Uncovering the Black Box of Startup Growth: How Startup Mergers drive Successful Exits

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Abstract

How did Google, Facebook and Paypal grew from vague ideas to billion-dollar companies in just a few years? This paper opens up the black box of startup growth and reveals a previously unexplored mechanism for success: startup-to-startup mergers. Creating a novel dataset, I find that startups merge with each other as a growth strategy in preparation for a successful exit. This approach seems effective: merging startups are 3.2 times more likely to achieve a successful exit than non-merging peers.

Keywords: Mergers and Acquisitions, Venture Capital, Startup Mergers, Startup Growth
JEL classification: G34, L26, O31

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1 Introduction

Venture capital-backed startups create massive economic value once they reach public capital markets (Lerner and Nanda (2020)). Even more remarkable is the short time frame in which this value is created: Startups like PayPal, Google, and Facebook went from vague ideas to billion-dollar companies in just 3-8 years. Yet the mechanisms behind this incredible growth remain a black box. This paper takes a first step toward opening this black box by shedding light on a strategy these startups employed: startup-to-startup mergers. I show that in preparation for an exit, startups strategically acquire peers to reach critical mass and secure successful outcomes.

The story of PayPal provides an illustrative example. Today, PayPal is an S&P 500 company with over 300 million customers. However, PayPal nearly failed just one year after its founding in 1999. During the dot-com crash venture funding dried up and Paypal was not able to continue its aggressive growth path. Investor Michael Moritz provided an unconventional solution: a strategic merger between PayPal and its rival Confinity. This combination allowed PayPal to consolidate resources and achieve rapid growth despite the difficult funding environment. Just one year after the merger, PayPal reached sufficient scale to pursue an IPO at a $1.2 billion valuation. This example reveals a crucial insight: what almost destroyed a future S&P 500 company wasn't simply capital shortage, but growth limitations - with a startup-to-startup merger providing the solution.

Interestingly, the startup merger phenomenon remains largely unexplored. Traditional M&A theory provides little explanation for why two young companies with minimal operations and different strategic visions would combine forces.[1] My evidence points to a novel

[1]Traditional M&A theory explains mergers between mature firms through market power gains (Eckbo (1983),Kim and Singal (1993)), operational synergies (Healy et al. (1992), or managerial motives (Jensen (1986)). However, these traditional frameworks are poorly suited to explain mergers between startups. Young companies typically lack established market positions to consolidate, have minimal operations to combine efficiently, and are still searching for viable business models.

explanation: startup mergers can be understood through the interplay between scale requirements and resource constraints. To exit successfully through either an IPO or acquisition, startups must reach a certain size threshold to prove their business model is scalable. However, during funding droughts, even the most promising startups may be unable to raise enough capital to fuel continued growth, while simultaneously lacking the necessary scale to exit successfully. In this precarious middle ground, mergers offer a potential solution by allowing promising ventures to combine their scarce resources and effectively double in size overnight. Resource combination through merger can thus provide the bridge needed to survive and grow until reaching viable exit scale.

Collecting data on all startup-to-startup mergers from Crunchbase reveals that these transactions have become an essential growth strategy among venture capital-backed companies. From 2000 to 2023, more than 7685 startup-to-startup mergers occurred worldwide, recently accounting for over 30% of total M&A activity involving VC-backed startups. Consistent with the survival motive, these transactions peak during financial market downturns, and merging startups exhibit consistently higher survival rates compared to their non-merging peers.

The most striking finding from the descriptive evidence is the difference in exit outcomes: merging startups are 3.2 times more likely to achieve a successful exit than their non-merging counterparts: 26.8% of merging startups reach an IPO or acquisition, compared to just 8.2% for nonmerging startups. This remarkable disparity underscores why these transactions have become a critical growth strategy to commercialize innovations. In addition, startup mergers play a vital role in young and transformative industries. In the AI sector, startup-to-startup mergers represent 27.4% of all M&A transactions in 2023. Industries facing intense competition for a limited pool of resources show higher early-stage consolidation, confirming that startup mergers are essential for bringing innovations to market in emerging fields where resources are limited, but growth demands are high.

Despite these compelling descriptive patterns, establishing a causal relationship between resource constraints and startup mergers requires addressing potential endogeneity concerns. Building on the insight that startups merge to overcome growth limitations when funding becomes scarce, I employ the Theranos scandal as a quasi-natural experiment to isolate this effect. When Elizabeth Holmes's fraud was revealed in 2015, female founders - though unrelated to the scandal - experienced a disproportionate decline in venture capital access compared to their male counterparts. This shock provides variation in funding constraints across otherwise similar startups. The results strongly support the resource-constraint hypothesis: following the funding shock, affected female founders were 3.7 percentage points more likely to pursue mergers than male founders. This evidence reinforces the broader narrative that startup mergers serve as a strategic response when promising ventures face growth limitations but still need to achieve scale for successful exits.

Finally, an important question arises: If startup mergers are such an effective strategy, why do some startups merge while others do not? The answer lies in unique frictions that hinder these deals. Startups often lack clear valuations, have limited organizational structure, and face misaligned incentives between founders and investors. Analysis of 3,886 U.S. deals shows that while most mergers occur within the same sector (89.1%), few involve firms from the same city (19.4%) or founders with shared educational backgrounds (4.9%). How do these deals overcome such search frictions? My data shows that a startup's investors often play a key role. Investors bring crisis management experience and can recognize when mergers offer a path to survival. They also leverage relationships with other venture capitalists to identify potential partners - critical since 79.1% of startup mergers occur between companies backed by different VC firms. A logit regression confirms this insight: the identity of the first lead investor alone explains over 20.9% of the variation in merger activity, far more than any other factor.

2 Related Literature & Contribution

The idea of mergers between startups connects to several strands of literature. Most importantly, my research extends the existing M&A literature by highlighting the distinct motivations and patterns of mergers among early-stage firms. Traditional M&A studies focus on large, mature firms engaging in mergers to achieve operational efficiencies, enhance market power, diversify product lines or fulfill managerial incentives (e.g. Morck et al. (1990), Moeller and Schlingemann (2005), Malmendier and Tate (2008) Cai and Sevilir (2012)). My study reveals that early-stage firms follow fundamentally different patterns. These differences yield striking new insights: while Celikyurt et al. (2010) show that firms pursue IPOs to gain resources for acquisitions, my findings reveal that startups frequently acquire other startups to reach the scale necessary to pursue an IPO. Similarly, while Gorton et al. (2009) find that large firms acquire others to reduce their risk of being acquired, I reveal that startups acquire other startups to increase their likelihood of being acquired themselves. By focusing on these unique dynamics of early-stage firms, this research contributes to a more nuanced understanding of M&A activities across different stages of corporate development.

Second, I expand the literature on venture capitalists' value-addition beyond monitoring and advising (Lerner (1995), Bernstein et al. (2016)) or professionalization (Hellmann and Puri (2002), Gompers et al. (2020)). I identify a new channel: VCs as experienced intermediaries during challenging times. First lead investors, who typically maintain board positions throughout a startup's lifecycle, bring valuable crisis management experience from their broader portfolio. Unlike founders who may face their first downturn, these investors have guided multiple companies through similar situations, enabling them to recognize when mergers might offer a path to survival. Moreover, while recent work has examined how common VCs facilitate deals within their own portfolios (González-Uribe (2020), Li et al. (2023), Eldar et al. (2024)), I document a different mechanism. Rather than focusing on innovation syner-

gies between portfolio companies sharing the same investor, I show how VCs leverage their broader network relationships with other, unrelated investors to help resource-constrained startups find merger partners. This distinction is quantitatively important—within-portfolio mergers represent only about 20% of startup merger activity, highlighting the crucial role of inter-investor networks in facilitating startup mergers.

Third, I contribute to the growing literature on how startups survive adverse market conditions. While recent work has highlighted the vulnerability of startups to financial shocks (Aghion et al. (2024)), we have a limited understanding of their coping mechanisms. My findings reveal horizontal mergers as a crucial survival strategy, complementing work on startup size and survival (Raz and Gloor (2007)) and the lifecycle dynamics of venture-backed firms (Puri and Zarutskie (2012)).

Fourth, my work also speaks to antitrust considerations in startup markets (Philippon (2019), Cunningham et al. (2021), Gilbert (2022)). The PayPal case illustrates an important tension: while the merger between these two startups could be viewed as an anti-competitive consolidation, it ultimately enabled the survival of innovations that might otherwise have perished, creating a significant competitor to traditional payment providers. This suggests that standard antitrust frameworks may need adaptation when applied to resource-constrained startup markets.

Finally, I contribute to the literature on technology clusters and their role in innovation. Prior work has established that tech hubs succeed through knowledge spillovers, liquid labor markets, and global production linkages (Kerr and Robert-Nicoud (2020), Moretti (2021)). I extend this literature by documenting how these clusters serve as incubators for startup mergers, providing a form of insurance during market downturns. The dense networks within these hubs facilitate consolidation opportunities that increase survival probability, adding a new dimension to our understanding of cluster benefits beyond those identified.

3 Data

For my analysis I use an international dataset of all venture capital backed startups found on Crunchbase. My main analysis focuses on the time period of 2010-2023. Crunchbase is a leading commercial database that compiles structured information on startups, investors, founders, and acquisition events. It aggregates data from public disclosures, press releases, user contributions, and automated web crawling, with editorial oversight to ensure accuracy. The platform is uniquely positioned to capture early-stage entrepreneurial activity and venture capital investment, offering detailed firm-level and individual-level data that is otherwise unavailable in traditional financial or administrative datasets.

This provides a unique advantage when it comes to startup-to-startup mergers. As I will show, startup mergers have become an essential part of the venture capital ecosystem. Still, these deals have received limited attention in the academic literature. The lack of research in this area might be explained by two data collection challenges. First, unlike public company transactions, M&As between private firms are not subject to regulatory reporting requirements to authorities like the SEC, nor do they typically involve advisory firms. Second, these transactions often generate minimal media coverage due to their relatively small deal volumes.

To address these data limitations, I use Crunchbase as the primary data source. Crunchbase employs web-scraping methods, enabling coverage of transactions that traditional data sources would miss. To make this point clear, I extracted all startup-to-startup mergers in Crunchbase and compared it to all deals in LSEG Refinitiv. LSEG Refinitiv is considered by many to be the gold standard for M&A deals in the academic literature as it provides the broadest coverage and deepest information, especially with respect to M&A data. However, as one can see especially in recent times, Refinitiv provides only around one fourth of the deals that are captured in Crunchbase (Figure A1 in the Appendix). The reason is sim-

ple: Refinitiv focuses on regulatory reportings and information from advisory firms, which is not suited for these tiny deals between two startups. Crunchbase instead uses webscraping methods which is much better to capture those deals. Especially after 2010, these methods became significantly superior to the methods used in Refinitiv, which allows for a unique coverage of startup mergers in Crunchbase that other data sources cannot offer.

However, a significant methodological challenge emerges from the database structure itself. Crunchbase updates a firm's funding status retroactively after a successful exit. The startup merger of PayPal illustrates this issue: PayPal emerged from the 2000 merger of two startups - Confinity and X.com. After PayPal's February 2002 IPO, Crunchbase retroactively classified it as a public company. As a result, the 2000 merger appears as a public company (PayPal) acquiring a startup (Confinity), rather than the startup-to-startup merger it actually was.

To overcome this limitation and construct an accurate sample of startup mergers, I implement the following procedure:

1. Identify all firms that received at least one round of venture capital financing during their lifecycle,

2. Collect all M&A transactions involving these firms from 2010 to 2023,

3. Flag transactions where both participating firms received venture capital financing,

4. Incorporate information on exits (IPO or M&A) for VC-backed firms and exclude all transactions occurring post-exit.

This methodology yields a final sample of 6,972 international startup mergers between 2010 and 2023, involving 11,750 unique venture capital-backed startups. The following section provides detailed descriptive statistics characterizing these transactions.

4 Stylized Facts on Startup Mergers

Given that startup-to-startup mergers have not been systematically documented in prior research, I begin by providing detailed descriptive evidence of this phenomenon.

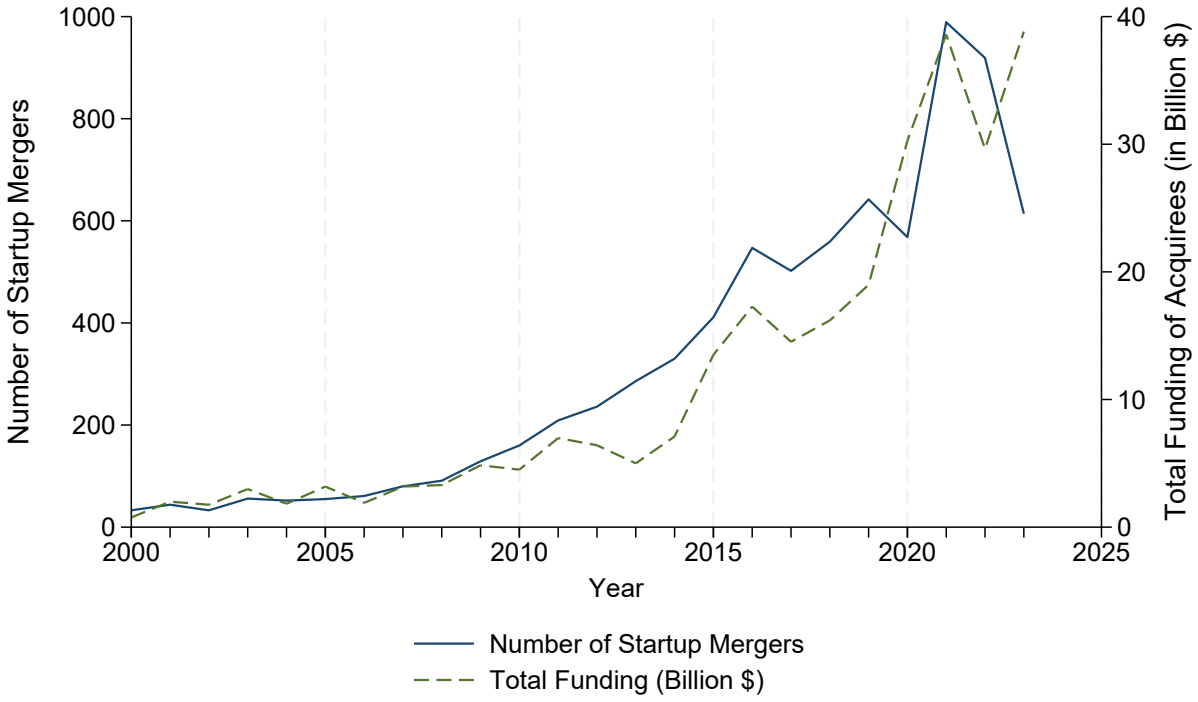

Figure 1: Startup M&A Activity and Transaction Volume (2000-2023)

Note: This figure shows the evolution of startup-to-startup merger activity from 2000 to 2023. The blue bars (left axis) represent the number of startup merger transactions per year. The green dotted line (right axis) shows the total funding amount in billions USD that merging startups received prior to their merger. The sample includes 7,685 startup mergers between VC-backed companies. Funding amounts are aggregated based on all venture capital rounds received by the merging startups before the merger date. Data source: Crunchbase

1. Startup-to-startup mergers are an economically important, but recent phenomenon: Figure 1 shows the evolution of startup merger activity from 2000 to 2023,

showing both the number of transactions (left axis) and the total funding received by merging startups prior to their mergers (right axis). The data reveals that startup M&As are a recent phenomenon. While such transactions occurred sporadically in the early 2000s, they have grown substantially in both frequency and volume since 2013. Over the period 2013-2023, I observe an average of 653 startup merger transactions annually. The startups in my sample received an average of $36.9 million in funding before their merger. Thus, in aggregate startup mergers involved companies that had received a yearly average of $24.14 billion in venture funding from 2013 to 2023. To contextualize the economic magnitude, I compare them to the broader venture capital market. During the same period (2013-2023), global venture capital investment averaged approximately $246.95 billion per year. This comparison suggests that startup mergers directly affect almost 10% of the global venture capital supply. These figures establish startup-to-startup M&As as an economically significant component of the venture capital ecosystem, despite their only recent emergence as a widespread phenomenon.

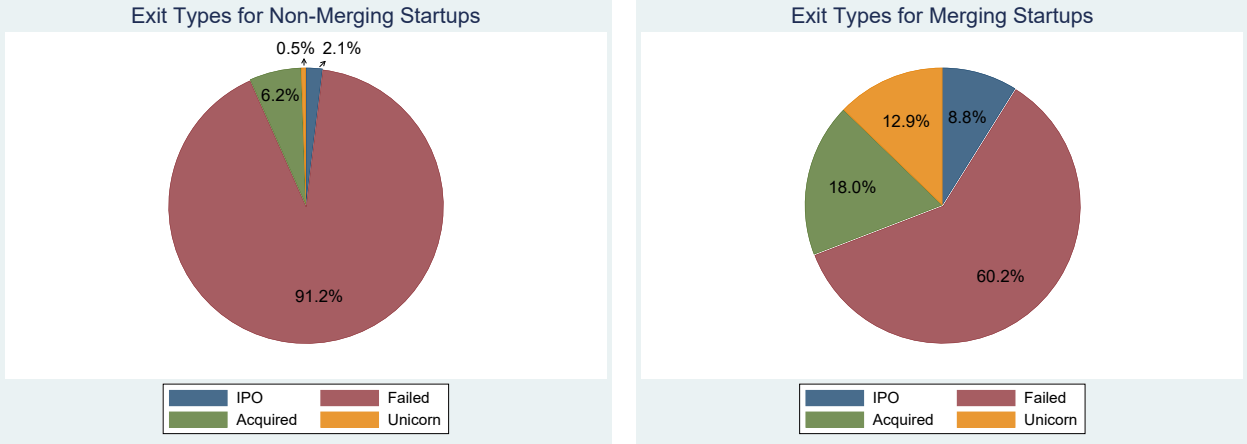

Figure 2: Comparison of Exit Types for Merging and Non-Merging Startups

Note: This figure compares the distribution of exit outcomes between startups that participated in at least one merger during their lifecycle (right panel) and those that never merged (left panel). The sample includes 296.315 VC-backed startups founded between 2000-2023. Of these, 5,426 are "merging startups" for which the outcome is already known. Exit types are classified as IPO, acquisition by established firms, achieving unicorn status (private valuation > $1Bil.), or failure. Data source: Crunchbase.

2. Merging Startups achieve successful exits at substantially higher rates than non-merging peers: Having documented the prevalence of startup mergers, I next examine their relationship with subsequent outcomes. Figure 2 compares exit outcomes between startups that participated in at least one merger during their lifecycle ("merging startups") and those that never merged ("non-merging startups"). The results reveal striking differences in exit success rates between these groups. Merging startups achieve successful exits at higher rates than their non-merging counterparts. Specifically, 39.7% of merging startups reach a successful exit—either through an IPO (8.8%) or acquisition by an incumbent firm (18.0%)—compared to just 8.8% of non-merging startups. Perhaps most notably, merging startups are substantially more likely to achieve unicorn status (12.9% versus 0.5%).

The stark contrast in failure rates—60.2% for merging startups versus 91.2% for non-

merging startups—further underscores the potential importance of these transactions for startup survival and success. While selection effects likely play a role in these differences, the magnitude of the disparity suggests that startup mergers might serve as a crucial mechanism for overcoming the resource constraints and scaling challenges that often lead to startup failure. Importantly, these findings suggest that startup mergers are not an exit strategy in themselves—merged entities rarely remain as private companies. Instead, the evidence indicates that startup mergers serve as a mechanism to achieve traditional exits, whether through IPO or acquisition by established firms. Moreover, the significantly higher likelihood of reaching unicorn status suggests that mergers can help achieve the scale needed to breach the billion-dollar valuation mark, which in turn can substantially alleviate future resource constraints (Brown and Wiles (2015), Company (2022)) by increasing investor confidence and enhancing market visibility.

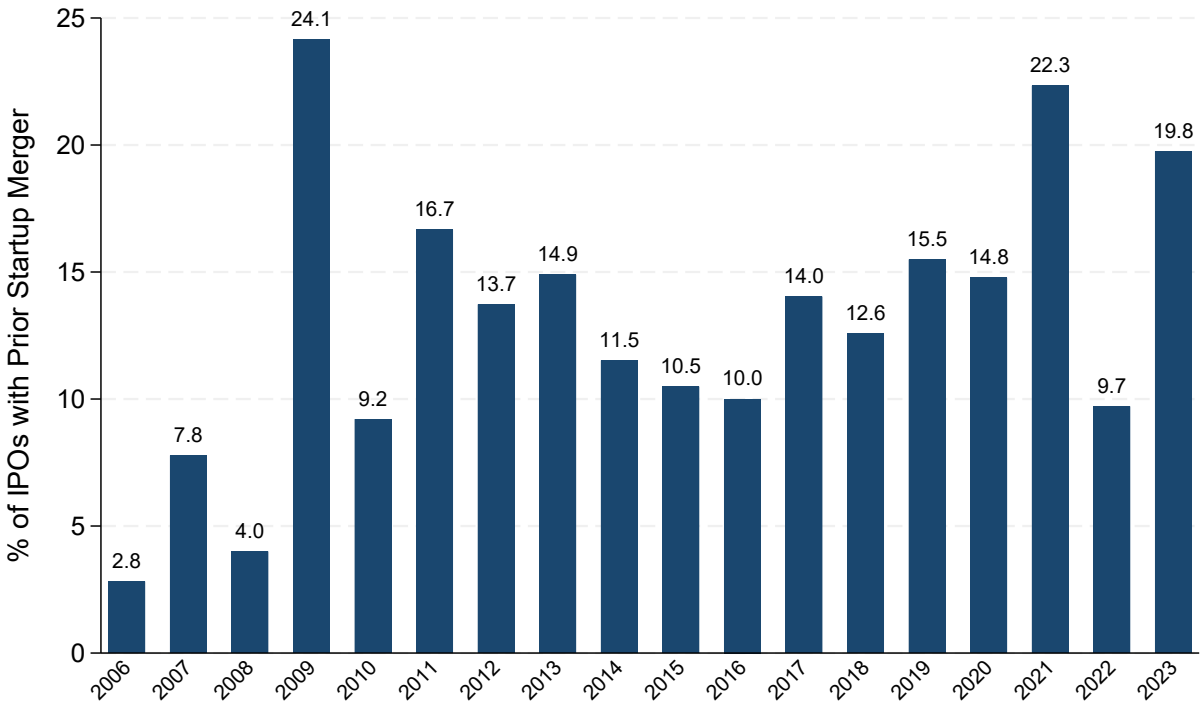

Figure 3: Percentage of VC-backed IPOs with Prior Startup Merger (2006-2023)

Note: This figure shows the percentage of VC-backed IPOs where the company participated in at least one startup merger before going public. The sample includes 2217 VC-backed IPOs between 2006-2023. Data source: Crunchbase.

3. Startup mergers are a common stepping stone to public markets, especially during market downturns: The economic importance of VC-backed companies extends far beyond their relatively small number. As Lerner and Nanda (2020) demonstrate, these firms create disproportionate economic value despite representing only a tiny fraction of overall firm creation. The PayPal case suggests that startup mergers might be an essential tool for reaching public markets and realizing this value-creation potential. Figure 3 reveals that PayPal's startup-merger-to-IPO path is not unique. In 2023, approximately 19.8% of all VC-backed IPOs involved companies that had previously participated in a startup merger. Perhaps most telling is the pattern after the financial crisis. The proportion of IPOs with prior startup mergers reached its historic peak of 24.1% in 2009, immediately

following the crisis. This spike is particularly instructive: it suggests that startups that merged during the crisis were more likely to survive and eventually go public, underscoring the role of these transactions as a survival mechanism during adverse market conditions. The time series pattern from 2006 to 2023 reveals that startup mergers have become increasingly common among firms that eventually go public, rising from just 2.8% in 2006 to consistently higher levels in recent years. This trend is especially significant given that VC-backed public companies are crucial drivers of innovation and economic growth. The data suggests that startup mergers often serve as a stepping stone toward public markets, helping innovative companies achieve the scale necessary to commercialize their innovations through public capital markets.

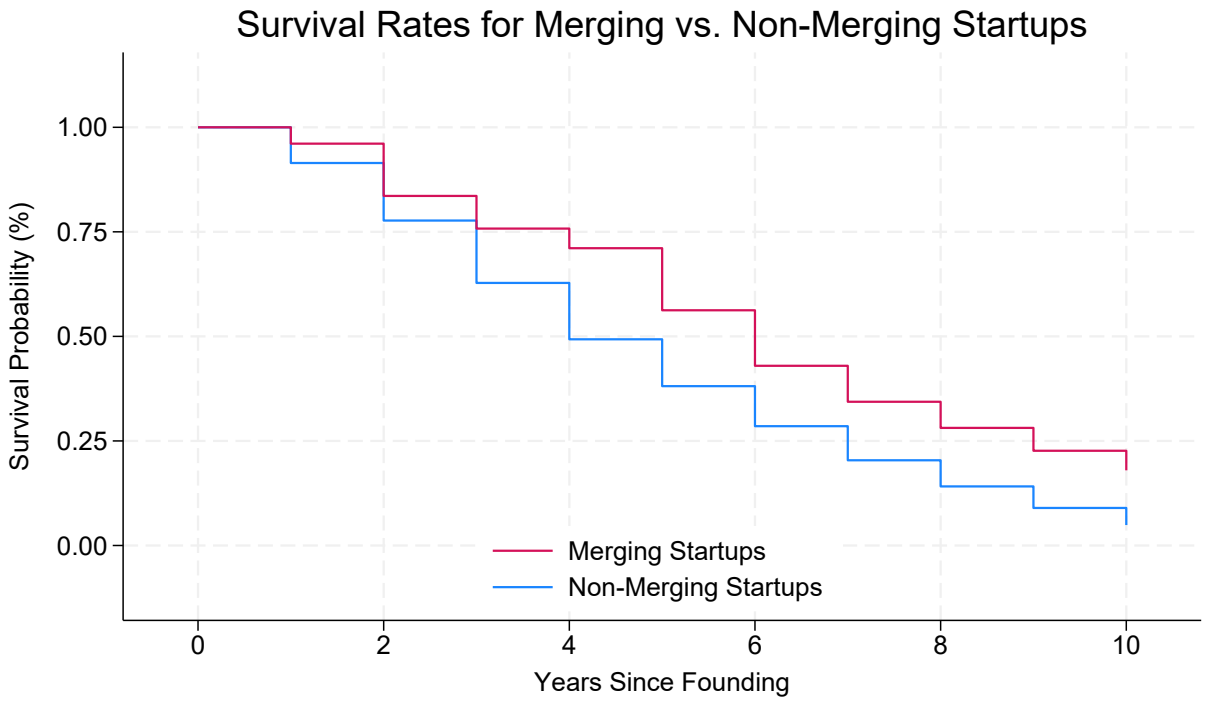

Figure 4: Survival Rates for Merging vs. Non-Merging Startups

Note: This figure presents Kaplan-Meier survival curves comparing startups that participated in at least one merger with those that never merged. The sample comprises 9293 VC-backed startups (131 merging) that were founded between 2000 and 2022 and for which the date of failure is known and falls within the time period. Time is normalized to zero at founding date. Survival is defined as continuing operation without failure. Data source: Crunchbase.

4. Merging startups are less likely to fail, compared to non-merging startups: After examining successful exits, I next analyze the survival patterns of startups that ultimately fail. Figure 4 presents a survival analysis comparing firms that participated in at least one startup merger during their lifecycle with those that never merged. The analysis normalizes each firm's founding date to t=0 to enable direct comparison of survival rates across cohorts. The results reveal that merging startups exhibit consistently higher survival rates throughout their lifecycle. This pattern suggests that startup mergers serve as an effective survival mechanism not only for "superstar entrepreneurs" like Elon Musk, but also

for the broader population of startups, including those that eventually fail. Perhaps most telling is the timing of the survival advantage. The gap in survival rates becomes most pronounced around the 5-6 year mark, after which it remains relatively stable. This timing coincides with the average age at which startups typically pursue mergers, as documented in Figure 6. This temporal alignment suggests that the survival advantage stems from the merger event itself rather than from inherent differences between merging and non-merging firms. The survival rates at the 8-year mark—the typical age for VC-backed IPOs (Ewens and Farre-Mensa (2020))—are particularly instructive. While only 14.1% of non-merging startups survive to this critical milestone, 28.1% of merging startups reach this age. This dramatic difference in survival rates helps explain the earlier finding about the high proportion of VC-backed IPOs with prior startup mergers, providing further evidence that these transactions serve as a crucial mechanism for extending startup longevity through critical growth phases.

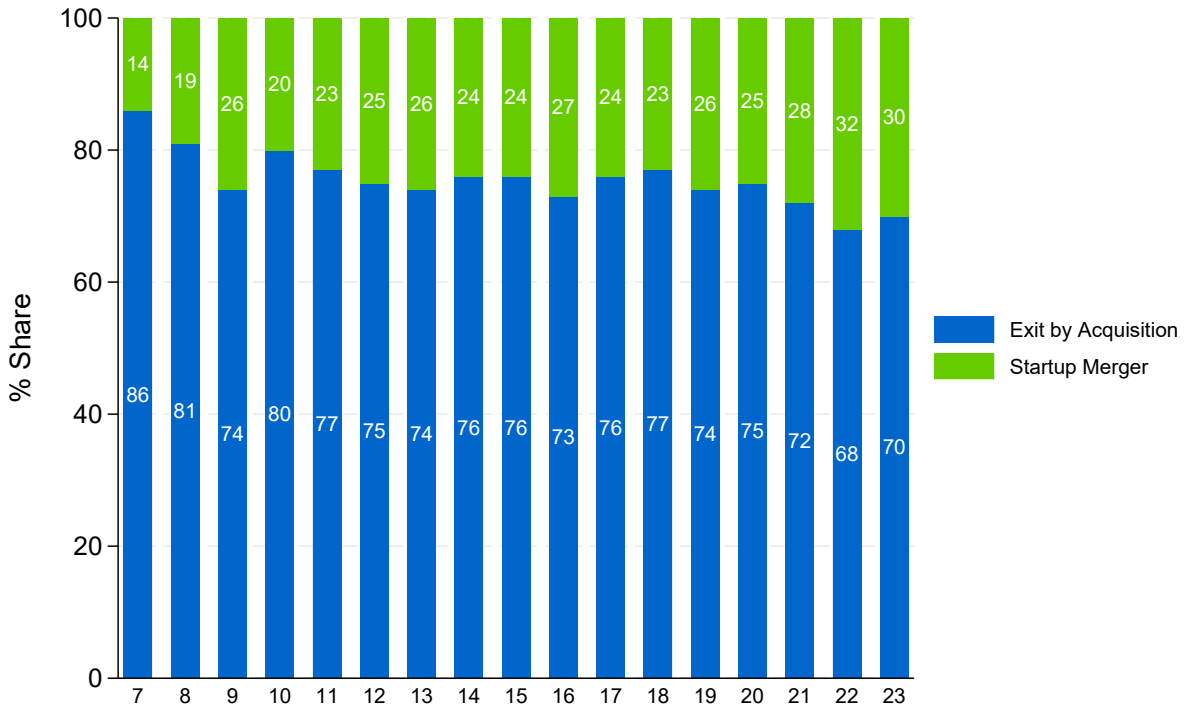

Figure 5: Acquisitions of VC-backed Startup in the US by type of "buyer" (2007-2023)

Note: This figure shows the breakdown of VC-backed startup acquisitions between acquisitions by mature incumbent firms ("exit") and startup-to-startup mergers. The sample includes 15214 acquisitions of VC-backed startups between 2007-2023. Percentages represent the share of each type of transaction in total acquisition volume per year. Data source: Crunchbase.

5. Startup mergers help to explain the recent increase in the acquisition of VC-backed startups: Figure 5 provides new insights into the increasing role of M&As in venture capital markets. Prior research (Phillips and Zhdanov (2013), Babina (2020), Ewens and Farre-Mensa (2020)) has documented a significant rise in M&A exits among VC-backed companies. By distinguishing between types of acquirers, I uncover an additional dimension to this trend. The figure decomposes all acquisitions of VC-backed startups from 2007 to 2023 into two categories: traditional exits through acquisition by mature firms and startup-to-startup mergers. While exits through acquisition by established companies have remained

relatively stable—accounting for about 70-80% of transactions throughout most of the sample period—the data shows a marked increase in startup-to-startup mergers in recent years, rising from 14% in 2007 to 30% in 2023. This finding suggests an important reinterpretation of the acquisition trends in venture capital markets. Rather than witnessing a pure increase in traditional exit events where mature firms acquire startups, we are also observing a wave of horizontal consolidation within the startup ecosystem itself. The conventional narrative of increasing M&A exits may thus conflate two distinct phenomena: traditional corporate acquisitions and startup-to-startup mergers, which likely serve different economic purposes.

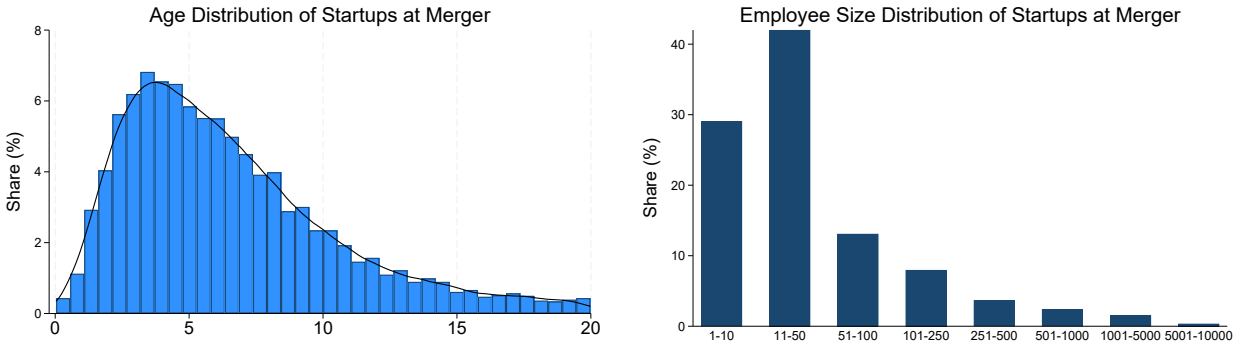

Figure 6: Characteristics of Acquirees at Merger: Age and Employee Size Distribution

Note: This figure presents the distribution of age (left panel) and employee size (right panel) for target companies at the time of merger. The sample includes 7,753 merging startups between 2000-2023 with known size and age information. Age is measured in years from founding to merger date. Employee size categories are based on the last reported headcount before merger. Data is limited to target firms as they cease to exist independently post-merger. Data source: Crunchbase

6. Merging Startups are typically 6.5 years old with fewer than 50 employees: Figure 6 presents the age and employee size distribution of acquired startups at the time of merger. I focus on target companies because their characteristics can be observed retrospectively, as these entities cease to exist independently after the transaction. The data reveals

that startup mergers typically involve remarkably young and small companies. The average target is 6.5 years old and falls within the 11-50 employee range. This size distribution is particularly striking: 81.4% of all deals involve companies with fewer than 100 employees. These characteristics stand in sharp contrast to the traditional M&A literature, which has primarily focused on large, public company transactions. The age distribution provides an interesting comparison with other startup milestones. While the median age of VC-backed companies at IPO is 8 years (Ewens and Farre-Mensa (2020)), I find that the median age at merger is 6.6 years. This suggests that startups typically merge about 1.4 years before they would traditionally be ready for public markets. This timing difference might indicate that mergers serve as an alternative path to achieving the scale necessary for either an IPO or an acquisition by a larger firm.

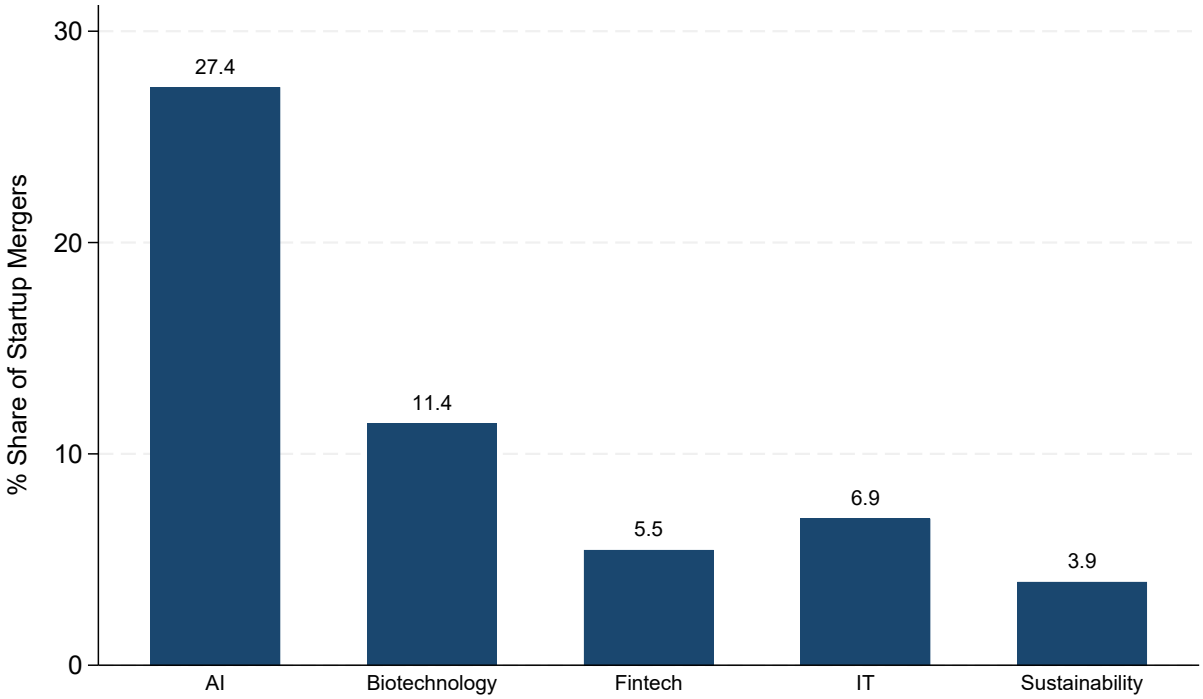

Figure 7: Percentage of Startup M&A Transactions by Industry (2023)

Note: This figure shows the percentage of M&A transactions that were startup-to-startup mergers across different industries in 2023. Industry classification is based on keyword searches in company descriptions from Crunchbase. The sample includes 5203 M&A transactions that took place in 2023. Percentages are calculated as (number of startup-to-startup mergers)/(total number of M&A transactions) within each industry. Data source: Crunchbase.

7. Startup mergers are especially prominent in transformative industries: Figure 7 compares the relative frequency of startup-to-startup mergers across different industries for 2023, expressed as a percentage of all M&A transactions within each sector. Due to the fluid nature of startup business models, I classify companies based on keyword searches in their business descriptions, focusing on five keywords: AI, Biotechnology, Fintech, Information Technology, and Sustainability. The analysis reveals striking variation across industries, with artificial intelligence (AI) standing out prominently. In the AI sector, startup-to-startup mergers account for 27.4% of all M&A transactions. This high concentration of horizontal

mergers likely reflects the particular challenges facing AI startups, especially the widely documented scarcity of specialized talent in machine learning and related fields (Financial Times (2023), Reuters (2023)). The contrast with the sustainability sector is particularly instructive. Despite being a high-priority area for innovation, sustainability startups show the lowest proportion of inter-startup mergers at 3.9%. This marked difference might be explained by the sector's more established nature and better access to resources. The sustainability sector has benefited from substantial government support and massive capital inflows in recent years, potentially reducing the need for consolidation among early-stage companies. Other technology-adjacent sectors fall between these extremes, with biotechnology at 11.4%, fintech at 5.5%, and information technology at 6.9%. This pattern suggests that the prevalence of startup mergers correlates with industry-specific resource constraints rather than merely reflecting sector maturity or overall transaction volume.

5 Why do Startups Merge?

5.1 Intuition - Startup mergers as a survival strategy

The significant rise in startup-to-startup mergers documented in the previous section raises a fundamental question: why do VC-backed startups merge? Traditional explanations for mergers between mature firms—such as reducing competition, managerial incentives, synergies, or market expansion —appear insufficient in the startup context. Moreover, merging startups face unique challenges: the complexity of integrating two young firms with limited organizational structure, the difficulty of establishing clear valuations, and the potential for misaligned incentives between founders, investors and early employees. Given these obstacles, the prevalence of startup mergers requires a distinct theoretical explanation.

The descriptive evidence presented earlier suggests that startup mergers primarily serve as a survival strategy. This interpretation aligns with recent newspaper articles, where

startup mergers have been documented for the first time in sectors experiencing funding contractions (Crunchbase News (2024)).

The mechanism behind startup mergers can be understood through the interplay between scale requirements and resource constraints. To exit successfully through either IPO or acquisition, startups must reach a certain size threshold. This requirement extends beyond merely demonstrating a viable product or profitable business model—companies must prove their ability to scale their innovations effectively. However, achieving this scale presents a significant challenge in practice. The fundamental obstacle is intense competition for limited resources. Startups must compete for both venture capital funding and specialized talent. These resource constraints create a critical survival challenge: most startups fail before reaching the typical exit age. Surveys confirm this - the most frequently cited reason for a startup's failure is: "we ran out of cash" CB Insights Research (2021). This pattern suggests that resource limitations often prevent promising ventures from achieving the scale necessary for a successful exit. Mergers offer a potential solution to this challenge by allowing startups to combine their scarce resources. Hence, resource combination through merger can provide the bridge needed to survive until reaching viable exit scale.

The recent surge in startup merger activity likely reflects increasing scale requirements for successful exits. Regulatory changes have raised the bar for IPOs (Huang et al. (2023)), while stricter antitrust enforcement has made acquisitions by industry leaders more challenging (Wörsdörfer (2022)). These developments have increased the minimum scale needed for exit, thereby strengthening the incentive for startups to merge as a means of achieving this scale.

5.2 "Cold"- Wave Startup Mergers

The survival strategy interpretation suggests that startup mergers serve a fundamentally different economic purpose than traditional corporate M&As. Rather than pursuing market power or efficiency gains, these transactions primarily represent a mechanism for resource

combination that enables survival until exit becomes feasible.

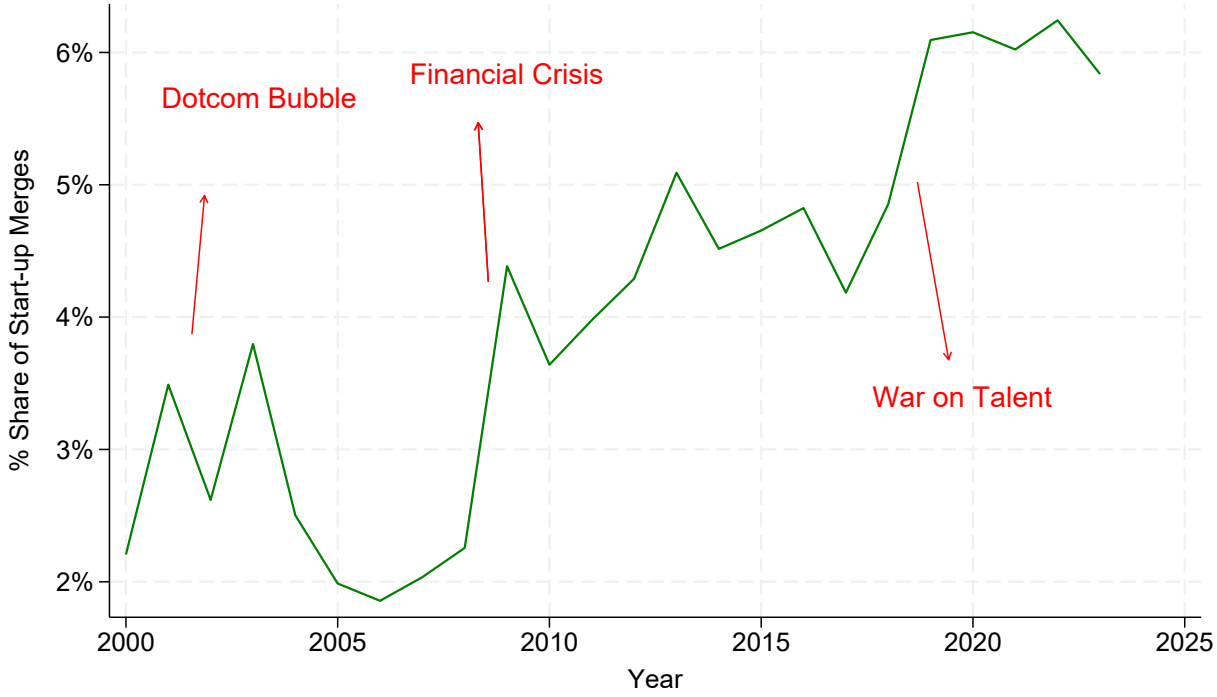

Figure 8: Startup Mergers as a share of total M&A Activity (2000 -2023)

Note: This figure shows startup-to-startup mergers as a percentage of total M&A activity. The sample includes 157.718 M&A transactions between 2000-2023 of which 7685 are startup mergers. Major market events are annotated to highlight the relationship between merger activity and market conditions. Data source: Crunchbase."

Figure 8 provides striking evidence for this distinction by plotting the relative frequency of startup mergers from 2000 to 2023. The data reveals clear spikes in startup merger activity during periods of resource scarcity in the entrepreneurial environment: the aftermath of the DotCom crash, the Great Financial Crisis, and the recent "War for Talent". This pattern stands in sharp contrast to the well-documented behavior of traditional corporate mergers. While a broad empirical literature shows that mature firm M&A activity clusters during "hot" financial markets (e.g. Harford (2005), Denes et al. (2019)), startup mergers appear to concentrate during "cold" markets.

This counter-cyclical pattern aligns with established research on venture capital market

dynamics. Nanda and Rhodes-Kropf (2013) document that "hot" VC markets lead to excessive startup formation. My analysis suggests that when these markets subsequently cool, the oversupply of startups forces consolidation through mergers. Thus, startup merger waves can be understood as a natural correction mechanism in venture markets, enabling resource reallocation during periods of scarcity rather than expansion during periods of abundance.

5.3 The "Theranos Scandal" - a quasi-natural experiment

While the descriptive evidence suggests that resource constraints drive startup mergers, establishing a causal relationship requires a more rigorous identification strategy. I address this challenge by exploiting a quasi-natural experiment: the high-profile collapse of Theranos and its differential impact on female founders' access to venture capital.

The story begins with Theranos, founded by Elizabeth Holmes in 2003. Holmes became a startup celebrity, often compared to Steve Jobs, by promising to revolutionize healthcare with a device that could run multiple tests from just a single drop of blood. However, in 2015, Wall Street Journal investigations revealed this technology didn't work as claimed (Carreyrou (2015)). By 2018, Theranos had shut down and Holmes faced fraud charges. The scandal's impact reached far beyond Theranos itself. As one of the most prominent female founders in the male-dominated tech world, Holmes' fraud had particularly severe consequences for other women entrepreneurs. Reports from the time show that investors became especially skeptical of female-led startups, making it harder for women founders to raise money. "It makes it harder when the most visible female founder in our space is one who's associated with fraud," - Heather Bowerman, founded DotLab in 2016, a year after Elizabeth Holmes' got exposed (Yahoo Finance (2023)). This reaction intensified existing challenges in an industry where female founders were already underrepresented. Recent research by Hebert et al. (2024) confirms this pattern, showing that when a female-founded startup fails, investors become more hesitant to fund other completly unrelated female founders.

This situation creates a unique opportunity to study how reduced access to venture capital affects startups merger decisions. The Theranos scandal made it harder for female founders to raise money while leaving male founders relatively unaffected. By comparing how these two groups behaved after the scandal, I can examine whether startups become more likely to merge when their access to funding is constrained.

First, to test whether the Theranos scandal affected female founders' access to venture capital, I analyze a comprehensive sample of U.S. startups founded between 2010 and 2014. Following standard industry practice, I classify a startup as female-founded if at least one founder is female, though I also use the continuous measure of female founder share as an alternative treatment variable. The sample comprises 18,346 startups (3,407 female-founded) observed over 2010-2019, yielding 116,200 startup-year observations. Table 1 presents startup characteristics prior to the Theranos shock for female and male founded startups (2010-2014).

Table 1: Descriptive Statistics: Female vs. Male Startups (2010 - 2014)

	Female	Male	Diff. (Female - Male)	N
Total Founders	2.18	1.84	-0.34***	51271
Female Share	0.66	0.00	-0.66***	51271
Nr. Funding Rounds	3.00	3.04	0.04	51271
Total Funding (Mil. USD)	2.89	4.06	1.17***	51271
Employee Count	8.9	13.6	0.20***	50915
Age	1.13	1.19	0.06***	51271

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Note: This table presents summary statistics comparing female-founded and male-founded startups between 2010 and 2014. The sample includes 18,346 U.S.-based startups (3,407 female-founded) that received at least one round of venture capital financing. A startup is classified as female-founded if at least one founder is female. Total Founders is the number of founders listed in Crunchbase. Female Share represents the proportion of female founders in the founding team. Nr. Funding Rounds counts the number of venture capital financing rounds. Total Funding is measured in millions USD. Employee Count represents the number of employees at the time of first VC funding. Age is measured in years since founding. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

I employ a difference-in-differences strategy using the following simple two-way fixed

effects specification:

$$Funding_{i,t} = \beta_0 + \delta(Female * Post2015)_{i,t} + \alpha_i + \alpha_t + \epsilon_{i,t}. \quad (1)$$

where $Funding_{i,t}$ measures funding (in millions USD) for startup i in year t, and ($Female*$ $Post2015$) indicates female-founded startups after the Theranos shock. The model includes startup fixed effects α_i to control for time-invariant firm characteristics and year fixed effects α_t to account for market-wide trends. Standard errors,$\epsilon_{i,t}$, are clustered at the startup-level.

Table 2: DID results: Impact of Theranos Scandal on Venture Capital Funding

	(1) Funding (Mil.USD)	(2) Funding (Mil.USD)	(3) Funding (Mil.USD)
ATET			
Post*Female	-0.822***		
	(0.205)		
Post*Femaleshare		-1.288***	
		(0.248)	
Post*Female*Single			-1.302***
			(0.209)
N	19033	19033	19033
Time-FE	Yes	Yes	Yes
Startup-FE	Yes	Yes	Yes

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Note: This table presents difference-in-differences estimates of the effect of the Theranos scandal on venture capital funding. The dependent variable is the amount of funding (in millions USD) received by a startup in a given year. Post is an indicator equal to one for years after 2015. Female is an indicator for startups with at least one female founder, Femaleshare is the continuous proportion of female founders, and Female*Single indicates solo female founders. All specifications include startup and year-fixed effects. Standard errors (in parentheses) are clustered at the startup level. The sample includes 116,200 startup-year observations from 2010-2019. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 2 presents the difference-in-differences estimates of how the Theranos scandal affected female founders' access to venture capital. The results show a substantial decline in funding for female-founded startups after 2015. On average female-founded startups experi-

enced a reduction in funding of 0.822 million USD per year relative to male-founded startups (Column 1). This effect is even stronger when considering the continuous measure of female representation: startups with 100% female founders faced a reduction of 1.288 million USD in annual funding (Column 2). The impact was particularly severe for solo female founders, who experienced a decline of 1.302 million USD in annual funding (Column 3).

Having established the funding shock, I next examine whether reduced access to venture capital led to increased startup merger activity of female-founded startups. I employ the same TWFE specification as in Equation (1), with the only modification being the dependent variable, which now indicates whether a startup merged with another startup in a given year. Table 3 presents these results using the full sample of 2,112 US-based startup mergers (267 involving female-founded mergers) between 2010 and 2019. The findings reveal that female-founded startups became significantly more likely to pursue mergers after the Theranos scandal. The probability of engaging in a startup merger increased by 3.7 percentage points for female-founded startups relative to male-founded ones (Column 1). This effect is similarly strong when using the continuous measure of female representation, with a 4.0 percentage point increase for fully female-founded teams (Column 2). Particularly telling is the result in Column 4 of Table 3, which compares merging versus non-merging female-founded startups. The significantly larger funding decline for merging startups (-1.423 mil. USD) suggests that those most severely affected by the funding shock were most likely to pursue mergers, reinforcing the resource-constraint mechanism. Interestingly, despite experiencing the largest funding shock, single-founded female startups show no significant increase in merger activity (Column 3). This striking contrast—severe funding constraints but no merger response—suggests the presence of important frictions that may make it particularly difficult for solo founders to execute merger transactions. I explore these merger frictions in detail in the next section.

Figure 9 presents event study plots that validate the parallel trends assumption and

reveal interesting dynamics in the treatment effect. The plot shows two distinct shocks to merger activity: an initial increase following the 2015 Wall Street Journal allegations, and a second surge after Theranos's 2018 dissolution and Holmes's fraud charges.

These results provide further evidence that reduced access to venture capital drives startup merger activity. When female founders faced heightened funding constraints following the Theranos scandal, they responded by increasingly pursuing mergers with other startups, particularly when their funding constraints were most severe.

Table 3: DID results: Impact of Theranos Scandal on Startup-Merger Activity

	(1) Startup-Merger	(2) Startup-Merger	(3) Startup-Merger	(4) Funding (Mil. USD)
ATET				
Post*Female	0.037***			
	(0.012)			
Post*Female-share		0.040**		
		(0.019)		
Post*Female*Single			-0.011	
			(0.027)	
Post*Merging-Startup				-1.423***
				(0.417)
N	2112	2112	2112	8524
Time-FE	Yes	Yes	Yes	Yes
Startup-FE	Yes	Yes	Yes	Yes

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Note: This table presents difference-in-differences estimates of startup merger activity following the Theranos scandal. In columns (1)-(3), the dependent variable is an indicator equal to one if a startup merged with another startup in a given year. Column (4) shows the funding impact specifically for merging versus non-merging female-founded startups. Post is an indicator equal to one for years after 2015. All specifications include startup and year fixed effects. The sample includes 2,112 startup mergers (267 involving female-founded startups) between 2010-2019. Standard errors (in parentheses) are clustered at the startup level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

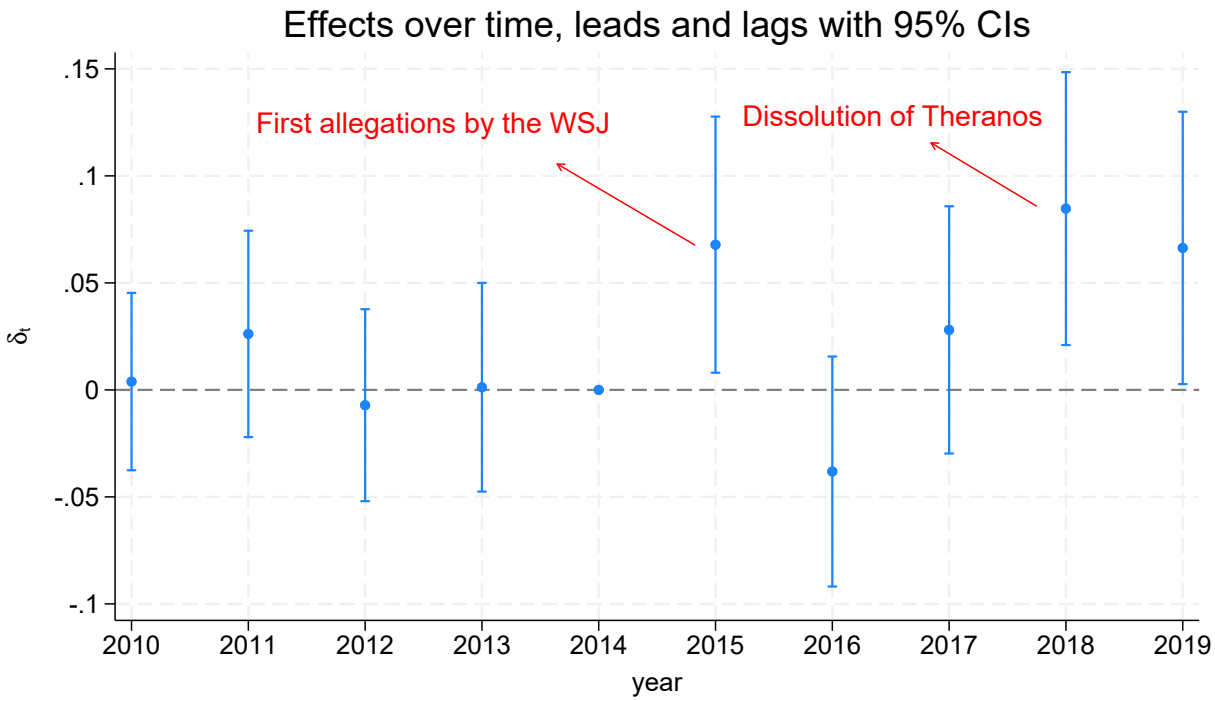

Figure 9: Event-Study Plots for DID Regression on Startup-Mergers

Note: This figure presents the event study coefficients from the difference-in-differences analysis of the Theranos shock. The dependent variable is an indicator for startup merger activity. Coefficients represent the differential effect on female-founded startups relative to male-founded startups. Vertical bars represent 95% confidence intervals. Standard errors are clustered at the startup level.

6 Who or What Facilitates Startup Mergers?

The PayPal merger story illustrates a crucial aspect of startup consolidation. Despite clear strategic benefits, these deals often face significant interpersonal and organizational challenges. In PayPal's case, Elon Musk and Peter Thiel's mutual hostility threatened to derail a potentially valuable merger. Only through the intervention of investor Michael Moritz, who visited their Palo Alto offices, did the transaction become feasible. This raises a fundamental question: given the inherent frictions in startup mergers, who or what facilitates these transactions? To address this question, I analyze the characteristics of 3,886 U.S.-based startup mergers, focusing on three potential facilitating mechanisms: founders, investors,

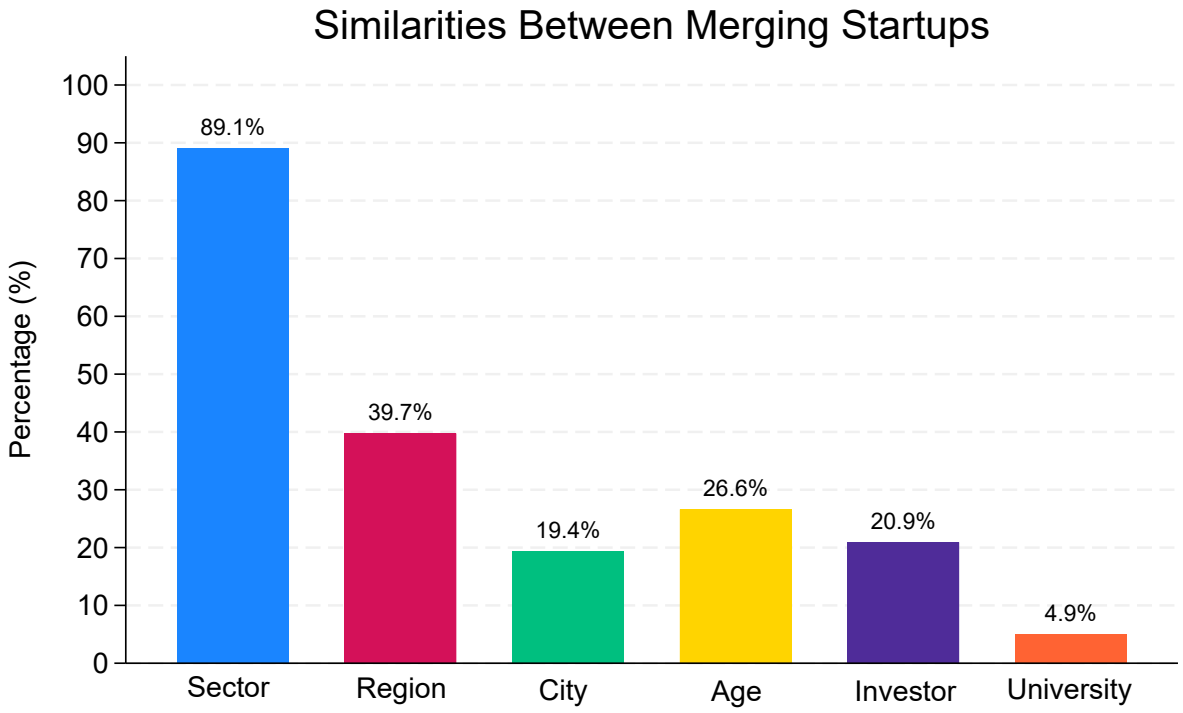

Figure 10: Similarities Between Merging Startups

Note: This figure shows the percentage of startup mergers where the merging firms share various characteristics. The sample includes 3,886 U.S.-based startup mergers. 'Sector' indicates same industry classification, 'Region' indicates same geographic region, 'City' indicates same city location, 'Age' indicates founding dates within 1 year, 'Investor' indicates at least one common investor, and 'University' indicates founders attended the same university. Data source: Crunchbase.

and broader networks. Figure 10 presents surprising findings about the similarities between merging startups. The most striking pattern is the relative lack of obvious connecting factors between merging firms. While 89.1% of mergers occur within the same sector—logical given the competition for similar resources—other potential linking mechanisms appear less important. Geographic proximity, often considered crucial in startup ecosystems, plays a surprisingly minor role. Only 19.4% of mergers involve firms from the same city, and just 39.7% from the same region. This suggests that intermediaries must play an important role in facilitating deals across geographic boundaries. Educational networks appear even less important. Only 4.9% of merging founders attended the same university, indicating that

alumni connections are not a primary merger facilitator. Perhaps most surprisingly, only 20.9% of mergers occur within the same investor's portfolio. Like in PayPal's case, this suggests that the broader investor network across different VC firms, rather than direct portfolio management, drives deal facilitation.

These patterns indicate that startup mergers typically require active intermediation rather than emerging naturally from obvious connections. The low prevalence of direct links between merging startups suggests that third parties—likely investors or other ecosystem participants—play a crucial role in identifying and facilitating these transactions.

To understand who facilitates startup mergers, I estimate a logit regression comparing merging and non-merging startups. Table 4 presents these results, focusing on target characteristics at the time of merger and excluding startups that achieved exits through IPO or acquisition.

The results reveal the crucial intermediary role of first lead investors, resonating with PayPal's merger story where Michael Moritz, as X.com's first lead investor, ultimately facilitated the deal. The increase in R-squared—from 0.020 to 0.204—when including first-lead investor fixed effects provides strong statistical evidence for this mechanism. Even after adding region and founding-year fixed effects in Column 3, the first lead investor's importance persists, with R-squared further increasing to 0.249.

While other factors also influence merger probability—such as founder team size, local startup density, and network events—their economic significance appears secondary. For instance, the total number of investors loses its significance once I control for the first lead investor, suggesting that the first lead investor relationship matters more than the broader investor network. This aligns with my earlier finding that only 20.9% of mergers occur within the same investor's portfolio, pointing to lead investors' role as bridge-builders across different VC networks. This result underscores the tremendous importance of venture capitalist networks, documented in earlier studies Hochberg et al. (2007).

Table 4: First Lead Investors as Key Facilitators of Startup Mergers: Logit Regression Results

	(1) Startup Merger	(2) Startup Merger	(3) Startup Merger
Log Total Funding (USD)	0.000	-0.015***	-0.012***
	(0.001)	(0.002)	(0.002)
Number of Funding Rounds	-0.002*	0.002	-0.008***
	(0.001)	(0.001)	(0.001)
Number of Founders	0.012***	0.015***	0.016***
	(0.002)	(0.003)	(0.003)
Event Count (Startup)	0.006***	0.006***	0.004***
	(0.001)	(0.001)	(0.001)
Startups in the City	0.005***	0.003***	0.006***
	(0.001)	(0.001)	(0.001)
Log Total Investment Count	0.008***	0.007***	0.010***
	(0.001)	(0.002)	(0.002)
Total Number of Investors	-0.001***	0.000	0.001***
	(0.000)	(0.000)	(0.000)
Female Founded	-0.028***	-0.025***	-0.017***
	(0.005)	(0.006)	(0.006)
R2	0.020	0.204	0.249
Adj. R2	0.019	0.044	0.092
N	21,350	16,175	16,114
Region-FE	No	No	Yes
Foundation-Year FE	No	No	Yes
First Lead-Investor-FE	No	Yes	Yes

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Note: This table presents logit regression results examining determinants of startup merger probability. The dependent variable is an indicator equal to one if a startup participates in a merger. The sample excludes startups that achieved exits through IPO or acquisition. Independent variables include funding characteristics, founder team attributes, and network measures. Fixed effects specifications progressively add controls for region, founding year, and first lead investor. Standard errors (in parentheses) are clustered at the startup level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

The data also reveals a concerning pattern: female-founded startups are 1.7-2.8 percentage points less likely to merge, even after controlling for other factors. Higher total funding shows a negative association with merger probability, consistent with my interpretation of mergers as a survival strategy for resource-constrained startups.

These findings suggest that while local ecosystems and founder characteristics matter, the first lead investor plays the decisive role in facilitating startup mergers. Much like Moritz in the PayPal case, these investors appear to serve as crucial intermediaries, helping startups overcome the substantial frictions involved in merger transactions.

7 Conclusion

This paper takes a first step toward opening the black box of startup growth by documenting and analyzing a previously understudied phenomenon in entrepreneurial finance: startup-to-startup mergers. Using a comprehensive dataset of 7,685 startup mergers between 2000 and 2023, I show that these transactions represent an increasingly important mechanism for startups to achieve the rapid scaling necessary for successful exits. These mergers are particularly prevalent during periods of resource scarcity and occur predominantly in transformative sectors where competition for specialized talent is intense. The analysis reveals that merging startups achieve substantially better outcomes: they show higher survival rates and are 4.5 times more likely to reach successful exits through either IPO or acquisition compared to their non-merging counterparts.

The empirical evidence supports the interpretation that these mergers serve as a strategic response to the dual challenge of resource constraints and scale requirements. Merger activity increases during funding droughts, and transactions typically cluster around "cold" financial markets. Using the Theranos scandal as a quasi-natural experiment, I establish a causal relationship by showing that female founders experiencing sudden funding constraints were

significantly more likely to pursue mergers following the shock. Moreover, the data suggests that first lead investors play a crucial role in facilitating these transactions, with investor identity alone explaining over 20% of merger activity variation.

Important questions remain for future research. We need to better understand the specific channels through which startup mergers create value. Do they primarily reduce labor market competition for scarce talent? Do they improve bargaining positions with venture capitalists? The role of scale is particularly intriguing—mergers might help firms reach critical thresholds for accessing growth capital or achieving successful exits.

Moreover, the case of PayPal illustrates both the complexity of evaluating these transactions and their potentially far-reaching policy implications. From a traditional antitrust perspective, the 2000 merger between PayPal and Confinity was clearly anticompetitive—it combined direct competitors to end a price war. Yet this same merger enabled the survival of an innovation that might otherwise have perished in the dot-com crash. Today, PayPal is an S&P 500 company with over 300 million customers that provides meaningful competition to traditional payment providers.

This raises fundamental questions about the aggregate welfare effects of startup mergers: Does the benefit of commercializing innovations outweigh the cost of reduced competition? When resource constraints threaten multiple competitors' survival, might consolidation actually preserve rather than harm competition? Traditional antitrust frameworks, designed for mature firms in established markets, may need adaptation when applied to startup mergers. When evaluating these transactions, regulators might consider not only standard competitive effects but also the likelihood that the innovations involved would survive independently. This is particularly relevant in transformative sectors where the path from innovation to commercialization is both critical for social welfare and inherently uncertain.

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A Appendix

A.1 Comparison Crunchbase vs. Refinitiv

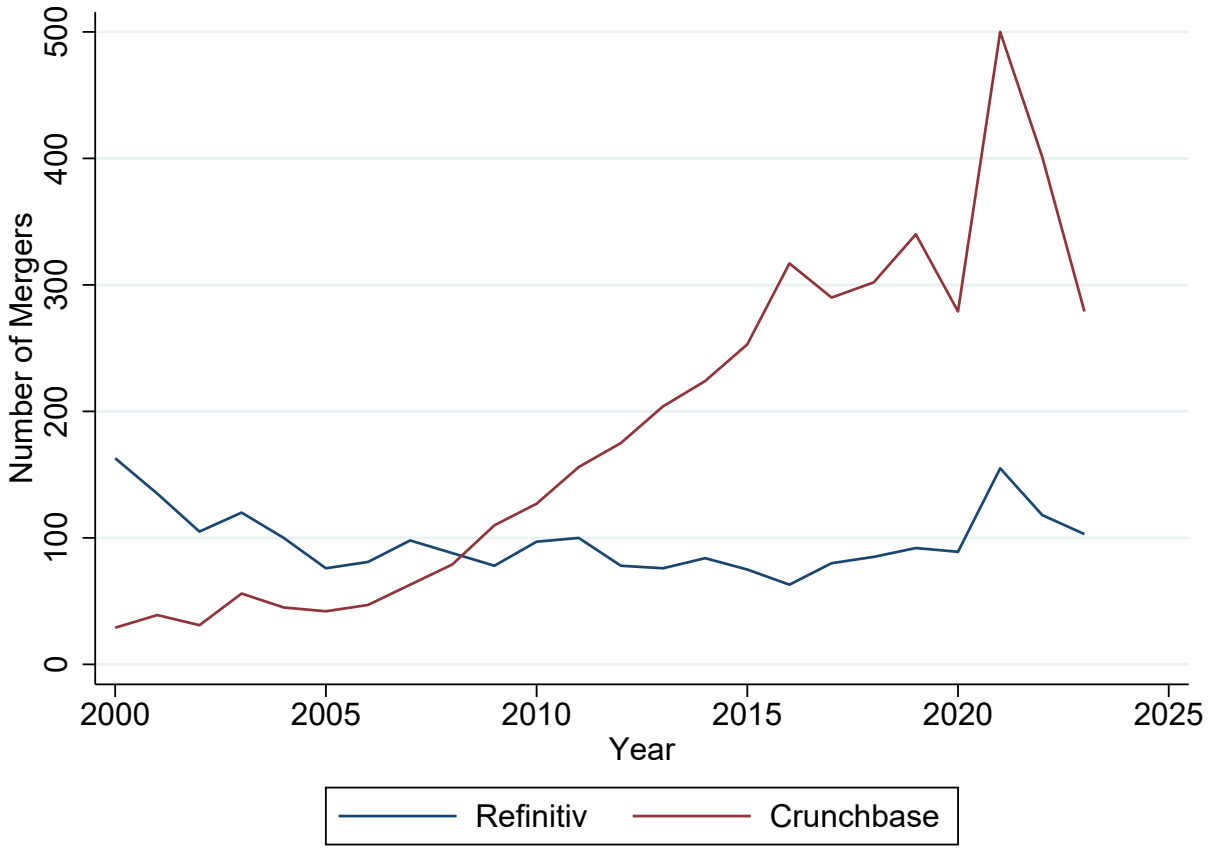

Figure A1: US-based Startup Mergers: Refinitiv vs. Crunchbase

Note: This figure shows the evolution of startup-to-startup merger activity in the United States from 2000 to 2023. The blue line represents the number of startup merger transactions per year recorded in LSEG Refinitiv, while the red line shows the corresponding number of deals reported in Crunchbase. Both datasets are restricted to U.S.-based startups to ensure a consistent comparison and to avoid capturing country-specific differences in coverage. Data source: Crunchbase and LSEG Refinitiv