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How do External Shocks Impact Exit Strategies in Healthcare Private Equity Investments?

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M

2024



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Dissertation
Master in Finance

Supervised by
Professor Fábio Dias Duarte

2024

Acknowledgements

I would like to express my deepest gratitude to my family, in particular my parents and sister, for their unconditional support throughout my life and academic journey. Your encouragement and belief in me have been invaluable, and I am deeply thankful for your constant presence by my side. This dissertation marks the end of a long and challenging journey, that would not be possible without you.

I would also like to extend my genuine thanks to all my professors and colleagues whom I have had the privilege to meet and learn from during my academic career. Your guidance and camaraderie have greatly enriched my educational experience.

In particular, I wish to express my sincere appreciation to Professor Fábio Duarte for his exceptional assistance, advice, and experienced insights. His generous investment of time and effort in helping me shape this dissertation has been indispensable, and I am profoundly grateful for his support.

Abstract

For investors, private equity (PE) exit strategies are essential as they enable the realization and distribution of investment returns. This research examines the impact of external shocks promoted by global health crises, with particular attention for the Covid-19 pandemic, on PE exit strategies in the healthcare sector. A topic that has received limited attention despite its growing importance. Analyzing daily PE exit deals worldwide from January 1, 2004, to December 31, 2023, we focus on Exit Value, Earnout Portion Over Exit Value, Time to Exit, and the PE Exit Strategy adopted. Our results show that COVID-19 significantly influenced PE investors' decision-making processes regarding exit strategies. Additionally, we studied other crises, namely H1N1, Zika, and Ebola. Despite these crises also had some impact, the weaker effects underscore the unprecedented magnitude and influence of the COVID-19 pandemic on PE exit strategies.

Key-words: Private Equity, Exit Strategies, COVID-19 Impact, Healthcare Sector, Earnout, Exit Value, Time-to-Exit, Global Health Crises, Pandemic Effects.

Highlights

- This research examines the impact of the COVID-19 pandemic on Private Equity exit strategies in the healthcare sector.
- COVID-19 impacted all sectors similarly regarding exit value and earnout portion over exit value.
- However, while the pandemic generally increased time-to-exit across sectors, it decreased in the healthcare sector.
- The pandemic reduced the earnout portion over exit value across all sectors, including healthcare.
- IPOs were the least attractive exit option during the pandemic across all sectors.
- Healthcare PE managers favored strategies such as Buybacks, Write-Offs, or Reverse-Takeovers over IPOs.

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List of Abbreviations

Abbreviation	Meaning
BB/WO/RT	Buybacks, Write-Offs or Reverse-Takeovers
GDP	Gross Domestic Product
IPO	Initial Public Offering
MNL	Multinomial Logit
OLS	Ordinary Least Squares
PE	Private Equity
VC	Venture Capital
WHO	World Health Organization

1. Introduction

Private equity (PE) involves investments made by investment funds in companies, usually with the objective of restructuring and improving their performance before subsequently selling them for a profit (Cumming, 2009). These funds consist of individual fund managers, known as General Partners, and outside investors, called Limited Partners, who inject capital directly into private, non-publicly traded companies or funds (Beyer et al., 2022). Typically organized as partnerships, PE firms raise capital and structure their investments in funds with limited liability (Hagen and Mundal, 2022). The involvement of PE in healthcare refers to the allocation of funds by PE firms into for-profit healthcare companies representing a strategic approach to generating returns through value adding and eventual exit, often through sales or public offerings (McInerney et al., 2023).

Compared to dispersed public ownership, PE offers a superior organizational form that can efficiently manage and restructure companies, leading to improved performance and value creation (Jensen, 1989). Throughout the 21st century, the PE industry has experienced substantial growth, attracting increased attention and capital (Ellis, 2013; Hagen and Mundal, 2022). Historically, PE has provided investors with superior returns compared to public equity benchmarks, particularly until 2006, although this outperformance has leveled off in recent years (Morris and Phalippou, 2020). Indeed, from 2006 to 2018, PE yielded an average annual return of 13%, significantly outperforming the S&P 500, which averaged 8% annually during the same period (Gruener and Marburger, 2022).

A critical component of the PE process is the strategy for exiting investments. Exit strategies are essential as they enable the realization and distribution of capital gains to investors, which constitute the majority of PE returns (Baker et. al, 2015). According to Gompers et al. (2022), the importance of exit strategies was particularly evident during the COVID-19 pandemic; despite the economic downturn, 55% of PE managers were actively seeking to exit existing portfolio companies, highlighting the necessity of strategic planning in uncertain times. The chosen exit route significantly impacts the allocation of issuing proceeds and the provision of incentives, making the exit decision a crucial factor in the value creation process in PE investments (Bienz and Leite, 2008).

Literature examining PE exit strategies is extensive. Cumming and MacIntosh (2003), Cumming and Johan (2008), and Johan and Zhang (2016) provide valuable insights into the mechanisms and outcomes of various PE exit routes. However, the impact of external

shocks, such as global health crises, on these exit strategies has received limited attention (Uddin and Chowdhury, 2021), presenting a significant gap in the existing literature. Indeed, the authors argue to be the first to examine the effect of COVID-19 on the choice of exit vehicles.

Given the growing importance of the healthcare sector within the context of PE (see Scheffler et al., 2021), it is crucial to expand the existing research to address the specific impacts of public health crises on this sector. Uddin and Chowdhury (2021) have examined exit strategies and the general impact of COVID-19 on PE exits. But the healthcare sector's unique characteristics and significant role in PE investments call for a focused study. For this reason, we start by guiding our study on the research conducted by these authors but extend it to the healthcare sector, which was one of the most impacted during this period (Mahmood et al., 2023). This research aims to fill this gap by providing a comprehensive analysis of the impact of global health crises on PE exit strategies within the healthcare sector.

Our study conducts a comprehensive analysis of daily PE exit deals worldwide from January 1, 2004, to December 31, 2023. As mentioned, the primary objective is to investigate the impact of global public health crises on PE exit strategies, with an initial focus on the COVID-19 pandemic. We will examine the effects of the pandemic on *Exit Value*, the *Earnout Portion Over Exit Value*, *Time to Exit*, and the *PE Exit Strategy* adopted. Although, COVID-19 is not the first pandemic examined in past research. For instance, back in 2018, Ichev and Marinč (2018) studied the impact of the Ebola Pandemic on the stock prices. We also extend our study to other global health crises. To determine whether other public health crises had similar impacts to COVID-19 in PE exit strategies, we assess the impact of the H1N1 influenza, Zika, and Ebola crises on PE exit outcomes. These analyses allow us to assess systematic idiosyncrasies in the impact of the COVID-19 pandemic, and related events, on PE exit strategies in the healthcare sector.

Previous studies show that disease-related aspects impact financial conditions in particular in some healthcare industries such as the pharmaceutical (e.g., Donadelli et al., 2017). For that reason, it potentially impacts also healthcare investors behave. To disclose this assumption, we also extend the analysis to assess the impact of critical timings in the vaccination timeline, namely the announcement that vaccines were in the final phase of development and the beginning of vaccine administration.

Our findings reveal that COVID-19 significantly influenced the decision-making processes regarding exit strategies among PE investors. We show that the pandemic had a

similar effect in the healthcare sector compared to the overall market, with a positive impact on exit value. We also find a negative effect of COVID-19 on the proportion of earnouts in all sectors, including the healthcare sector. However, in terms of time-to-exit, the healthcare sector diverged from the trend observed in other sectors. During the pandemic, the time-to-exit significantly decreased in the healthcare sector, whereas it increased significantly across other sectors.

Regarding PE exit strategies our results report that in the overall market during the pandemic an Initial Public Offering (IPO) exit was the least likely to happen compared to all alternative exit types. In healthcare sector, our findings suggest that PE managers also disfavored IPOs exit strategies when compared to Buybacks, Write-Offs, or Reverse-Takeovers (BB/WO/RT), but did not find significant evidence regarding the remaining ones. Even after applying all control variables to our baseline model, the findings remain statistically robust. These results are robust to additional checks.

This dissertation is structured as follows: Section 2 provides a comprehensive literature review. Section 3 outlines the data and methodology used to conduct this study. Section 4 presents and discuss the findings of our analysis for our baseline model and robustness check models. Section 5 extends to study to the effect of other global health crises on PE exit deals. Section 6 concludes.

2. Literature Review

2.1. Healthcare sector and Private Equity

Healthcare is a mainstay of the global economy, generating nearly \$4 trillion in annual revenues and accounting for 18% of the US' Gross Domestic Product (GDP) (Rhyan et al., 2020). Over the past few decades, healthcare spending in the United States has grown much faster than the economy itself. The U.S. spends nearly twice as much on healthcare as other developed countries, both as a percentage of its GDP and on per capita basis (Papanicolas et al., 2018). This sharp growth demonstrates the sector's increasing economic significance and its appeal as a robust investment arena.

Indeed, the most recent decades has seen a surge in consolidation across the healthcare industry, driven by financial pressures, reductions in government funding, and the advent of new technologies that facilitate the virtual integration of diverse healthcare providers such as hospitals, outpatient clinics, and physician practices (Appelbaum and Batt, 2020).

Healthcare's economic prominence has naturally attracted the attention of private equity (PE) investors (Beyer et al., 2022). The sector has become a focal point for PE investments, with healthcare emerging as the second-largest sector for such activity (Scheffler et al., 2021). Between 2010 and 2020, US PE deals in healthcare increased by over 250% (Billig et al., 2021), indicating a rapid acceleration of interest and investment in this area. By 2018, PE investments in the healthcare sector had reached unprecedented levels, with 855 deals and \$100 billion in capital committed (Appelbaum and Batt, 2020). This upward trend persisted into 2019, with nearly all of the approximately 4,000 PE firms in the United States expressing significant interest in healthcare services, and in 2021, with investments in the U.S. healthcare sector surging to \$206 billion through 1,400 acquisitions (Schulte, 2022).

The sector's attractiveness is boosted by the stable supply of profitable businesses and the scope for innovation, providing fertile ground for PE investors (Abraham et al., 2015). The robust investment activity in the sector highlights healthcare's vital role in the economy. Its solid growth has positioned the healthcare sector as one of the main targets for PE investments, with its resilience and stability offering substantial opportunities for value creation. Consequently, the sector has become a focal point for investors seeking to capitalize on its dynamic and expanding business environment (Choi et al., 2021).

The healthcare sector's appeal to PE investors branches from its perceived stability and resilience to economic fluctuations, supported by the aging population and increasing prevalence of chronic illnesses, which ensure consistent demand for services (Kaiser, 2024). Additionally, current financial and regulatory conditions have fostered deeper PE integration into healthcare, where demographic shifts and technological advancements present numerous opportunities for investment and innovation, enhancing its attractiveness to PE firms (Henry and Loomis, 2023).

But do health-related external shocks, such as COVID-19, influence the sector's appeal for PE investors and their exit strategies? (Research question 1, RQ1)

2.2. The COVID-19 Pandemic

The COVID-19 pandemic had unprecedented effects on the healthcare sector and its peers as the global economy experienced a significant downturn (Ghorbel et al., 2022; Karim et al., 2022). The recession induced by the pandemic has impacted the health sector in ways unseen in previous economic downturns as lockdowns lead to a severe economic crisis (Rhyan et al., 2020; Smales, 2021). The pandemic generated significant uncertainty in financial markets, impacting firms' revenues and cash flows, leading to the underpricing of many firms. (Naqvi et al., 2021; Umar et al., 2021). Thus, forcing PE firms to reassess their strategies, which in turn affected their ability to make new investment decisions (Gompers et al., 2022). Volatility in financial markets increased substantially during the pandemic period (Mazur et al., 2021; Zhang et al., 2020; Cheng, 2020). Consequently, the shock and panic associated with the pandemic led to severe uncertainty worldwide, impacting investors behave across all sectors (Baker et al., 2020).

The impact of COVID-19 was felt globally by most businesses and organizations (Budhwar and Cumming, 2020), including the PE industry, which saw reduced value and growth in portfolio companies (Uddin and Chowdhury, 2021). Indeed, Gompers et al. (2022) showed that PE managers reported that approximately 50% of their portfolio companies were negatively affected by the pandemic. Though, for new investors, the damages created by COVID-19 in businesses valuation has created some new potential investments opportunities so the initial shock of the pandemic led to a significant increase in spending, investments, and liquidity in capital markets (European Central Bank, 2022; Labonte, 2021). Some literature helps to justify that. For instance, Kou et al. (2021) reported a significant rise

in the use of technology and innovation following the global pandemic. Indeed, Cumming and Johan (2013) suggest that during crises, going public can be challenging, but it can open new opportunities in secondary markets, which are crucial for maintaining PE's attractiveness to new investors.

There is strong evidence that the impact of COVID-19 on PE decisions as the pandemic created obstacles that made it difficult to complete deals, changed portfolio companies' competitiveness, and sudden changes in valuation may explain those effects (Green, Oxman, and Seghers, 2020). The pandemic forced PE managers to adapt by making strategic changes, such as selecting appropriate exit vehicles or adjusting the duration of their exit strategies, which were crucial for maximizing investment value (Uddin and Chowdhury, 2021). *But did COVID-19 impacted all sectors in the same way?* (RQ2).

In fact, some researchers have founded positive impact of the pandemic over some healthcare industries, such as pharmaceuticals and biotechnology (Chundakkadan and Nedumparambil, 2022). Therefore, would be reasonable to examine whether there were also differences in exit strategies in the context of the healthcare investors in comparison to the generality of sectors. This study answers that question.

2.3. The COVID-19 Vaccine

It is widely established that the deployment of safe and effective vaccines is essential for controlling COVID-19 transmission and implementing successful exit strategies (Forman et al., 2020). Indeed, the role of COVID-19 vaccines in influencing economic and financial outcomes has been extensively examined in prior research. For instance, previous research has analyzed the COVID-19 vaccine authorization impact on equity fund returns (e.g., Mirza et al., 2023), on crowdfunding campaign success rates (e.g., Gama et al., 2023) and specifically after the vaccination announcement, and its impact on financial and commodity markets (e.g., Kucher et al., 2023).

The introduction of the first vaccine had a very positive impact in economy, businesses conditions and investors sentiment on the announcement day (Mirza et al., 2023). Confirming the findings of Arifuzzaman and Sattar (2021), Yousefnaghani et al. (2021) and Hussain et al. (2021) who also noted evidence of higher positive sentiments about COVID-19 vaccines on social media reactions. This is substantiated by the authors' findings, which identified a positive impact on funds' returns, as well as by Gama et al. (2023), who observed

that the onset of vaccination positively influenced the likelihood of funding success on crowdfunded microfinance platforms. Piñeiro-Chousa et al. (2022) also observed the stock market reaction to Pfizer and Moderna, the first COVID-19 vaccines. They noted that market volatility and investor sentiment caused by the vaccine related news asymmetrically influence stock returns.

Despite the valuable insights provided by the current literature in such a short period, there is, to our knowledge, no research focusing on the impact of COVID-19 vaccination periods on PE managers' exit strategies. This is another gap we aim to fill, especially given that previous studies have found evidence of different patterns during the COVID-19 pandemic and the post-vaccination period. For instance, Kucher et al. (2023) discovered that stock and commodity markets experienced larger declines at the beginning of the pandemic and received a significant boost from positive vaccine update. To address this, we will examine how PE exit strategies behave after two main vaccine-related events in comparison to the COVID-19 period: vaccine research, which saw intensive investment from both governments and private investors, particularly in the pharmaceutical industry, one of the largest sectors in healthcare (Forman et al., 2020; Joshi, 2015), and vaccine authorization, an aspect still lacking in the literature (Mirza et al., 2023).

2.4. PE exit strategies

PE investors typically provide capital to private companies for expansion, new product development, or restructuring. As the companies grow, PE investors often divest their stakes to return capital to limited partners or to pursue new investment opportunities by exiting (Dziekoński and Ignatiuk, 2015). Indeed, Cumming and Macintosh (2003) suggest that, over time, as portfolio company management gains experience, the marginal value added by sustained investment is likely to reduce; consequently, the PE firm will eventually reach a stage where continued investment no longer provides a positive marginal value added, prompting investors to start considering exiting their investments.

Exit plays a crucial role in PE managers success as it provides investors a reliable measure of the PE firm's performance and enables them to reallocate funds to more successful firms, as highlighted by Black and Gilson (1998) and Chang (1996). Indeed, there are empirical evidence that shows that sometimes managers compromise their good investments success due to their exit strategies (Elfenbein and Knott, 2014).

Previous literature identifies profitability and exit value (e.g., Cumming and Johan, 2013), investment horizon (e.g., Cumming and Macintosh, 2003), and the selection of the most appropriate exit strategy (e.g., Hagen and Mundal, 2022) as some of the most crucial considerations for PE managers when planning an exit.

2.4.1 Exit Value

Achieving high returns is a fundamental objective of the majority of PE investments (Agbloyor et al., 2020). According to Cumming and Johan (2013), these investments are mainly valued based on the capital gains realized upon an exit event. Thus, measuring the potential exit value is crucial for a well-succeed exit, making it one of the most significant aspects of PE exit strategies. The authors also highlight the critical role of exit value in the relationship between the fund and the portfolio company. They suggest that when a fund exercises greater management control over the financed company, the anticipated exit value tends to be higher. On the other hand, a lower degree of management control associates with a reduced exit value. In fact, McConnell et al. (2008) also found evidence of a positive association between the level of ownership retention and exit value.

However, exit value also depends a lot on market conditions (Clausen-Jørgensen and Flor, 2024). In the case of an IPO exit, the exit value to partial or fully sell a stake depends on a profitability index that fluctuates with financial market conditions, resulting in higher valuations during favorable markets (Axelson et al., 2013; Gorbenko and Malenko, 2014). As PE funds aim to secure the highest possible exit price, they try to take advantage of “windows of opportunity” (Jenkinson and Sousa, 2015; Cao, 2011; Michala, 2019). When the exit is to another PE fund, the exit value depends on various factors – such as the complementary skills between the selling and buying PE funds, or whether the selling fund is under time pressure or not, significantly influence secondary sales (Degeorge et al., 2016; Arcot et al., 2015).

Busenitz et al. (2005) also found a behavioral influence associated with exit value. The authors suggest that the founders' financial commitment reflects their optimism, and it can potentially increase the exit value. Different exit alternatives, investor presence and founders' human capital are other drivers of the exit value target of research (see Montanaro et al., 2021).

Yet, the impact of external shocks on exit value still requires further research (Uddin and Chowdhury, 2021). Some authors have studied the impact of COVID-19 on the exit value of companies leaving the market during this period (e.g., Miyakawa et al., 2021). However, the pandemic's impact on PE exit strategies has only been addressed by Uddin and Chowdhury (2021), who noted that COVID-19 had a significant negative impact on the value of exit deals. In our research, we aim to determine if the healthcare sector follows the same pattern in this regard.

2.4.2. Earnout

An earnout is a contingent payment method used in acquisitions with a two-stage structure. The first stage involves an agreed-upon upfront payment made at the closing of the transaction. The second stage, the earnout, is a deferred payment contingent on the target's performance, based on specific metrics at a later date (Barbopoulos and Sudarsanam, 2012). Differences in target valuation often cause mutually beneficial deals to fall through (Cain and Denis, 2010). However, Kohers and Ang (2000) show that earnout can have a crucial role in preventing these situations, arguing that using earnouts can facilitate deal completion despite valuation disagreements. Moreover, Wolf and Fox (2010) find that earnouts are commonly used in the pharmaceutical industry because they suit the binary outcomes (approval or rejection) of new drug approvals.

Numerous drivers influencing the practice of earnouts have been examined in the literature. For instance, Kohers and Ang (2000) and Datar et al. (2001) provide evidence that informational asymmetry significantly impacts the likelihood of employing earnouts. They find that earnouts are more commonly used in acquisitions involving private targets, where valuation-relevant information is less accessible due to the scarcity of public data. Moreover, financial constraints and the need for external funding also play a crucial role (Kaplan and Zingales, 1997; Bates et al., 2018). These studies reveal a negative relationship between the use of external funding and the likelihood of employing earnouts, suggesting that external funding and earnouts are competing mechanisms in business financing.

To the best of our knowledge, no study has investigated the influence of external shocks and global health crises on the decision-making process regarding the inclusion of earnouts in deals. However, earnouts are commonly linked to periods of uncertainty (Ferguson et al., 2024). Considering the profound market and financial activity uncertainty

during the COVID-19 pandemic (Gompers et al., 2022), we assert the importance of including this topic in our study aiming to answer to following question: *Do external shocks, such as COVID-19, impact the portion of earnouts in PE deals?* (RQ3). In Section 3.1., we explain in detail how we address this question.

2.4.3. Time to Exit

In the investment process as much important as deciding when to exit an investment, is deciding for how long to invest (Cumming and Johan, 2013). Timing of exit is indeed crucial for funds managers ability to create value in PE investments (Hagen and Mundal, 2022). For example, Henry and Loomis (2023) states that PE firms secure profits through strategically structuring the terms and duration of their investments. Moreover, Horn et al. (2006) suggests that sometimes business ventures spend more economic resources than need by keeping their investment for too long. Guler (2003) also highlights exits' timing importance in bad investment decisions, suggesting that sometimes PE managers low performance is not motivated by their choice but for their inability to exit unsuccessful venture in the right time.

Typically, PE investments have a finite lifetime, with portfolio companies being held for a period of three to seven years (Cumming and Walz, 2010). However, some firms may have lock-up periods extending up to ten years, allowing for a longer horizon to improve the financial health and operations of their portfolio companies (Ivashina and Lerner, 2019).

According to Bienz (2017), on average, a portfolio company is held for about five years, but these durations can be adjusted based on market conditions and external shocks. For instance, in response to the COVID-19 pandemic, 72.2% of surveyed PE managers reported extending the investment horizon for existing portfolio companies (Gompers et al., 2022).

Numerous researchers have examined various factors influencing the time it takes for investors to exit their investments. The impact of investment stage and the number of available venture funds (Cumming and MacIntosh, 2001), the role of ventures, entrepreneur, deal, and market characteristics (Cumming and Johan, 2010), the effect of Venture Capital (VC) type (Guo et al., 2012), and the influence of sector, investor type, location, and investment rounds (Ramesh and Annamalai, 2021) are just some examples of the vast body of literature on this topic. However, the impact of exogenous shocks in this important

nuance of exit strategy remains underexplored (Uddin and Chowdhury, 2021). That is another gap that we aim to fill, by adding new perspectives to these authors' paper.

2.4.4. Exit Type

There are five methods for PE investors to exit their investments: IPO, Mergers, secondary sales, buyback and write-off (Cumming and MacIntosh, 2003). IPOs involve listing portfolio companies on public stock exchanges, facilitating the sale of shares to public investors. A Merger involves combining the portfolio company with another company. This can be a strategic exit where the portfolio company merges with a competitor or a company in a complementary business to create a larger entity (Hossain, M. S., 2021). Secondary Sales occur when one PE firm sells a portfolio company to another PE firm, while other stakeholders retain their investments (Degeorge et al., 2016; Agyapong, 2017). The buyback strategy involves PE firms selling their stake back to portfolio companies, often using the company's surplus cash or external borrowing (Wang and Sim, 2001). A significant drawback of buybacks is their inability to raise new capital for the portfolio company (Agyapong, 2017). In more extreme scenarios, a write-off happens when a PE firm decides that the investment in a portfolio company is no longer recoverable and removes the asset from its books, recognizing the loss (Yang and Zhang, 2009).

Past research indicates that returns can differ significantly across various exit outcomes (Nikoskelainen and Wright, 2007). IPOs are often perceived as the most successful and profitable exit strategy (Zingales, 1995). It allows entrepreneurs to negotiate a better price, and consequently get higher returns than a direct sale (Wang and Sim, 2001; Schwienbacher, 2002; Schmidt et al., 2007). However, IPOs are fraught with uncertainties. This is largely due to the lock-up periods and stringent regulatory requirements associated with them (Jenkinson and Sousa, 2015).

In contrast, the 2000s saw a rise in the popularity of secondary sales, achieving over 40% of PE exits (Kaplan and Strömberg, 2009). This trend was fueled by increased availability of capital and the advantages of lower search costs and reduced adverse selection risks (Bird et al., 2011). Mergers offer an alternative that often involves less regulatory burden and superior pricing, as strategic buyers are typically willing to pay premiums for synergies, leading to a more efficient divestment process (Hagen and Mundal, 2022). Achleitner et al. (2012) demonstrated that in North America and Europe, returns from secondary sales are

comparable to those from IPOs. Although mergers typically generate lower returns compared to IPOs (Bygrave and Timmons, 1992; Wall and Smith, 1997; Bienz and Leite, 2008). Nevertheless, mergers remain attractive to PE firms due to their strong pricing potential and provision of instant liquidity (Klonowski, 2010).

Cumming and Macintosh (2003) further hypothesized that exits for higher quality firms would occur in a descending order of likelihood from IPOs to acquisitions, secondary sales, buybacks, and finally write-offs. They suggest that buybacks may indicate difficulties in achieving performance targets or securing more profitable. Their findings, however, only confirmed IPOs as the preferred exit strategy for high-value companies, while write-offs were linked to the least valuable firms.

The COVID-19 pandemic shifted investor preferences toward strategic sales and sales to financial buyers as preferred exit strategies, with only larger and more established PE firms showing a tendency for IPOs (Gompers et al., 2022). However, common exit strategies in practice include IPOs, trade sales, and secondary buyouts (Hagen and Mundal, 2022), with Uddin and Chowdhury (2021) observing a trend toward mergers as the favored exit method during the pandemic.

Predominantly, IPOs and acquisitions are regarded as the most crucial exit methods, and consequently, the majority of literature on exit strategies concentrates on these two modes (Black and Gilson, 1998). There is an even more notable lack of research concerning the impact of external shocks on these exits (Uddin and Chowdhury, 2021). Building on the findings of these authors, we aim to fill this gap, by investigate whether PE investors in the healthcare sector maintain a similar pattern in their exit choices during diverse external shocks in the context of public emergency situations.

3. Data and Method

3.1. Data

We investigate the impact of COVID-19 on Private Equity (PE) exit strategies. Our empirical examination is based on daily exit data collected from Refinitiv (Thomson Reuters) on worldwide PE funds, using announcement dates from 1 January 2004 to 31 December 2023. Table 1 details the definitions of the variables employed in our analysis.

Table 1. Variables definition

Variables	Definition
Dependent variable	
Exit Value	The value at which PE firms sell their investments. It is calculated by summing the proceeds amount, including overallotment sold across all markets (total transaction proceeds plus overallotment or green shoe sold), and rank value (transaction value minus liabilities assumed, plus the target's net debt).
Earnout Portion over Exit Value	Earnout value is the additional compensation that the seller receives in a deal contingent on the business meeting specific financial goals. Exit value is the value at which PE firms sell their investments. This metric is the ratio of the earnout portion of the deal's value to the total exit deal value (earnout value/exit value), ranging between 0 and 1.
Time-to-Exit	The duration investors take to divest their investments. Indicates time in Years between company's first investment received post previous vs the fund's exit date.
PE Exit Strategy	The type of exit by the investors. Possible Exit Types: IPO, Merger, Secondary Sale, Buybacks, Write-Offs, or Reverse-Takeovers.
IPO	Initial Public Offering.
Merger	Merger.
Secondary Sales	Secondary Sales.
BB/WO/RT	Buybacks, Write-Offs, or Reverse-Takeovers.
Main Covariates	
COVID	COVID-19 dummy variable: it has a value of 1 if the exit announcement date took place between March 11, 2020, and May 5, 2023 (dates in which the WHO declared the beginning and the end of the global health emergency for COVID-19, respectively). Otherwise, it has a value of 0. dates source: https://www.who.int/
Robustness Check and Additional Analysis	
COVID Vaccine Research	Period between the day it was announced that vaccines were in the last stage of research on July 27, 2020 and May 5, 2023 (date in which the WHO declared the end of the global health emergency for COVID-19, respectively). dates source: https://www.who.int/
COVID Vaccine Authorization	Period between the day that was given authorization by the European regulatory authority for public use of a vaccine on December 21, 2020 and May 5, 2023 (date in which the WHO declared the end of the global health emergency for COVID-19, respectively.) dates source: https://www.who.int/
H1N1	Influenza A dummy variable: it has a value of 1 if the exit announcement date took place between April 25, 2009, and August 10, 2010 (dates in which the WHO declared the beginning and the end of the global health emergency for Influenza A pandemic, respectively). Otherwise, it has a value of 0. dates source: https://www.who.int/
Zika	Zika dummy variable: it has a value of 1 if the exit announcement date took place between February 1, 2016, and November 18, 2016 (dates in which the WHO declared the beginning and the end of the global health emergency for Zika pandemic, respectively). Otherwise, it has a value of 0. dates source: https://www.who.int/

Ebola	Ebola dummy variable: it has a value of 1 if the exit announcement date took place between August 8, 2014, and March 3, 2016 (dates in which the WHO declared the beginning and the end of the global health emergency for Ebola pandemic, respectively.). Otherwise, it has a value of 0. dates source: https://www.who.int/
Controls	
<i>Firm-deal characteristics</i>	
Firm Age	The age of the exit PE firm, at the exit announcement date.
Stage	The portfolio company's life-cycle stage at the round date.
Seed/Early Stage	If the round occurred in the "Seed" or "EarlyStage" stage.
Growth/Expansion	If the round occurred in the "AcquisitionforExpansion", "Expansion" or "BridgeLoan" stage.
Later Stage	If the round occurred in the "LaterStage", "Mezzanine", "SecondaryBuyout" or "Recap/Turnaround" stage.
Final Stage/Other	If the round occurred in the "Acquisition", "LBO", "MBO", "MBI", "PIPE", "PendingAcquisition", "OpenMarketPurchase", "SecondaryPurchase", "VCPartnership" or "Other" stage.
<i>Exiting PE-fund characteristics</i>	
Prior investment	The total known equity that an exiting fund has invested to date.
ln(Prior investment)	The natural logarithm of the total known equity that an exiting fund has invested to date. This transformation is used to deal with large numbers and to normalize the distribution of investment amounts and mitigate the effects of outliers.
<i>Macroeconomics</i>	
GDPpc Growth	The growth rate of Gross Domestic Product per capita for the country where the exiting fund is located, measured in the year of the exit. Source: https://databank.worldbank.org/
Market Return	The average return of the S&P 500 index over the three months preceding the exit date. Source: https://www.investing.com/indices/us-spx-500-historical-data
YTM 10y	The average yield to maturity of 10-year U.S. Treasury bonds over the previous 12 months. Source: https://fred.stlouisfed.org/series/T10Y2Y

In this study, our primary focus is on the variable *COVID*, a dummy variable indicating whether the exit announcement date occurred within the pandemic period defined by the World Health Organization (WHO). Our main objective is to examine the impact of COVID-19 on *Exit Value*, *Earnout Portion over Exit Value*, *Time-to-Exit* and *PE Exit Strategy*. The *Exit Value* variable enables us to investigate whether PE investors were able to realize higher or lower valuations for their investments during the COVID-19 pandemic (*ceteris paribus*). The *Earnout Portion over Exit Value* is employed as a proxy for measuring the risk exposure of a PE firm. Note that a value of zero for this ratio indicates no earnouts¹; this means the firm receives the full exit value in “cash” up front. For PE firms exiting, this situation implies no risk because the cash-inflows of the deals do not depend on the future performance of the company sold in that deal. Conversely, if the ratio takes the value one,

¹ An earnout contract is an agreement where the portfolio company's purchase price is paid in two stages: an initial payment, agreed between the two parties, at the time of the deal announcement. And a second payment, typically in cash, based on the target's performance after a pre-determined period (Barbopoulos et. al, 2016). In our study, *earnout* refers to the part of the value received by the PE firm that is dependent on whether or not the portfolio company meets performance metrics.

that indicates the entire exit value is contingent on the future performance of the sold company (i.e., all of the exit value is an earnout). This situation implies a high level of risk because the return is entirely dependent on the future success of the portfolio company.

The *Time-to-Exit* variable will allow us to determine if the pandemic accelerated or decelerated the timeline for PE investors to exit their investments. *PE Exit Strategy* variable will provide an understanding of the preferences and strategic choices of PE investors during pandemic periods.

To ensure the robustness of our model, we include various control variables. Firm-deal characteristics: *Firm Age* and *Stage*, included to account for differences in the maturity of different PE firms and development stages of the portfolio companies as both can influence the exit outcomes. Exiting PE-fund characteristics: *Prior investment*, as larger and more experienced funds may have better resources, negotiation power, and strategies for maximizing exit values and managing exit timing. Additionally, macroeconomic variables that allow us to isolate the effect of COVID-19 mitigating some potential macroeconomic factors that could also influence our results. *GDP per capita growth*, indicates the overall economic growth and conditions that naturally influence all the sectors including PE. *Market Return* captures the general performance of the stock market, reflecting investor sentiment and overall economic conditions and the *Yield to maturity of 10-year U.S. Treasury bonds (YTM 10y)* is used to represent the prevailing interest rate environment, which affects borrowing costs and investment decisions.

In order to check the robustness of the effect of COVID on PE exit strategies, we rely on two alternative COVID-related binary variables: *COVID Vaccine Research* and *COVID Vaccine Authorization*. These variables are used to ensure our results are not only driven by the overall context of the pandemic but also consider the specific periods related to the vaccine progress. We report an additional analysis based on the effect of *H1N1*, *Zika*, and *Ebola*; we use these variables to assess the impact of other global crises on exit outcomes. By extending the analysis to *COVID Vaccine Research* and *COVID Vaccine Authorization* and to other health-related crises we can better understand whether the effects observed during COVID-19 are unique.

Table 2 provides the descriptive statistics, with Panel A covering the full sample and Panel B focusing on the healthcare sector. The data distribution of the categorical variables *Exit Strategy* and *Investment Stage* is further detailed in Tables 2.1 and 2.2. Table 2.1 shows that in the full sample, *IPOs* account for 14.65% of exits, *Mergers* for 59.35%, *Secondary Sales* for

22.41%, and other strategies for 3.59%. In contrast, the healthcare sector exhibits a higher preference for *IPOs* at 23.85%, while *Mergers* account for 55.55%, *Secondary Sales* for 15.70%, and other strategies for 4.90%.

Table 2.2 examines the distribution by *Investment Stage*. In the full sample, *Final Stage/Other* comprise 29.41%, *Growth-Stage* investments 32.58%, *Later-Stage* investments 20.17%, and *Seed-Stage* investments 17.84%. In the healthcare sector, *Final Stage/Other* represent 26.89%, *Growth-Stage* investments 33.71%, *Later-Stage* investments 18.89%, and *Seed-Stage* investments 20.60%. The slightly higher proportions of growth and seed-stage investments in the healthcare sector reflect its dynamic and evolving nature, often characterized by significant early-stage funding.

Table 3 highlights the distribution by activity sector in the full sample. The technological sector leads with 35.99% of exits, followed by industrial at 16.28%, consumer cyclicals at 14.40%, and healthcare at 14.03%. The strong representation of the healthcare sector reinforces its critical role and influence in our study. This strong representation allows us to draw meaningful insights into how the healthcare sector's exit strategies differ in response to global health crises compared to other sectors.

Table 2. Descriptive Statistics

Variables		Measure	Panel A. Full Sample					Panel B. Healthcare Sector				
Dependent variables			Obs.	Mean.	Std. Dev.	Min.	Max	Obs.	Mean.	Std. Dev.	Min.	Max
Exit value	in Million USD	5,824	4.50e+08	1.57e+09	10000	6.83e+10	1,070	3.87e+08	9.98e+08	30000	1.37e+10	
ln(Exit value)	ln(Million USD)	5,824	18.54427	1.750232	9.21034	24.94745	1,070	18.53159	1.617052	10.30895	23.34021	
Earnout Portion	Ratio (0:1)	5,824	.0239019	.1079484	0	1	1,070	.0662142	.1884811	0	1	
Time-to-Exit	Years	12,075	5.74029	3.800672	0.1	42.2	1,694	5.997048	3.917776	0.1	42.2	
Exit Strategy												
IPO	Categories	12,075	.146501	.3536225	0	1	1,694	.2384888	.4262853	0	1	
Merger	Categories	12,075	.5935404	.4911926	0	1	1,694	.55549	.4970581	0	1	
Secondary Sales		12,075	.2240994	.4170051	0	1	1,694	.1570248	.3639316	0	1	
BB/WO/RT		12,075	.0358592	.1859467	0	1	1,694	.0489965	.2159244	0	1	
Main Covariates												
COVID	Binary	12,075	.1228157	.3282392	0	1	1,694	.1180638	.3227789	0	1	
Additional Analysis												
COVID Vaccine Research	Binary	12,075	.1139545	.3177691	0	1	1,694	.1097993	.3127317	0	1	
COVID Vaccine Authorization	Binary	12,075	.0968944	.2958262	0		1,694	.0950413	.2933586	0	1	
H1N1	Binary	12,075	.0739545	.2617076	0	1	1,694	.0773318	.267196	0	1	
Zika	Binary	12,075	.0308903	.1730276	0	1	1,694	.0360094	.1863686	0	1	
Ebola	Binary	12,075	.0857143	.2799533	0	1	1,694	.0962222	.2949825	0	1	
Controls												
Firm-level characteristics												
Firm Age	Years	12,075	22.18046	25.22808	1	817	1,694	20.30815	21.67179	1	227	
Stage												
Final Stage/Other		12,075	.2940787	.4556464	0	1	1,694	.2680047	.4430509	0	1	
Growth/Expansion	Categories	12,075	.3257971	.4686913	0	1	1,694	.337072	.4728493	0	1	
Later Stage		12,075	.2017391	.4013151	0	1	1,694	.188902	.3915463	0	1	
Seed/ Early Stage		12,075	.1783851	.3828524	0	1	1,694	.2060213	.4045653	0	1	
Exiting PE-fund characteristics												
Prior investment	in Million USD	12,075	5.56e+07	2.31e+08	700	6.67e+09	1,694	4.99e+07	1.79e+08	2900	3.32e+09	
ln(Prior investment)	ln(Million USD)	12,075	16.12056	1.883645	6.55108	22.62089	1,694	16.12919	1.832108	7.972466	21.92329	
Macroeconomics												
GDPpc Growth	%	12,075	1.673917	2.778842	-17.14539	23.30469	1,694	1.732394	2.719213	-10.68717	23.30469	
Market Return	%	12,075	.6433507	4.001902	-16.94	12.68	1,694	.7915407	4.024801	-16.94	12.68	
YTM10y	%	12,075	126.9205	89.34603	-75.01563	280.4375	1,694	131.7979	87.60257	-52.04762	280.4375	

Table 2.1. Sample distribution by Exit Strategy

	Panel A. Full Sample			Panel B. Healthcare Sector		
	Obs.	Freq.	Cum.	Obs.	Freq.	Cum.
IPO	1,769	14.65	14.65	404	23.85	23.85
Marger	7,167	59.35	74.00	941	55.55	79.40
Secondary Sales	2,706	22.41	96.41	266	15.70	95.10
Others	433	3.59	100.00	83	4.90	100.00
Total	12,075	100.00		1,694	100.00	

Table 2.2. Sample distribution by Investment Stage

	Panel A. Full Sample			Panel B. Healthcare Sector		
	Obs.	Freq.	Cum.	Obs.	Freq.	Cum.
Final Stage/Other	3,551	29.41	29.41	454	26.80	26.80
Growth/Expansion	3,934	32.58	61.99	571	33.71	60.51
Later Stage	2,436	20.17	82.16	320	18.89	79.40
Seed/ Early Stage	2,154	17.84	100.00	349	20.60	100.00
Total	12,075	100.00		1,694	100.00	

Table 3. Sample distribution by Activity Sector

Panel A. Firm Activity Sector			
	Obs.	Freq.	Cum.
Academic & Educational Services	92	0.76	0.76
Basic Materials	669	5.54	6.30
Consumer Cyclicals	1,739	14.40	20.70
Consumer Non-Cyclicals	654	5.42	26.12
Energy	258	2.14	28.26
Financials	495	4.10	32.36
Government Activity	11	0.09	32.45
Healthcare	1,694	14.03	46.48
Industrials	1,966	16.28	62.76
Institutions, Associations & Organizations	3	0.02	62.78
Real Estate	59	0.49	63.27
Technology	4,346	35.99	99.26
Utilities	89	0.74	100.00
Total	12,075	100.00	

3.2. Method

To examine the impact of COVID-19 on *exit values*, the proportion of *earnout over exit values*, and the *time to exit* for PE exits deals we apply for the following Ordinary Least Squares (OLS) regression model is formulated as follows:

$$Y_i = \alpha_1 + \beta_1 cov_i + \sum_{k=2}^{12} \beta_k X_{it} + \sum_{W=13}^{25} \beta_W FE_i + \varepsilon_i \text{ (eq. 1)}$$

where Y_{it} represents the dependent variable for the i th PE exit deal at time t . We employ three different dependent variables for our empirical tests: the logarithm of the exit value (*exit_value_ln*), the proportion of earnout over the exit value (*earnout_over_exit_v*) and the time-to-exit (*tte*). The key independent variable, cov_i , indicates the COVID-19 pandemic, while X_{it} is a vector of control variables including firm-deal characteristics, exiting PE-funds characteristics and time-variant (t) macroeconomic controls. The term FE_i represents vector fixed effects, specifically *iec_sec_cat*, which controls for the economic sector of activity, and ε_i is the independently and identically distributed error term.

To investigate the effects of COVID-19 on PE exit strategies we apply for a Multinomial Logit (MNL) model as our dependent variable is a categorical one that do not follow a specific order. The MNL is formulated as follows:

$$Y_i^* = \alpha_1 + \beta_1 cov_i + \sum_{k=2}^8 \beta_k X_{it} + \sum_{W=9}^{21} \beta_W FE_i + \varepsilon_i \text{ (eq. 2)}$$

Here, the dependent variable Y_i^* , representing the chosen exit strategy, was coded numerically for practical application, and the codes were applied without implying any specific order. And it goes as follows:

$$Y_i^* = \begin{bmatrix} 1 = \text{if exit type is IPO (the baseoutcome)} \\ 2 = \text{if exit type is MER} \\ 3 = \text{if exit type is SS} \\ 4 = \text{if exit type BB, WO or RT} \end{bmatrix}$$

Based on the established preference of PE managers for IPOs (Schmidt et al., 2007), and also because there have been only a limited number of studies examining the choice between IPOs and alternative exit options (Bayar and Chemmanur, 2012; Brau et al., 2003;

Poulsen and Stegemoller, 2008), we will use IPO as the base outcome of our MNL model. For simplicity and since the last three types of exits only accounts for 3,59% of our sample (see table 2.1) we aggregated Buybacks, Write-Offs, and Reverse-Takeovers into a single category (i.e., *BB, WO or RT*) to organize the analysis. This approach simplifies the interpretation of the results and facilitates a clearer understanding of the different exit paths chosen by PE managers during the pandemic.

For our analysis, the data is segmented into a full sample surrounding all markets and a subsample specific to the healthcare sector. In the full sample, we include sector fixed effects to account for the diverse economic sectors, while these controls are excluded in the healthcare subsample due to its sector homogeneity.

4. Findings

This section reports the results discussed in detail in Section 6.

4.1. Baseline: the impact of COVID-19

Table 4 reports the OLS estimations for the effect of the *COVID-19* on the *Exit Value* (Column I), *Earnout Portion over Exit Value* (Column II), and the *Time-to-Exit* (Column III). Table 5 reports the MNL estimations for the *COVID-19* effect on *Exit Strategy* of private equity (PE) firms. All estimations include control variables and robust estimators. Columns .1 report the estimations for the global sample with all activity sectors controlling for industry-fixed effects. Columns .2 report the estimations for the subsample of exit deals involving firms in the healthcare sector. These tables also report the Variance Inflation Factors (VIF) (see Attachment A.1); the values are below the threshold of 5 which suggest that perfect multicollinearity is not an issue (Kutner et al., 2005).

4.1.1. Exit Value

In Columns I.1 (All sectors) and I.2 (Healthcare) of Table 4, the coefficients for *COVID-19* are positive and statistically significant at the 1% level, indicating that COVID-19 had a significant positive impact on the exit value of firms. This evidence also suggests that COVID-19 increased the value of PE exit deals in the Healthcare sector as it happens in other activity sectors in general. This positive impact indicates that, across all sectors, the pandemic has improved exit outcomes. This evidence is contrary to the overall findings reported by Uddin and Chowdhury (2021).

These differences might be due to different measures of the exit value. While the authors measured the deal's value using separate metrics, i.e., the sum of the proceeds amount and the rank value. We measure the aggregated exit value by combining these two metrics into a single measurement. Data limitations prevent us to disaggregate our measure. Furthermore, our temporal horizon is quite different. Uddin and Chowdhury (2021) covered exit deals from April.1999 to Jun.2020. We cover the period Jan.2004-Dec.2023, thus covering pre-, during-, and post-COVID-19 exit deals. Hence, our conflicting evidence recommend some cautions when concluding about the impact of COVID-19 on the exit value as it may be driven by the measure of exit outcome and the time horizon under analysis.

Table 4. Effects of COVID on Exit Value (*in logarithm form*), Earnout Portion over Exit Value, and on Time to Exit; OLS

<i>Dependent variables</i>	Column I		Column II		Column III	
	Exit Value		Earnout Portion over Exit Value		Time-to-Exit	
<i>Activity sectors</i>	All sectors	Healthcare	All sectors	Healthcare	All sectors	Healthcare
	I.1	I.2	II.1	II.2	III.1	III.2
Independent variable						
COVID	1.085*** (0.067)	1.244*** (0.131)	-0.009** (0.004)	-0.030** (0.014)	0.482*** (0.124)	-0.702** (0.312)
Controls						
<i>Firm-deal characteristics</i>						
Firm Age	0.005*** (0.001)	0.006*** (0.002)	-0.000** (0.000)	-0.000 (0.000)	0.004*** (0.001)	0.002 (0.004)
Stage (Baseoutcome: Final Stage/Other)						
Growth/Expansion	-0.143*** (0.052)	-0.054 (0.114)	0.012*** (0.003)	0.003 (0.012)	0.057 (0.090)	-0.373 (0.263)
Later Stage	-0.104* (0.059)	-0.098 (0.121)	0.009*** (0.003)	0.030** (0.015)	0.189* (0.103)	0.182 (0.316)
Seed/Early Stage	-0.281*** (0.070)	-0.196 (0.146)	0.022*** (0.005)	0.056*** (0.017)	-0.043 (0.106)	-0.339 (0.310)
Exit Strategy (Baseoutcome: IPO)						
Merger	0.071 (0.046)	0.610*** (0.089)	0.044*** (0.003)	0.120*** (0.010)	0.632*** (0.100)	0.568** (0.227)
Secondary Sales	0.378*** (0.072)	0.918*** (0.174)	0.017*** (0.002)	0.006 (0.005)	0.923*** (0.116)	0.162 (0.275)
BB/WO/RT	0.794*** (0.156)	0.453 (0.333)	0.030*** (0.007)	0.045** (0.021)	0.831*** (0.224)	1.283* (0.663)
<i>Exiting PE-fund characteristics</i>						
ln(Prior investment)	0.287*** (0.012)	0.274*** (0.026)	-0.000 (0.001)	0.003 (0.003)	0.031* (0.018)	0.062 (0.051)
<i>Macroeconomics</i>						
GDPpc Growth	0.021*** (0.008)	0.003 (0.016)	-0.001 (0.000)	-0.000 (0.001)	-0.019 (0.013)	-0.044 (0.035)
Market Return	0.013** (0.005)	-0.010 (0.011)	0.001** (0.000)	0.001 (0.001)	-0.003 (0.009)	-0.017 (0.022)
YTM 10y	-0.000 (0.000)	-0.000 (0.001)	0.000* (0.000)	0.000 (0.000)	0.000 (0.000)	0.001 (0.001)
Fixed Effects						
Firm activity sector	Yes	No	Yes	No	Yes	No
Constant	13.628*** (0.303)	13.575*** (0.433)	-0.036*** (0.013)	-0.062 (0.049)	4.074*** (0.456)	4.785*** (0.855)
Observations	5,824	1,070	5,824	1,070	12,075	1,694
R-squared	0.207	0.234	0.079	0.125	0.015	0.018

*** p<0.01, ** p<0.05, * p<0.1

Robust standard errors in parentheses

Table 5. Effects of COVID on PE exit strategy; Multinomial Logit (Base: IPO)

<i>Activity sectors</i>	Column I			Column II		
	All Sectors			Healthcare Sector		
	I.1	I.2	I.3	II.1	II.2	III.3
Exit Strategy (Base: IPO)	Merger	Secondary	BB/WO/RT	Merger	Secondary	BB/WO/RT
Independent variable						
COVID	0.706*** (0.108)	0.744*** (0.118)	1.482*** (0.165)	0.052 (0.202)	-0.072 (0.260)	0.901** (0.363)
Controls						
<i>Firm-deal characteristics</i>						
Firm Age	0.005*** (0.002)	0.008*** (0.002)	-0.001 (0.004)	0.003 (0.004)	0.006 (0.004)	-0.021** (0.010)
Stage (Baseoutcome: Final Stage/Other)						
Growth/Expansion	0.036 (0.071)	-0.084 (0.082)	0.115 (0.147)	0.332** (0.164)	-0.060 (0.206)	0.368 (0.368)
Later Stage	-0.095 (0.079)	-0.019 (0.089)	0.156 (0.158)	-0.053 (0.181)	-0.391* (0.236)	0.560 (0.366)
Seed/Early Stage	0.105 (0.088)	-0.116 (0.103)	0.208 (0.175)	0.145 (0.190)	-0.493* (0.254)	0.005 (0.413)
<i>Exiting PE-fund characteristics</i>						
ln(Prior investment)	0.059*** (0.014)	0.035** (0.016)	0.072** (0.031)	0.123*** (0.032)	0.127*** (0.044)	0.137** (0.069)
<i>Macroeconomics</i>						
GDPpc Growth	-0.103*** (0.011)	-0.102*** (0.013)	-0.065*** (0.022)	-0.083*** (0.025)	-0.054* (0.029)	-0.083* (0.050)
Market Return	-0.014** (0.007)	-0.014* (0.008)	-0.007 (0.014)	-0.015 (0.015)	-0.014 (0.021)	-0.077*** (0.029)
YTM 10y	-0.001*** (0.000)	-0.003*** (0.000)	0.002*** (0.001)	-0.001 (0.001)	-0.002*** (0.001)	0.003** (0.001)
Fixed Effects						
Firm activity sector	Yes	Yes	Yes	No	No	No
Constant	1.346*** (0.499)	1.377*** (0.527)	-2.654*** (0.984)	-0.997* (0.535)	-1.955*** (0.720)	-4.053*** (1.241)
Observations	12,075	12,075	12,075	1,694	1,694	1,694
Pseudo-R2		0.0555			0.0228	

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Moreover, the results show that *Firm Age* emerges as a crucial factor in explaining the exit value. More established PE-firms tend to have higher exit values. Additionally, the positive coefficient for PE-fund *Prior Investments* (in *ln* form) in the *Exit Value* analysis suggests that funds with higher value of prior investments also tend to have higher exit values.

The coefficients of the categorical variable *Stage* reported in Column II.2 are not statistically significant. This evidence suggests that in the healthcare sector, the life-cycle stage of the company involved in the deal does not seem to significantly impact the exit value. In contrast, across all sectors, the estimates reported in Column I.1. show that regardless of whether the fund is invested at an early/seed-, growth-, or later-stage, the exit value tends to be lower than that obtained from within the context of funds invested in firms in the final stage (i.e., the base outcome). As expected, the exit value is particularly lower in the context of firms in the seed/early stage.

The estimates for the effects of the *Exit Strategy* reported in Columns I.1 and I.2 suggest that they have different impacts on the exit value across sectors. In Column I.1., for all sectors, *Secondary sales* or an exit via *BB/WO/RT* report higher exit values than that reported by *IPO*. There are no statistically significant differences in exit values produced by *IPOs* and *Mergers*. In contrast to this evidence, Column I.2 shows that the *exit value* for *Mergers* is statistically higher than that obtained from an *IPO* exit strategy. Additionally, contrary to the evidence obtained from the sample with all sectors, the estimates reported in Column I.2 suggest that there are not systematically significant differences in exit values obtained from *BB/WO/RT* compared to that obtained from an *IPO*.

Finally, macroeconomic factors do not appear to impact the exit value in the healthcare sector, contrary to the evidence reported for the full sample of exit deals that show a growing economy and higher market returns tend to be associated with higher exit values.

4.1.2. Earnout Portion over Exit

In Table 4, Column II.1 reports a negative statistically significant coefficient for the variable *COVID-19*, which indicates that the pandemic had a negative effect on the ratio of earnouts to exit value across all sectors. Likewise, in Column II.2, the negative coefficient for *COVID-19* suggests that this effect is marked in the Healthcare sector. This is a novel result not reported in the extant literature.

Unlike the findings related to exit value, the *age* of the firm does not appear to be a relevant factor in the context of earnout proportions in the healthcare sector. However, it slightly impacts negatively the earnout portion when analyzing the overall market. Furthermore, also contrary to what was observed when studying the exit value, the past value of fund investments appears to have no influence on the portion of earnouts involved in the exit deal. Macroeconomic characteristics also seem to not influence the portion of earnouts in the healthcare sector. However, overall, an increase in market returns and an increase in yields seem to indicate an increase in portion of earnouts in the exit value for the full sample.

On the other hand, the *Stage* and *Exit Strategy* and the investment stage seem to have a relevant impact on the earnout portion over exit value. The coefficients for the categorical variable *Stage* reported in the Healthcare Sector (Column II.2) are statistically significant, with the exception of the growth stage. This indicates that in the healthcare sector, similar to other sectors (Column II.1), the life-cycle stage of the company involved in the deal significantly influences the earnout portion relative to exit value. Across all sectors, including healthcare, the earnout portion over exit value tends to be higher when funds are invested at the early/seed or later stages compared to investments made at the final stage (i.e., the base outcome). However, in the growth stage, while this pattern is evident in the overall sector, the healthcare sector does not show a statistically significant influence on the earnout portion if the investment occurs at this stage of the company's life cycle, relative to final stage. This suggests that for the healthcare sector, the growth stage does not significantly affect the earnout portion in the context of exit value when compared to the final stage.

Regarding the effects of the *Exit Strategy*, Column II.1 indicates that, across all sectors, the earnout portion is higher for all exit strategies compared to IPOs. Column II.2 demonstrates that within the healthcare sector, the earnout portion relative to exit value is statistically higher for *Mergers* and *BB/WO/RT* compared to IPO exit strategies. Moreover, unlike the overall sector data, the estimates in Column II.2 suggest that there are no statistically significant differences in the earnout portions obtained from *Secondary Sales* compared to those obtained from IPOs in the healthcare sector. This indicates that, while IPOs generally have lower earnout portions across all sectors, in the healthcare sector, *Secondary Sales* do not exhibit systematically significant differences in earnout portions relative to IPOs.

4.1.3. Time-to-Exit

In Table 4, Column III.1. shows that the impact of *COVID-19* on the *Time to Exit* is positive and statistically significant at the 1% level. This suggests that, overall, COVID-19 significantly increased the time to exit for firms. These results align with the findings of Uddin and Chowdhury (2021), who also found that COVID-19 had a positive impact on time to exit. However, Column III.2. reports a negative coefficient for *COVID-19* for the subsample of exit deals within the Healthcare sector. Despite the overall increase of the duration in the exit deal during the pandemic, when analyzing the healthcare sector, the trends shift, suggesting that investors in healthcare firms shortened the time to exit their positions. These results suggest that COVID-19 had a substantially negative effect on the time to exit for healthcare firms.

However, the time that investors take to exit their investments across the global market also seems to be positively associated with the *Age* of the PE-Firm involved in the deal. This evidence suggest that more mature firms tend to extend the time to divest compared to younger firms under uncertainty periods. Nonetheless, in the healthcare sector, this factor loses its statistical significance, suggesting that for healthcare investors, firm's age appears no to be a significant manner regarding their *Time-to-Exit*.

Analyzing the remaining control variables, we find that the macroeconomic factors introduced into our model do not significantly impact the exit timing for managers in either the healthcare sector or other sectors. Similarly, the investment *Stage* appears to exert low influence on *Time-to-Exit*. Additionally, the *past investment* values of funds are not statistically significant in the healthcare sector and are only marginally significant at the 10% level for the overall sector. This suggests that these variables have limited predictive influence in determining exit timing within the range of our sample.

However, on the other hand the type of exit chosen by PE managers seems to influence the exit timing. In the overall market, if investors opt for any other exit type instead of an IPO, this decision will positively and significantly increase the exit time. This suggests that investors who tend to hold their positions longer generally choose exit types other than an IPO. In healthcare, this issue is not statistically as significant, but for exits via merger or BB/WO/RT instead of an IPO, the results suggest a similar impact.

4.1.4. Exit strategy

Table 5 displays the results concerning the influence of *COVID-19* on PE firms' selection of *Exit strategies*. The IPO is the base outcome of the MNL estimations. The results indicate that PE managers were more likely to choose alternative exit strategies over IPOs during the COVID-19 pandemic, particularly Buyback, Write-Off, or Reverse-Takeover (BB/WO/RT). In other words, IPOs were the least attractive exit option during this period. These results align somehow with findings from Uddin and Chowdhury (2021); using a model similar to ours but with mergers as the base outcome they also noted that PE managers preferred exits via mergers over IPOs.

In the healthcare sector, however, the estimations reveal that PE managers favored exits via Buyback, Write-Off, or Reverse-Takeover (BB/WO/RT) over IPOs, but there are no differences in the likelihood of exiting through Secondary Sales, Mergers, or IPO as the coefficient are not statistically significant at, at least 10% level. Therefore, these results seem to uncover a different impact of COVID-19 on exit strategies of PE within the Healthcare sector.

The positive coefficient of *Firm Age* in Columns I.1 and I.2, Table 5, statistically significant at the 1% level, suggests that more mature is the PE Firms the higher the probability that PE firms will exit through *Mergers* or *Secondary sales*, compared to exiting via *IPO*. This result does not hold true for firms in the Healthcare sector; there are no statistically systematic differences in the likelihood of an exit occurring through *Merger* (Column II.1) or *Secondary Sales* (Column II.2) compared to exit through *IPO*. Nonetheless, the negative coefficient of *Firm Age* in Column III.3 suggests that in this sector, the older the PE firm, the lower the probability of exiting through *BB/WO/RT*.

Interestingly, the coefficients for the *Growth Stage*, *Later Stage*, and *Seed/Stage* in Column I.1-I.3 suggest that, overall, there are no statistically significant differences in the likelihood of a PE exit occurring through a *Merger* (I.1), *Secondary Sales* (I.2), or *BB/WO/RT* (over an *IPO*) based on the investment *Stage*. However, there are some statistical effects of firm *Stage* on *Exit strategy* within the healthcare sector. The coefficient of +0.332 in Column II.1 is significant at the 5% level, and indicates a higher likelihood of opting for a *Merger* (over an *IPO*) for PE exits involving companies in a growing or expansion stage (over final stage). In Column II.2, the negative coefficient of *Later Stage* (i.e., -0.391) and *Seed/Early Stage* (-0.493) suggests a reduced likelihood of choosing *Secondary Sales*

compared to IPOs in *Seed Stage* and *Later Stage* compared to investments that happened in the *Final Stage*.

The *Prior investments* exert a relevant influence on PE exit strategy. For all sectors, prior investment increases the likelihood of selecting any alternative exit strategies over IPO, with coefficients for all exit strategies ranging from +0.035 to +0.072 (Column I.1 to I.3) and significance levels between 1% and 5%. In the healthcare sector, the coefficients remain positive and highly significant, ranging from +0.123 to +0.137 (II.1 to II.3). This indicates that higher levels of *Prior investment* consistently increase the preference for *Mergers*, *Secondary Sales*, or *BB/WO/RT* over IPOs, both globally and specifically within the healthcare sector.

Regarding macroeconomic aspects, higher *GDP growth* generally reduces the likelihood of choosing alternative exit strategies over IPOs. In all sectors, higher *Market returns* decrease the likelihood of opting for *Mergers* or *Secondary Sales* over IPOs. In the healthcare sector, these returns also reduce the probability of selecting *BB/WO/RT* over IPOs. The effects of higher yields are varied. In general sectors, higher yields decrease the likelihood of *Mergers* or *Secondary Sales* over IPOs but increase the likelihood of *BB/WO/RT* over IPOs. Similarly, in the healthcare sector, higher *Yields* decrease the likelihood of *Secondary Sales* and increase the likelihood of *BB/WO/RT* over IPOs.

4.2. Robustness: the impact of COVID-19 vaccine research and vaccine authorization

In this section, we examine whether the launch of vaccines to combat COVID-19 produced any relevant signals for investors, particularly in the healthcare sector, and their exit decisions. To do so, we extend our analysis of the impact of COVID-19 on PE exit deals (eq. 1 and 2) by examining the effects of vaccine research and vaccine commercial authorization, thus checking for the robustness of our baseline results for different COVID-19 events.

Table 6 presents the OLS estimations for the effect of *Vaccine Research* (Panel A) and *Vaccine Authorization* (Panel B) on *Exit Value* (Column I), *Earnout Portion over Exit Value* (Column II), and *Time to Exit* (Column III). Table 7 reports the MNL estimations for the effect of vaccines on the exit strategies of PE firms. All estimations follow the same structure as those reported in Tables 4 and 5. For brevity, we report only the estimations for the main covariates. Full estimates are available upon request.

Table 6. Effects of COVID Vaccine Research (Panel A) and Vaccine Authorization (Panel B) on Exit Value (*in logarithm form*), Earnout Portion over Exit Value, and on Time to Exit; OLS

<i>Dependent variables</i>	Column I		Column II		Column III	
	Exit Value		Earnout Portion over		Time-to-Exit	
<i>Activity sectors</i>	All sectors	Healthcare	All sectors	Healthcare	All sectors	Healthcare
<i>COVID Effects reported in Table 4 (Baseline Findings)</i>	+ ***	+ ***	- **	- **	+ ***	- **
Panel A	A.I.1	A.I.2	A.II.1	A.II.2	A.III.1	A.III.2
Independent variable						
Vaccine Research	1.143*** (0.070)	1.316*** (0.139)	-0.008* (0.004)	-0.028* (0.015)	0.500*** (0.129)	-0.761** (0.320)
Controls	YES	YES	YES	YES	YES	YES
Fixed Effects (activity sector)	YES	NO	YES	NO	YES	NO
Constant	YES	YES	YES	YES	YES	YES
Observations	5,824	1,070	5,824	1,070	12,075	1,694
R-squared	0.208	0.235	0.079	0.124	0.015	0.018
Panel B	B.I.1	B.I.2	B.II.1	B.II.2	B.III.1	B.III.2
Independent variable						
Vaccine Authorization	1.118*** (0.080)	1.319*** (0.153)	-0.009** (0.004)	-0.034** (0.014)	0.621*** (0.146)	-0.722** (0.364)
Controls	YES	YES	YES	YES	YES	YES
Fixed Effects (activity sector)	YES	NO	YES	NO	YES	NO
Constant	YES	YES	YES	YES	YES	YES
Observations	5,824	1,070	5,824	1,070	12,075	1,694
R-squared	0.200	0.223	0.079	0.125	0.015	0.017

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7. Effects of COVID Vaccine Research (Panel A) and Vaccine Authorization (Panel B) on PE exit strategy; Multinomial Logit (Base: IPO)

<i>Activity sectors</i>	Column I			Column II		
	All Sectors			Healthcare Sector		
	I.1	I.2	I.3	II.1	II.2	III.3
Exit Strategy (Base: IPO)	Merger	Secondary	BB/WO/RT	Merger	Secondary	BB/WO/RT
<i>COVID Effects reported in Table 5 (Baseline Findings)</i>	+ ***	+ ***	- **	n.s.	n.s.	+ ***
Panel A.	A.I.1	A.I.2	A.II.1	A.II.2	A.III.1	A.III.2
Independent variable						
Vaccine Research	0.807*** (0.113)	0.874*** (0.122)	1.661*** (0.171)	0.213 (0.213)	0.149 (0.268)	1.146*** (0.385)
Controls	YES	YES	YES	YES	YES	YES
Fixed Effects (activity sector)	YES	YES	YES	NO	NO	NO
Constant	YES	YES	YES	YES	YES	YES
Observations	12,075	12,075	12,075	1,694	1,694	1,694
Pseudo-R2		0.0562			0.0233	
Panel B.						
Independent variable						
Vaccine Authorization	0.952*** (0.119)	0.962*** (0.132)	1.805*** (0.193)	0.308 (0.229)	0.338 (0.286)	1.405*** (0.452)
Controls	YES	YES	YES	YES	YES	YES
Fixed Effects (activity sector)	YES	YES	YES	NO	NO	NO
Constant	YES	YES	YES	YES	YES	YES
Observations	12,075	12,075	12,075	1,694	1,694	1,694
Pseudo-R2		0.0565			0.0239	
Robust standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						
n.s. = no statistical significance						

In Table 6, the results reported in Panel A and Panel B for the impact *Vaccine Research* and *Vaccine Authorization*, respectively, are consistent to those reported in Table 4 for the impact of the COVID-19 for the full sample and for the impact on the healthcare sector. Indeed, *Vaccine Research* and *Vaccine Authorization* increased the *Exit Value* of PE exit deals in all sectors, including the healthcare sector, suggesting positive expectation from the investment following these events. However, these two events negatively impacted the *Earnout Portion over Exit Value*, again within both, the full sample and when analyzing just the healthcare industry. In regard of *Time-to-Exit*, the vaccinations events apparently contributed for healthcare investors decrease their *Time-to-Exit*, while it contributed for increasing investors' *Time-to-Exit* in the overall markets.

From the analysis of Table 7, the findings for the healthcare sector in Panel A (*Vaccine Research*) and Panel B (*Vaccine Authorization*) are consistent with those in Table 4 regarding the impact of COVID-19. This consistency is observed across the full sample as well, except for the likelihood of choosing *BB/WO/RT* over *IPOs*. In the periods after vaccination main events, the probability of exiting through any alternative *Exit strategy* compared to *IPO* exit increased. The same is verified regarding the likelihood of choosing an exit via *BB/WO/RT* over an *IPO*, in the case of the healthcare sector. Moreover, the results suggest that during the periods after the beginning of the last stage of development and also after the vaccination process started, there is no evidence that these events have led to a greater likelihood of *Mergers* or *Secondary Sales* over *IPOs*, confirming the similarities of the impacts observed during all period of the pandemic, thus confirming the robustness of our main model.

5. Additional Analysis: other global health emergencies

To expand our study and assess whether the conclusions drawn during the COVID-19 pandemic apply to other global public health crises, we applied our models (i.e., eq.1 and eq.2) to additional events. Thus, we analyzed the effects of *H1N1*, *Zika*, and *Ebola* on *Exit Value*, *Earnout Portion over Exit Value*, and *Time-to-Exit*.

Table 8 presents these effects, with Panel A covering *H1N1*, Panel B addressing *Zika*, and Panel C examining *Ebola*, across Columns I, II, and III, respectively. Our analysis includes both the overall private equity (PE) sectors and the healthcare sector. In Table 9, we report the impact of these health crises on PE *Exit strategies* using a MNL model, with the

IPO as the base outcome. Again, for clarity and brevity, only the coefficients these health events are reported in Tables 8 and 9 to highlight the effects of these events in comparison to COVID-19. It is crucial to note that we maintained the same control variables as in the initial model (see Tables 4 and 5), although they are not explicitly detailed in the current tables.

Table 8. Effects of H1N1 (Panel A), ZIKA (Panel B), and ÉBOLA (Panel C) on Exit Value (in logarithm form), Earnout Portion over Exit Value, and on Time to Exit; OLS

	Column I		Column II		Column III	
	Exit Value		Earnout Portion over Exit		Time-to-Exit	
	All sectors	Healthcare	All sectors	Healthcare	All sectors	Healthcare
<i>COVID Effects reported in Table 4 (Baseline Findings)</i>	***	***	**	**	***	**
Panel A.	A.I.1	A.I.2	A.II.1	A.II.2	A.III.1	A.III.2
Independent variable						
H1N1	-0.124 (0.085)	-0.102 (0.183)	0.005 (0.006)	-0.015 (0.024)	-0.577*** (0.133)	-0.714** (0.359)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects (activity sector)	Yes	No	Yes	No	Yes	No
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,824	1,070	5,824	1,070	12,075	1,694
R-squared	0.174	0.175	0.079	0.123	0.014	0.017
Panel B	B.I.1	B.I.2	B.II.1	B.II.2	B.III.1	B.III.2
Independent variable						
ZIKA	0.379*** (0.129)	0.220 (0.198)	-0.008 (0.008)	-0.012 (0.031)	0.618*** (0.212)	0.345 (0.584)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects (activity sector)	Yes	No	Yes	No	Yes	No
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,824	1,070	5,824	1,070	12,075	1,694
R-squared	0.175	0.176	0.079	0.122	0.014	0.015
Panel C	C.I.1	C.I.2	C.II.1	C.II.2	C.III.1	C.III.2
Dependent variable						
ÉBOLA	0.197** (0.079)	0.095 (0.144)	-0.012*** (0.005)	0.001 (0.019)	0.503*** (0.128)	0.423 (0.388)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects (activity sector)	Yes	No	Yes	No	Yes	No
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,824	1,070	5,824	1,070	12,075	1,694
R-squared	0.175	0.175	0.079	0.122	0.014	0.016

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9. Effects of H1N1 (Panel A), ZIKA (Panel B), and ÉBOLA (Panel C) on PE exit strategy; Multinomial Logit (Base: IPO)

<i>Activity sectors</i>	Column I			Column II		
	All Sectors			Healthcare Sector		
	I.1	I.2	I.3	II.1	II.2	III.3
Exit Strategy (Base: IPO)	Merger	Secondary	BB/WO/R	Merger	Secondary	BB/WO/R
<i>COVID Effects reported in Table 5 (Baseline Findings)</i>	+ ***	+ ***	- **	n.s.	n.s.	+ **
Panel A.	A.I.1	A.I.2	A.II.1	A.II.2	A.III.1	A.III.2
Independent variable						
H1N1	-0.380*** (0.107)	-0.776*** (0.141)	0.317* (0.183)	0.135 (0.259)	0.126 (0.364)	0.425 (0.450)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects (activity sector)	Yes	Yes	Yes	No	No	No
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,075	12,075	12,075	1,694	1,694	1,694
Pseudo-R2		0.0537			0.0213	
Panel B	B.I.1	B.I.2	B.II.1	B.II.2	B.III.1	B.III.2
Independent variable						
ZIKA	0.878*** (0.224)	0.995*** (0.240)	-0.636 (0.619)	1.689*** (0.608)	2.268*** (0.622)	-12.168*** (0.603)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects (activity sector)	Yes	Yes	Yes	No	No	No
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,075	12,075	12,075	1,694	1,694	1,694
Pseudo-R2		0.0531			0.0278	
Panel C	C.I.1	C.I.2	C.II.1	C.II.2	C.III.1	C.III.2
Dependent variable						
ÉBOLA	0.511*** (0.109)	0.562*** (0.121)	0.037 (0.224)	-0.223 (0.196)	-0.118 (0.260)	-0.955* (0.535)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects (activity sector)	Yes	Yes	Yes	No	No	No
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,075	12,075	12,075	1,694	1,694	1,694
Pseudo-R2		0.0530			0.0222	

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

n.s. = no statistical significance

In Table 8, the results reported from Panel A to Panel C for the impact of *H1N1*, *Zika* and *Ébola*, respectively, appear to often diverge from those reported in Table 4 for the impact of the *COVID-19* within the full sample and for the impact on the healthcare sector. For *H1N1*, its influence is only observed on the *Time-to-Exit*, maintaining the tendency observed during the COVID-19 pandemic of negatively impacting this metric in the healthcare sector. Regarding *Ébola* and *Zika* there is no significant impact identified within the healthcare sector. However, across all sectors, *Ébola* positively affected *Exit Value* and *Time-to-Exit*, while negatively influencing the *Earnout Portion over Exit Value*. Similarly, *Zika* also increased both *Exit Value* and *Time-to-Exit* when analyzing the overall sample.

The results presented in Table 9 indicate that *H1N1* influences *PE investors' exit strategy* choices only within the overall markets, exhibiting completely opposite trends from those observed during the COVID-19 pandemic. *H1N1* increased the likelihood of opting for *BB/WO/RT* exits over *IPOs* while decreasing the probability of choosing *Mergers* or *Secondary Sales* instead of *IPOs*. *Zika* had a significant impact on *PE exit strategies*, increasing the likelihood of exits through *Mergers* or *Secondary Sales* rather than *IPOs* in both the overall and healthcare sectors. On the other hand, it decreased the probability of opt for *BB/WO/RT* over *IPOs* in healthcare sector investments. Similarly, *Ébola* increased the propensity for exits via *Mergers* or *Secondary Sales* over *IPOs* in the wide-ranging sector while decreasing the likelihood of opting for *BB/WO/RT* exits over *IPOs* within the healthcare sector. These findings underline that Covid-19 was indeed a unprecedented crisis with specific impacts on *PE* exits deals and strategies.

6. Conclusions

6.1. Discussion

Our findings reveal that COVID-19 significantly influenced the decision-making processes regarding exit strategies among private equity (PE) investors. This aligns with the argument by Uddin and Chowdhury (2021), who argued that during periods of exogenous shocks, PE fund exit strategies diverge as external shocks present substantial threats to organizations, leading to strategic changes to address these threats (Meyer, 1982; Tushman and Romanelli, 1985; Wright et al., 2016).

But did COVID-19 impact all sectors in the same way? (RQ2). Yes, for the exit value and earnout portion over exit value, *but No* in terms of time-to exit and the type of the exit strategy selected. We show that the pandemic had a similar effect in the healthcare sector compared to the overall market, with a positive impact on exit value, especially if the investments was made by more established firms that tend to exhibit higher exit values. This evidence is contrary to Uddin and Chowdhury (2021) findings. Another interesting finding regarding exit value is that the life-cycle stage of the company involved in the deal does not seem to significantly impact the exit value in the case of the healthcare industry. In terms of Time to Exit, the healthcare sector diverged from the trend observed in other sectors. Gompers et al. (2022) suggests that 72.2% of the PE managers in their sample have extended investment period for existing portfolio companies in response to the Covid-19 pandemic. Our findings, indeed, confirm this results revealing that time to exit increased significantly across all sectors during the pandemic. However, it significantly decreased in the healthcare sector. Interestingly, the age of the PE-firm involved in the deal appears to also impact the time-to-exit. Globally, investors from more mature PE firms tend to take longer to exit investments. However, in the healthcare sector, this factor loses statistical significance, suggesting that a firm's age is not a significant factor in determining the time to exit for healthcare investors.

We also find a negative effect of COVID-19 on the proportion of earnouts over exit value in all sectors, including the healthcare sector, finding answers to our RQ3. Therefore, taking the earnout portion as a risk metric, from the exiting PE firm viewpoint, that means that the COVID decreases the reimbursement risk of the deal value. These results might be surprising given the increased uncertainty in the market; in uncertain contexts, we might expect the buyer to negotiate a decrease in the portion of the exit value paid upfront (i.e., an

increase of the earnout ratio). However, from the perspective of the PE firm, this is positive because if the exit value increased and the earnout portion decreased, it means that PE firms received more money upfront and became less dependent on unpredictable future performance. The need for immediate liquidity for sellers due to the economic conditions at that time could be one reason for the reduced reliance on earnouts. This evidence can also suggest that these deals were not conducted under pressure to sell. Note that, a reduction in the earnout ratio during periods of greater uncertainty is beneficial for the PE seller but disadvantageous for the buyer, implying that the bargaining power of sellers may have increased during COVID-19. We acknowledge that this study did not specifically examine the bargaining power of the parties involved in exit deals, as it is beyond the scope of our investigation. We recommend that future research addresses this aspect.

Evidence on the impact of COVID-19 on PE exit strategies shows that IPOs were the least attractive exit option during this period. But revealed slight differences within the healthcare sector compared to the general findings. We find that PE managers in the healthcare sector disfavored IPOs exit strategies when compared to Buybacks, Write-Offs, or Reverse-Takeovers (BB/WO/RT). This trend contrasts with the wide-ranging trend identified also by Uddin and Chowdhury (2021). In the healthcare sector, while exits via BB/WO/RT were preferred over IPOs, there was no statistically significant difference in the likelihood of exiting through Secondary Sales, Mergers, or IPOs due to the COVID-19 impact on exit strategies.

The closely aligned results observed in the additional robustness checks, conducted through the study of vaccination effects, confirm the robustness and validity of our findings.

As mentioned, the healthcare sector's economic prominence has drawn the attention of PE investors (Beyer et al., 2022). Establishing the sector as one of the most interesting for PE investments (Choi et al., 2021). However, the pandemic introduced significant uncertainty into financial markets, affecting firms' revenues and cash flows, and resulting in the underpricing of many firms (Naqvi et al., 2021; Umar et al., 2021). So, *do health-related external shocks, such as COVID-19, influence the sector's appeal for PE investors and their exit strategies? (RQ1)*. In fact, the pandemic had positive impact on exit value suggest that this event has improved exit outcomes. In other words, the pandemic increased the exit value, indicating a higher valuation of companies at the time of sale. This can be attributed to the increased demand and investment in strategic sectors, such as healthcare. Although, the fact that the

life-cycle stage does not seem to significantly impact the exit value challenges traditional views that more mature companies typically yield higher exit values.

Moreover, during COVID-19, the time to exit increased in the overall market but decreased in the healthcare sector. This indicates that while the pandemic generally slowed down exits due to market uncertainty, the healthcare sector experienced accelerated exits. Which can be another positive sign for the sector as this suggest a possible increment in demand and investor interest. Showing signs of resilience and attractiveness of the healthcare sector in times of crisis like this. Indeed, reports from the European Central Bank (2022) and Labonte (2021) already had stated that COVID-19 created new opportunities for new investors. Interestingly, an aspect that seems not to influence much the time to exit, is the portfolio company's life cycle stage in which the investments were made. This is unexpected, as one might anticipate that investments made in earlier stages, such as seed or even growth stages, would require a longer time to mature before exit compared to those made in later stages. However, these results could suggest that this lack of influence could be attributed to the unique pressures and opportunities created by the COVID-19 pandemic. First, the pandemic created a series of new opportunities, especially for businesses in the healthcare sector, which may have increased the potential of smaller companies and consequently increased investor interest in these companies; allowing PE firms to expedite exits even for investments in earlier stages, as the market interest and valuations provided favorable conditions for selling. On the other hand, strategic decisions made by PE firms in response to the pandemic could have also played a significant role. Faced with unprecedented uncertainty, PE firms might have adopted more flexible and opportunistic exit strategies, prioritizing liquidity and de-risking their portfolios. These strategies could involve exiting investments earlier than planned, regardless of their life cycle stage, to capitalize on favorable market conditions or to reallocate capital to more promising ventures arising from the pandemic's disruption.

The fact that IPOs were the least attractive exit option during this period, also reflects market volatility and investor uncertainty during this period. This suggests that companies and investors preferred more predictable and less risky exit strategies.

What about other crises? Our results suggest that the impact of H1N1, Zika and Ébola, appear to often diverge from those reported for the impact of the COVID-19 within the full sample and for the impact on the healthcare sector. During the H1N1 and COVID-19 pandemics, both influenced time-to-exit negatively within the healthcare sector,

underscoring prolonged exit timelines amidst heightened uncertainty. Conversely, Ébola and Zika did not show significant effects on the healthcare sector, suggesting resilience or minimal impact in exit value, earnout portion over exit value or time-to-exit.

Regarding the impact of this crises on PE exit strategies, our findings suggest that H1N1 influenced PE investors to adjust their exit strategies only in all the market. Meanwhile, Zika altered exit preferences by increasing the likelihood of exits through mergers or secondary sales over IPOs, demonstrating a shift towards more stable and less volatile exit avenues in both overall and healthcare-specific investments. Also in healthcare investments, Zika reduced the preference for BB/WO/RT exits compared to IPOs. However, the weaker impact of these three key global public health crises on PE exit strategies emphasizes that the COVID-19 pandemic was indeed unprecedented in its magnitude and influence.

6.2. Limitations and future research

Data limitations posed our main challenge in this study, particularly concerning the exit value estimation. Our conflicting evidence with the Uddin and Chowdhury (2021) findings recommend some cautions when concluding about the impact of COVID on the exit value as it may be driven by the measure and the time horizon in analysis. Consequently, the earnout portion over exit value, also requires careful conclusions.

Moreover, our analysis was constrained by the available quantitative data, limiting our ability to incorporate qualitative insights that could provide a richer context to the observed trends. Future research should consider mixed-method approaches, combining quantitative data with qualitative interviews or case studies to capture a wider range of factors influencing exit strategies.

Geographical considerations are recommended for future research. Even though Influenza A, Zika and Ebola were considered global pandemics by the WHO, contrary to COVID-19, these had more impacts in certain regions than others, and we kept the same worldwide sample when studying them.

Despite the increasing importance of the healthcare sector within the PE field, it would be beneficial to expand this study to encompass other well-established sectors, as well as newly emerging ones. Furthermore, examining other events with substantial economic

and financial impacts, beyond health crises, would provide a more comprehensive understanding of the various external factors that influence PE exit strategies.

Attachments

Table A.1. VIF Test

Variable	VIF	1/VIF
Independent variable		
COVID	1.08	0.921838
Controls		
<i>Firm-deal characteristics</i>		
Firm Age	1.14	0.875111
Stage (Baseoutcome: Final Stage/Other)		
Growth/Expansion	1.64	0.611127
Later Stage	1.45	0.688093
Seed/Early Stage	1.67	0.600523
Exit Strategy (Baseoutcome: IPO)		
Merger	1.18	0.850141
Secondary Sales	1.14	0.876799
BB/WO/RT	1.08	0.924964
<i>Exiting PE-fund characteristics</i>		
ln(Prior investment)	1.04	0.960455
<i>Macroeconomics</i>		
GDPpc Growth	1.04	0.957235
Market Return	1.01	0.987788
YTM 10y	1.07	0.937503
Mean VIF	1.21	

References

- Abraham, F., Cha, M., & Nyaruwata, G. (2015, July 1). *Capturing returns in healthcare*. McKinsey & Company.
<https://www.mckinsey.com/industries/healthcare/our-insights/capturing-returns-in-healthcare>
- Achleitner, A., Bauer, O., Figge, C., & Lutz, E. (2012). The case for secondary buyouts as exit channel. *Journal of Applied Corporate Finance*, 24(4), 102–111.
<https://doi.org/10.1111/j.1745-6622.2012.00404.x>
- Agbloyor, E. K., Abor, J. Y., Issahaku, H., & Adjasi, C. K. D. (2020). Finance and Economic Development: The role of the private sector. In *Contemporary Issues in Development Finance* (pp. 411-434). Routledge.
- Agyapong, N. K. (2017). *Determinants of PE exit strategies in South Africa* [Doctoral dissertation, University of the Witwatersrand, Faculty of Commerce, Law and Management, Wits Business School].
<https://wiredspace.wits.ac.za/server/api/core/bitstreams/3f6656f0-8397-4287-947e-0c7530d54c62/content>
- Appelbaum, E., & Batt, R. (2020). Private Equity Buyouts in Healthcare: Who Wins, Who Loses? *Institute for New Economic Thinking Working Paper Series*, 118.
<https://doi.org/10.36687/inetwp118>
- Arcot, S., Z. Fluck, J.M. Gaspar, & U. Hege. (2015). Corporate Governance and Value Creation: evidence from PE. *Journal of Financial Economics*, 115(1), 102–1352.
- Axelson, U., Jenkinson, T., Strömberg, P., & Weisbach, M. S. (2013). Borrow cheap, buy high? The determinants of leverage and pricing in buyouts. *The Journal of Finance*, 68(6), 2223–2267.
<https://doi.org/10.1111/jofi.12082>
- Baker, H. K., Filbeck, G., & Kiymaz, H. (2015). *Private equity: Opportunities and Risks*.
- Baker, S. R., Bloom, N., Davis, S. J., & Terry, S. J. (2020). COVID-Induced economic uncertainty. *National Bureau of Economic Research*.
<https://ideas.repec.org/p/nbr/nberwo/26983.html>
- Barbopoulos, L. G., Molyneux, P., & Wilson, J. O. (2016). Earnout financing in the financial services industry. *International Review of Financial Analysis*, 47, 119–132.
<https://doi.org/10.1016/j.irfa.2016.07.001>

- Barbopoulos, L., & Sudarsanam, S. (2012). Determinants of earnout as acquisition payment currency and bidder's value gains. *Journal of Banking & Finance*, 36(3), 678–694.
<https://doi.org/10.1016/j.jbankfin.2011.10.007>
- Bates, T. W., Neyland, J. B., & Wang, Y. Y. (2018). Financing acquisitions with earnouts. *Journal of Accounting and Economics*, 66(2–3), 374–395.
<https://doi.org/10.1016/j.jacceco.2018.08.002>
- Bayar, O., & Chemmanur, T. J. (2012). IPOs versus Acquisitions and the Valuation Premium Puzzle: A Theory of Exit Choice by Entrepreneurs and Venture Capitalists. *SSRN Electronic Journal*.
https://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID1494060_code668689.pdf?abstractid=966004&mirid=2
- Beyer, K. M., Demyan, L., & Weiss, M. J. (2022). PE and its increasing role in US healthcare. *Advances in Surgery*, 56(1), 79–87.
<https://doi.org/10.1016/j.yasu.2022.02.003>
- Bienz, C. (2017). Leveraged buyouts in Norway. In <https://www.nhh.no/en/>. Norwegian School Of Economics (NHH).
<https://www.nhh.no/contentassets/c8b510742aa041a2a9944e8239de6cf6/pe-in-norway-09-16.pdf>
- Bienz, C., & Leite, T. E. (2008). A pecking order of venture capital exits. In <https://papers.ssrn.com/>.
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=916742
- Billig, J. I., Kotsis, S. V., & Chung, K. C. (2021). Trends in funding and acquisition of surgical practices by private equity firms in the US from 2000 to 2020. *JAMA Surgery*, 156(11), 1066.
<https://doi.org/10.1001/jamasurg.2021.3642>
- Bird, R., Liem, H., & Thorp, S. (2011). Private Equity: Strategies for improving performance. *The Paul Woolley Centre for Capital Market Dysfunctionality, UTS Working Paper*, 12.
<https://www.uts.edu.au/sites/default/files/wp12.pdf>
- Black, B. S., & Gilson, R. J. (1998). Venture capital and the structure of capital markets: banks versus stock markets. *Journal of Financial Economics*, 47(3), 243–277.
[https://doi.org/10.1016/s0304-405x\(97\)00045-7](https://doi.org/10.1016/s0304-405x(97)00045-7)

- Brau, J. C., Francis, B., & Kohers, N. (2003). The Choice of IPO versus Takeover: Empirical Evidence*. *The Journal of Business*, 76(4), 583–612.
<https://doi.org/10.1086/377032>
- Budhwar, P., & Cumming, D. (2020). New Directions in Management Research and Communication: Lessons from the COVID-19 Pandemic. *British Journal of Management*, 31(3), 441–443.
<https://doi.org/10.1111/1467-8551.12426>
- Busenitz, L. W., Fiet, J. O., & Moesel, D. D. (2005). Signaling in Venture Capitalist—New Venture Team Funding Decisions: Does it Indicate Long-Term Venture Outcomes? *Entrepreneurship Theory and Practice*, 29(1), 1–12.
<https://doi.org/10.1111/j.1540-6520.2005.00066.x>
- Bygrave, W. D., & Timmons, J. (1992). Venture capital at the crossroads. *SSRN Electronic Journal*.
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1496172
- Cain, M. D., & Denis, D. J. (2010). Do fairness opinion valuations contain useful information? In <https://business.purdue.edu/>. Purdue University, Department of Economics.
<https://business.purdue.edu/research/working-papers-series/2010/1244.pdf>
- Cao, J. X. (2011). IPO timing, buyout sponsors' exit strategies, and firm performance of RLBOs. *Journal of Financial and Quantitative Analysis*, 46(4), 1001–1024.
<https://doi.org/10.1017/s0022109011000160>
- Chang, S. J. (1996). An Evolutionary perspective on diversification and corporate restructuring: entry, exit, and economic performance during 1981–1989. *Strategic Management Journal*, 46(4), 1001–1024.
[https://doi.org/10.1002/\(SICI\)1097-0266\(199610\)17:8<587::AID-SMJ834>3.0.CO;2-1](https://doi.org/10.1002/(SICI)1097-0266(199610)17:8<587::AID-SMJ834>3.0.CO;2-1)
- Cheng, I. (2020). Volatility markets underreacted to the early stages of the COVID-19 pandemic. *The Review of Asset Pricing Studies*, 10(4), 635–668.
<https://doi.org/10.1093/rapstu/raaa010>
- Choi, J., Shin, N., & Chang, Y. S. (2021). Strategic Investment Decisions for Emerging Technology Fields in the Health Care Sector Based on M&A Analysis. *Sustainability*, 13(7).
<https://doi.org/10.3390/su13073644>

- Chundakkadan, R., & Nedumparambil, E. (2022). In search of COVID-19 and stock market behavior. *Global Finance Journal*, 54, 100639.
<https://doi.org/10.1016/j.gfj.2021.100639>
- Clausen-Jørgensen, C. S., & Flor, C. R. (2024). Exit strategies and holding period for PE acquisitions under time-varying market conditions. In <https://www.efmaefm.org/>. European Financial Management Association.
https://www.efmaefm.org/0EFMAMEETINGS/EFMA%20ANNUAL%20MEETINGS/2024-Lisbon/papers/TTS_InvestmentPolicy_MS_EFMA_2024_FULL.pdf
- Cumming, D. (2009). *Private equity: Fund Types, Risks and Returns, and Regulation*. John Wiley and Sons.
- Cumming, D. J., & MacIntosh, J. G. (2003). A cross-country comparison of full and partial venture capital exits. *Journal of Banking & Finance*, 27(3), 511–548.
[https://doi.org/10.1016/s0378-4266\(02\)00389-8](https://doi.org/10.1016/s0378-4266(02)00389-8)
- Cumming, D., & Johan, S. a. B. (2008). Preplanned exit strategies in venture capital. *European Economic Review*, 52(7), 1209–1241.
<https://doi.org/10.1016/j.eurocorev.2008.01.001>
- Cumming, D. J., & Johan, S. A. (2013). *Venture capital and private equity contracting: An international perspective*. Academic Press.
- Cumming, D. J., & MacIntosh, J. G. (2001). Venture capital investment duration in Canada and the United States. *Journal of Multinational Financial Management*, 11(4–5), 445–463.
[https://doi.org/10.1016/s1042-444x\(01\)00034-2](https://doi.org/10.1016/s1042-444x(01)00034-2)
- Cumming, D., & Johan, S. (2010). Venture Capital Investment duration. *Journal of Small Business Management*, 48(2), 228–257.
<https://doi.org/10.1111/j.1540-627x.2010.00293.x>
- Cumming, D., & Walz, U. (2010). Private equity returns and disclosure around the world. *Journal of International Business Studies*, 41(4), 727–754.
<https://doi.org/10.1057/jibs.2009.62>
- Datar, S., Frankel, R., & Wolfson, M. (2001). Earnouts: The effects of adverse selection and agency costs on acquisition techniques. *The Journal of Law Economics and Organization*, 17(1), 201–238.
<https://doi.org/10.1093/jleo/17.1.201>

- Degeorge, F., Martin, J., & Phalippou, L. (2016). On secondary buyouts. *Journal of Financial Economics*, 120(1), 124–145.
<https://doi.org/10.1016/j.jfneco.2015.08.007>
- Donadelli, M., Kizys, R., & Riedel, M. (2017). Dangerous infectious diseases: Bad news for Main Street, good news for Wall Street? *Journal of Financial Markets*, 35, 84–103.
<https://doi.org/10.1016/j.finmar.2016.12.003>
- Dziekoński, K., & Ignatiuk, S. (2015). Venture capital and PE investment strategies in selected European countries. *Financial Internet Quarterly*, 11(4), 34–45.
https://doi.org/10.14636/1734-039X_11_4_003
- Elfenbein, D. W., & Knott, A. M. (2014). Time to exit: Rational, behavioral, and organizational delays. *Strategic Management Journal*, 36(7), 957–975.
<https://doi.org/10.1002/smj.2262>
- Ellis, C. (2013). The economic impact of PE. *World Economics*, 14(3), 105–120.
- European Central Bank. (2022, December 8). *Our response to the coronavirus pandemic*.
<https://www.ecb.europa.eu/home/search/coronavirus/html/index.en.html>
- Federal Reserve Bank of St. Louis. (2024). *10-Year Treasury constant maturity minus 2-Year Treasury constant maturity*. Retrieved May 25, 2024, from
<https://fred.stlouisfed.org/series/T10Y2Y>
- Ferguson, A., Hu, C. W., & Lam, P. (2024). Fair value of earnouts: valuation uncertainty or managerial opportunism? *The Accounting Review*, 99(3), 141–167.
<https://doi.org/10.2308/tar-2021-0613>
- Forman, R., Anderson, M., Jit, M., & Mossialos, E. (2020). Ensuring access and affordability through COVID-19 vaccine research and development investments: A proposal for the options market for vaccines. *Vaccine*, 38(39), 6075–6077.
<https://doi.org/10.1016/j.vaccine.2020.07.068>
- Fox, D., & Wolf, D. E. (2010). An earnout is in the eye of the beholder. *Investment Dealers' Digest*, 76(4), 29.
- Gama, A. P. M., Emanuel-Correia, R., Duarte, F. D., & Augusto, M. (2023). The COVID-19 impact on crowdfunding performance: evidence from a peer to-peer lending platform. *Applied Economics Letters*, 1–5.
<https://doi.org/10.1080/13504851.2023.2178616>

- Ghorbel, A., Fakhfekh, M., Jeribi, A., & Lahiani, A. (2022). Extreme dependence and risk spillover across G7 and China stock markets before and during the COVID-19 period. *The Journal of Risk Finance*, 23(2), 206–244.
<https://doi.org/10.1108/jrf-11-2021-0179>
- Gompers, P. A., Kaplan, S. N., & Mukharlyamov, V. (2022). Private equity and Covid-19. *Journal of Financial Intermediation*, 51, 100968.
<https://doi.org/10.1016/j.jfi.2022.100968>
- Gorbenko, A. S., & Malenko, A. (2014). Strategic and financial bidders in takeover auctions. *The Journal of Finance*, 69(6), 2513–2555.
<https://doi.org/10.1111/jofi.12194>
- Green, A., Oxman, A., & Seghers, L. (2020). *Preparing for private-equity exits in the COVID-19 era*. McKinsey & Company.
<https://www.genevalbogroup.com/wp-content/uploads/2020/07/Preparing-for-private-equity-exits-in-the-COVID-19-era.pdf>
- Gruener, A., & Marburger, L. (2022). New insights into PE: empirical evidence from more than 500 buyouts. *The Journal of Portfolio Management*.
<https://www.alexandria.unisg.ch/server/api/core/bitstreams/0c105cf2-b7a2-4063-b576-e3a3d2722668/content>
- Guler, I. (2003). *A study of decision making, capabilities and performance in the venture capital industry* [University of Pennsylvania].
<https://www.proquest.com/openview/2cfd71b07d6052b464cf68106d1152f5/1?pq-origsite=gscholar&cbl=18750&diss=y>
- Guo, B., Lou, Y., & Pérez-Castrillo, D. (2012). Investment, duration, and exit strategies for corporate and independent Venture Capital-Backed Start-Ups. *Journal of Economics & Management Strategy*, 24(2), 415–455.
<https://doi.org/10.1111/jems.12097>
- Hagen, A. H., & Mundal, Ø. S. (2022). *Determinants of PE exit Strategies: An Empirical study of the Nordic PE market* [MA thesis, Norwegian School of Economics].
<https://openaccess.nhh.no/nhh-xmlui/bitstream/handle/11250/3013152/masterthesis.pdf?sequence=1>
- Henry, C., & Loomis, J. M. (2023). Healthcare as asset: Private equity investment and the changing geographies of care in the United States. *Geoforum*, 146, 103866.
<https://doi.org/10.1016/j.geoforum.2023.103866>

- Horn, J. T., Lovallo, D. P., & Viguerie, S. P. (2006). *Learning to let go: making better exit decisions*. McKinsey & Company.
<https://www.mckinsey.com/~media/McKinsey/Business%20Functions/Strategy%20and%20Corporate%20Finance/Our%20Insights/Learning%20to%20let%20go%20Making%20better%20exit%20decisions/Learning%20to%20let%20go%20Making%20better%20exit%20decisions.pdf>
- Hossain, M. S. (2021). Merger & Acquisitions (M&As) as an important strategic vehicle in business: Thematic areas, research avenues & possible suggestions. *Journal of Economics and Business*, 116, 106004.
<https://doi.org/10.1016/j.jeconbus.2021.106004>
- Hussain, A., Tahir, A., Hussain, Z., Sheikh, Z., Gogate, M., Dashtipour, K., Ali, A., & Sheikh, A. (2021). Artificial Intelligence–Enabled analysis of public attitudes on Facebook and Twitter toward COVID-19 vaccines in the United Kingdom and the United States: observational study. *Journal of Medical Internet Research*, 23(4), e26627.
<https://doi.org/10.2196/26627>
- Ichev, R., & Marinč, M. (2018). Stock prices and geographic proximity of information: Evidence from the Ebola outbreak. *International Review of Financial Analysis*, 56, 153–166.
<https://doi.org/10.1016/j.irfa.2017.12.004>
- Instituto Nacional de Saúde Doutor Ricardo Jorge. (2023). *Organização Mundial da Saúde declara fim da emergência global da COVID-19*. Retrieved May 17, 2024, from
<https://www.insa.min-saude.pt/organizacao-mundial-da-saude-declara-fim-da-emergencia-global-da-covid-19/>
- Investing.com. (2024). *U.S. S&P 500 Historical Data*. Retrieved May 25, 2024, from
<https://www.investing.com/indices/us-spx-500-historical-data>
- Ivashina, V., & Lerner, J. (2019). Pay now or pay later? The economics within the private equity partnership. *Journal of Financial Economics*, 131(1), 61–87.
<https://doi.org/10.1016/j.jfineco.2018.07.017>
- Jenkinson, T., & Sousa, M. (2015). What determines the exit decision for leveraged buyouts? *Journal of Banking & Finance*, 59, 399–408.
<https://doi.org/10.1016/j.jbankfin.2015.06.007>
- Jensen, M. (1989). Eclipse of the public corporation. In *Corporate Governance* (1st ed., pp. 61–67).

- Johan, S., & Zhang, M. (2016). Private equity exits in emerging markets. *Emerging Markets Review*, 29, 133–153.
<https://doi.org/10.1016/j.ememar.2016.08.016>
- Joshi, A. (2015). A study on internal determinants of export in pharmaceutical industry. *International Journal of Marketing and Technology*, 5(9), 153–168.
<http://www.indianjournals.com/ijor.aspx?target=ijor:ijmt&volume=5&issue=9&article=010>
- Kaiser, L. R. (2024). Private equity in health care. *Annals of Surgery*.
<https://doi.org/10.1097/sla.0000000000006318>
- Kaplan, S. N., & Strömberg, P. (2009). Leveraged buyouts and private equity. *The Journal of Economic Perspectives/The Journal of Economic Perspectives*, 23(1), 121–146.
<https://doi.org/10.1257/jep.23.1.121>
- Kaplan, S. N., & Zingales, L. (1997). Do Investment-Cash flow sensitivities provide useful measures of financing constraints? *The Quarterly Journal of Economics*, 112(1), 169–215.
<https://doi.org/10.1162/003355397555163>
- Karim, S., Naeem, M. A., Mirza, N., & Paule-Vianez, J. (2022). Quantifying the hedge and safe-haven properties of bond markets for cryptocurrency indices. *The Journal of Risk Finance*, 23(2), 191–205.
<https://doi.org/10.1108/jrf-09-2021-0158>
- Klonowski, D. (2010). Initial screening. In *Palgrave Macmillan US eBooks* (pp. 77–104).
https://doi.org/10.1057/9780230110076_4
- Kohers, N., & Ang, J. (2000). Earnouts in mergers: agreeing to disagree and agreeing to stay. *The Journal of Business*, 73(3), 445–476.
<https://doi.org/10.1086/209649>
- Kou, G., Akdeniz, Ö. O., Dinçer, H., & Yüksel, S. (2021). Fintech investments in European banks: a hybrid IT2 fuzzy multidimensional decision-making approach. *Financial Innovation*, 7(1).
<https://doi.org/10.1186/s40854-021-00256-y>
- Kucher, O., Kurov, A., & Wolfe, M. H. (2023). A shot in the arm: The effect of COVID-19 vaccine news on financial and commodity markets. *Financial Review*, 58(3), 575–596.
<https://doi.org/10.1111/fire.12345>
- Kutner, M. H., Nachtsheim, C. J., Neter, J., & Li, W. (2005). *Applied Linear Statistical Models*. McGraw-Hill Education.

- Labonte, M. (2021). Federal Reserve's response to COVID-19: Policy issues [Updated February 8, 2021]. *Library of Congress. Congressional Research Service*.
<https://www.hsdl.org/?abstract&did=850112>
- Mahmood, T., Meda, A., TriVedi, S., AnamiKa, F., Garg, S., & JaiN, R. (2023). Impact of the COVID-19 Pandemic on the US healthcare system. *Turkish Journal of Internal Medicine*, 5(3), 150–155.
<https://doi.org/10.46310/tjim.1285390>
- Mazur, M., Dang, M., & Vega, M. (2021). COVID-19 and the march 2020 stock market crash. Evidence from S&P1500. *Finance Research Letters*, 38, 101690.
<https://doi.org/10.1016/j.frl.2020.101690>
- McConnell, J. J., Servaes, H., & Lins, K. V. (2008). Changes in insider ownership and changes in the market value of the firm. *Journal of Corporate Finance*, 14(2), 92–106.
<https://doi.org/10.1016/j.jcorpfin.2008.02.001>
- McInerney, M., Hinchcliff, R., FitzGerald, G., & King, R. (2023). PE investment in private for-profit healthcare in Australia and New Zealand: A scoping review. *Asia Pacific Journal of Health Management*, 18(2), 4–19.
<https://search.informit.org/doi/10.3316/informit.353866036381918>
- Meyer, A. D. (1982). Adapting to environmental jolts. *Administrative Science Quarterly*, 27(4), 515.
<https://doi.org/10.2307/2392528>
- Michala, D. (2019). Are private equity backed initial public offerings any different? Timing, information asymmetry and post-IPO survival. *Journal of Corporate Finance*, 59, 31–47.
<https://doi.org/10.1016/j.jcorpfin.2016.10.005>
- Mirza, N., Umar, M., & Mangafic, J. (2023). Covid-19 vaccines and investment performance: Evidence from equity funds in European Union. *Finance Research Letters*, 53, 103650.
<https://doi.org/10.1016/j.frl.2023.103650>
- Miyakawa, D., Oikawa, K., & Ueda, K. (2021). Firm Exit during the COVID-19 Pandemic: Evidence from Japan. *Journal of the Japanese and International Economies*, 59, 101118.
<https://doi.org/10.1016/j.jjie.2020.101118>
- Montanaro, B., Cavallo, A., Giudici, G., & Ghezzi, A. (2021). Determinants of the exit value in European venture capital-backed technology startups. *Competitiveness Review an International Business Journal Incorporating Journal of Global Competitiveness*, 32(7), 62–84.
<https://doi.org/10.1108/cr-03-2021-0032>

- Morris, P., & Phalippou, L. (2020). Thirty years after Jensen's prediction: Is private equity a superior form of ownership? *Oxford Review of Economic Policy*, 36(2), 291–313.
<https://doi.org/10.1093/oxrep/graa004>
- Naqvi, B., Mirza, N., Rizvi, S. K. A., Porada-Rochón, M., & Itani, R. (2021). Is there a green fund premium? Evidence from twenty seven emerging markets. *Global Finance Journal*, 50, 100656.
<https://doi.org/10.1016/j.gfj.2021.100656>
- Nikoskelainen, E., & Wright, M. (2007). The impact of corporate governance mechanisms on value increase in leveraged buyouts. *Journal of Corporate Finance*, 13(4), 511–537.
<https://doi.org/10.1016/j.jcorpfin.2007.04.002>
- Papanicolas, I., Woskie, L. R., & Jha, A. K. (2018). Health care spending in the United States and other High-Income countries. *JAMA*, 319(10), 1024.
<https://doi.org/10.1001/jama.2018.1150>
- Piñeiro-Chousa, J., López-Cabarcos, M. Á., Quiñoá-Piñeiro, L., & Pérez-Pico, A. M. (2022). US biopharmaceutical companies' stock market reaction to the COVID-19 pandemic. Understanding the concept of the 'paradoxical spiral' from a sustainability perspective. *Technological Forecasting and Social Change*, 175, 121365.
<https://doi.org/10.1016/j.techfore.2021.121365>
- Poulsen, A. B., & Stegemoller, M. (2008). Moving from Private to Public Ownership: Selling Out to Public Firms versus Initial Public Offerings. *Financial Management*, 37(1), 81–101.
<https://doi.org/10.1111/j.1755-053x.2008.00005.x>
- Ramesh, K., & Annamalai, T. R. (2021). Which cat to bell? Investment duration, exit type, and returns in venture investments. *The Journal of Alternative Investments*, 23(4), 47–60.
<https://doi.org/10.3905/jai.2021.1.123>
- Refinitiv. (2024). *ScreenerApp.Refinitiv*. Retrieved April 23, 2024, from
<https://workspace.refinitiv.com/web/Apps/ScreenerApp/?univ=DEALSMNA>
- Rhyan, C., Turner, A., & Miller, G. (2020). Tracking the U.S. health sector: the impact of the COVID-19 pandemic. *Business Economics*, 55(4), 267–278.
<https://doi.org/10.1057/s11369-020-00195-z>
- Sattar, N. S., & Arifuzzaman, S. (2021). COVID-19 vaccination awareness and aftermath: public sentiment analysis on Twitter data and vaccinated population prediction in the USA. *Applied Sciences*, 11(13), 6128.
<https://doi.org/10.3390/app11136128>

- Scheffler, R. M., Alexander, L. M., & Godwin, J. R. (2021). Soaring private equity investment in the healthcare sector: consolidation accelerated, competition undermined, and patients at risk. *SSRN Electronic Journal*.
<https://doi.org/10.2139/ssrn.3860353>
- Schmidt, D., Steffen, S., & Szabó, F. (2007). Exit strategies of buyout investments: An empirical analysis. *The Journal of Alternative Investments*, 12(4), 58–84.
<https://www.proquest.com/scholarly-journals/exit-strategies-buyout-investments-empirical/docview/234994443/se-2>
- Schulte, F. (2022, November 14). *Sick Profit: Investigating private equity's stealthy takeover of health care across cities and specialties* - KFF Health News. KFF Health News.
<https://kffhealthnews.org/news/article/private-equity-takeover-health-care-cities-specialties/>
- Schwiebacher, A. (2002). An empirical analysis of venture capital exits in Europe and the United States. *SSRN Electronic Journal*.
<https://doi.org/10.2139/ssrn.302001>
- Smales, L. (2021). Investor attention and global market returns during the COVID-19 crisis. *International Review of Financial Analysis*, 73, 101616.
<https://doi.org/10.1016/j.irfa.2020.101616>
- Tushman, M. L., & Romanelli, E. (1985). Organizational Evolution: A Metamorphosis Model of Convergence and Reorientation. *Research in Organizational Behavior*, 7, 171–222.
- Uddin, M., & Chowdhury, A. (2021). Private Equity Exit Strategies and Profitability During the Global Pandemic: Evidence from Around the World. *British Journal of Management*, 32(4), 1302–1337. <https://doi.org/10.1111/1467-8551.12543>
- Umar, M., Mirza, N., Rizvi, S. K. A., & Furqan, M. (2021). Asymmetric volatility structure of equity returns: Evidence from an emerging market. *The Quarterly Review of Economics and Finance*, 87, 330–336.
<https://doi.org/10.1016/j.qref.2021.04.016>
- Wall, J., & Smith, J. (1997). Better exits. *The Journal of PE*, 1(2), 31–43.
<https://www.jstor.org/stable/43503185>
- Wang, C. K., & Sim, V. Y. (2001). Exit strategies of venture capital-backed companies in Singapore. *Venture Capital*, 3(4), 337–358.
<https://doi.org/10.1080/13691060110060664>

- World Bank. (2023). *World Bank Data*. Retrieved May 25, 2024, from <https://databank.worldbank.org/>
- World Health Organization. (2023). *World Health Organization*. Retrieved May 17, 2024, from <https://www.who.int/>
- Wright, M., Wilson, N., Gilligan, J., Bacon, N., & Amess, K. (2016). Brexit, private equity and management. *British Journal of Management*, 27(4), 682–686.
<https://doi.org/10.1111/1467-8551.12191>
- Yang, J., & Zhang, L. (2009). Research on the Exit Routes of Chinese PE Funds. *International Business Research*, 1, 145.
- Yousefinaghani, S., Dara, R., Mubareka, S., Papadopoulos, A., & Sharif, S. (2021). An analysis of COVID-19 vaccine sentiments and opinions on Twitter. *International Journal of Infectious Diseases*, 108, 256–262.
<https://doi.org/10.1016/j.ijid.2021.05.059>
- Zhang, D., Hu, M., & Ji, Q. (2020). Financial markets under the global pandemic of COVID-19. *Finance Research Letters*, 36, 101528.
<https://doi.org/10.1016/j.frl.2020.101528>
- Zingales, L. (1995). Insider ownership and the decision to go public. *The Review of Economic Studies*, 62(3), 425.
<https://doi.org/10.2307/2298036>