The success of IPOs on firm competitors: Evidence from the U.S. in the tech sector

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Dissertation written under the supervision of Professor Geraldo Cerqueiro

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Abstract

This study investigates the impact of Initial Public Offerings (IPOs) on the stock performance of public traded competing firms in the U.S. technology sector. Using data from 1975 to 2023, it explores how IPO announcements affect (cumulative) abnormal returns (AR and CAR) and cumulative total returns (CTR) of industry incumbents. Event studies and cross-sectional regression analysis indicate a statistically significant negative impact on competitors' firm value, particularly around the IPO announcement and completion dates. Larger IPO firms exacerbate this effect, signaling competitive threats through higher financial resources and growth potential, which is particularly detrimental to incumbents with higher leverage due to their limited financial flexibility. Robustness tests, including alternative event windows and risk models such as the Fama-French Three-Factor Model, confirm these findings. Results suggest that IPOs intensify market concerns about incumbents' profitability and market share while occasionally offering positive externalities in scenarios of increased industry visibility. This study contributes to understanding the strategic implications of IPOs and highlights avenues for future research in diverse industries and markets.

Keywords: IPOs, (cumulative) abnormal returns, competitors, event study, cross-sectional regression

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Resumo

Este estudo investiga o impacto das Ofertas Públicas Iniciais (OPIs) no desempenho acionista das empresas concorrentes cotadas em bolsa no setor tecnológico dos EUA. Utilizando dados de 1975 a 2023, o estudo examina como os anúncios das OPIs afetam os retornos anormais (acumulados) (AR e CAR) e os retornos totais acumulados (CTR) das empresas concorrentes do setor tecnológico. Os estudos de eventos e análises de regressão transversal indicam um impacto negativo estatisticamente significativo no valor de mercado das empresas rivais, particularmente nas datas de anúncio e conclusão das OPIs. As empresas com maior valor de ativos que anunciam a sua intenção de se tornar públicas exacerbam este efeito, sinalizando ameaças competitivas devido aos seus recursos financeiros mais robustos e maior potencial de crescimento, o que prejudica as empresas concorrentes mais endividadas, dada a sua flexibilidade financeira limitada. Os testes de robustez, incluindo janelas de eventos alternativas e modelos de risco como o modelo de três fatores de Fama-French, corroboram estes resultados. Os resultados indicam que as OPIs intensificam as preocupações do mercado sobre a rentabilidade e a quota de mercado das empresas concorrentes, embora ocasionalmente ofereçam externalidades positivas em cenários de maior visibilidade do sector. Este estudo contribui para a compreensão das implicações estratégicas das OPIs e destaca caminhos para investigação futura em diversos sectores e mercados.

Palavras-chave: OPIs, retornos anormais (acumulados), empresas concorrentes, estudo de evento, análise de regressão transversal

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List of abbreviations

CAR – Cumulative Abnormal Return

CTR – Cumulative Total Return

IPO – Initial Public Offering

LNAGE - Natural Logarithm of AGE (difference between the sample IPO firm date and the IPO date of its competitor)

LNIPOSIZE - Natural Logarithm of The Total Funds Raised from the IPO

LNTACO - Natural Logarithm of Total Assets for IPO firm competitors

LNTAIPO - Natural Logarithm of Total Assets of the IPO firm

LNTDCO - Natural Logarithm of Total Debt for IPO firm competitors

LNTDIPO - Natural Logarithm of Total Debt of the IPO firm

Max - Maximum

Min – Minimum

N – Number of Observations (e.g., Rival Firms)

OLS – Ordinary Least Squares

P25 – 25th Percentile

P75 – 75th Percentile

RET15 - Median Return on the first 15 days of IPO firm

STDEV - Standard Deviation

TDTSH - Ratio of Shares Traded on the Day of Listing to the Total Number of Shares

U.S. – United States

UNDERP – Underpricing

1. Introduction

In the past decades, significant developments in the global financial landscape have emerged, with Initial Public Offerings becoming a powerful technique for companies to raise capital, strengthen their market position, and stimulate growth, thereby attracting considerable attention. While much research has examined IPO success as financial support and growth accelerator for the issuing companies, the effects on competitors remain a less explored yet equally important aspect of the process. The announcement of an IPO could signal a shift in the overall outlook for the industry, leading to significant valuation effects for incumbent firms, or it may prompt a revaluation of the competitive dynamics within the industry (Akhigbe, Borde & Whyte, 2003).

Even though the tech industry is no different from other sectors when it comes to overall economic development, the industry saw significant periods of growth. In the 1990s, the commercialization of the internet and the dot-com boom drove rapid expansion. In the late 2000s to early 2010s, advancements in mobile technology and the rise of cloud computing further accelerated growth. Recently, the early 2020s witnessed a digital transformation driven by the Covid-19 pandemic. As a result, IPO activity has been increasing, as companies aim to capitalize on expanding market opportunities and investor interest.

Between 1975 and 2023, major tech companies such as Amazon, Meta, Microsoft, Cisco, Oracle and Google (Alphabet) went public. In 2004, Google announced its intention of becoming publicly traded. The gains Google saw in the wake of its IPO, including increased capital and market visibility, signaled a promising future for online search engines. As a consequence, the stock prices of its competitors increased, with the IPO seen as evidence of a broad market open to competing incumbent firms (Lee, Bach & Baik, 2011; Lemonn, 2024). In 2019, there were reports of Uber unveiling its public offering, expected to seek a valuation of $90 billion to $100 billion. As a result, Lyft, Uber's competitor that become public in the same year, saw its stock dropping nearly 11% (Feiner, 2019). Similarly, on May 18, 2012, Facebook's weaker-than-expected debut dragged down several social media and Internet companies that hoped to benefit from the tech giant's halo effect, with Web 2.0 company Zynga Inc. seeing a nearly 15 percent drop (Oreskovic, 2012). These examples show that incumbents' market reactions to IPO announcements, especially for technology companies, are both positive and negative, which motivates future research on competitors' market reactions.

The recent surge in IPO activity within the tech industry has sparked considerable debate over its impact on competing firms. This study explores the effects of IPO announcements on the stock performance of industry incumbents, focusing on cumulative abnormal returns (CAR)

and cumulative total returns (CTR). Through event studies and cross-sectional regression analysis, the research reveals that, on average, incumbent firms experience significant declines in stock prices around IPO events. The findings suggest a competitive information transfer (McGilvery, Faff & Pathan, 2012) that amplifies market concerns about incumbents' profitability and market share, particularly when IPO firms exhibit robust financial health or high growth potential.

The results indicate a negative average CAR of -1.54% over the extended event window (-20, 20), with significant declines observed around IPO announcements, particularly on the first and third days within the (-8, 8) event window, and around completion dates. Robustness tests, including the use of alternative event windows and risk models such as the Fama-French Three-Factor Model, confirm the validity of these findings. Larger IPO firms heighten competitive pressures, reducing competitors' CAR by 0.884 percentage points per unit increase in firm size. Furthermore, using CTR as the dependent variable for robustness purposes reveals consistent patterns, with leveraged incumbents experiencing a 0.354 percentage point decrease in CTR in response to well-capitalized IPO entrants. These findings underscore the strategic competitive effects of IPOs on industry participants.

The structure of this research is as follows: the next section reviews the relevant literature [2.]. This is followed by a discussion of the data [3.], which includes an overview of the selected sample and its timeframe [3.1.], a description of the variables used [3.2.], and their descriptive statistics [4.]. The methodology section [5.] outlines the approaches employed, namely the event study method [5.1.] and the cross-sectional regression analysis [5.2.], where two sets of OLS regression models are conducted. The empirical results of both the event study and the OLS regressions are then presented [6.]. Section [7.] provides robustness checks, addressing alternative event windows and risk models for the event study, as well as alternative OLS specifications. These include changing the dependent variable from cumulative abnormal return (CAR) to cumulative total return (CTR) and introducing the natural logarithm of total debt of IPO firm competitors (LNTDCO) as a primary independent variable rather than a control variable. Finally, a section of discussion of results is displayed [8.], followed by an examination of the study's limitations and suggestions for future research [9.], and the conclusion of the dissertation [10.].

2. Literature Review

This chapter of the study aims to provide insights from prior research on how the success of initial public offerings (IPOs) (i.e., their success) impacts the firm value of industry competitors. This part is divided into three sub-sections: the first explores theories of market behaviour and corporate valuation, the second introduces IPOs and discusses their competitive implications, and the third examines investor reactions and insights on IPOs' impact on existing industry players.

2.1. Market Behaviour and Corporate Valuation

The conventional reasoning for understanding market reactions to new information is built on the efficient market hypothesis (EMH). The latest suggests that investors assess stock prices using all the available information known to them. If the efficient market hypothesis holds true, stock prices would reflect the accurate underlying value of the company. As a result, investors' response to new information would be impacted by how they perceive the impact of that information on the company's value. Because privately held information is not always available to all investors, the semi-strong form of the efficient market hypothesis highlights that at least all public available information is incorporated into stock prices (Fama, 1970). Semi-strong-form tests involve an event study, which is used to test the adjustment speed of asset prices in response to an event announcement released to the public (Woo et al., 2020).

A company and its group of stakeholders are the two agents that are involved in the economic and social valuation of the firm. Stakeholders are composed of investors, customers, employees, suppliers and the local community in which the company operates. On the first hand, the stakeholders seek higher quantity and quality of information about the main business of the firm. On the other hand, the managers, – who know more about the firm than its stakeholders -, release information strategically to the stakeholders (Saboo & Grewal, 2013). Signals are defined as activities in a market 'which by design or accident, alter the beliefs of, or convey information to, other individuals in the market.' (Spence, 1974). The stakeholder's reaction to a signal is influenced by the signal, the signaler and the signaling environment. The characteristics of the signal include credibility, which refers to the reliability and trustworthiness of the information being disclosed (Saboo & Grewal, 2013). If it presents a high cost, the more credible the signal can be interpreted (Billett, Ma & Yu, 2023). In addition, signals are most effective when the quality of a substance is harder to discern, as greater uncertainty will enhance the impact of the signal (Milgrom & Roberts, 1986). The signaling environment refers to the number of similar signals sent by the signaler or its peers in the recent

past, the state of the economy and the timing of when the signal is sent (Eshgui & Astvansh, 2023). The competitive impact of IPOs holds meaningful consequences for different agents, including investors, industry competitors, and issuing firms (Hsu, Reed & Rocholl, 2010).

The firm's announcement of IPO can be seen as a (positive) signal from the announcing firm of future market growth to the investors of competing incumbent firms in industries characterized by its growth and uncertainty (Benveniste, Busaba, and Wilhelm, 2002; Benveniste et al., 2003). This positive signal might be interpreted as increasing market demand and reduce concerns regarding the existing competing incumbents' future prospects (Mahajan, Sharma & Buzzell, 1993).

2.2. Initial Public Offerings (IPOs) and its Competitive Effects

An Initial Public Offering represents a pivotal moment during the operating cycle of a firm, indicating its transition from a privately held entity to a publicly traded firm, creating the opportunity to sell shares to a new group of investors for the first time (Pulikottil, 2023; McGilvery, Faff & Pathan, 2012).

The main motive why companies go public is to generate equity to finance their business operations rather than to take a loan from a financial institution as well as to access better liquidity and obtain funds from diversified investors (Farooq et al., 2021). By reaching a wide group of investors and raising a significant amount of capital, IPO firms tend to increase their production capacity and explore new growth opportunities (Billett, Ma & Yu, 2023). The success of the IPO is highly related with the IPO's after market price performance. When IPO price is set too high, it diminishes demand as investors tend to avoid the risk. Therefore, firms set the IPO price below the fair market price, increasing potential buyers – underpricing (Farooq et al., 2021).

Previous research by Hsu et al. (2010) have three main competitive effects of an IPO. Firstly, a firm going public gets recapitalized such that its debt-to-equity ratio gets reduced, allowing not also to be advantageous over much leveraged competitors, but also to give more flexibility at the usage of funds for future investments. Secondly, issuing companies have the benefit of being recently certified by top reputed investment banks, increasing the willingness to sign up to the particular IPO. Finally, if a firm invests in research and development (e.g., knowledge capital), it will develop more patents and designs, increasing its level of innovation and gaining a competitive advantage (Hsu, Reed & Rocholl, 2010; Kenton, 2019).

Firms delivering high-quality products are more likely to undergo an IPO. By listing, a company signals its willingness to be subject to the scrutiny of external market participants,

presenting a greater competitive threat to already public traded firms (Stoughton, Pong & Zechner, 2001). Industry players monitor the actions of each other to make thoughtful decisions based on them. Hence, a capital decision by a firm will affect its competitors whose response can be observed either through their actions or a change in the price of their stock (Chen & Ma, 2017).

2.3. Competing Incumbent Firms Investors' Reaction to IPOs and Insights

An Initial Public Offering (IPO) is a significant corporate event that can influence the way investors view a competitive position of a company in the market (Akhigbe, Borde & Whyte, 2003).

Investor perception of an IPO firm's competitors may enhance favourably as the IPO firm is more likely to share positive news and highlight optimistic industry prospects. Additionally, increased media coverage for IPO firms has a positive impact on their competitors by capturing greater investor attention (Chintya et al., 2020). Lee et al. (2011) found that CAR increases by approximately 0.478 percentage points for directly competing firms around IPO announcements within a three-day window. A favourable interpretation of the latest would the that the IPO firms and its incumbents operate in a growing and uncertain industries where a growing industry demand and better future prospects will be experienced. Whether the competing incumbent firms can take advantage of these positive externalities, they will be experiencing positive results. Particularly, an incumbent firm, which has a substantial investment in research and development, may absorb more of this increased demand in the industry. However, in a more concentrated market, competing incumbents are negatively impacted towards an IPO announcement (Lee, Bach & Baik, 2011).

Nevertheless, IPO firms' goal to heighten their competitive advantage could result in the reduction of their competitors' competitiveness. IPO firms can improve their competitive advantage in various ways, which include rejuvenating and acquiring new strategic assets, paying off debt, marketing expansion and sales promotion, and enhancing the working capital management (Ben Amor & Kooli, 2017). IPO firms that use their proceeds for debt repayment tend to pose a greater competitive threat to rival companies compared to those that direct their funds toward other purposes (Akhigbe, Borde & Whyte, 2003). As a consequence, previous literature highlights that a successful IPO weakens the performance of its industry competitors. On average, incumbent firms encounter declines in stock prices, with losses of roughly -1.0% of their market value, dwindling market shares, and significant deterioration in their operating performance around IPOs in their industries (Slovin, Sushka & Ferraro, 1995; Hsu, Reed &

Rocholl, 2010; Chemmanur & He, 2011; Chod & Lyandres, 2010). These findings are supported by Li et al. (2018) and McGilvery et al. (2012), who observed similar negative market reactions to IPO announcements in the Chinese and Australian stock markets, respectively, with the latter reporting a mean abnormal return of -0.30% on the announcement date. The study by Slovin, Sushka & Ferraro (1995) examined 107 IPO announcements, revealing a negative reaction among firm rivals, as IPO conveys unfavourable information to the market regarding industry prospects.

For instance, investors may take the above effect into consideration when deciding how to allocate their portfolios, industry incumbents could adjust their strategic position to navigate the shifting competitive landscape, and issuing companies might use an IPO to enhance their competitive advantage (Hsu, Reed & Rocholl, 2010). Moreover, the previous study by Hsu et al. (2010) highlight the economic significance of the negative effect: a significant IPO in the United States resulted in an aggregate market loss for its industry rivals totalling 1.81% of the S&P 500 market capitalization – a number considerable high compared to the 2.5% average market capitalization of IPO firms of relative to the industry's total market capitalization in the study. Additionally, industry competitors experienced an estimated 2.5% drop in the return on assets, 3.3% decline in sales growth and a 2.9% reduction in profitability.

However, industry incumbents' overall price reaction to IPO announcements could be insignificant (Akhigbe, Borde & Whyte, 2003). Since their sample is comprised of relatively small offerings – which present a low significant competitive threat -, their incorporation weakens the testing power, making it more difficult to identify a reaction (McGilvery, Faff & Pathan, 2012). Additionally, the event window begins at the completion of IPO assuming no abnormal performance leading up to the event (Hsu, Reed & Rocholl, 2010).

3. Data

This section will begin with a brief overview of the types of companies selected and the timeframe selected, followed by a discussion of the variables considered. Finally, it will present the descriptive statistics for these variables.

3.1. Sample Selection

In order to examine the impact of a firm's IPO announcement on competing incumbent firms in the U.S., an extensive data collection was conducted. The base sample of IPOs includes companies that announced such deals over the past 49 years (i.e., from 1975 to 2023), for which data was available from the Center for Research in Security Prices (CRSP) and COMPUSTAT. This sample was obtained from the SDC New Issues Database. To analyse the market reaction to these IPO announcements, only technology companies were selected, i.e., the *Issuer Macro Industry* was selected to be either *High Technology* or *Telecommunications*. The event date is defined as the announcement date of the IPO. Additional criteria were applied to include only IPO firms with complete data; firms not displaying the IPO success measure (i.e., *Percent Change Offer Price to Closing Price at Offer/First Trade*) as well as deals with a *Transaction Status* other than *Live* (indicating completed IPOs) were excluded. After filtering the data, the final sample of IPOs comprised 619 observations. Industry competitors were selected based on the requirement that these rival firms must have completed their listing prior to the IPO announcement date of the new market entrant. At least one publicly listed competitor in the same industry was chosen for each IPO announcement using the six-digit NAICS industry group classification. The final sample of industry competitors includes 747 observations for the initial set of 619 IPO firm announcements. Table 1 below shows the distribution of IPO filings in the technology sector, with annual filings ranging from a minimum of 0 during the first nine years of the sample period (reflecting the infancy of the technology sector) and in 1985, to a peak of 76 in 2021. This recent peak likely reflects a surge in investor interest and digital transformation driven by the COVID-19 pandemic.

Concerning the timespan used in this study, the period from 1975 to 2023 captures the rapid growth of the technology and telecommunications sectors, as major technological advancements and the rise of internet created new opportunities and challenges for both new entrants and incumbent firms, alongside major changes in the IPO landscape. This timeframe enables to understand how regulatory shifts and evolving investor behaviour have influenced the competitor reactions to IPO announcements in high-tech industries.

Table 1 - Distribution of IPOs (1984-2023)

This table presents the number of IPOs per year and the percentage of the total number of IPOs occurring each year. **While the sample analysis begins in 1975, the table displays data starting from 1984, the first year with an IPO.**

Year	All IPO Fillings	% of total
1984	26	4.20
1985	0	0.00
1986	18	2.91
1987	15	2.42
1988	2	0.32
1989	3	0.48
1990	4	0.65
1991	4	0.65
1992	6	0.97
1993	11	1.78
1994	9	1.45
1995	13	2.10
1996	15	2.42
1997	5	0.81
1998	5	0.81
1999	13	2.10
2000	4	0.65
2001	1	0.16
2002	1	0.16
2003	11	1.78
2004	31	5.01
2005	25	4.04
2006	29	4.68
2007	45	7.27
2008	1	0.16
2009	3	0.48
2010	6	0.97
2011	12	1.94
2012	22	3.55
2013	30	4.85
2014	36	5.82
2015	21	3.39
2016	11	1.78
2017	22	3.55
2018	25	4.04
2019	23	3.72
2020	28	4.52
2021	76	12.28
2022	3	0.48
2023	4	0.65
TOTAL	**619**	**100.00**

3.2. Variables

This section will provide a thorough explanation of the variables utilized in conducting this study. Firstly, the dependent variables CAR and CTR will be presented. Secondly, the independent variables will be addressed. Finally, the pertinent control variables will be outlined.

3.2.1. Dependent Variables

The variables selected to measure the performance of industry competitors were Cumulative Abnormal Return (CAR) and Cumulative Total Return (CTR), both observed over a period spanning from -15 to +15 relative to the IPO announcement date (t = 0). The cumulative abnormal return measures changes in competing firms' stock market values around an IPO announcement, helping investors and analysts assess actual performance relative to expectations. It indicates how much a stock's return exceeds or falls short of its expected return due to the announcement. A positive CAR suggests that an IPO announcement may benefit incumbent rivals (Stanek & Villanova, 2024; Lee, Bach & Baik, 2011).

Cumulative abnormal returns (CARs) were computed around the announcement event date across a range of windows (i.e., (-15,15)) to reflect abnormal industry competitor reaction across several periods (McGilvery, Faff & Pathan, 2012).

$$CAR_i = \sum_{t=1}^{t} AR_{i,t} \tag{1}$$

where $AR_{i,t}$ indicates the abnormal return for rival firm i on day t and is calculated as

$$AR_{i,t} = R_{i,t} - E(R_{i,t}) = R_{i,t} - (\alpha_i + \beta_i R_{m,t} + e_{i,t}) \tag{2}$$

in which $R_{i,t}$ is the rate of return for rival firm i for event day t, R_{mt} denotes rate of return on the CRSP equally weighted index on event day t, and the $e_{i,t}$ is the error term for rival firm i on event day t. Daily abnormal returns are computed as the equally weighted average abnormal return of all rival firms on the specific event window day (McGilvery, Faff & Pathan, 2012).

$$AR_t = \frac{1}{N} \sum_{t=1}^{t} AR_{i,t} \tag{3}$$

where N corresponds to the total number of rival firms in the final sample.

The market model (CAPM) was utilized to analyse whether industry incumbents realize abnormal returns at IPO firm announcements (Fama, 1977; Doukas & Travlos, 1988).

The cumulative total return refers to the total change in the investment price over a set time – it is an aggregate return and is expressed as a percentage (Chen, 2020). This measure

was solely employed to assess the robustness of the analysis, ensuring the reliability of the results across different evaluation metrics.

$$RET_{i,t} = \frac{Price_t - Price_{t-1}}{Price_{t-1}} \quad (4)$$

$$CTR_{i,t} = \sum_{Event\ Window\ Start}^{Event\ Window\ Start} RET_t \quad (5)$$

where $RET_{i,t}$ and $CTR_{i,t}$ indicates the total return and cumulative total return, respectively, for rival firm i on day t.

Both dependent variables were derived using the CRSP Event Study Module (U.S. Daily Event Study) from Wharton Research Data Services (WRDS).

3.2.2. Independent Variables

To assess the impact of an IPO firm announcement on the performance of industry incumbents (i.e., measured by CAR and CTR), the independent variables used were the Percentage Change from Offer Price to First Trade Closing Price (Underpricing – UNDERP), the Median Return on the first 15 days of IPO firm (RET15), the Natural Logarithm of Total Assets of the IPO firm (LNTAIPO) and the Natural Logarithm of Total Debt of IPO firm's competitors (LNTDCO). The natural logarithm in the last two is used to correct for potential skewness and reduce variation in scale, as firms' size and debt can vary significantly. The underpricing variable (UNDERP), which refers to initial returns (Ritter & Welch, 2002), is the most widely used measure of initial IPO outcomes (Daily et al., 2003). This measure of IPO success also reflects investor interest and initial demand for the offering (Beatty & Ritter, 1986) and it is linked to pre-IPO excitement (Staikouras & Tsatsanis, 2004). A highly underpriced IPO can generate enthusiasm across the industry, influencing rival companies, as it often attracts market and media attention or analyst coverage (Demers & Lewellen, 2003). Since both measures of competitor performance are calculated within the event window of (-15,15), this study also considers the median return over the first 15 days post-IPO as an additional measure of IPO success (RET15). Both explanatory variables were extracted from the SDC New Issues Database.

Furthermore, the Natural Logarithm of Total Assets of the IPO firm (LNTAIPO), which represents the firm size, is a key factor in determining the profitability and financial strength of a company. It can also serve as a competitive threat, potentially confounding the impact of IPO firms on their incumbent competitors (Mule, Mukras & Nzioka, 2015; Hsu, Reed & Rocholl,

2010). This measure (i.e., book value) encompasses all the resources, assets and capacity needed to operate and expand and was retrieved from SDC New Issues Database. Additionally, the Natural Logarithm of Total Debt for IPO firm competitors (LNTDCO), which gauges financial leverage, was obtained from COMPUSTAT. This variable represents the sum of the long-term debt and short-term debt of rival firms. High debt levels among competitors may indicate financial constraints, limiting their ability to compete with a well-capitalized IPO entrant, and thus negatively impacting the firm value (Jadiyappa et al, 2020). Moreover, RET15 will also function as a control variable, accounting for the short-term performance and investor sentiment following the IPO, which may influence the reaction of industry incumbents - except in sections [5.2.1.] and [6.2.1.]**.** Similarly, both LNTAIPO and LNTDCO will also serve as control variables - except in sections [5.2.2.] and [6.2.2.], respectively – to account for firm size and financial leverage, which might otherwise confound the relationships under examination.

3.2.3. Control variables

This sub-section outlines the control variables included in this research. This study controls for factors such as size, liquidity and investor confidence, financial leverage, magnitude and maturity.

To control for the impact of competing incumbents' size on the variation in their CAR and CTR, the Natural Logarithm of Total Assets for IPO firm competitors (LNTACO) was used, as larger firms may convey a stronger signal to investors than small firms. Stock price reactions to IPO announcements may differ between large and small competing firms (Lang & Stulz, 1992). This variable represents the total value of assets reported on the balance sheet of rival firms and was retrieved from COMPUSTAT.

To account for liquidity and investor confidence (Baker & Wurgler, 2006), trading volume was used as a variable. Although trading volume typically refers to the number of traded on the first day of listing, this study uses the ratio of shares traded on that day of listing to the total number of shares (TDTSH). This proportional measure better captures the intensity of trading and investor interest, making it more useful for analysing how the IPO affects competitors. Large trading volume, indicating increased buying and selling activity, often reflects an oversubscribed offering where demand surpasses supply, signalling strong investor interest (Pollock & Rindova, 2003; Reese, 1998). Such enthusiasm can shift investor focus away from competitors, potentially impacting their stock prices. Data for the number of shares traded on the first day and the total number of shares were both obtained from CRSP.

To control for financial leverage, the Natural Logarithm of Total Debt of the IPO firm (LNTDIPO) was chosen as the variable. Retrieved from SDC New Issues Database, it reflects the sum of current and non-current debt, indicating the extent to which the IPO firm relies on borrowed funds to finance its operations, assets and growth. If equity issuance by competing firms signals a scarcity of financial resources, investors in highly leveraged firms - which carry higher default risks - may respond negatively to the IPO announcements of these competitors (Lee, Bach & Baik, 2011).

To capture the effects of IPO magnitude, the Natural Logarithm of IPO Proceeds (LNIPOSIZE) was used. Sourced from the SDC New Issues Database, it represents the actual amount raised from the IPO and may influence the stock price reactions to competing firms' IPO announcements (Lee, Bach & Baik, 2011). As Ritter and Welch (2002) observed, total IPO proceeds from an IPO reflect the growth potential perceived by institutional investors, with higher proceeds signaling greater growth opportunities and more positive market sentiment.

To control for maturity, the Natural Logarithm of AGE (LNAGE) at the time of an IPO announcement was selected as a variable (Clark, 2002; Loughran & Ritter, 2004). It represents the difference between the IPO date of the company in the sample and the IPO date of its competitor (Chintya et al., 2020) and was also obtained from the SDC New Issues Database. A longer pre-IPO period increases the likelihood of a successful IPO, resulting in stronger stock performance. IPOs by older firms tend to convey a more positive signal of business opportunity and incumbent competitors.

As with the independent variables, using the natural logarithm helps correct for potential skewness and reduces variation in scale.

4. Descriptive Statistics

Due to insufficient returns from some industry competitors and the need for balanced data in this research, the final sample was reduced from 747 to 652 observations. The summary of key statistics for the final sample are presented in the table below.

Table 2 - Descriptive statistics

Category	Variables	N	Mean	P25	Median	P75	STDEV	Min	Max
Dependent	**CAR**	652	-0.01	-0.08	-0.01	0.06	0.14	-0.55	0.90
	CTR	652	0.02	-0.06	0.01	0.09	0.14	-0.60	1.05
Independent	**UNDERP**	652	1.19	0.00	0.18	0.40	12.75	-0.91	249.00
	RET15	652	1.67	0.00	0.20	0.43	24.78	-0.65	598.00
	LNTAIPO	652	3.94	2.43	4.28	5.51	2.35	-1.61	10.10
	LNTDCO	652	1.36	0.00	0.00	2.75	2.39	-2.30	9.38

Table 2 provides summary statistics for several variables based on a dataset of 652 observations. On average, the rival firms in this sample exhibit a -1% CAR and a 2% CTR, with the negative CAR indicating weak performance among industry incumbents. Additionally, there is substantial variability in IPO underpricing and RET15, with some firms experiencing minimal or extreme underpricing and first 15-day returns ranging from significant losses to high gains. The descriptive statistics of LNTAIPO and LNTDCO reveal that LNTAIPO has a relatively high mean and median, reflecting larger asset sizes for most IPO firms, while LNTDCO shows a lower mean and median, suggesting that many firms maintain modest debt levels.

5. Methodology

This chapter presents the methods used to investigate the impact of IPO success on firm competitors. Two primary methods are applied: an event study and cross-sectional regression models. To conduct the event study, the CRSP Event Study Module (U.S. Daily Event Study) from Wharton Research Data Services (WRDS) was used, while the regression analysis was performed using the statistical software *Stata.*

5.1. Event Study Approach

One objective of this research is to conduct an event study to examine the impact, such as the potential success, of IPO announcements on the market value of competitors (McWilliams & Siegel, 1997). Additionally, the event study was extended to investigate the further impact of IPO completion (or listing) on these competitors, allowing for further analysis whether the initial announcement effects persist once the IPO is finalized. An event study assesses the return behaviour of a group of firms experiencing a similar event, even if the event occurs at different points in time. Typically, for each security in the sample, the return during time period t relative to the event is defined as follows:

$$R_{i,t} = K_{i,\mathrm{t}} + e_{i,\mathrm{t}} \tag{6}$$

in which $K_{i,\mathrm{t}}$ indicates the normal (i.e., predicted return given a particular model of expected returns) and $e_{i,\mathrm{t}}$ is the component of returns that is abnormal or unexpected. The primary goal of an event study is to determine whether the cross-section distributional of returns is abnormal, signaling a systematic deviation from expected values (Kothari & Warner, 2007). This research uses the CRSP event study module (U.S. Daily Event Study) to conduct a technical event study following a standard market model approach. Specifically, the event study aims to investigate

whether the distribution of returns across different assets during a particular event deviates from normal circumstances. In other words, it examines whether asset returns during the event show patterns that differ from those predicted by past data or typical expectations. This research will focus on both the mean distribution of abnormal returns and the mean distribution of cumulative abnormal returns, with detailed estimation and explanations provided in section [3.2.1.].

The study design for the CRSP event study module incorporates a 180-day estimation window to project returns prior to the event date. A minimum of 70 valid returns within the estimation window was considered as a requirement for the analysis. To avoid potential confounding effects, a 1-day interval prior to the event day was introduced, ensuring no overlap between the estimation window and the event date.

Following Mikkelson and Partch's (1988) methodology, this study employs cross-sectional statistical measures, such as z-statistics, to evaluate the significance of performance metrics like AR and CAR. According to the literature review, there is no clear prediction regarding whether CAR will be positive or negative. Test statistics were employed to evaluate the significance of the recorded outcomes. Additionally, Patell Z-tests will be used to evaluate if abnormal returns significantly deviate from zero. Unlike many studies that rely on conventional statistical methods, this study considers potential differences in abnormal returns across firms and addresses the possibility of cross-correlation in these returns. The unique feature of the Patell Z statistic is its normalization process, where abnormal returns are standardized using the estimated variance from the return model before computing the test statistic. This standardization aims to enhance the statistical power of the testing procedure (Bhandari, 2021). If the event has no significant impact, the Patell test assumes that the scales abnormal returns have equal variances (Kolari & Pynnönen, 2010).

5.2. Cross-Sectional Regression Models

This section outlines the Ordinary Least Square (OLS) regression models used in this research to assess the impact of IPO success on rival firms. The models, along with their dependent, independent, and control variables, are described below.

5.2.1. Impact of UNDERP and RET15 on CAR with Control Variables

The first set of OLS regression models implemented in this study are as follows:

$$CAR_{i,t} = \alpha + \beta_1 UNDERP_{i,t} + e_{i,t} \quad (7)$$

$$CAR_{i,t} = \alpha + \beta_1 UNDERP_{i,t} + \beta_2 LNTAIPO_{i,t} + \beta_3 LNTDCO_{i,t} + \beta_4 LNTACO_{i,t} + \beta_5 TDTSH_{i,t} + \beta_6 LNTDIPO_{i,t} + \beta_7 LNIPOSIZE_{i,t} + \beta_8 LNAGE_{i,t} + e_{i,t} \quad (8)$$

$$CAR_{i,t} = \alpha + \beta_1 RET15_{i,t} + e_{i,t} \quad (9)$$

$$CAR_{i,t} = \alpha + \beta_1 UNDERP_{i,t} + \beta_2 LNTAIPO_{i,t} + \beta_3 LNTDCO_{i,t} + \beta_4 LNTACO_{i,t} + \beta_5 TDTSH_{i,t} + \beta_6 LNTDIPO_{i,t} + \beta_7 LNIPOSIZE_{i,t} + \beta_8 LNAGE_{i,t} + e_{i,t} \quad (10)$$

For these regression models, the dependent variable is CAR (cumulative abnormal return) in the event window (-15,15). The main independent variable is UNDERP (percentage change from offer price to first trade closing price) in models (1) and (2), and RET15 (median return on the first 15 days of IPO firm) in models 3 and 4. Additionally, models (2) and (4) include several control variables to account for potential additional factors that might influence CAR: LNTDCO (natural logarithm of total debt of the IPO firm competitor), LNTACO (natural logarithm of total assets for IPO competitors), TDTSH (ratio of shares traded on the first day of listing to the total number of shares), LNTDIPO (natural logarithm of total debt of the IPO firm), LNIPOSIZE (natural logarithm of IPO proceeds), LNTAIPO (natural logarithm of total assets of the IPO firm), and LNAGE (natural logarithm of age, representing the difference between the IPO date of the company in the sample and IPO date of its competitor). These variables are explained in detail in section [3.2.].

5.2.2. Impact of UNDERP and LNTAIPO on CAR with Control Variables

The second set of OLS regressions models used in this study are as follows:

$$CAR_{i,t} = \alpha + \beta_1 UNDERP_{i,t} + e_{i,t} \quad (11)$$

$$CAR_{i,t} = \alpha + \beta_1 UNDERP_{i,t} + \beta_2 RET15_{i,t} + \beta_3 LNTDCO_{i,t} + \beta_4 LNTACO_{i,t} + \beta_5 TDTSH_{i,t} + \beta_6 LNTDIPO_{i,t} + \beta_7 LNIPOSIZE_{i,t} + \beta_8 LNAGE_{i,t} + e_{i,t} \quad (12)$$

$$CAR_{i,t} = \alpha + \beta_1 LNTAIPO_{i,t} + e_{i,t} \quad (13)$$

$$CAR_{i,t} = \alpha + \beta_1 LNTAIPO_{i,t} + \beta_2 RET15_{i,t} + \beta_3 LNTDCO_{i,t} + \beta_4 LNTACO_{i,t} + \beta_5 TDTSH_{i,t} + \beta_6 LNTDIPO_{i,t} + \beta_7 LNIPOSIZE_{i,t} + \beta_8 LNAGE_{i,t} + e_{i,t} \quad (14)$$

In this analysis, the dependent variable (used across all models) and the control variables (included in models (6) and (8)) remain consistent with those in the first set of regression models, with one exception: LNTAIPO. Specifically, while UNDERP (the percentage change from the offer price to the first trade closing price) continues to serve as a key independent variable in models (5) and (6), LNTAIPO (the natural logarithm of total assets of the IPO firm) replaces RET15 as the main independent variable in models (7) and (8). A detailed explanation of these variables is provided in section [3.2.].

6. Empirical Results

This section provides the results of the event study and cross-sectional regression analysis conducted and, it is subdivided into two sub-sections. Each sub-section outlines the findings for one of the two methods implemented in this study.

6.1. Average rival firm reaction

This subsection reports the average price reaction of rival firms in the tech industry around both the IPO announcement and listing dates. As explained in detail in section [3.2.1.], abnormal returns for all competitors are averaged across each day surrounding the IPO announcement and completion dates. Figure 1 below presents a graphical representation of the cumulative abnormal returns (CAR) around the IPO announcement date, showing a clear negative trend. This suggests that, on average, rival firms in the tech industry experience a decline in stock prices following the announcement. Panel A of Table 3 complements these findings by visualizing the results of the event study based on the market model, using an event window of (-8,8). While the results show a positive but very close-to-zero abnormal return on the announcement day, significantly negative abnormal returns are observed on the first and third days following the IPO announcement, with values of -0.24% and -0.20%, respectively. These findings indicate a negative initial market response to IPO announcements, consistent with McGilvery et al. (2012), who suggest that abnormal reaction is negative due to the competitive information transfer. Although the mean CAR is overall negative (Figure 1), it is noteworthy that there are 312, 298, and 312 instances of positive abnormal returns on the t, t+1, and t+3 days around the announcement, respectively, corresponding to 48%, 46%, and 48% of the total. These results align with prior literature on IPO announcements and market reactions. Furthermore, when examining the Patell Z statistics, it is clear that the market reaction on the days following the announcement (e.g., t+1 and t+3) is statistically significant,

with a Patell Z scores of -1.7307 and -1.6991, respectively. This indicates that the probability of these results occurring by chance is very close to 0.

Figure 2 presents a graphical representation of the average CAR for rival firms around the IPO listing date. Similarly to Figure 1, Figure 2 also shows a distinct downward trend throughout the entire event window, with the decline beginning at the start. Panel B of Table 3 shows that the daily abnormal returns are significantly negative from t-2 leading up and including the completion date. Additionally, the abnormal return of -0.07% on the completion date may be the attributed to competitive information transfer, as suggested by McGilvery et al. (2012). Although the overall mean CAR is negative (Figure 2), it is noteworthy that 333 abnormal returns on the IPO listing date are positive, representing approximately 51% of the total. The results in Panel B of Table 3 are consistent with the findings of Hsu et al.'s (2010), who argue that stock prices tend to decline in the lead-up to the completion date as the market grows more confident in the IPO's success. In alignment with their research, Figure 2 also shows evidence of a negative market reaction after the listing date, which could reflect the release of additional information in the days following the IPO completion. When looking the Patell Z statistic, it is evident that the market reaction on the IPO completion date is significantly negative, with a Patell Z score of -1.9971, indicating that the probability of the results occurring by chance is very close to 0. This indicates that the likelihood of these results occurring by chance is extremely low.

Panel C of Table 3 presents estimates of cumulative abnormal returns (CARs) across several event windows around the announcement date. The cumulative abnormal return over the longest window (-20,20) is approximately -1.54% and statistically significant, indicating a larger impact than -1.28% found by Lee et al. (2011). Statistically significant negative CARs are also observed for the (-10,10) and (-9,9) windows. The (-15,15) window, used as the basis for the cross-sectional regression analysis, shows a significant negative CAR of -0.98%, though smaller than Lee et al.'s (2011) comparable result. In contrast, the (-5,5) and (-1,1) windows show no significant abnormal returns, aligning with findings by Akhigbe et al. (2003), who also report no evidence of abnormal returns over a similar event windows.

Overall, the event study methodology results suggest that tech industry experience share price declines around the announcement and completion of large IPOs.

Figure 1 - Cumulative abnormal returns around the IPO announcement date

This figure graphically displays the cumulative abnormal return, expressed as a percentage over the announcement period from -8 to 8 where day 0 denotes the IPO announcement date.

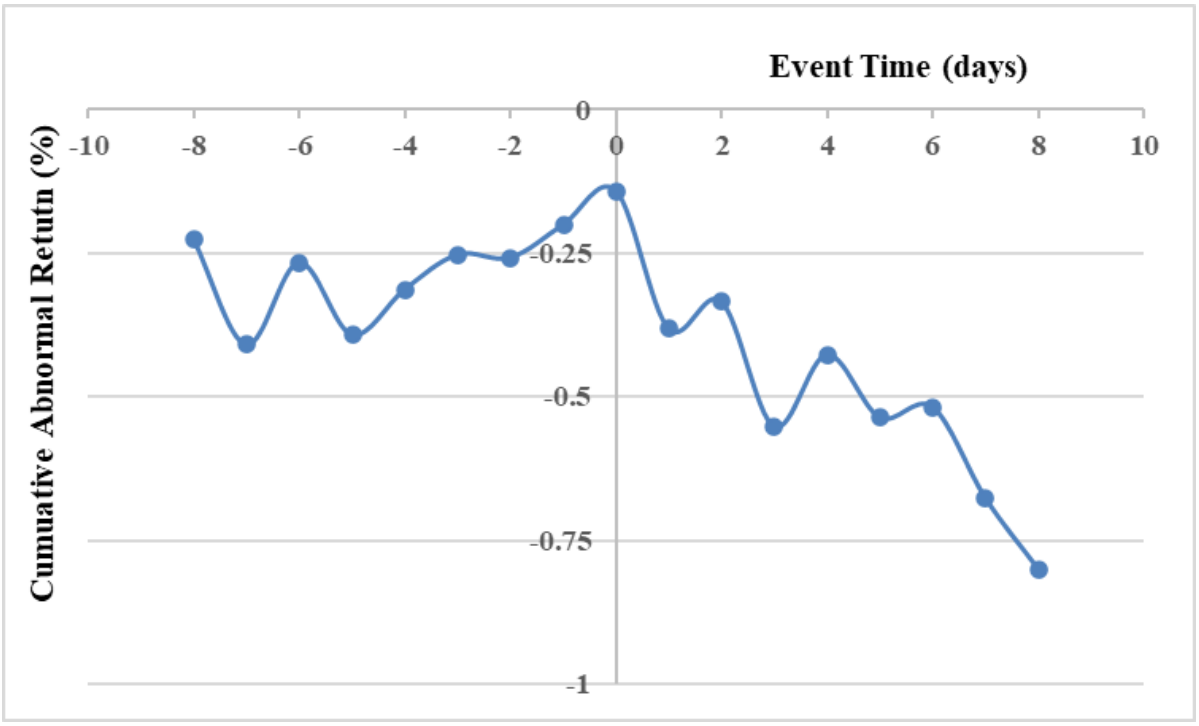

Figure 2 - Cumulative abnormal returns around the IPO listing date

This figure graphically displays the cumulative abnormal return, expressed as a percentage over the announcement period from 2 to 10 where day 0 denotes the IPO listing date.

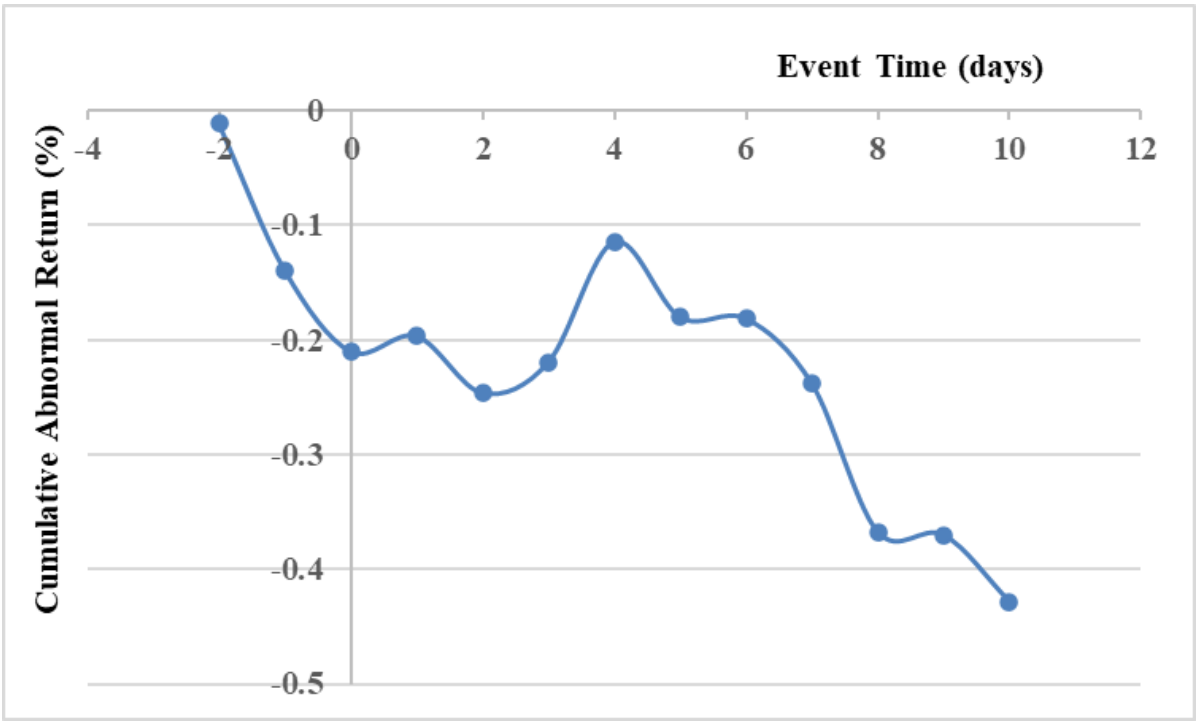

Table 3 – Average firm rival reaction

Rival firm abnormal returns. This table presents abnormal returns for rival firms around IPO announcements and completion dates. Rival firms are classified as publicly listed firms using the six-digit NAICS industry group classification. Panel A shows daily abnormal returns around the announcement date. Panel B shows daily abnormal returns around the completion date. Panel C shows cumulative abnormal returns (CARs) for various event windows around the announcement date. T-statistics and Patell Z scores are presented to assess significance. ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.

Event time	Mean AR (%)	T-statistic	Patell Z Score	No. of Rivals Firms	% Negative
Panel A: Daily Abnormal returns around the annoucement date					
-8	-0.2260	**-2.5332****	-1.6229	652	54
-7	-0.1837	-1.4561	**-1.9131***	652	52
-6	0.1430	1.3776	0.4621	652	54
-5	-0.1255	-1.2167	**-1.9680****	652	53
-4	0.0786	0.7473	0.9737	652	49
-3	0.0605	0.5959	0.7959	652	53
-2	-0.0051	-0.0482	0.9251	652	47
-1	0.0572	0.5980	0.3204	652	50
0	0.0590	0.5755	0.2784	652	52
1	-0.2402	**-2.5574****	**-1.7307***	652	54
2	0.0475	0.4729	1.0267	652	51
3	-0.2020	**-1.9806****	**´-1.6991***	652	52
4	0.1251	1.0540	1.5253	652	49
5	-0.1091	-1.1028	-1.6210	652	53
6	0.0179	0.1672	0.7020	652	50
7	-0.1583	**-1.8468***	-1.2683	652	55
8	-0.1234	-1.0533	-1.5299	652	55
Panel B: Daily Abnormal returns around the completion date					
-2	-0.0115	**-1,9674****	**-1,8932***	652	49
-1	-0.1280	**-2,1095****	**-1,9248***	652	54
0	-0.0706	**−2,1798****	**-1,9971****	652	49
1	0.0133	**-2,1484****	**-1,8017***	652	51
2	-0.0495	**-2,1835****	**-1,9177***	652	50
3	0.0268	**-2,0710****	**-1,8565***	652	50
4	0.1050	**-1,8770***	**-1,7168***	652	52
5	-0.0658	**-1,9409***	**-1,6836***	652	49
6	-0.0012	**-1,9181***	**-1,9145***	652	52
7	-0.0568	**-1,9721****	**-1,9463***	652	55
8	-0.1293	**-2,0771****	**-1,9268***	652	54
9	-0.0026	**-2,0521****	**-1,6528***	652	52
10	-0.0581	**-2,1044****	**-1,6967***	652	53

Event window	Mean CAR (%)	T-statistic	Patell Z Score	No. of Rivals Firms	% Negative
Panel C: Rival CARs around the annoucement date					
(-20,20)	-1.5405	**-2.3167****	**-2.1503****	652	56
(-15,15)	-0.9824	**-1.8908***	**-1.9393***	652	52
(-10,10)	-0.9085	**-2.0013****	**-2.1017****	652	49
(-9,9)	-0.8987	**-2.0751****	**-2.1219****	652	52
(-5,5)	-0.2039	-0.2068	-0.2145	652	53
(-1,1)	-0.1149	-0.5361	-0.5747	652	55

6.2. Cross-Sectional Regression Results

This section presents the results of two sets of OLS regressions, divided into two sub-sections, each detailing the outcomes of one set of models.

6.2.1. Impact of UNDERP and RET15 on CAR with Control Variables

Table 4 presents the results of the first set of OLS regression models, which examine cross-sectional variations in industry competitor abnormal returns. Specifically, columns (1), (2), (3), and (4) report the regression coefficients and t-statistics (denoted by stars indicating significance levels) for Equations (7), (8), (9), and (10), respectively. These models estimate the average effects of IPO firm and industry competitor variables on cumulative abnormal returns (CAR) within the (-15, 15) window, consistent with Akhigbe et al. (2003). The dependent variable is the equally weighted CAR for all rival firms within this window for a given IPO.

The regression estimates and t-statistics in columns (1) and (3) reveal that the independent variables UNDERP and RET15 are not statistically significant in explaining the variation in CAR, as their t-statistics fall outside the critical thresholds for 10%, 5%, or 1% significance levels. The coefficients suggest that a one-unit increase in UNDERP and RET15 corresponds to increases in CAR of 0.0287 and 0.00212 percentage points, respectively. Although statistically insignificant, the positive coefficients may reflect investor perceptions of IPO success (e.g., strong demand or high growth potential) as signaling positive prospects for the broader industry, especially within the tech sector.

In columns (2) and (4), where UNDERP and RET15 serve as the main independent variables alongside all control variables, the results for UNDERP and RET15 remain consistent with those in models (1) and (3), respectively. Among the control variables, only LNTAIPO is statistically significant and negative across columns (2) and (4) at the 10% significance level. The coefficients indicate that a one-unit increase in LNTAIPO leads to a reduction in CAR by 0.903 and 0.888 percentage points in models (2) and (4), respectively. This suggests that larger IPO firms may signal a competitive threat to industry rivals, as investors perceive their financial and operational advantages as enhancing their ability to dominate the market.

Notably, the addition of control variables in columns (2) and (4) increases the R-squared, indicating improved explanatory power.

Table 4 – First set of OLS regression results

In which the dependent variable is cumulative abnormal return (CAR) for (1), (2), (3) and (4). The main independent variables are UNDERP (IPO firm underpricing) for (1) and (2) and RET15 (median return over the first 15 days of IPO firm) for (3) and (4). The control variables are LNTAIPO (natural logarithm of IPO firm's total assets), LNTDCO (natural logarithm of total debt of IPO firm competitor), LNTACO (natural logarithm of total assets of IPO firm competitor), TDTSH (ratio of shares traded on the day of listing to the total number of shares), LNTDIPO (natural logarithm of IPO firm's total debt), LNIPOSIZE (natural logarithm of the funds raised from the IPO) and LNAGE (difference in days between the IPO firm date and the IPO date of its competitor). Standard errors are presented below the coefficients between parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.

	Dependent variable			
Variables	**(1)** $\boldsymbol{CAR_{(-15,15)}}$	**(2)** $\boldsymbol{CAR_{(-15,15)}}$	**(3)** $\boldsymbol{CAR_{(-15,15)}}$	**(4)** $\boldsymbol{CAR_{(-15,15)}}$
UNDERP	0.000287	0.00031	-	-
	(0.000438)	(0.00045)		
RET15	-	-	0.0000212	0.0000388
			(0.00023)	(0.00023)
LNTAIPO	-	**-0.00903***	-	**-0.00884***
		(0.004840)		**(0.004850)**
LNTDCO	-	-0.000941	-	-0.000904
		(0.00188)		(0.00188)
LNTACO	-	0.00196	-	0.00203
		(0.00330)		(0.00330)
TDTSH	-	-0.0125	-	-0.0121
		(0.0150)		(0.0150)
LNTDIPO	-	-0.000502	-	-0.000486
		(0.00290)		(0.00290)
LNIPOSIZE	-	0.00878	-	0.00809
		(0.00644)		(0.00646)
LNAGE	-	-0.000257	-	-0.000242
		(0.00537)		(0.00537)
N	652	652	652	652
R-squared	0.000661	0.010500	0.000014	0.009880

6.2.2. Impact of UNDERP and LNTAIPO on CAR with Control Variables

Table 5 presents the results of the second set of OLS regression models, analysing the cross-sectional-variation in industry competitor abnormal returns. Columns (1), (2), (3) and (4) display the regression coefficients and their corresponding t-statistics, indicated by stars denoting significance levels, for Equations (11), (12), (13) and (14), respectively. These models assess the average effects of IPO firm and industry competitor variables on the cumulative abnormal returns (CAR) within the (-15,15) window, consistent with the approach of Akhigbe et al. (2003). The dependent variable is the equally weighted CAR of all rival firms for a given IPO.

In columns (1) and (2), the regression estimate and t-statistic for the independent variable UNDERP show it is not statistically significant in explaining the variation in CAR, as its t-statistic does not exceed the critical thresholds for the 10%, 5%, or 1% significance levels. Consistent with the results of the initial regression models, the positive coefficient, while not statistically significant, could imply that investors perceive successful IPOs, such as those with strong demand or high growth potential, as signals of favourable conditions for the wider industry, particularly in the technology sector. Conversely, in column (3), the independent variable LNTAIPO is statistically significant, with a negative coefficient and a t-statistic below the critical value of -1.645. The coefficients imply that a one-unit increase in UNDERP results in a 0.0287 percentage point increase in CAR, while a one-unit increase in LNTAIPO corresponds to a 0.485 percentage point decrease in CAR.

In column (3), none of the control variables are statistically significant in explaining CAR variations.

In column (4), only LNTAIPO is significant, with a t-statistic below -1.645. The coefficient indicates that a one-unit increase in the IPO firm's total assets reduces CAR by 0.884 percentage points. Consistent with the findings from the first set of regression models, this result suggests that IPO firms with substantial assets may be perceived as a competitive threat to industry rivals, potentially diminishing investor confidence in the rivals' long-term prospects.

Furthermore, the inclusion of control variables in columns (2) and (4) increases the R-squared, highlighting improved explanatory power.

Table 5 – Second set of OLS regression results

In which the dependent variable is cumulative abnormal return (CAR) for (1), (2), (3) and (4). The main independent variables are UNDERP (IPO firm underpricing) for (1) and (2) and LNTAIPO (natural logarithm of IPO firm total assets) for (3) and (4). The control variables are RET15 (median return on the first 15 days of IPO firm), LNTDCO (natural logarithm of total debt of IPO firm competitor), LNTACO (natural logarithm of total assets of IPO firm competitor), TDTSH (ratio of shares traded on the day of listing to the total number of shares), LNTDIPO (natural logarithm of total debt of IPO firm), LNIPOSIZE (natural logarithm of the funds raised from the IPO) and LNAGE (difference in days between the IPO firm date and the IPO date of its competitor). Standard errors are presented below the coefficients between parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.

	Dependent variable			
Variables	**(1)** $\boldsymbol{CAR_{(-15,15)}}$	**(2)** $\boldsymbol{CAR_{(-15,15)}}$	**(3)** $\boldsymbol{CAR_{(-15,15)}}$	**(4)** $\boldsymbol{CAR_{(-15,15)}}$
UNDERP	0.000287	0.00166	-	-
	(0.000438)	(0.00120)		
LNTAIPO	-		**-0.00485****	**-0.00884***
			(0.00236)	**(0.00485)**
RET15	-	-0.000752	-	0.0000388
		(0.000620)		(0.000233)
LNTDCO	-	-0.000825	-	-0.000904
		(0.00188)		(0.00188)
LNTACO	-	0.00199	-	0.00203
		(0.00330)		(0.00330)
TDTSH	-	-0.0120	-	-0.0121
		(0.0150)		(0.0150)
LNTDIPO	-	-0.000530	-	-0.000486
		(0.00290)		(0.00290)
LNIPOSIZE	-	0.00821	-	0.00809
		(0.00645)		(0.00646)
LNAGE	-	-0.000301	-	-0.000242
		(0.00537)		(0.00537)
N	652	652	652	652
R-squared	0.000661	0.012800	0.006430	0.009880

7. Robustness Testing

This section outlines various robustness tests conducted to evaluate the reliability of the results across different conditions. It is essential to emphasize that two distinct types of tests/methods were performed.

7.1. Alternative Event Windows and Risk Models – Event Study

The first set of robustness tests employed the same statistical method as the empirical analysis—the event study approach using the CRSP Event Study Module (U.S. Daily Event Study). To ensure the robustness of the results, an additional risk model, the Fama and French Three-Factor (3FF) model, was used alongside the market model for return predictions. The Fama and French Three-Factor Model, introduced in 1992 by Eugene Fama Keneth French, is an asset pricing framework that builds upon the Capital Asset Pricing Model (CAPM). Unlike CAPM, which focuses solely on market risk, this model incorporates two additional factors: size risk (SMB) and value risk (HML) (Hayes, 2024).

$$CAR_i = \sum_{t=1}^{t} AR_{i,t} \qquad (1)$$

where $AR_{i,t}$ indicates the abnormal return for rival firm i on day t and is calculated as

$$AR_{i,t} = R_{i,t} - E(R_{i,t}) = R_{i,t} - (\alpha_i + \beta_{i,1}R_{m,t} + \beta_{i,2}SMB_{i,t} + \beta_{i,3}HML_{i,t} + e_{i,t}) \qquad (15)$$

in which $R_{i,t}$ is the rate of return for rival firm i on event day t, R_{mt} denotes the rate of return on the CRSP equally weighted index on event day t, $SMB_{i,t}$ reflects the size factor (small minus big) for rival firm i on event day t, $HML_{i,t}$ captures the book-to-market factor (high minus low) for rival firm i on event day t, and the $e_{i,t}$ is the error term for rival firm i on event day t.

Tests were conducted to detect abnormal occurrences across various event windows and risk models, with the primary windows being (-8, 8) and (-2, 10) around the IPO announcement and completion dates, respectively.

The robustness tests confirmed that the original findings were replicable when the 3FF model was used instead of the market model. While a small positive abnormal return (AR) of 0.03% was observed on IPO announcement day, negative ARs of -0.22% occurred on the first and third days after the IPO announcement. Additionally, significantly negative ARs were observed from $t-2$ through the IPO listing date when using the 3FF model. These results were statistically significant at the 5% and 10% levels, as evidenced by the corresponding t-statistics and Patell Z-scores in Appendix 1.

The estimates of cumulative abnormal returns (CARs) across several event windows surrounding the IPO announcement date show a small but significant decrease. For the largest

event window (-20,20), a statistically significant CAR of -1.53% is observed. Similarly, significant negative CARs are reported for the (-10,10) and (-9,9) windows, with values of approximately -0.83%. The (-15,15) window also shows a slightly less negative CAR of -0.94%. In contrast, the (-5,5) and (-1,1) windows indicate no statistically significant abnormal performance. These results align with prior findings obtained using the market model, as shown in Appendix 1.

Additional windows (-10, 10) and (-15, 15) were analysed to examine abnormal occurrences around the IPO announcement date. For both the market model and the Fama-French Three-Factor (3FF) model, statistically significant negative abnormal returns were observed on the first and third days following the IPO announcement. This indicates a negative abnormal market reaction after the IPO announcement. Consistent with prior findings, the results were statistically significant at the 5% and 10% levels, as evidenced by the corresponding t-statistics and Patell Z-scores presented in Appendices 2, 3, and 4.

7.2. Alternative OLS Specifications: Replacing CAR with CTR as the dependent variable

The second set of robustness testing involves conducting the same type of regressions presented before in the methodology, utilizing the same sample as before. It is aimed to evaluate whether the conclusions remain valid, and to determine if the findings are more pronounced in these regression than the first ones conducted (section [6.2.]). However, the cumulative total return (CTR) will now be used as a dependent variable for both sets of regression tests in this robustness section.

7.2.1. Impact of UNDERP and RET15 on CTR with Control Variables

As previously stated, for these regression models, the dependent variable is CTR (cumulative total return). The main independent variable is UNDERP (percentage change from offer price to first trade closing price) in columns (1) and (2), and RET15 (median return on the first 15 days of IPO firm) in models (3) and (4). Additionally, columns (2) and (4) include several control variables to account for potential additional factors that might influence CTR: LNTAIPO, LNTDCO, LNTACO, TDTSH, LNTDIPO, LNIPOSIZE, and LNAGE.

The regression results and t-statistics in columns (1) and (3) show that the independent variables UNDERP and RET15 are not statistically significant in explaining variations in CTR, as their t-statistics fail to meet the critical thresholds for significance at the 10%, 5%, or 1% levels. However, it is worth noting that, despite being close to zero, the negative coefficient of

RET15 could indicate a potential competitive threat to incumbent industry competitors. In terms of statistical significance, these findings align with previous results.

In columns (2) and (4), where UNDERP and RET15 are the main independent variables, the results remain consistent with those in columns (1) and (3). LNTDCO is the only significant control variable, showing a negative relationship with CTR (e.g., a one-unit increase in LNTDCO leads to a reduction in CTR by 0.357 and 0.354 percentage points in columns (2) and (4), respectively). This suggests that highly leveraged rivals may face financial constraints, limiting their ability to compete with well-capitalized IPO entrants (Jadiyappa et al., 2020). Additionally, the inclusion of control variables in these columns results in higher R-squared values, indicating improved explanatory power.

Table 6 - Robustness testing: First set of OLS regression results

In which the dependent variable is cumulative abnormal return (CAR) for (1), (2), (3) and (4). The main independent variables are UNDERP (IPO firm underpricing) for (1) and (2) and RET15 (median return over the first 15 days of IPO firm) for (3) and (4). The control variables are identical to those in **Table 4**, with the same definitions. Standard errors are presented below the coefficients between parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.

	Dependent variable			
Variables	**(1)** $CTR_{(-15,15)}$	**(2)** $CTR_{(-15,15)}$	**(3)** $CTR_{(-15,15)}$	**(4)** $CTR_{(-15,15)}$
UNDERP	0.000046	0.00015	-	-
	(0.000430)	(0.00044)		
RET15	-	-	-0.0000668	-0.00000107
			(0.00022)	(0.00023)
LNTAIPO	-	-0.006630	-	-0.0065000
		(0.004740)		(0.004750)
LNTDCO	-	**-0.00357***	-	**-0.00354***
		(0.00184)		**(0.00184)**
LNTACO	-	0.00310	-	0.00314
		(0.00324)		(0.00324)
TDTSH	-	-0.0168	-	-0.0166
		(0.0147)		(0.0147)
LNTDIPO	-	-0.000904	-	-0.000895
		(0.00284)		(0.00284)
LNIPOSIZE	-	0.00875	-	0.00830
		(0.00631)		(0.00633)
LNAGE	-	-0.007500	-	-0.007490
		(0.00526)		(0.00526)
N	652	652	652	652
R-squared	0.000018	0.017100	0.000014	0.016900

7.2.2. Impact of UNDERP and LNTDCO on CTR with Control Variables

In this subsection of second robustness testing, the dependent variable (used across all models) and the control variables (included in columns (2) and (4)) remain consistent with those in the first set of regression models, with one exception: LNTDCO. Specifically, while UNDERP (the percentage change from the offer price to the first trade closing price) continues to serve as a key independent variable in columns (1) and (2), LNTDCO (the natural logarithm of total debt of the IPO firm competitor) replaces RET15 as the main independent variable in models (3) and (4). A detailed explanation of these variables is provided in section [3.2.].

In columns (1) and (2), the regression estimates and t-statistics for the independent variable UNDERP indicate that it is not statistically significant in explaining variations in CTR, as its t-statistic falls below the critical thresholds for significance at the 10%, 5%, or 1% levels. On the other hand, in column (3), the newly introduced independent variable LNTDCO is statistically significant, showing a negative coefficient and a t-statistic less than the critical value of -1.645.

Additionally, in column (3), none of the control variables demonstrate statistical significance in explaining variations in CTR.

In column (4), LNTDCO remains the only significant variable, with a t-statistic below -1.645. The coefficient indicates that a one-unit increase in the total debt of IPO firm competitors results in a 0.354 percentage point decrease in CTR. Likewise, as noted in the first set of regressions in this robustness testing section, this implies that highly leveraged rival firms may indicate financial limitations, hindering their capacity to compete effectively against a well-funded IPO entrant (Jadiyappa et al., 2020).

Additionally, the inclusion of control variables in columns (2) and (4) increases the R-squared, indicating improved explanatory power.

Table 7 – Robustness testing: Second set of OLS regression results

In which the dependent variable is cumulative abnormal return (CAR) for (1), (2), (3) and (4). The main independent variables are UNDERP (IPO firm underpricing) for (1) and (2) and LNTDCO (natural logarithm of total debt of IPO firm competitor) for (3) and (4). The control variables are identical to those in **Table 5**, with the addition of LNTAIPO and the same definitions. Standard errors are presented below the coefficients between parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.

	Dependent variable			
Variables	**(1)** $CTR_{(-15,15)}$	**(2)** $CTR_{(-15,15)}$	**(3)** $CTR_{(-15,15)}$	**(4)** $CTR_{(-15,15)}$
UNDERP	0.000046	0.00111	-	-
	(0.000430)	(0.00118)		
LNTDCO	-	-	**-0.00344****	**-0.00354***
			(0.00144)	**(0.00184)**
RET15	-	-0.000555	-	-0.0000011
		(0.000608)		(0.000229)
LNTAIPO	-	-0.007730	-	-0.006500
		(0.00471)		(0.00475)
LNTACO	-	0.00022	-	0.00314
		(0.00286)		(0.00324)
TDTSH	-	-0.0150	-	-0.0166
		(0.0147)		(0.0147)
LNTDIPO	-	-0.000801	-	-0.000895
		(0.00285)		(0.00284)
LNIPOSIZE	-	0.00766	-	0.00830
		(0.00633)		(0.00633)
LNAGE	-	-0.007400	-	-0.007490
		(0.00527)		(0.00526)
N	652	652	652	652
R-squared	0.000018	0.012600	0.008700	0.016900

8. Discussion of findings

In general, negative market reactions to IPO announcements among competing incumbent firms often arise from concerns about increased competition and reduced market share. IPO firms can leverage the proceeds raised to enhance their competitive position by acquiring strategic assets, expanding marketing efforts, improving operational efficiency, or reducing debt, which poses a significant threat to rival firms, particularly in concentrated markets. Moreover, as highlighted by McGilvery et al. (2012), the negative initial market reaction to IPO announcements may stem from the transfer of competitive information. However, positive market reactions to IPO announcements among rival firms are often driven by increased media coverage of the IPO, growing industry demand or substantial investments in research and development by competitors (see literature review, section [2.2.]). The sample analysed shows a negative mean CAR and AR, suggesting that the market perceives IPO announcements as a negative signal for tech industry competitors. While both positive and negative ARs and CARs are observed - 298 and 312 positive abnormal reactions on t+1 and t +3 days around the announcement, respectively -, the overall mean remains notably negative, aligning with the literature that highlights mixed findings regarding rival firms' reactions to IPO announcements.

For tech companies, IPO announcements are often interpreted as efforts to strengthen operational capabilities or market position, posing a significant threat to incumbents. This negative interpretation by investors is reflected in mean abnormal returns of -0.24% and -0.20% on the first and third days following the announcements, respectively. When examining the evolution of CAR around the IPO announcement and IPO completion date, distinct patterns emerge: for the announcement, a negative market sentiment is observed immediately following the IPO disclosure, while for the completion date, the negative abnormal reaction begins even before the listing date, with a consistent downward trend throughout the event window. This suggests that some leakage of information regarding the IPO announcement may have exacerbated the negative impact, amplifying concerns among investors and intensifying the adverse market response. Such reactions indicate that competitors face challenges in profitability and sales growth, struggling to sustain their competitive edge.

Additionally, the size and resources of an IPO firm exacerbate this impact; a well-funded IPO entrant can expand internationally or acquire strategic assets, reducing competitors' cumulative abnormal return (CAR) by 0.357 percentage points. Similarly, the cumulative total return (CTR) of a highly leveraged competitor is reduced by 0.354 percentage points when an economically robust IPO firm enters the market. Notably, the distribution of abnormal returns

reveals that positive reactions tend to be less pronounced than negative ones, indicating a predominantly negative market sentiment toward IPO announcements for tech industry competitors.

However, although insignificant, it is noteworthy that a higher percentage change from the offer price to the first trade closing price of the IPO firm (UNDERP), as well as its median return over the first 15 days (RET15), tends to increase the CAR of rival firms. Such a strong IPO debut signals investor confidence, enhances sector visibility, and suggests growth opportunities, creating positive spillover effects on rival firms.

9. Limitations and further research

This section will outline the key limitations associated with the findings of this study, which could provide valuable avenues for further research.

Firstly, it is important to note that this study is confined to the U.S. technology sector, which may not fully capture industry-specific dynamics in other regions or industries with different competitive structures or levels of IPO activity. Future research could explore markets such as Europe or China, or sectors such as healthcare or retail, to compare results and assess the generalizability of the findings.

Secondly, this research focuses solely on publicly available data, such as CRSP and COMPUSTAT, thereby excluding smaller firms or private competitors not covered in these databases. To address this limitation, future studies could include both public and private competitors or analyse the effects of IPOs on upstream and downstream firms in the supply chain, providing a more comprehensive perspective.

Thirdly, even though the reasons why large corporations like Google, Facebook or Microsoft are announcing their IPOs may be homogenous and not a sign for serious operational problems, that may not be true for all companies that announced IPOs recently. Thus, analysing the reasons for the entering into the market and clustering them in internal and external factors while at the same time increasing the sample size would allow further conclusions regarding the market perception of IPO announcements among industry incumbents.

In addition, this study assumes uniform competitive pressures across technology firms but overlooks the unique dynamics of sub-industries (e.g., software vs. hardware) and their reliance on research and development (R&D). Future research could examine how sub-industry characteristics and IPO firms' R&D intensity influence competitors, identifying whether the impact is more significant in innovation-driven sectors or faster-paced markets.

Finally, this study employs cross-sectional regression analysis with specific control variables selected based on their potential influence on both CAR and CTR (the latter for robustness purposes). While factors such as firm size and leverage are included, other influences on competitor performance, such as macroeconomic conditions or investor sentiment, are not fully accounted for in the models. Future research could incorporate macroeconomic variables (e.g., interest rates, GDP growth) to evaluate their moderating effects on market reactions to IPO announcements. Expanding the range of variables may provide further insights and help validate the findings presented here.

10. Conclusion

The impact of IPOs on competing firms has garnered significant attention over the last few decades, particularly as the technology sector continues to evolve rapidly. Key milestones, such as the commercialization of the internet in the 1990s and the rise of mobile and cloud technologies in the 2000s, have reshaped competitive landscapes. Given this increasing relevance, understanding how IPO announcements affect incumbent firms' stock performance and market dynamics is crucial for enabling stakeholders to make informed strategic decisions.

In conclusion, this study reveals significant insights into the impact of IPO announcements on the market value of rival firms. The analysis demonstrates that the market value of industry incumbents is closely linked to these announcements. Statistical measures, including the t-statistic and Patell Z, confirm that both the mean abnormal return (AR) and mean cumulative abnormal return (CAR) are statistically significant, exceeding critical values at the 10% and 5% significance levels.

The findings highlight that IPO announcements generally elicit a negative investor response, with a mean abnormal return of -0.24% and -0.20% on the first and third days following the announcement, respectively, and a mean CAR of -1.54% over the (-20,20) event window. The size and financial strength of IPO firms exacerbate this impact, as well-funded entrants use their resources to expand internationally or acquire strategic assets, reducing competitors' CAR. Similarly, the cumulative total return (CTR) of highly leveraged rivals declines in response to strong IPO entrants, highlighting the competitive challenges faced by incumbents.

The fact there are both positive and negative market reactions towards IPO announcements is in line with what existing research provides as the market reaction is highly dependent on the context. Positive market reactions may occur when IPO announcements are accompanied by increased media coverage or signals of growing industry demand. However, announcements perceived as efforts to strengthen operational efficiency or competitive positioning often yield negative reactions, as they are seen as threats to market share and profitability. These negative abnormal returns may be explained by the perception that IPO announcements signal increased competition, as new entrants leverage raised capital to strengthen their market position.

The robustness of these findings is supported by their consistency across multiple event windows, such as (-10,10) and (-15,15), and through alternative prediction models, including the Fama and French Three-Factor Model (3FF).

Overall, the results demonstrate that IPO announcements in the tech industry tend to provoke significantly negative market reactions among rival firms, driven by competitive concerns. However, the ambiguous nature of market responses opens the door for further research into other industries and markets to explore varying dynamics and investor behaviour.

11. Appendices

Appendix 1. Average firm rival reaction: Robustness testing – Results for 3FF model

Rival firm abnormal returns. This table presents abnormal returns for rival firms around IPO announcements and completion dates. Rival firms are classified as publicly listed firms using the six-digit NAICS industry group classification. Panel A shows daily abnormal returns around the announcement date. Panel B shows daily abnormal returns around the completion date. Panel C shows cumulative abnormal returns (CARs) for various event windows around the announcement date. T-statistics and Patell Z scores are presented to assess significance. ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.

Event time	Mean AR (%)	T-statistic	Patell Z Score	No. of Rivals Firms	% Negative
Panel A: Daily Abnormal returns around the annoucement date					
-8	-0.2015	**-2.3587****	-1.4532	652	53
-7	-0.1321	-1.0578	**-1.7821***	652	52
-6	0.1491	1.4418	0.3198	652	55
-5	-0.0996	-1.01	**-1.6868***	652	54
-4	0.1097	1.0711	1.2827	652	50
-3	0.0197	0.2009	0.4941	652	52
-2	0.0169	0.1667	1.3677	652	47
-1	0.0323	0.3511	0.1501	652	49
0	0.0779	0.7872	0.367	652	51
1	-0.2210	**-2.4759****	**-1.658***	652	55
2	0.0262	0.276	0.8026	652	52
3	-0.2218	**-2.1593****	**-2.1838****	652	53
4	0.1244	1.0515	1.2067	652	50
5	-0.0933	-0.9889	-1.4983	652	55
6	-0.0279	-0.2709	0.5002	652	51
7	-0.1271	-1.5003	-1.18	652	53
8	-0.1346	-1.1539	**-1.821***	652	54
Panel B: Daily Abnormal returns around the completion date					
-2	-0.0115	**-1,9674****	**-1,8932***	652	49
-1	-0.1280	**-2,1095****	**-1,9248***	652	54
0	-0.0706	**−2,1798****	**-1,9971****	652	49
1	0.0133	**-2,1484****	**-1,8017***	652	51
2	-0.0495	**-2,1835****	**-1,9177***	652	50
3	0.0268	**-2,0710****	**-1,8565***	652	50
4	0.1050	**-1,8770***	**-1,7168***	652	52
5	-0.0658	**-1,9409***	**-1,6836***	652	49
6	-0.0012	**-1,9181***	**-1,9145***	652	52
7	-0.0568	**-1,9721****	**-1,9463***	652	55
8	-0.1293	**-2,0771****	**-1,9268***	652	54
9	-0.0026	**-2,0521****	**-1,6528***	652	52
10	-0.0581	**-2,1044****	**-1,6967***	652	53

Event window	Mean CAR (%)	T-statistic	Patell Z Score	No. of Rivals Firms	% Negative
Panel C: Rival CARs around the annoucement date					
(-20,20)	-1.5311	**-2.4284****	**-2.6884*****	652	55
(-15,15)	-0.9418	**-2.1095****	**-2.1731****	652	52
(-10,10)	-0.8304	**-2.1094****	**-2.2557****	652	49
(-9,9)	-0.8262	**-2.1460****	**-2.2540****	652	52
(-5,5)	-0.1796	-0.2722	-0.2852	652	55
(-1,1)	-0.0889	-0.5140	-0.5519	652	55

Appendix 2. Average firm rival reaction: Robustness testing – Results for Market Model and 3FF Model under event (-10,10) window

Rival firm abnormal returns. This table presents abnormal returns for rival firms around IPO announcements. Rival firms are classified as publicly listed firms using the six-digit NAICS industry group classification. T-statistics and Patell Z scores are presented to assess significance. ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.

Event time	Mean AR (%)	T-statistic	Patell Z Score	No. of Rivals Firms	% Negative
-10	0.0003	0.0029	-0.5427	652	52
-9	-0.0966	-0.9005	-1.4586	652	53
-8	-0.2277	**-2.5505****	-1.6116	652	54
-7	-0.1825	-1.4445	**-1.9681****	652	52
-6	0.1428	1.3744	0.4566	652	54
-5	-0.1278	-1.237	**-2.0459****	652	53
-4	0.0802	0.764	0.9777	652	49
-3	0.0608	0.599	0.76	652	52
-2	-0.0058	-0.0547	0.9081	652	47
-1	0.0581	0.6059	0.3421	652	50
0	0.0611	0.5958	0.2465	652	52
1	-0.2388	**-2.5447****	**-1.7326***	652	54
2	0.0475	0.4735	1.0251	652	51
3	-0.2031	**-1.9932****	-1.6374	652	53
4	0.1248	1.0487	1.5013	652	49
5	-0.1093	-1.1045	-1.6112	652	53
6	0.0148	0.1382	0.6922	652	50
7	-0.1599	**-1.863***	-1.2763	652	55
8	-0.1250	-1.0667	-1.5201	652	55
9	0.0171	0.1953	-0.7231	652	52
10	-0.0284	-0.3592	-0.1824	652	49

Event time	Mean AR (%)	T-statistic	Patell Z Score	No. of Rivals Firms	% Negative
-10	-0.0162	-0.1458	-0.7046	652	52
-9	-0.0845	-0.7803	-1.2991	652	54
-8	-0.1991	**-2.3365****	-1.4202	652	53
-7	-0.1334	-1.0669	-1.861	652	53
-6	0.1458	1.4084	0.2751	652	56
-5	-0.1017	-1.0285	**-1.7657***	652	54
-4	0.1102	1.0777	1.2812	652	50
-3	0.0180	0.1834	0.4519	652	53
-2	0.0182	0.179	1.3613	652	47
-1	0.0305	0.3339	0.1446	652	50
0	0.0776	0.7846	0.3347	652	50
1	-0.2210	**-2.4698****	**-1.688***	652	55
2	0.0236	0.2489	0.7736	652	52
3	-0.2256	**-2.1952****	**-2.1981****	652	53
4	0.1219	1.0291	1.166	652	50
5	-0.0952	-1.0084	-1.4994	652	54
6	-0.0318	-0.3087	0.4863	652	51
7	-0.1274	-1.5039	-1.1725	652	52
8	-0.1389	-1.19	**-1.8332***	652	53
9	0.0084	0.1021	-0.8426	652	52
10	0.0029	0.0365	-0.0728	652	49

Appendix 3. Average firm rival reaction: Robustness testing – Results for Market Model under event (-15,15) window

Rival firm abnormal returns. This table presents abnormal returns for rival firms around IPO announcements. Rival firms are classified as publicly listed firms using the six-digit NAICS industry group classification. T-statistics and Patell Z scores are presented to assess significance. ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.

Event time	Mean AR (%)	T-statistic	Patell Z Score	No. of Rivals Firms	% Negative
-15	-0.0142	-0.1624	-0.0534	652	51
-14	-0.0187	-0.1390	-0.7358	652	56
-13	-0.0254	-0.2446	-1.0605	652	52
-12	-0.0430	-0.4347	-0.7824	652	53
-11	0.0168	0.1697	0.1380	652	51
-10	-0.0024	-0.0205	-0.5756	652	53
-9	-0.0998	-0.9296	-1.4726	652	53
-8	-0.2298	**-2.5629****	-1.6285	652	54
-7	-0.1867	-1.4789	**-2.0015****	652	52
-6	0.1407	1.3522	0.4215	652	54
-5	-0.1306	-1.2596	**-2.0551****	652	53
-4	0.0699	0.6670	0.8860	652	50
-3	0.0526	0.5193	0.6485	652	53
-2	-0.0098	-0.0926	0.8215	652	47
-1	0.0514	0.5355	0.3002	652	50
0	0.0577	0.5617	0.1991	652	53
1	-0.2434	**-2.5915*****	**-1.764***	652	54
2	0.0437	0.4370	0.9572	652	51
3	-0.2036	**-1.9955****	**-1.6661***	652	53
4	0.1257	1.0579	1.4822	652	49
5	-0.1124	-1.1342	-1.6313	652	53
6	0.0127	0.1190	0.7413	652	50
7	-0.1661	**-1.9405***	-1.3180	652	54
8	-0.1294	-1.1025	-1.5241	652	54
9	0.0152	0.1737	-0.7230	652	51
10	-0.0268	-0.3395	-0.1747	652	49
11	0.1008	1.0612	1.5108	652	47
12	-0.0849	-0.8930	-1.0441	652	53
13	-0.0354	-0.3570	1.0318	652	55
14	-0.0534	-0.5161	-1.0286	652	56
15	0.1571	1.3469	1.5709	652	52

Appendix 4. Average firm rival reaction: Robustness testing – Results for 3FF Model under event (-15,15) window

Rival firm abnormal returns. This table presents abnormal returns for rival firms around IPO announcements. Rival firms are classified as publicly listed firms using the six-digit NAICS industry group classification. T-statistics and Patell Z scores are presented to assess significance. ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.

Event time	Mean AR (%)	T-statistic	Patell Z Score	No. of Rivals Firms	% Negative
-15	-0.0471	-0.5362	-0.4715	652	52
-14	-0.0079	-0.0594	-0.6026	652	54
-13	-0.0512	-0.5103	-1.5485	652	54
-12	-0.0545	-0.5758	-0.9915	652	53
-11	-0.0143	-0.1528	-0.1372	652	51
-10	-0.0196	-0.1752	-0.7391	652	52
-9	-0.0850	-0.7851	-1.2554	652	54
-8	-0.1995	**-2.3354****	-1.4050	652	53
-7	-0.1384	-1.1047	**-1.882***	652	52
-6	0.1394	1.3431	0.2025	652	56
-5	-0.1016	-1.0206	**-1.7519***	652	54
-4	0.1051	1.0316	1.2533	652	50
-3	0.0114	0.1168	0.3614	652	53
-2	0.0133	0.1317	1.2501	652	48
-1	0.0274	0.3005	0.1264	652	50
0	0.0704	0.7095	0.2442	652	51
1	-0.2216	**-2.495****	**-1.6771***	652	55
2	0.0173	0.1841	0.6838	652	54
3	-0.2229	**-2.1693****	**-2.2246****	652	54
4	0.1195	1.0117	1.1107	652	50
5	-0.0991	-1.0448	-1.5667	652	54
6	-0.0337	-0.3275	0.5100	652	52
7	-0.1291	**-1.5322**	-1.1684	652	52
8	-0.1381	-1.1844	**-1.8121***	652	54
9	0.0050	0.0607	-0.8882	652	53
10	-0.0024	-0.0298	-0.1373	652	49
11	0.1136	1.2406	**1.8143***	652	49
12	-0.0980	-1.0294	-1.0019	652	52
13	-0.0319	-0.3201	0.8689	652	52
14	0.0037	0.0353	-0.3870	652	54
15	0.1402	1.2499	1.3714	652	52

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