Hedge funds and financial stability: A review of the evidence

Ron Alquist
Managed Funds Association

Craig Lewis
Owen Graduate School of Management,
Vanderbilt University

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Owen Graduate School of Management, Vanderbilt University

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Abstract: This paper examines the role of hedge funds as investors and arbitrageurs in the financial system, emphasizing how they provide diversified investment opportunities to their clients, enhance market liquidity, improve price discovery, and promote capital formation, as well as the implications of their use of leverage, funding dependencies, and counterparty relationships for financial stability. It examines several significant episodes of hedge fund distress and concludes that the near-collapse of Long-Term Capital Management (LTCM) in 1998 is an isolated case in which hedge fund failure posed widespread risks to the broader financial system. In the other cases we examine, we find that hedge funds' impact on broader financial stability is minimal or absent. The paper also studies regulatory changes that have enhanced the resilience of the financial system, including improved risk management, expanded central clearing for derivatives, and greater transparency. These reforms have made the financial system less vulnerable to possible financial stability risks associated with hedge funds. In particular, effective counterparty credit risk management (CCRM) practices and the market discipline imposed by investors, creditors, and other counterparties limit the impact of hedge fund distress or failures on other parts of the financial system and the broader economy.

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Correspondence: Ron Alquist, Managed Funds Association, 546 5th Ave, 12th Floor, New York, NY 10036. Email: ralquist@mfaalts.org. Craig Lewis, Owen Graduate School of Management, Vanderbilt University, 401 21st Avenue South, Nashville, TN 37203. Email: craig.lewis@vanderbilt.edu.

1. Introduction

Hedge funds play a unique and, at times, misunderstood role in the financial system. As private investment vehicles with more diversified and flexible investment strategies than traditional investment funds, hedge funds employ sophisticated investment, trading, and arbitrage strategies that use leverage, derivatives, and short-selling to seek higher risk-adjusted returns for their clients, who are primarily institutional investors. This flexibility allows them to operate not only as investors, but also – much like the arbitrageurs in textbooks and economic models – to perform many of the same functions within financial markets. Yet this flexibility has led to concerns about their potential impact on financial stability, particularly when markets are stressed.

The relation between hedge funds and financial stability is complex and multifaceted. On the one hand, hedge funds contribute to financial market functioning by enabling investors to diversify their portfolios and improve their risk-return profiles, enhancing price discovery, facilitating efficient capital allocation, and deepening liquidity. They conduct in-depth research and analysis to develop their investment strategies, which enables them to take on risk, make contrarian trades, and correct mispricing, contributing to improved market efficiency. On the other hand, the near collapse of Long-Term Capital Management (LTCM) inflicted substantial losses on its creditors and counterparties, forcing the fund to liquidate its positions at steep discounts. At that time, policymakers became concerned that interlocking credit exposures among LTCM's counterparties could transmit risks from one institution to another, causing a systemic event.

This paper examines the hedge funds' net positive influence on financial stability. It reviews research regarding their role in enhancing market efficiency, supporting capital formation, and enhancing market liquidity. That research indicates that hedge

funds benefit the financial system and the broader economy by, for instance, ensuring that the prices of fundamentally similar assets are aligned, enabling corporations to raise capital more cheaply and efficiently.

The paper then analyzes the risks associated with leverage, funding dependencies, and interconnections with prime brokers and banks. It employs the Brunnermeier and Pedersen (2009) model to determine the conditions under which the liquidation of leveraged positions can create an adverse feedback loop between funding liquidity and market liquidity. Specifically, the model shows that deleveraging is likely to be disruptive when market liquidity is limited, causing asset liquidations to drive prices against the leveraged investor. In this manner, the model underscores when the interaction between funding and market liquidity is malign or benign.

The paper also analyzes significant historical episodes in which hedge funds have been implicated in financial turmoil. It assesses whether their activities contributed to systemic risk or reflected broader market dynamics. One of the principal findings of this section is that the near failure of LTCM in 1998 stands out as an isolated example of hedge fund distress posing a risk to its creditors, counterparties, and the financial system more broadly. The evidence from other episodes does not suggest that hedge funds were major contributors to systemic risk. If anything, hedge fund distress often signals that risks are accumulating in the financial system rather than serving as the direct cause of the buildup. Generally, hedge funds are more likely to become distressed due to an adverse systemic shock rather than their distress causing a systemic event.

The paper then examines the evolution of financial regulation since the 2007–2009 financial crisis, which has resulted in significant and enduring reforms affecting hedge funds. These reforms include strengthened risk management practices, mandatory central clearing of derivatives, and enhanced transparency through the real-time

public dissemination of swap transaction and pricing data. Regulatory transparency has also increased through requirements such as Form PF position reporting. In theory, daily trade reporting and quarterly position disclosures allow regulators to monitor the buildup of hedge fund risk exposures. These measures have strengthened the resilience of financial markets and ensure that the impacts of hedge fund distress or failure remain contained.

Although these reforms have reduced risks in the financial system, they have not eliminated them, which, in any case, would be undesirable and counterproductive. When hedge funds act as arbitrageurs, they assume risks that other financial institutions are unwilling or unable to take. Reducing risk in the financial system to zero would undermine hedge funds' contributions to price discovery and market efficiency, which promote capital formation and economic growth. Post-financial crisis reforms are important elements in enabling market participants to accurately price the counterparty risks associated with hedge funds, ensuring the risks they take are covered and effectively managed, and limiting the potential repercussions of a hedge fund's distress or failure.

By analyzing the benefits and risks of hedge funds, this paper highlights the conditions under which hedge funds may either reinforce or undermine financial stability. The findings contribute to the debate about hedge fund regulation and how to design a regulatory framework that maximizes the social benefits hedge funds provide to the financial system and the broader economy while minimizing the potential risks associated with hedge fund distress or failure. The right policy response is to ensure there are proper guardrails so that the benefits of hedge funds can be realized.

2. Hedge Funds' Benefits to the Financial System

Hedge funds are private investment partnerships that use complex strategies to generate returns for their investors. Unlike most mutual funds, which are typically long-only investment vehicles, hedge funds have the flexibility to use leverage, short sell, trade derivatives, and employ other advanced investment strategies. Hedge funds are subject to a different regulatory regime than mutual funds because the pool of potential hedge fund investors is largely restricted to accredited investors and qualified purchasers, so-called sophisticated investors. Accredited investors must meet specific requirements regarding a minimum level of income or assets to invest in hedge funds. Similarly, qualified purchasers must meet defined financial thresholds based on the value of the investor's assets. Typical hedge fund investors include institutional investors, such as pension funds and insurance companies, as well as endowments, foundations, and wealthy individuals. The composition has shifted toward institutional investors since the late 1990s (Fung and Hsieh, 2013).

The premise of limiting investments in hedge funds to sophisticated investors is that they neither demand nor require the same types of prescriptive regulation and disclosure rules that apply to investments available to retail investors. Sophisticated investors are responsible for conducting due diligence on the hedge funds they choose to invest in. At the same time, hedge funds are subject to the same prohibitions against fraud as other market participants, and their managers share the same fiduciary responsibility to their investors as other investment advisers, such as mutual funds.

Hedge funds are unique in that they are unconstrained investors able to pursue opportunities that are often inaccessible to other financial institutions. Their flexibility, particularly in exploiting arbitrage opportunities, is a defining feature and central to their role in the financial system. For investors, hedge funds offer diversification benefits and the potential for higher risk-adjusted returns. More

broadly, their ability to implement a wide range of strategies contributes to more efficient capital allocation by providing liquidity, enhancing market efficiency, supporting corporate governance, and facilitating capital formation.

2.1. Portfolio Diversification

Hedge funds play a central role in portfolio diversification and improving risk-adjusted returns for their investors, as Brown (2016) highlights. Their flexibility in developing innovative trading strategies allows investors to access a broader range of opportunities, enhancing returns while reducing exposure to market risk. The fundamental principle of diversification is to improve the risk-return tradeoff by spreading investments across several asset classes rather than concentrating them in a single category, such as equities. A well-diversified portfolio is expected to outperform an undiversified one over the long term by reducing the influence of idiosyncratic risks on the diversified portfolio and lowering its volatility. In this way, diversification enables investors to bear financial risk more efficiently.

Hedge funds enhance diversification by providing access to alternative investment strategies that are imperfectly correlated with traditional asset classes. Expanding the investment opportunity set enables investors to construct portfolios with a broader range of risk and return profiles, which aligns well with the analytical conclusions of modern portfolio theory (Markowitz, 1952). By increasing the variety of available investments, hedge funds expand the efficient frontier, allowing for higher returns at a given risk level or reduced risk for the same expected return.

Empirical evidence supports the idea that hedge funds provide meaningful diversification benefits beyond traditional asset classes by offering more flexible and sophisticated investment strategies (Ilmanen, 2011; Pedersen, 2015; Ilmanen, 2022). They expand the investment universe, improve portfolio efficiency, and reduce idiosyncratic risk, providing investors access to risk premia unavailable in traditional

equity and bond portfolios. Consequently, as the investor base of hedge funds has broadened from wealthy private investors to institutional investors, hedge funds have proven to be attractive diversifiers for different types of investors with various mandates and investment objectives (Fung and Hsieh, 2013). Integrating hedge funds into a reference portfolio of conventional assets helps institutional investors enhance their portfolio’s performance and find alternative sources of return uncorrelated with the reference portfolio.

2.2. Price Discovery

Hedge funds also contribute to price discovery. Unlike other investment vehicles, such as mutual funds, hedge funds do not explicitly track indices, passively manage their investment portfolios, or follow narrow mandates. Instead, they have a comparative advantage in conducting research and using proprietary techniques to actively identify and trade mispriced securities. By trading based on this research, hedge funds incorporate this information into prices and volumes, speeding up the reversion of prices to fundamental values. More efficient pricing enables firms to raise capital at prices that more accurately reflect their fundamental value, providing them with the incentive to invest in the most productive projects. The ability of hedge funds to enhance price discovery improves the economy’s overall allocation of capital.

For instance, Cao, Chen, Goetzmann, and Liang (2018) examine how hedge funds contribute to price formation. The paper finds that hedge funds hold undervalued stocks and help correct mispricing over time through their trading activities. Hedge fund ownership and trading frequently precede the correction of stock mispricing, a pattern that is either absent or weaker among other institutional investors. By aligning security prices closely with their fundamental values, hedge funds enhance market efficiency and improve capital allocation.

This enhanced price efficiency is especially valuable for passive investors, whose indexing and rule-based strategies depend on accurate and timely prices to track benchmarks effectively. When hedge funds identify and exploit mispricings, they help minimize tracking errors and slippage. Moreover, by supplying liquidity through trading during periods of stress or rapid informational shifts, hedge funds help prevent extreme distortions in index valuations. In this way, the information hedge funds impound information into prices and enhance liquidity for the assets they trade, which contributes to the success of passive investing.

2.3. Corporate Governance and Activism

Activist hedge funds can enhance corporate governance and increase shareholder value by influencing companies' strategic, operational, and financial improvements. Brav, Jiang, Partnoy, and Thomas (2008) and Brav, Jiang, Song, and Tian (2018) show that activist hedge funds propose changes to target firms that increase shareholder value by improving firm performance, increasing shareholder payouts, and, when necessary, facilitating CEO turnover. Furthermore, the value provided by hedge fund activists not only benefits shareholders; these activists also improve target firms' productivity growth, cost and capital allocation, and product differentiation (Aslan and Kumar, 2015; Brav, Jiang, and Kim, 2015). In these ways, hedge funds play a role in monitoring management to ensure they take actions consistent with maximizing shareholder value.

This evidence shows how hedge funds improve corporate governance and firm performance by mitigating the agency problems inherent in other institutional investors' passive stances (Kahan and Rock, 2007). Activist hedge funds' ability to take significant positions and operate with fewer prescriptive regulatory constraints allows them to overcome the classic agency problem of publicly held companies more effectively than traditional institutional investors.

2.4. Capital Formation

Finally, hedge funds facilitate capital formation, particularly for firms that encounter high costs or other barriers in accessing traditional capital markets. Brown, Grundy, Lewis, and Verwijmeren (2012) show how hedge funds utilize convertible arbitrage strategies to offer cost-effective financing solutions.[1] By purchasing convertibles and shorting the underlying stock, hedge funds enable firms with high equity issuance costs—often due to stock volatility or financial distress—to raise capital more quickly and efficiently than through seasoned equity offerings. This method of raising capital reduces issuance costs and attracts institutional investors by enhancing stock liquidity and lowering transaction costs.

Brav, Jiang, Partnoy, and Thomas (2008) find that hedge fund activism enhances capital formation by improving firm value, reducing information asymmetries, and facilitating more efficient financial structuring. Their study documents that activist hedge funds target undervalued, liquid firms with strong fundamentals but suboptimal capital allocation or governance practices. Upon acquiring stakes of typically 5-10 percent, activists pursue changes in capital structure, strategic direction, or governance, leading to significant abnormal returns around the announcement of activism. These gains persist over time, suggesting that activism enhances underlying firm performance. Target firms often subsequently engage in recapitalizations or equity offerings, which benefit from the higher valuations and improved investor confidence generated by activist hedge fund interventions. The value-enhancing changes attributable to hedge fund activism enhance capital formation and facilitate more efficient access to external financing.

2.5. Liquidity Provision

[1] A convertible bond is a corporate bond that can be converted into equity and includes additional option-like features that can be callable (i.e., the issuer can redeem the bond before it matures). Smaller companies in need of cash often issue convertibles because the financing costs are lower than those of a seasoned equity offering, allowing them to leverage hedge funds' expertise in distributing equity exposure.

Hedge funds' diverse trading strategies indirectly provide liquidity to financial markets. Their willingness and ability to take complex and illiquid positions allow other market participants to execute trades more readily. Hedge funds enhance liquidity by taking long or short positions in securities they believe to be mispriced relative to their fundamentals, aiming to profit from price changes. They use research and proprietary investment techniques to identify assets that are mispriced on an absolute basis or relative to each other. By trading on the information derived from such research, hedge fund buying or selling drives market prices towards their fundamental values.

In this way, hedge fund liquidity provision fundamentally differs from that of traditional market-makers, such as dealers. Dealers earn profits by simultaneously quoting buy and sell prices and profiting from the bid-ask spread. They typically buy and sell the same security in roughly equal amounts over short time intervals.

Examples of how hedge funds' trading activities indirectly provide liquidity to other market participants are abundant. Cao, Liang, Lo, and Petrasek (2018) examine the relation between changes in hedge fund equity holdings and several measures of the informational efficiency of stock prices. Hedge funds invest in stocks with pricing inefficiencies and improve the informativeness of the stock prices as their holdings increase. However, during liquidity crises, stocks heavily owned by hedge funds experience significant declines in price efficiency. This evidence suggests that hedge funds enhance market efficiency under normal conditions, but their impact is constrained when funding for arbitrage activities becomes limited. In a similar vein, Aragon and Strahan (2012) use the Lehman Brothers' bankruptcy as a quasi-natural experiment to study the effects of hedge fund trading on the liquidity of individual stocks. The stocks held by hedge funds connected to Lehman experienced greater declines in market liquidity than similar stocks held by hedge funds without Lehman exposure, indirectly showing that hedge funds withdrew from the market.

Other examples of research showing the effects of hedge funds ceasing to provide liquidity include Mitchell, Pedersen, and Pulvino (2007), Lewis, Munyan, and Verwijmeren (2024), and Mitchell and Pulvino (2012). Mitchell, Pedersen, and Pulvino (2007) focus on merger arbitrage following the 1987 stock market crash and convertible arbitrage in 2005. They find evidence that redemptions forced hedge funds to shift from providing liquidity to demanding it. Lewis, Munyan, and Verwijmeren (2024) also examine the 2005 convertible arbitrage crash and show that hedge funds could delay trades and largely avoid selling at fire-sale prices. Their findings suggest that bond dealers recognized the trades as liquidity-driven rather than information-based, allowing hedge funds to minimize losses. In a separate paper, Mitchell and Pulvino (2012) examine the effects of arbitrageurs trading relative value strategies losing access to debt financing during the 2007-2009 financial crisis. As a result of the adverse funding shock, the arbitrageurs could not ensure that the differences in the prices of closely related securities remained small.

3. Hedge Funds and Financial Stability

Although hedge funds provide considerable benefits to the financial system and economy, LTCM's near failure over 25 years ago continues to be the example that policymakers and regulators adduce to illustrate how a hedge fund could threaten the stability of certain markets and the financial system more generally. To put the LTCM case into context and better understand how and why it posed a systemic risk, this section examines the relationship between hedge funds and financial stability. It defines financial stability and systemic risk, presents an analytical framework for hedge funds' responses to adverse liquidity shocks and the implications for financial stability, and discusses historical examples of how distressed or failed hedge funds affected the financial system.

3.1. What are Financial Stability and Systemic Risk?

Financial stability and systemic risk can be difficult to define, with several credible definitions available.[2] Financial stability describes a financial system that allocates capital efficiently among investment projects, assesses and manages financial risks, and enables the economy to operate and grow. Systemic risk is the likelihood that financial institutions may become distressed or fail, with the distress or failure potentially spreading to other parts of the financial system and disrupting the economy's functioning.

Therefore, the relationship between financial stability, systemic risk, and hedge funds illustrates how the distress or failure of an individual fund or a group of funds can transmit stress throughout the financial system, leading to disruptions in the economy that hinder its proper functioning. In this context, economic theory clarifies

[2] See, for example, the Federal Reserve Board of Governor's definition of financial stability available at: https://www.federalreserve.gov/aboutthefed/fedexplained/financial-stability.htm#:~:text=What%20Is%20Financial%20Stability%3F,in%20a%20well%2Dfunctioning%20economy.

the channels through which shocks can impose significant losses on hedge funds and the conditions under which they could jeopardize financial stability.

3.2. Hedge Funds, Funding Liquidity, and Market Liquidity

Brunnermeier and Pedersen (2009) develop a model that highlights how economic mechanisms alter the incentive structures of leveraged investors, such as investment and commercial banks, market makers, and hedge funds, when they experience a negative funding shock. The model examines the interaction between funding liquidity and market liquidity and identifies the conditions under which such adverse shocks can exacerbate each other. Funding liquidity refers to how easily traders can obtain the funding needed to finance their positions, while market liquidity describes traders' ability to liquidate an asset without significantly affecting its price. Brunnermeier and Pedersen demonstrate that when leveraged investors reach their capital constraints or risk doing so during a trade, they liquidate their positions, resulting in a decline in market liquidity.

The model predicts two distinct equilibria, depending on the level of market liquidity. If the market is liquid, it can absorb the asset liquidation without disruption. By contrast, if the market is illiquid, the asset liquidation causes prices to move against the leveraged investor, which, in turn, leads to additional margin and capital calls. In the illiquid market equilibrium, funding and market liquidity mutually reinforce each other. The model implies that if a leveraged investor must quickly unwind positions at unfavorable prices due to market illiquidity, those liquidations exert added pressure on asset prices, potentially leading to another round of margin calls, capital calls and liquidations and, in extreme cases, a fire sale.

Forced liquidations caused by adverse funding shocks typically occur when a hedge fund must rapidly sell assets to meet margin requirements, often at times when market liquidity is already impaired. Investor redemption requests represent another

immediate financial obligation that may necessitate the rapid liquidation of positions. However, hedge funds typically implement lock-up periods and require advance notice for investor redemptions. Lock-up periods limit the risk of investor runs associated with the liquidity transformation inherent in other financial institutions, such as money market mutual funds with daily redemptions and banks that borrow short-term and lend long-term. Many hedge funds also rely on short-term financing arrangements like repurchase agreements and loans from prime brokers, which are sensitive to funding conditions. During periods of financial stress, lenders often tighten these terms by increasing margin requirements, reducing credit lines, or withdrawing funding altogether.

Empirical evidence supports several key predictions of the Brunnermeier and Pedersen model. It explains why corporate arbitrage strategies fail during periods of market stress and why arbitrageurs face margin or capital calls that incentivize them to close out their positions and prevent them from providing liquidity (Mitchell, Pedersen, and Pulvino, 2007; Aragon and Strahan, 2012; Mitchell and Pulvino, 2012). During the 2007-2009 global financial crisis, many hedge funds encountered abrupt funding constraints as banks and prime brokers scaled back their counterparty exposures, compelling them to liquidate their positions (Adrian and Shin, 2010). Moreover, the model provides an account for why poor returns are clustered across hedge fund strategies during liquidity events, such as increases in credit spreads and decreases in market liquidity (Boyson, Stahel, and Stulz, 2010), and how large equity funds that employ correlated strategies and unwind them simultaneously can adversely affect each other (Pedersen, 2009).

3.3. Long-Term Capital Management (LTCM)

LTCM's near failure in 1998 marked the first significant hedge fund collapse that credibly presented a systemic risk. The LTCM incident influenced regulators' and policymakers' views on hedge funds and financial stability, prompting changes in

regulations and oversight aimed at averting a similar crisis in the decade following that failure. Consequently, the lessons learned from LTCM continue to shape policy discussions about hedge funds and systemic risks, particularly concerns regarding how hedge funds manage their leverage using internal risk controls and the necessity for hedge funds' creditors and counterparties to implement appropriate CCRM practices.

LTCM was a prominent U.S. hedge fund recognized for generating high net-of-fee returns between 1994 and 1997.[3] It employed a carefully crafted statistical arbitrage portfolio that spanned several asset markets worldwide. However, starting in May and June of 1998, LTCM experienced a drawdown that lasted until September 1998. The initial losses were triggered by a downturn in the mortgage-backed securities (MBS) market, resulting in a 16% decline in LTCM's capital (Jorion, 2000). In response to this drawdown, LTCM chose to unwind the most liquid parts of its portfolio, as they were expected to be less profitable, thereby shifting the portfolio's composition toward less liquid assets. This decision ultimately hindered LTCM's ability to liquidate its less liquid, loss-making positions as the drawdown continued through the summer, consistent with the underlying logic of Brunnermeier and Pedersen's model.

LTCM's losses accelerated in early August when the Russian government restructured its bond payments. This de facto default caused a reassessment of credit and sovereign risks in global financial markets. Credit spreads, risk premia, and liquidity spreads increased rapidly, resulting in a flight to quality that disrupted many of the long-run statistical relations upon which LTCM's trades were based (Jorion, 2000). LTCM's leveraged positions across various markets incurred significant losses because of Russia's default. The losses led to margin and capital calls that the fund

[3] The full history of LTCM is recounted in Jorion (2000), Dunbar (2001), and Lowenstein (2001).

could not cover with its remaining capital, forcing it to try to liquidate more assets from its portfolio.

By late September, Federal Reserve officials had become concerned that the fund's attempt to unwind its positions would strain market liquidity and threaten systemic stability, necessitating a coordinated rescue by major financial institutions (Greenspan, 1998; McDonough, 1998). Their primary concern was that a disorderly unwinding of LTCM's positions with its lenders and counterparties could spill over into other areas of the financial system, leading to further market disruptions. For the Federal Reserve, it was imperative to impose market discipline and prevent moral hazard by ensuring that the private sector, and not the public sector, addressed the problem, with LTCM's creditors, counterparties, and equity holders bearing the losses (McDonough, 1998). Consequently, the Federal Reserve Bank of New York limited itself to coordinating meetings between LTCM and a consortium of major banks and financial institutions, culminating in a final agreement on September 23, 1998. The consortium provided a capital infusion of $3.6 billion in exchange for a 90% stake in LTCM, effectively taking over its management. LTCM's creditors, investors, and principals suffered significant losses, although these were likely less than they would have been without the capital infusion (Edwards, 1999). LTCM's portfolio was unwound in December 1999, with all capital repaid to the investors.

In the wake of LTCM's near collapse, hedge funds and their trading activities faced scrutiny from policymakers and regulators to understand what made it a systemic risk, as exemplified by the analysis in the Report of the President's Working Group (PWG) on Financial Markets (1999). The Report emphasized two primary causes of LTCM's distress: the importance of leverage and the failure of its counterparties to appropriately monitor and manage their exposures to the fund, which could have disciplined LTCM's use of leverage.

Research conducted after the Report's release has provided caveats to the generalizability of its conclusions about LTCM's use of leverage. Danielsson, Taylor, and Zigrand (2005) note that, unlike LTCM, the typical hedge fund employs a moderate level of leverage and is significantly less leveraged than regulated institutions, such as banks. This point remains true today: the amount of leverage a hedge fund employs is typically inversely related to the volatility of the assets in which it invests. Similarly, Gupta and Liang (2004) find that only a small share of hedge funds were undercapitalized as of March 2003. In any case, undercapitalized funds tend to be a small fraction of total fund assets in their sample. Moreover, Jorion (2000) stresses the interaction of LTCM's leverage use with other factors, such as the failure of LTCM's risk model to accurately capture the risks to which the fund was exposed, the lack of diversification in the fund's strategies during stress periods, and the partners' decision, at the end of 1997, to return $2.7 billion in capital to investors. He argues that if LTCM had retained that capital, it could have survived the following year.

Regarding LTCM's ability to destabilize markets through forced liquidations, Adrian, Borowiecki, and Tepper (2022) develop an empirical model that extends the logic of the Brunnermeier and Pedersen model to determine, counterfactually, whether LTCM's deleveraging would have disrupted certain markets if it had not received a private-sector bailout. In the model, leveraged investors must control a significant proportion of the market and exert price pressure when liquidating positions to destabilize it, like Brunnermeier and Pedersen's notion of the fragile equilibrium when markets are illiquid. The paper finds that LTCM liquidating its positions in the equity volatility and bank funding markets likely would have been destabilizing, given the size of its positions (Adrian, Borowiecki, and Tepper, 2022). These findings suggest that the failure of LTCM's internal risk and liquidity management practices, its counterparties'

CCRM failures, and the size of its positions, in combination, were the driving forces behind its near failure and the risks it posed for the financial system.

On the other hand, the Report's conclusions about LTCM's counterparties' risk-management failures have been subject to fewer caveats. LTCM's counterparties had limited information about the amount of leverage LTCM was employing, how concentrated its positions were, or the risks associated with those positions (Edwards, 1999). Following the LTCM crisis, CCRM practices related to leveraged institutions were strengthened (Basel Committee on Banking Supervision, 1999). Regulators encouraged banks to monitor their hedge fund adviser clients and manage their exposures to them through counterparty CCRM practices (McDonough, 1999; Geithner, 2004; Bernanke, 2006; Kambhu, Schuermann, and Stiroh, 2007). For instance, after LTCM, supervisors in jurisdictions where banks have significant dealings with hedge funds began to conduct onsite examinations to review banks' risk-management policies (Cole, Feldberg, and Lynch, 2007). Today, strong and effective CCRM practices remain a first line of defense for managing the effects of hedge fund distress or failures.

3.4. Hedge Fund Distress and Financial Stability: Other Important Examples

This section examines several other prominent examples of hedge fund deleveraging or distress that did not necessarily become systemic: the 2006 failure of Amaranth Advisors, the August 2007 Quant Quake, the March 2020 dash for cash, and the collapse of the family office, Archegos Capital Management—a notable non-example.[4] Of these four cases, three—Amaranth's failure, the Quant Quake, and

[4] In the 1990s, policymakers and regulators debated the role of hedge funds in precipitating currency crises and destabilizing government bond markets. The research from analyzing those events generally concludes that hedge funds were not uniquely culpable for causing the financial distress and market dislocations (Borio and McCauley, 1995; Eichengreen, Mathieson, Chadha, Jansen, Kodres, and Sharma, 1998; Choe, Kho, and Stulz, 1999; Brown, Goetzmann, and Park, 2000; Fung, Hsieh, and Tsatsaronis, 2000). Other larger market

Archegos's collapse—are examples of hedge fund distress or failure that, in different ways, conform to the patterns predicted by the Brunnermeier and Pedersen model but did not become systemic. The March 2020 Treasury market disruption falls into a different category because it was, arguably, a systemic event. As the name dash for cash suggests, however, all major Treasury market participants demanded dollar liquidity in response to the COVID-19 shock, and dealers were unable to meet that demand, making it difficult to disentangle the separate contribution of hedge funds to the temporary Treasury market dislocations.

A notable omission from this set of examples is the 2007-2009 global financial crisis, but it is for good reason. Hedge funds were not a primary contributor to the crisis. Instead, the fundamental causes were the severe downturn in housing prices and highly leveraged homeowners, with leveraged investment banks depending on short-term funding and practices like inadequately backed credit-default swaps (CDSs) playing a more prominent role than hedge funds in magnifying and propagating the initial shocks (Dixon, Clancy, and Kumar, 2012; Mian and Sufi, 2014; McDonald and Paulson, 2015; Duffie, 2019). Although hedge funds traded various financial products central to the collapse and many hedge funds failed during the crisis, they played limited roles in the housing bubble that preceded the crisis.[5] In the run-up to the crisis, some hedge funds were invested in MBSs, collateralized debt obligations (CDOs), and collateralized mortgage obligations (CMOs), such as Bear Stearns's two internal hedge funds. Other hedge funds recognized the unsustainability of rising home prices and took short positions on the U.S. housing market, providing liquidity to the funds that had long positions by taking the other side of the trades. In addition, Billio, Getmansky, Lo, and Pelizzon (2012) show that hedge funds contributed the least to the propagation of systemic risk during the crisis in a sample of different types of financial

participants played more decisive roles in them. Additionally, research on post-LTCM currency crises shows that hedge funds did not profit from their short positions in the currencies and tended to unwind them before the devaluations occurred (International Monetary Fund, 2004).

[5] Dixon, Clancy, and Kumar (2012) report that about 1,700 (or 18% of the funds active in 2007) failed in 2008.

institutions. Most hedge funds deleveraged before the start of the crisis in mid-2007. At the peak of the crisis in late 2008, hedge fund leverage was at its lowest, while investment bank leverage was at its highest (Ang, Gorovyy, and van Inwegen, 2011). In the end, the Financial Crisis Inquiry Commission's report on the crisis does not highlight hedge funds as a central cause (Financial Crisis Inquiry Commission, 2011).

3.4.1. Amaranth Advisors

Amaranth Advisors' failure is instructive because the fund was almost twice as large as LTCM—$9.2 billion (Amaranth) compared with $4.7 billion (LTCM)—yet it did not lead to significant disruptions to the financial system. The difference in Amaranth's case is that most of its trades were centrally cleared, unlike those of LTCM, illustrating how clearing can help markets absorb the failure of a fund that has a concentrated position without causing disruption.

Amaranth was a multi-strategy hedge fund founded in 2000. At first, it focused on trading convertible bonds, but later expanded into other strategies, including energy trading. By the end of June 2006, energy trades accounted for about half of the fund's capital and generated about three-quarters of its profits (Till, 2008). Amaranth's energy trading strategy involved taking positions in the U.S. natural gas market. The fund held long positions in winter contract deliveries and short positions in non-winter contract deliveries—this approach is known as spread trading. This strategy profits from an increase in the price of winter contract deliveries relative to non-winter contract deliveries. In 2006, Amaranth accumulated large spread positions in natural gas derivatives, partly in response to the substantial profits it had earned from the same position in 2005. However, the trade in 2006 incurred heavy losses due to an unusually mild hurricane season, totaling $6.6 billion by mid-September (Stulz, 2007). On September 20, Amaranth sold its positions to J.P. Morgan Chase and Citadel Investment Group at a discount from the prior day's market-to-market values.

Despite these substantial and rapid losses, Amaranth's failure did not pose a systemic risk like LTCM and is hardly remembered today, primarily because its trades were centrally cleared. Most of Amaranth's natural gas trades were exchange-traded and centrally cleared energy derivatives that were marked to market daily. As a result, Amaranth's mounting losses required it to supply additional cash to cover its margin calls, thereby preventing its losses and ultimate failure from propagating risk to its counterparties or other parts of the financial system. In this way, central clearing provided a mechanism to manage Amaranth's wind-down in an orderly manner. It allowed the fund to sell its positions, despite the manifest internal risk management failures that caused significant losses (Till, 2008).

3.4.2. August 2007 Quant Quake

The August 2007 Quant Quake serves as a near-perfect textbook example of how the interplay between funding liquidity and market liquidity can create an adverse feedback loop, with the additional feature that it involved hedge funds using correlated strategies (Pedersen, 2009). In the context of financial stability, this case demonstrates that such a feedback loop does not necessarily lead to systemic risk (Pedersen, 2009; Khandani and Lo, 2007, 2011). The Quant Quake had limited effects on markets in general and the broader economy, although there was a brief period of heightened market volatility. Instead, the Quant Quake highlights the vulnerabilities associated with crowded trading strategies and the need for funds to manage their exposures.

Although the exact cause of the initial forced liquidation remains unclear, the most plausible explanation is linked to the developments in the U.S. subprime mortgage market and the turmoil in fixed-income and credit markets during the second and

third quarters of 2007 (Khandani and Lo, 2007; Pedersen, 2009).[6] The first forced liquidation on August 6 resulted in price impacts that caused losses for other similarly structured equity funds. These losses prompted other funds to deleverage their portfolios, leading to further price impacts that caused additional losses and further deleveraging, in line with the Brunnermeier and Pedersen (2009) model.

On August 10, the prices of the equities responsible for the losses rebounded significantly, though not entirely. The cause of the rebound remains unclear, even in hindsight. It is possible that the forces behind the deleveraging and risk reductions ended, or other market participants identified and capitalized on the mispricings caused by the earlier liquidations (Khandani and Lo, 2007). Despite the rebound, many of the affected hedge funds had reduced their risk exposures over the prior four days. As a result, they could not take advantage of the reversals on August 10. The financial press reported month-to-date losses ranging from -5% to -30% for the largest hedge funds (Khandani and Lo, 2007).

Ultimately, the Quant Quake is a clearer example of how crowded trading strategies are vulnerable to adverse shocks than it is of hedge funds contributing to financial instability. Significant distress among hedge funds does not necessarily pose a systemic threat or jeopardize financial stability.

3.4.3. March 2020 Dash for Cash

The market disruptions in the U.S. Treasury from March 9 to 18, 2020, have been recognized as a potential risk to financial stability, with policymakers attributing part of the issue to hedge funds active in the Treasury cash-futures basis trade (Federal

[6] In June 2007, several banks and some hedge funds reported substantial losses due to credit exposure and the broader impacts of the emerging credit crisis. By July, many institutions began to reduce risk and generate cash by selling liquid assets, such as their stock positions, leading to losses for stock-selection strategies like the quantitative value strategy. Some banks shut down trading desks, including their quantitative proprietary trading operations.

Reserve Board of Governors, 2020; Financial Stability Oversight Council, 2020; International Monetary Fund, 2020; Bank of England, 2023). Despite these claims, academic research has yet to determine how the market effects of Treasury sales by hedge funds compare with those of other sellers or why the actions of hedge funds should be considered qualitatively different from those of other major Treasury sellers. Hedge funds sold their Treasury holdings to satisfy internal risk limits in the same way that other major Treasury market participants liquidated their positions.

The basis trade is an arbitrage strategy that exploits price differences between Treasury futures contracts and the underlying cash securities. The Treasury cash-futures basis—the price difference between a U.S. Treasury futures contract and the underlying Treasury security to which it is linked— is driven by a combination of a shortage of bank intermediation capacity in the Treasury market and the demand for futures contracts by other asset managers such as mutual funds and pension funds. This demand has resulted in Treasury futures contracts being overvalued relative to the cash bond with the same maturity (Barth, Kahn, Monin, and Sokolinskiy, 2024; Market Structure Subcommittee, Market Risk Advisory Committee of the U.S. Commodity Futures Trading Commission, 2024). The trade involves shorting a Treasury futures contract, going long on the cash security, and financing the purchase in the repo market.

In early March 2020, in response to the uncertainty surrounding the economic effects of COVID-19, an initial flight to safety into Treasuries reversed as Treasury market volatility increased (Schrimpf, Shin, and Sushko, 2020). The spread between Treasury yields and Overnight Index Swap (OIS) rates widened dramatically, indicating a rise in uncertainty and risk aversion. By March 12, the financial press reported that mutual funds were selling liquid assets to meet redemption requests (Brettell and Pierog, 2020).

As Treasury volatility spiked and market liquidity declined, the basis widened. This widening prompted some hedge funds to unwind their positions due to increased margin requirements, tighter financing conditions, and risk management stop-outs. Using regulatory data, Kruttli, Monin, Petrasek, and Watugala (2021) find that hedge funds reduced their Treasury exposures by nearly 20% in March 2020, undertaking a precautionary flight to cash. Hedge funds primarily engaged in basis trading experienced greater margin pressure and significantly reduced their Treasury exposures and repo borrowing. In this behavior, hedge funds were not alone. Foreign central banks and mutual funds also sold substantial quantities of Treasury securities in March 2020 and were, in fact, the two largest sellers (Banegas, Monin, and Petrasek, 2021; Vissing-Jorgenson, 2021).

Treasury sales by mutual funds, foreign central banks, hedge funds, and other market participants exerted significant selling pressure in the cash market. Typically, dealers absorb this pressure; however, in March 2020, selling surpassed their risk-bearing capacity and ability to maintain markets, as broker-dealers faced a 50% increase in daily customer transactions compared with February and some dealer banks were unwilling to make markets in Treasuries (Baer, 2020; Logan, 2020; Rennison, Smith, Stafford, and Wigglesworth, 2020; Chen, Liu, Rubio, Sarkar, and Song, 2021). From March 15 through the end of the month, the Federal Reserve lowered the Fed funds rate by 100 basis points and introduced backstop facilities and stabilization measures to restore orderly market functioning (Fleming, Sarkar, and Van Tassel, 2020).

Although the events of March 2020 have been thoroughly studied, estimating the market impact of hedge funds relative to other sellers has proven to be difficult. The volume of Treasury sales by other market participants complicates efforts to conclusively determine hedge funds' role in the Treasury market dislocations. The COVID-19 shock was so pervasive that isolating the individual contributions of mutual funds, foreign central banks, and hedge funds to Treasury market illiquidity is

difficult. Barone, Chaboud, Copeland, Kavoussi, Keane, and Searls (2022) shed some light on this question by comparing the Treasury market disruption with those in other advanced economy sovereign bond markets. However, they do not separate the effects of hedge funds from those of other confounding factors, such as the U.S. dollar's role as the dominant global investment and funding currency and the limited capacity of banks and dealers to absorb investor sales due to increased Treasury inventories.

Dealers' balance sheet constraints are an especially important factor to consider. These constraints represent a long-standing structural issue and have caused earlier dislocations in the Treasury market unrelated to hedge funds (Duffie, 2023). Furthermore, while the effects of counterfactuals are uncertain, evidence suggests that broad central clearing in the Treasury market could have significantly reduced peak daily settlements in March 2020 (Fleming and Keane, 2021). Central clearing eases dealers' intermediation constraints because capital and leverage requirements recognize the risk-mitigating effects of netting centrally cleared trades. In any case, it is important to distinguish between dealers' supply of balance sheet capacity and Treasury market participants' demand for it when examining the forces that caused the Treasury market dislocations in March 2020.

Other evidence shows that hedge fund behavior during March 2020 was more complicated than it initially appears. For example, hedge funds may have absorbed some selling pressure in the Treasury market, mitigating some of the effects of the fire sale. During March 2020, spreads for the cheapest-to-deliver securities across contracts indicate that the basis trade continued to provide liquidity compared to similar off-the-run Treasuries, suggesting that some hedge funds remained active in the trade throughout the market dislocations (Barth and Kahn, 2020). Furthermore, Barth and Kahn (2021) find that the prices of the so-called cheapest-to-deliver (CTD) Treasury securities—the preferred Treasuries for a short futures position to deliver

and likely the predominant securities held by hedge funds in the basis trade—appreciated relative to otherwise similar Treasuries during this period. This appreciation reduced hedge funds' incentive to exit their positions, as the rising value of their collateral helped offset higher margin requirements and repo rates. They also find that dealers sold only small amounts of CTD Treasury securities to the Federal Reserve during the market stress, suggesting that hedge fund sales of these securities to dealers during March 2020 were less destabilizing than the sales of non-CTD off-the-run bonds by mutual funds and foreign official accounts (Barth and Kahn, 2021). Data from the 10-year U.S. Treasury futures market show that among the market participants that submitted liquidity-consuming trades during March 2020, asset managers, rather than basis traders, raised transaction costs the most and had the largest impact on market illiquidity (Gousgounis, Mixon, Tuzun, and Vega, 2025). Evidence from other sovereign bond markets adds further nuance to the role hedge funds played in the March 2020 events. Pension funds, insurers, liability-driven investment asset managers, other asset managers, and foreign official accounts were the largest sellers of gilts, and hedge funds were net purchasers (Czech, Gual-Ricart, Lillis, and Worlidge, 2021). As a group, hedge funds provided liquidity to these sellers.

The Bank of England's System-Wide Exploratory Scenario (SWES) reached a similar conclusion. In this stress scenario—triggered by a hypothetical geopolitical shock that led to the failure of a mid-sized relative value fund—the Bank examined the broader financial system response. Hedge funds' behavior varied based on their profitability, liquidity, funding, and risk management practices. Some funds withdrew liquidity by exiting positions, while others entered or maintained positions to exploit dislocated prices (Bank of England, 2024). Overall, the direct impact of hedge funds on gilt markets and the U.S. Treasury basis trade was limited.

Taken together, this evidence indicates that hedge funds were not the principal drivers of the March 2020 market dislocations. The primary disruptor was the COVID-19 shock, an unprecedented event that compelled hedge funds to adjust their exposures in line with their internal risk management protocols. Like other major participants in the Treasury market, hedge funds were affected by the widespread repercussions of the COVID-19 shock that rippled through the financial system and the broader economy. The one-sided sales pressure was compounded by banks' balance sheet constraints, which prevented them from meeting market participants ' demand for dollar liquidity, resulting in increased illiquidity and volatility. Given those constraints, one way to improve the resilience of market intermediation in Treasuries is to expand access to central clearing, a practice already employed for other assets.

3.4.4. Archegos Capital Management

Archegos Capital Management' s failure in 2021 exemplifies a situation in which a large financial firm's collapse did not threaten financial stability. Archegos was a family office, not a hedge fund, which is a crucial distinction for understanding why drawing comparisons between Archegos' s default and a potential hedge fund failure is misleading. Wealthy families establish family offices to manage their wealth and provide various services to family members, such as tax and estate planning (SEC, 2011a). Such offices are not required to register with the Securities and Exchange Commission (SEC) under the Advisers Act due to an exemption for investment advisers with fewer than 15 clients. Family offices enjoy exemptions from certain reporting requirements applicable to hedge funds (SEC, 2011b), which limited the transparency of Archegos's positions and exposures.

As a family office, Archegos managed the personal wealth of its founder, Sung Kook (Bill) Hwang, and did not have outside investors. The lack of governance and internal compliance rules at Archegos enabled Hwang and his portfolio managers to take

large, highly leveraged, and concentrated positions in a few stocks using total return swaps.[7] When the value of the stocks in Archegos's portfolio declined, the firm could not meet its margin calls, leading to significant losses for its prime brokers, including several major banks, such as Credit Suisse and Nomura. The total losses were estimated to exceed $10 billion (Lewis and Walker, 2021). While the banks' losses were considerable, they did not become systemically important, primarily because the banks had sufficient capital to absorb them.

Archegos Capital's collapse revealed failures in banks' counterparty credit risk management (CCRM), exposing critical weaknesses in risk assessment, margining practices, and exposure limits. Archegos amassed highly leveraged positions across several banks. These banks failed to recognize their total exposures due to inadequate real-time risk monitoring. Lax margining and delayed collateral calls allowed Archegos to overextend itself, resulting in a disorderly liquidation when its positions lost value. The Archegos failure underscores the need for creditors to leveraged investors to effectively manage their credit risk by conducting rigorous due diligence, maintaining strong internal risk governance controls, and continuously monitoring their risk exposures.

Such risk management failures are less likely to occur with hedge funds. First, institutional investors, who have become the dominant source of capital for hedge funds since the late 1990s, are more demanding about operational integrity and governance (Fung and Hsieh, 2013). Given the risk management, operational, and governance failures revealed by subsequent investigations, Archegos likely could not

[7] A total return swap (TRS) is a derivative contract where one counterparty makes payments based on a floating interest rate and receives payments based on the return of a reference asset (e.g., a stock or equity index). The returns to the buyer include gains or losses in the reference asset's price and any dividend payments over the duration of the contract. Archegos used TRSs to obtain exposure to a small number of stocks without owning them and, in exchange, assumed the price and default risks of the stocks.

have met the corporate governance requirements that institutional investors impose on hedge funds before investing in them.

For instance, hedge funds commonly use quantitative risk management tools to actively monitor exposures and avoid the kind of concentrated, leveraged positions taken by Archegos (Jorion, 2007; Jorion, 2010). This technology enables hedge funds to implement strong risk management frameworks, including limits on position sizes, diversification requirements, and stress testing protocols. Such practices help hedge funds manage risk internally, comply with investors' risk governance requirements, and reduce the likelihood of large losses that could threaten the fund's stability or that of its counterparties.

Ultimately, Archegos failed because it was a family office rather than a hedge fund. Had Archegos operated as a hedge fund, it would have followed internal risk limits and protocols designed to protect the firm from the size of the losses it experienced.

3.5. What Do We Learn from These Cases?

Let us take stock of the lessons we can draw from these cases. First, of these five cases of hedge fund distress or failure, LTCM stands out as the singular example of a fund that poses a financial stability risk. LTCM's near collapse was related to inadequate internal risk management practices that did not take account of the possibility of regime shifts in market volatility as well as the failure of its counterparties to prudently manage their credit risk exposures. Although the March 2020 dash for cash was systemic, the Treasury market dislocations were driven by one-sided selling pressure and insufficient intermediation capacity. One way to mitigate the risks of such events in the future is to enhance Treasury market resilience by, for example, expanding access to central clearing in Treasury markets.

Another lesson from these examples is that hedge funds can become distressed or fail without becoming a systemic risk. Since LTCM, many hedge funds have failed—a desirable and natural outcome—without endangering financial stability because the effects of those failures were effectively contained. Despite Amaranth's internal risk management failures, its wind-down was orderly, in part, because its trades were centrally cleared, showing that robust and efficient central clearing can mitigate systemic risk related to a large hedge fund's failure. The Quant Quake created temporary volatility and severe losses for quantitative equity funds but did not escalate further. Instead, the crisis revealed the investment risks inherent in crowded positions, a portfolio management problem more than anything else.

The final lesson is how imperative prudent risk management practices and corporate governance are as risk management tools. The failure of Archegos demonstrates the importance of hedge fund counterparties and investors in imposing market discipline on hedge funds—oversight to which Archegos was not subjected.

4. Hedge Funds and the Evolution of the Financial System

Since the LTCM crisis, the financial system has undergone major changes in its regulatory and supervisory structure, driven in part by the LTCM crisis in 1998 and in part by the 2007-2009 financial crisis. The three most notable changes are improved risk CCRM practices, mandatory central clearing of derivatives, and increased transparency regarding hedge fund activities through Form PF disclosures. These changes have made the financial system less vulnerable to hedge fund distress and failures. This section discusses those changes and their relation to hedge funds' ability to pose systemic risk.

4.1. Improved CCRM Practices

Prime brokers and banks, acting as counterparties, provide essential services to hedge funds, including financing, securities lending, trade execution, and custody. They extend credit, facilitate market access to hedge funds, and enable them to achieve leverage. As a result, these counterparties incur credit risk associated with their hedge fund clients, making it imperative for them to monitor and manage this risk to remain financially viable.

This alignment of incentives is a principal advantage of using CCRM to manage hedge funds' risk-taking and ensures that monitoring is self-enforcing. By holding market participants accountable for managing leverage usage and preventing imprudent risk-taking, it capitalizes on the strong incentives of investors, creditors, and counterparties to monitor hedge funds, along with their access to the information they require to do so effectively (Bernanke, 2006). Institutional investors vet hedge funds before investing and require them to comply with specific standards of operational integrity and corporate governance (Fung and Hsieh, 2013). Banking supervisors and regulators can also promote prudent CCRM practices by ensuring the integrity of risk management and capital adequacy of the regulated counterparties that extend financing to hedge funds.

Appropriate CCRM involves assessing the creditworthiness of hedge funds, setting appropriate margin requirements, and continuously monitoring exposures. Counterparties should conduct due diligence to understand a hedge fund's investment strategies, risk management practices, performance history, and operational capabilities. This due diligence gives prime brokers and banks an accurate view of the hedge fund’ s risk profile and enables them to establish prudent leverage limits and collateral requirements.

Establishing appropriate margin requirements is essential for reducing potential losses. Counterparties require hedge funds to post collateral to cover the risk of default, with margin levels determined by the volatility and liquidity of the underlying assets and market conditions. A fundamental risk-management principle in setting haircuts or margin requirements is that they are proportionate to the counterparty risk involved in a trade, thereby avoiding excessive collateral requirements on comparatively low-risk exposures while leaving high-risk exposures with adequate margin—so-called proportionate margining (Kahn and McCormick, 2025). During market stress, counterparties may also demand that hedge funds post more collateral or margin, heighten their surveillance of funds, and request more information from funds to manage their risk exposures.

Implementing stress testing is another critical aspect of CCRM. Stress tests simulate adverse market scenarios to assess their potential impact on the hedge fund's portfolio and the counterparty's exposure. Acharya and Viswanathan (2011) show that counterparties are incentivized to assess how the fund might perform under extreme conditions, allowing them to decide whether to mitigate risks by adjusting margin requirements or reducing exposures.

Robust CCRM practices such as these reduce the likelihood of forced liquidations by ensuring sustainable leverage levels and collateral sufficient to cover potential losses. Hedge fund creditors can ensure hedge funds take appropriate amounts of leverage by extending leverage based on a fund's characteristics, such as the volatility of its strategy, its risk management practices, any applicable haircuts or margin requirements, and the size of the creditor's risk exposure. Moreover, regular reporting and information sharing enhance risk monitoring and build trust between hedge funds and their counterparties.

During periods of market stress, effective CCRM also helps to prevent the sudden withdrawal of funding that could lead to asset fire sales. Counterparties confident in their risk assessments are less likely to abruptly tighten funding terms, which contributes to market stability. By maintaining strong risk management practices, counterparties can protect their financial viability and support the operation of the financial system.

The techniques for measuring counterparty credit risk and potential exposures have also improved over time and especially since the 2007-2009 global financial crisis. Duffie (2010) observes that since the 2007-2009 global financial crisis, banks have developed more advanced models to monitor and control counterparty risk and apply scenario analysis to evaluate potential losses under adverse market conditions. These models help banks set appropriate exposure limits and manage their exposures when risks exceed certain thresholds.

The Archegos default prompted a similar reassessment of CCRM practices for leveraged investors (Federal Reserve Board of Governors, 2021; Financial Conduct Authority, 2021; European Central Bank, 2023). A review of Archegos's creditors revealed significant shortcomings in risk management and internal governance, particularly at Credit Suisse, which suffered the largest losses. Although the bank's

internal risk systems correctly flagged that Archegos was breaching risk limits, senior management failed to act on these warnings. Credit Suisse's risk management processes operated as intended and correctly identified the risks connected to Archegos's positions, but individual managers within Credit Suisse's prime brokerage and risk teams did not respond appropriately. Consequently, supervisory agencies levied substantial fines on Credit Suisse, one of Archegos's primary creditors (Prudential Regulatory Authority, 2021; Federal Reserve Board of Governors, 2023). To the extent that this review of CCRM practices management remedies these deficiencies in risk governance, banks and their broker-dealer affiliates will be less exposed to the distress or collapse of leveraged counterparties such as hedge funds.

Hedge fund risk management techniques have also become increasingly sophisticated, allowing for timely assessments of risk exposures that reflect the unique characteristics of hedge fund investments (Lo, 2001; Jorion, 2007; Jorion, 2010). Modern risk management systems decompose individual positions into underlying risk factors, enabling the calculation of Value-at-Risk (VaR) and related risk metrics tailored to hedge fund strategies. These tools also allow risk managers to evaluate how extreme events could impact the distribution of profits and losses (Jorion, 2010). Like the risk management practices at banks, this apparatus supports setting appropriate risk limits, adjusting exposures under varying market conditions, and controlling the specific types of risks embedded in funds' positions.

Banks are also now better capitalized than they were during the LTCM crisis. Regulatory reforms after the 2007-2009 financial crisis have increased capital requirements, ensuring banks maintain more equity to absorb losses (Basel Committee on Banking Supervision, 2011). Larger capital buffers enhance banks' resilience to shocks from counterparty defaults, reducing the likelihood that distress at a hedge fund leads to broader losses across interconnected banks. Higher capital requirements are a core reason banks could absorb the losses related to Archegos's

default without causing wider disruptions to the financial system. Duffie (2018) argues that the post-crisis regulatory environment has strengthened the financial system through better-capitalized banks. He emphasizes that while this resiliency has come at the cost of reducing the liquidity of certain secondary markets, the stricter capital and liquidity requirements have made them better able to absorb losses from their counterparties.

Since the LTCM crisis and the 2007-2009 global financial crisis, banks have strengthened counterparty credit assessments and demanded greater transparency regarding their positions and risk profiles from hedge funds. At the same time, hedge funds' internal risk management systems have also improved. They provide risk managers with timely information about the risks to which the fund's positions are exposed. As a result, these more sophisticated real-time risk monitoring systems have bolstered the system's resilience. More recently, the Archegos default prompted banking supervisors to enforce improvements in internal risk governance. Taken together, these advances and higher bank capitalization have made the financial system more resilient to counterparty risk failures.

4.2. Mandatory Central Clearing

Since 1998, mandatory central clearing has emerged as a widespread regulatory tool that mitigates some of the risks associated with LTCM's near collapse. LTCM obtained significant leverage through over-the-counter (OTC) derivatives trades that were not centrally cleared. The synthetic leverage inherent in derivative securities presents unique counterparty risk challenges, as the value of these contracts relies on the counterparty's ability to fulfill its obligations. Concentrated risks in derivatives markets such as the CDS market and their interconnections with other markets can amplify systemic risk (Getmansky, Girardi, and Lewis, 2016).

A key mechanism for mitigating these risks is clearing through central counterparties (CCPs), which function as intermediaries in derivative transactions. By novating contracts–a process that assumes each party's obligations–CCPs replace bilateral counterparty risk with a centralized structure, ensuring that the default of one entity does not directly impact others in the clearinghouse. This process enhances financial stability by reducing contagion risks.

The Dodd-Frank Act imposed mandatory clearing requirements for certain swaps and mandated that the SEC and Commodity Futures Trading Commission (CFTC) establish minimum margin requirements on uncleared swaps. Enhanced derivatives clearing contributes to financial stability by mitigating counterparty risk, improving transparency, and standardizing risk management practices. By requiring central clearing for standardized derivatives, regulators seek to enhance transparency in the derivatives markets and strengthen oversight. Standardizing risk management through CCPs ensures that all market participants adhere to uniform margin requirements and default procedures. Additionally, CCPs have mechanisms to manage defaults without disrupting the broader financial system, thereby preventing cascading failures.

In many of LTCM's OTC trades, its counterparties did not require margin, which would have been necessary in a centrally cleared trade, allowing it to build large leveraged positions. Although ultimately unknowable, it is plausible that central clearing LTCM's derivative positions might have prevented the LTCM crisis (Dixon, Clancy, and Kumar 2012). At a minimum, mandatory central clearing would have mitigated some of the losses LTCM imposed on its counterparties, as demonstrated by the limited repercussions of Amaranth's failure.

Central clearing of derivatives generally enhances financial market stability for all participants. Since the LTCM crisis, central clearing mandates and minimum margin requirements on certain uncleared derivatives have strengthened the financial system's resilience to losses from derivative positions.

4.3. Enhanced Transparency with Form PF

The Dodd-Frank Act introduced comprehensive regulatory reforms after the 2007-2009 financial crisis to reduce systemic risk, including a mandate to increase transparency of hedge funds to regulators. As private funds, hedge funds were generally exempt from the disclosure requirements imposed on other investment products, leading some researchers to argue that this lack of transparency exacerbates systemic vulnerabilities (Lo, 2008).

The Act requires hedge fund advisers to register with the SEC and report information about their fund’ s trading activities and exposures through Form PF (SEC, 2011b). This information is intended to enable regulators to monitor potential systemic risks and take preventive measures when necessary–something regulators were unable to do in 1998. For example, the Office of Financial Research (OFR) has used the Form PF data to develop a hedge fund monitor. The monitor provides information on several hedge fund characteristics, including size, leverage, and counterparty exposures.[8] Form PF data also enable research economists at U.S. government agencies to study hedge funds empirically in a way that was not possible before Form PF reporting became mandatory (e.g., Barth and Kahn, 2021; Kruttli, Monin, Petrasek, and Watugala, 2021).

Form PF data provides regulators with more data on hedge funds at regular intervals, addressing some of the concerns raised by Lo (2008). On the other hand, critics have

[8] The OFR’s hedge fund monitor is available at: https://www.financialresearch.gov/hedge-fund-monitor/.

raised concerns that Form PF does not collect data that are sufficiently uniform to be meaningfully aggregated across funds, nor do the form's questions seek the right type of information that would aid regulators in understanding systemic risk. How effective this data collection proves to be remains an open question, as there have been no systemic events linked to hedge funds since the collapse of LTCM over 25 years ago, which, it is important to stress, preceded the existence of Form PF.

5. Conclusion

Hedge funds are financial institutions that most closely resemble the arbitrageurs found in textbooks and economic models. Consequently, they occupy a unique and sometimes controversial position in the financial markets. On the one hand, by executing their individual investment theses, they improve risk-sharing, provide liquidity to other market participants, enhance market efficiency and price discovery, and promote capital formation. On the other hand, the traits that cause hedge funds to mirror textbook arbitrageurs, such as their use of leverage, create channels and interconnections that, if not effectively managed, can contribute to systemic risk, as LTCM's near-failure illustrates. The challenge for regulators and policymakers is to harness the positive contributions of hedge funds to the financial system while mitigating the risks and potential costs arising from the infrequent but potentially systemic distress within the hedge fund sector.

To answer this question, this paper analyzes several instances of hedge fund distress or failure since the 1998 LTCM crisis and evaluates whether they contributed to systemic risk. In these cases, the evidence shows that the role of hedge funds in systemic risk was limited or non-existent. Our assessment indicates that hedge funds are more likely to become distressed due to an adverse systemic shock rather than their distress causing a systemic event. Indeed, the best available example of hedge fund distress threatening financial stability is LTCM's near collapse in 1998, prior to fundamental regulatory reforms.

Since 1998, the financial system has undergone several significant reforms that have made it more resilient to hedge fund distress. These reforms include improved CCRM practices, mandatory central clearing, increased transparency in hedge fund exposures and leverage through Form PF disclosures, and better-capitalized banks. Enhanced CCRM practices serve as a crucial first line of defense for protecting other parts of the financial system and the broader economy against the impacts of hedge

fund or other market participants' distress. Relying on the market discipline that effective CCRM practices impose on hedge funds' leverage and risk-taking has the added benefit of placing the responsibility for monitoring risk on private market participants, who have the strongest incentives and capacity to do so.

Finally, while these reforms have reduced the level of risk in the system, they have not eliminated it—nor should they. After all, hedge funds specialize in taking risks that other financial institutions are either unable or unwilling to take. Completely removing the risk of hedge fund distress would negate the benefits they provide to markets and their contribution to capital formation. Instead, these reforms are essential for ensuring that market participants accurately price the risks associated with hedge funds, making sure the risks they choose to accept are properly covered, and managing the repercussions of a hedge fund's distress or failure.

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