	19,650 Visa Inc. (2008)	2,606 Pagseguro Digital Ltd. (2018)
Mean	246	249	217
Median	104	104	94
Minimum	0	0	0

Source: Own illustration, based on Bloomberg (2024)

Table 4: Number of Foreign IPOs in the USA by Country

Region	Country	Number of IPOs
APAC	China	64
EMEA	Israel	60
Americas	Canada	42
EMEA	United Kingdom	20
EMEA	Greece	15
EMEA	Netherlands	14
EMEA	Ireland	12
Americas	Brazil	11
EMEA	Switzerland	11
APAC	Hong Kong	7
EMEA	Luxembourg	5
Americas	Argentina	4
EMEA	Germany	4
EMEA	United Arab Emirates	4
EMEA	Russia	3
APAC	India	2
EMEA	Italy	2
APAC	Singapore	2
APAC	Taiwan	2

Region	Country	Number of IPOs
APAC	Australia	1
Americas	Bahamas	1
EMEA	Belgium	1
Americas	Costa Rica	1
EMEA	Denmark	1
EMEA	France	1
EMEA	Iceland	1
APAC	Indonesia	1
Americas	Panama	1
Americas	Peru	1
EMEA	Spain	1
Total		295

Source: Own illustration, based on Bloomberg (2024)

Table 6: Underpricing of International IPOs

Statistical Variable	Underpricing (All Variables in log Returns)
Mean	11.47%
Median	3.92%
Standard Deviation	0.18
Range	91.17%
p-value (two-tailed test)	0.00

Source: Own illustration, based on Bloomberg (2024)

Table 7: Underpricing of Domestic IPOs

Statistical Variable	Underpricing (All Variables in log Returns)
Mean	13.11%
Median	7.56%
Standard Deviation	0.17
Range	92.09%
p-value (two-tailed test)	4.12E-261

Source: Own illustration, based on Bloomberg (2024)

Table 9: Post-IPO Share Price Performance of International IPOs (Market-adjusted)

Statistical Variable (All Variables in log Returns)	6 Months	1 Year	3 Years
Mean	-7.14%	-29.75%	-39.70%
Median	-3.71%	-24.68%	-42.08%
Standard Deviation	0.45	0.71	1.31
Range	240.52%	349.19%	839.62%
p-value (two-tailed test)	0.0005	0.0000	0.0000

Source: Own illustration, based on Bloomberg (2024)

Table 10: Post-IPO Share Price Performance of Domestic IPOs (Market-adjusted)

Statistical Variable (All Variables in log Returns)	6 Months	1 Year	3 Years
Mean	2.25%	-12.00%	-21.06%
Median	6.41%	-2.28%	-9.62%
Standard Deviation	0.17	0.67	1.23
Range	249.86%	412.56%	915.44%
p-value (two-tailed test)	8.36E-01	5.68E-30	7.20E-39

Source: Own illustration, based on Bloomberg (2024)

Table 12: Underpricing Regression Analysis

OLS Regression Results						
=====						
Dep. Variable:	log Offer To 1st Open	R-squared:	0.170			
Model:	OLS	Adj. R-squared:	0.144			
Method:	Least Squares	F-statistic:	6.500			
Date:	-	Prob (F-statistic):	1.02e-64			
Time:	-	Log-Likelihood:	1237.7			
No. Observations:	2922	AIC:	-2295.			
Df Residuals:	2832	BIC:	-1757.			
Df Model:	89					
Covariance Type:	nonrobust					
=====						
	coef	std err	t	P> t	[0.025	0.975]

const	-0.1247	0.097	-1.292	0.197	-0.314	0.065
Domestic IPO Dummy	0.0289	0.014	2.089	0.037	0.002	0.056
Economic Freedom Index Ranking	0.0004	0.000	1.823	0.068	-2.88e-05	0.001
log Offer Size in USD (M)	0.0221	0.003	8.061	0.000	0.017	0.027
Year_2001	-0.1077	0.020	-5.300	0.000	-0.148	-0.068
Year_2002	-0.1187	0.021	-5.550	0.000	-0.161	-0.077
Year_2003	-0.0632	0.021	-3.044	0.002	-0.104	-0.022
Year_2004	-0.0945	0.015	-6.361	0.000	-0.124	-0.065
Year_2005	-0.1093	0.015	-7.099	0.000	-0.139	-0.079
Year_2006	-0.1004	0.016	-6.410	0.000	-0.131	-0.070
Year_2007	-0.1071	0.016	-6.888	0.000	-0.138	-0.077
Year_2008	-0.0252	0.035	-0.718	0.473	-0.094	0.044
Year_2009	-0.1263	0.026	-4.880	0.000	-0.177	-0.076
Year_2010	-0.1235	0.018	-6.819	0.000	-0.159	-0.088
Year_2011	-0.1154	0.019	-6.091	0.000	-0.153	-0.078
Year_2012	-0.0735	0.018	-3.983	0.000	-0.110	-0.037
Year_2013	-0.0512	0.016	-3.239	0.001	-0.082	-0.020
Year_2014	-0.0689	0.014	-4.775	0.000	-0.097	-0.041
Year_2015	-0.0540	0.017	-3.245	0.001	-0.087	-0.021
Year_2016	-0.0645	0.019	-3.356	0.001	-0.102	-0.027
Year_2017	-0.0663	0.017	-3.911	0.000	-0.099	-0.033
Year_2018	-0.0468	0.016	-2.861	0.004	-0.079	-0.015
Year_2019	-0.0452	0.018	-2.574	0.010	-0.080	-0.011

	coef	std err	t	P> t	[0.025	0.975]
Year_2020	0.0082	0.016	0.510	0.610	-0.023	0.040
Industry_Advertising	0.2865	0.101	2.841	0.005	0.089	0.484
Industry_Aerospace/Defense	0.1731	0.104	1.658	0.098	-0.032	0.378
Industry_Agriculture	0.1980	0.110	1.808	0.071	-0.017	0.413
Industry_Airlines	0.1717	0.106	1.613	0.107	-0.037	0.380
Industry_Apparel	0.3229	0.104	3.096	0.002	0.118	0.527
Industry_Auto Manufacturers	0.1847	0.112	1.655	0.098	-0.034	0.404
Industry_Auto Parts&Equipment	0.1403	0.102	1.373	0.170	-0.060	0.341
Industry_Banks	0.1599	0.094	1.692	0.091	-0.025	0.345
Industry_Beverages	0.2636	0.107	2.471	0.014	0.054	0.473
Industry_Biotechnology	0.1925	0.094	2.050	0.040	0.008	0.377
Industry_Building Materials	0.1500	0.100	1.495	0.135	-0.047	0.347
Industry_Chemicals	0.0975	0.099	0.984	0.325	-0.097	0.292
Industry_Coal	0.1336	0.112	1.197	0.231	-0.085	0.352
Industry_Commercial Services	0.1615	0.095	1.707	0.088	-0.024	0.347
Industry_Computers	0.2239	0.095	2.360	0.018	0.038	0.410
Industry_Cosmetics/Personal Care	0.1968	0.118	1.670	0.095	-0.034	0.428
Industry_Distribution/Wholesale	0.1456	0.101	1.440	0.150	-0.053	0.344
Industry_Diversified Finan Serv	0.1624	0.094	1.719	0.086	-0.023	0.348
Industry_Electric	0.1526	0.102	1.502	0.133	-0.047	0.352
Industry_Electrical Compo&Equip	0.2751	0.101	2.718	0.007	0.077	0.474
Industry_Electronics	0.1413	0.098	1.439	0.150	-0.051	0.334
Industry_Energy-Alternate Sources	0.1551	0.097	1.593	0.111	-0.036	0.346
Industry_Engineering&Construction	0.1453	0.118	1.231	0.218	-0.086	0.377
Industry_Entertainment	0.1208	0.100	1.211	0.226	-0.075	0.316
Industry_Environmental Control	0.1719	0.101	1.697	0.090	-0.027	0.371
Industry_Food	0.2101	0.097	2.157	0.031	0.019	0.401
Industry_Food Service	0.0705	0.147	0.478	0.633	-0.219	0.360
Industry_Forest Products&Paper	0.1711	0.187	0.917	0.359	-0.195	0.537
Industry_Gas	0.1098	0.186	0.589	0.556	-0.256	0.475
Industry_Hand/Machine Tools	-0.0055	0.186	-0.030	0.976	-0.371	0.360
Industry_Healthcare-Products	0.2010	0.094	2.131	0.033	0.016	0.386
Industry_Healthcare-Services	0.1892	0.095	1.984	0.047	0.002	0.376
Industry_Home Builders	0.1847	0.105	1.752	0.080	-0.022	0.392
Industry_Home Furnishings	0.2024	0.102	1.979	0.048	0.002	0.403
Industry_Household Products/Wares	0.4343	0.132	3.283	0.001	0.175	0.694
Industry_Housewares	0.2089	0.187	1.116	0.264	-0.158	0.576

	coef	std err	t	P> t	[0.025	0.975]
Industry_Insurance	0.1425	0.095	1.496	0.135	-0.044	0.329
Industry_Internet	0.2545	0.094	2.704	0.007	0.070	0.439
Industry_Investment Companies	0.0592	0.096	0.616	0.538	-0.129	0.248
Industry_Iron/Steel	0.1281	0.132	0.972	0.331	-0.130	0.387
Industry_Leisure Time	0.1030	0.100	1.035	0.301	-0.092	0.298
Industry_Lodging	0.0836	0.106	0.786	0.432	-0.125	0.292
Industry_Machinery-Constr&Mining	0.1832	0.114	1.602	0.109	-0.041	0.407
Industry_Machinery-Diversified	0.1213	0.102	1.188	0.235	-0.079	0.321
Industry_Media	0.0975	0.099	0.985	0.325	-0.097	0.292
Industry_Metal Fabricate/Hardware	0.1417	0.105	1.345	0.179	-0.065	0.348
Industry_Mining	0.0372	0.108	0.345	0.730	-0.174	0.249
Industry_Miscellaneous Manufactur	0.1313	0.108	1.218	0.223	-0.080	0.343
Industry_Office Furnishings	0.1549	0.186	0.831	0.406	-0.211	0.520
Industry_Office/Business Equip	0.3093	0.186	1.660	0.097	-0.056	0.675
Industry_Oil&Gas	0.1271	0.096	1.331	0.183	-0.060	0.314
Industry_Oil&Gas Services	0.1305	0.097	1.344	0.179	-0.060	0.321
Industry_Packaging&Containers	0.0514	0.105	0.489	0.625	-0.155	0.258
Industry_Pharmaceuticals	0.1519	0.094	1.615	0.106	-0.032	0.336
Industry_Pipelines	0.1008	0.105	0.958	0.338	-0.105	0.307
Industry_Private Equity	0.0677	0.118	0.574	0.566	-0.164	0.299
Industry_Real Estate	0.1075	0.101	1.062	0.288	-0.091	0.306
Industry_Retail	0.2372	0.095	2.510	0.012	0.052	0.423
Industry_Savings&Loans	0.2377	0.096	2.486	0.013	0.050	0.425
Industry_Semiconductors	0.2059	0.095	2.166	0.030	0.020	0.392
Industry_Software	0.2472	0.094	2.632	0.009	0.063	0.431
Industry_Telecommunications	0.2310	0.095	2.442	0.015	0.046	0.416
Industry_Toys/Games/Hobbies	0.2354	0.148	1.592	0.112	-0.055	0.525
Industry_Transportation	0.0967	0.097	1.001	0.317	-0.093	0.286
Industry_Trucking&Leasing	0.0559	0.148	0.379	0.705	-0.233	0.345
Industry_Water	0.1078	0.134	0.806	0.421	-0.155	0.370
Omnibus:	521.986	Durbin-Watson:		0.310		
Prob(Omnibus):	0.000	Jarque-Bera (JB):		951.826		
Skew:	1.114	Prob(JB):		2.06e-207		
Kurtosis:	4.691	Cond. No.		6.38e+03		

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

[2] The condition number is large, $6.38e+03$. This might indicate that there are strong multicollinearity or other numerical problems.

Source: Own illustration, based on Bloomberg (2024)

Table 13: Three-year Long-run Regression Analysis

OLS Regression Results

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=====
Dep. Variable: Underlying log Performance vs log RAY 3y    R-squared:                0.083
Model:                                                    OLS          Adj. R-squared:          0.055
Method:                                                    Least Squares    F-statistic:            2.931
Date:                                                       -              Prob (F-statistic):      1.60e-17
Time:                                                       -              Log-Likelihood:          -4648.6
No. Observations:                                         2921          AIC:                    9475.
Df Residuals:                                             2832          BIC:                    1.001e+04
Df Model:                                                 88
Covariance Type:                                         nonrobust
=====

```

	coef	std err	t	P> t	[0.025	0.975]
const	-1.6703	0.725	-2.305	0.021	-3.091	-0.249
Domestic IPO Dummy	0.1020	0.104	0.983	0.326	-0.102	0.305
Economic Freedom Index Ranking	-0.0003	0.002	-0.185	0.853	-0.003	0.003
log Offer Size in USD (M)	0.0465	0.021	2.215	0.027	0.005	0.088
Year_2001	0.3996	0.153	2.614	0.009	0.100	0.699
Year_2002	0.3771	0.158	2.380	0.017	0.066	0.688
Year_2003	0.1116	0.158	0.706	0.480	-0.198	0.421
Year_2004	0.3978	0.112	3.558	0.000	0.179	0.617
Year_2005	0.2689	0.116	2.328	0.020	0.042	0.495
Year_2006	0.1853	0.119	1.560	0.119	-0.048	0.418
Year_2007	0.4656	0.117	3.980	0.000	0.236	0.695
Year_2008	0.5519	0.259	2.132	0.033	0.044	1.060
Year_2009	0.0915	0.192	0.477	0.633	-0.284	0.468
Year_2010	0.2792	0.136	2.058	0.040	0.013	0.545
Year_2011	0.2501	0.143	1.750	0.080	-0.030	0.530
Year_2012	0.4886	0.137	3.568	0.000	0.220	0.757
Year_2013	0.3403	0.118	2.891	0.004	0.109	0.571
Year_2014	0.4149	0.107	3.861	0.000	0.204	0.626
Year_2015	0.4386	0.125	3.504	0.000	0.193	0.684
Year_2016	0.5198	0.146	3.557	0.000	0.233	0.806
Year_2017	0.3671	0.126	2.915	0.004	0.120	0.614
Year_2018	0.3813	0.121	3.148	0.002	0.144	0.619
Year_2019	0.1139	0.127	0.895	0.371	-0.136	0.363

	coef	std err	t	P> t	[0.025	0.975]
Year_2020	-0.6121	0.116	-5.275	0.000	-0.840	-0.385
Industry_Advertising	0.2297	0.754	0.305	0.761	-1.248	1.707
Industry_Aerospace/Defense	1.0451	0.783	1.334	0.182	-0.491	2.581
Industry_Agriculture	1.1160	0.837	1.333	0.182	-0.525	2.757
Industry_Airlines	1.4283	0.808	1.767	0.077	-0.156	3.013
Industry_Apparel	0.7833	0.777	1.009	0.313	-0.739	2.306
Industry_Auto Manufacturers	0.8776	0.837	1.048	0.295	-0.764	2.519
Industry_Auto Parts&Equipment	0.7597	0.767	0.991	0.322	-0.743	2.263
Industry_Banks	1.0122	0.709	1.428	0.153	-0.377	2.402
Industry_Beverages	0.0530	0.800	0.066	0.947	-1.516	1.622
Industry_Biotechnology	1.0197	0.704	1.448	0.148	-0.361	2.401
Industry_Building Materials	0.7126	0.755	0.943	0.346	-0.769	2.194
Industry_Chemicals	0.9822	0.750	1.309	0.191	-0.489	2.453
Industry_Coal	1.0505	0.837	1.255	0.209	-0.590	2.691
Industry_Commercial Services	1.0199	0.709	1.437	0.151	-0.371	2.411
Industry_Computers	1.0075	0.711	1.418	0.156	-0.386	2.401
Industry_Cosmetics/Personal Care	0.4857	0.884	0.549	0.583	-1.248	2.219
Industry_Distribution/Wholesale	0.7938	0.762	1.042	0.297	-0.699	2.287
Industry_Diversified Finan Serv	0.9426	0.709	1.330	0.184	-0.447	2.333
Industry_Electric	0.5474	0.762	0.718	0.473	-0.947	2.042
Industry_Electrical Compo&Equip	0.5411	0.766	0.707	0.480	-0.960	2.042
Industry_Electronics	0.5595	0.735	0.761	0.447	-0.882	2.001
Industry_Energy-Alternate Sources	0.8665	0.736	1.178	0.239	-0.576	2.309
Industry_Engineering&Construction	1.4902	0.857	1.739	0.082	-0.190	3.170
Industry_Entertainment	0.4323	0.750	0.576	0.565	-1.039	1.903
Industry_Environmental Control	0.5572	0.763	0.730	0.465	-0.939	2.054
Industry_Food	1.0444	0.732	1.426	0.154	-0.391	2.480
Industry_Food Service	1.0207	1.106	0.923	0.356	-1.149	3.190
Industry_Forest Products&Paper	0.3868	1.113	0.348	0.728	-1.795	2.569
Industry_Gas	1.1059	1.398	0.791	0.429	-1.635	3.847
Industry_Hand/Machine Tools	0.5868	1.396	0.420	0.674	-2.151	3.325
Industry_Healthcare-Products	0.9817	0.708	1.388	0.165	-0.406	2.369
Industry_Healthcare-Services	1.0087	0.715	1.410	0.159	-0.394	2.411
Industry_Home Builders	0.7231	0.791	0.914	0.361	-0.828	2.274
Industry_Home Furnishings	0.8183	0.772	1.060	0.289	-0.695	2.332
Industry_Household Products/Wares	1.2499	1.104	1.132	0.258	-0.914	3.414
Industry_Housewares	2.8628	1.404	2.040	0.041	0.111	5.615

	coef	std err	t	P> t	[0.025	0.975]
Industry_Insurance	1.1574	0.715	1.620	0.105	-0.244	2.559
Industry_Internet	0.6556	0.706	0.929	0.353	-0.729	2.040
Industry_Investment Companies	0.7076	0.720	0.982	0.326	-0.705	2.120
Industry_Iron/Steel	1.2141	0.989	1.228	0.220	-0.725	3.153
Industry_Leisure Time	0.6061	0.751	0.808	0.419	-0.866	2.078
Industry_Lodging	1.0889	0.797	1.366	0.172	-0.474	2.652
Industry_Machinery-Constr&Mining	0.8184	0.837	0.977	0.328	-0.823	2.460
Industry_Machinery-Diversified	0.5429	0.766	0.709	0.478	-0.958	2.044
Industry_Media	0.4598	0.744	0.618	0.537	-0.999	1.919
Industry_Metal Fabricate/Hardware	0.4084	0.790	0.517	0.605	-1.141	1.958
Industry_Mining	0.3588	0.809	0.444	0.657	-1.227	1.944
Industry_Miscellaneous Manufactur	1.2069	0.821	1.470	0.142	-0.403	2.817
Industry_Office Furnishings	0.8100	1.398	0.579	0.562	-1.931	3.551
Industry_Oil&Gas	0.8462	0.717	1.181	0.238	-0.559	2.251
Industry_Oil&Gas Services	0.5506	0.728	0.756	0.450	-0.878	1.979
Industry_Packaging&Containers	0.4425	0.789	0.561	0.575	-1.104	1.989
Industry_Pharmaceuticals	1.0249	0.705	1.453	0.146	-0.358	2.408
Industry_Pipelines	0.8537	0.789	1.082	0.279	-0.694	2.401
Industry_Private Equity	-0.0569	0.856	-0.066	0.947	-1.736	1.622
Industry_Real Estate	0.6005	0.759	0.791	0.429	-0.889	2.090
Industry_Retail	0.9734	0.709	1.373	0.170	-0.417	2.364
Industry_Savings&Loans	1.3528	0.717	1.886	0.059	-0.054	2.759
Industry_Semiconductors	1.0602	0.713	1.487	0.137	-0.338	2.458
Industry_Software	0.8659	0.704	1.230	0.219	-0.515	2.247
Industry_Telecommunications	0.4985	0.709	0.703	0.482	-0.892	1.889
Industry_Toys/Games/Hobbies	1.0634	0.991	1.073	0.283	-0.880	3.007
Industry_Transportation	1.1902	0.726	1.638	0.101	-0.234	2.614
Industry_Trucking&Leasing	1.1319	1.107	1.023	0.306	-1.038	3.302
Industry_Water	0.7595	1.004	0.757	0.449	-1.208	2.727
Omnibus:	121.617	Durbin-Watson:	0.310			
Prob(Omnibus):	0.000	Jarque-Bera (JB):	309.122			
Skew:	-0.201	Prob(JB):	7.50e-68			
Kurtosis:	4.542	Cond. No.	6.15e+03			

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

[2] The condition number is large, $6.15e+03$. This might indicate that there are strong multicollinearity or other numerical problems.

Source: Own illustration, based on Bloomberg (2024)