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Derivatives as Risk-Management Instruments in Global Financial Markets: A Structured Review of Post-2010 Evidence

Deepak Kumar Aggarwal[1], Mini Srivastava[2]

Ph.D. Scholar, School of Management and Commerce Studies
Shri Guru Ram Rai University, Dehradun, Uttarakhand 248001, India
Email: deepak1782@gmail.com ORCID: https://orcid.org/0009-0008-7731-3204

Associate Professor, School of Management and Commerce Studies
Shri Guru Ram Rai University, Dehradun, Uttarakhand 248001, India
Email: mini.abhi13@gmail.com, ORCID: https://orcid.org/0000-0002-9002-5126

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Abstract

Purpose – This review synthesises post-2010 evidence on derivatives as risk-management instruments: their effects on firm value and risk, their links to bank systemic risk, the effects of post-crisis market-structure reforms, and evidence from emerging and newly industrialised economies.

Design/methodology/approach – A structured integrative review guided by SANRA. Twenty peer-reviewed primary studies (2010–2025), three pre-2010 benchmark studies and five prior syntheses were identified through documented searches and citation tracing, then appraised for identification strategy, sample and period.

Findings – Derivative use reliably lowers firm-level risk, but value effects are conditional and sensitive to identification. Designs exploiting exogenous variation link hedging to cheaper credit and higher investment, while constrained airlines hedge less, not more. Banks' credit and foreign-exchange derivative holdings, and aggregate holdings across countries, are associated with higher systemic risk, although non-performing loans and leverage matter more where compared. Clearing and trade transparency have reduced counterparty risk and trading costs in credit default swap markets but concentrate liquidity risk in clearing houses, and model evidence finds their net systemic effect ambiguous.

Research limitations/implications – Scopus and Web of Science were not searched directly and no screening counts are reported; replication strings are supplied.

Practical implications – The synthesis offers evidence-based guidance for treasurers, bank risk managers and supervisors.

Originality/value – The review integrates firm-, bank- and market-level evidence within one appraisal framework and sets out a testable agenda on crisis-period hedging, benchmark transition, clearing-house resilience and emerging markets.

1. Introduction

Derivatives are the principal instruments through which non-financial firms, banks and investors transfer interest-rate, exchange-rate, credit, equity and commodity risk. After almost a decade in which the notional amount of over-the-counter (OTC) derivatives grew by about 5% a year, activity has accelerated. Notional amounts outstanding reached USD 846 trillion at end-June 2025, 16% more than a year earlier and the largest annual increase since 2008, while gross market value, a closer measure of economic exposure, rose by 29% to USD 21.8 trillion (Bank for International Settlements [BIS], 2025). The International Swaps and Derivatives Association (ISDA, 2026a) links the expansion to hedging demand amid uncertainty over trade, the monetary policy outlook and geopolitical developments. By end-2025, notional amounts outstanding were 20.7% higher than a year

earlier and gross credit exposure had risen by 13.2%, although close-out netting reduced mark-to-market exposure by 85.3% (ISDA, 2026b). These statistics describe the market context of the review; they are not part of the evidence base synthesised below.

The growth of derivative markets sits alongside a long-standing puzzle. Theory identifies conditions under which hedging should raise firm value when capital markets are imperfect (Froot et al., 1993; Smith & Stulz, 1985), yet a comprehensive review of the empirical tests found only mixed support for these rationales (Aretz & Bartram, 2010). At the level of the financial system, the same instruments create networks of counterparty exposures through which distress can spread (Cont et al., 2013), and regulators responded to the financial crisis of 2007–2009 by requiring most interest-rate and credit derivatives to be cleared through central counterparties (Menkveld & Vuillemey, 2021). Whether derivatives reduce risk or merely redistribute it therefore depends on the level of analysis: the individual firm, the bank or the market as a whole.

These questions have produced three literatures that are usually synthesised separately. Reviews and meta-analyses of corporate hedging concentrate on its determinants and value effects (Arnold et al., 2014; Bachiller et al., 2021; Bessler et al., 2019), while a recent survey of central clearing addresses market structure (Menkveld & Vuillemey, 2021). Less attention has been paid to how firm-level evidence, bank-level evidence on systemic risk and evidence on post-crisis reforms fit together, or to how much of each body of evidence rests on credible identification. Evidence from emerging and newly industrialised economies is also comparatively scarce: as Gupta et al. (2025) note, most studies of corporate hedging use data from developed economies, where information on derivative use is easier to obtain.

This paper addresses these gaps through a structured integrative review of peer-reviewed evidence published between 2010 and 2025. It synthesises 20 primary studies, interpreted against three pre-2010 benchmark studies and five prior syntheses, and grades each primary study by the credibility of its identification strategy. The review makes three contributions. First, it brings the firm-level, bank-level and market-structure strands into a single framework and shows that they converge on a common theme: derivatives transform risk more reliably than they eliminate it. Second, it separates findings that rest on exogenous variation from those that are associational, which clarifies which conclusions are robust. Third, it tests commonly asserted research gaps against the literature and derives a research agenda using the Theory–Context–Characteristics–Methodology (TCCM) framework.

Four research questions guide the review:

RQ1. How does the post-2010 evidence characterise the relationship between corporate derivative use and firm value and risk, and how consistent is it across settings and identification strategies?

RQ2. What does the evidence show about the relationship between banks' derivative holdings and systemic risk?

RQ3. What evidence exists on the effects of post-crisis market-structure reforms (central clearing, trade transparency and margin requirements) on counterparty risk, liquidity and systemic risk?

RQ4. What is known about derivatives as risk-management instruments in emerging and newly industrialised economies, and which gaps remain across the field?

The remainder of the paper is organised as follows. Section 2 sets out the theoretical framework, and Section 3 describes the review design, search and appraisal. Section 4 profiles the evidence base, and Section 5 presents the thematic findings. Section 6 answers the

research questions, positions the review against prior syntheses and sets out a research agenda. Sections 7 to 9 present implications, limitations and conclusions.

2. Theoretical framework

2.1 Frictions-based rationales for hedging

In frictionless capital markets a firm's financial policy, including its risk management, cannot affect its value, because investors can replicate or undo any corporate hedge on their own account (Modigliani & Miller, 1958). The theory of corporate hedging therefore rests on identifying the frictions that break this irrelevance result. Smith and Stulz (1985) trace hedging to taxes, contracting costs and the interaction between hedging and investment decisions. With a convex tax schedule, less variable taxable income lowers expected taxes; hedging reduces the expected deadweight costs of financial distress; and managers whose wealth is concentrated in the firm have a personal incentive to reduce risk. Froot et al. (1993) develop the investment channel into the rationale that has since shaped much of the empirical work. When external finance is more costly than internal funds, shortfalls in cash flow force firms to forgo valuable investment, and hedging creates value by aligning the supply of internal funds with investment needs.

Two further channels concern financing and information. Graham and Rogers (2002) find that the convexity of the tax function does not explain hedging, but that firms hedge to expand their debt capacity, with the resulting tax benefits averaging 1.1% of firm value. DeMarzo and Duffie (1995) show that hedging can make reported earnings more informative about managerial ability and that accounting disclosure affects managers' incentives to hedge, while Breeden and Viswanathan (2016) model hedging as a means by which more able managers make their quality visible to outside investors.

2.2 Financing constraints and the limits of hedging

Frictions-based theories imply that firms facing tighter financial constraints should hedge more. Rampini et al. (2014) challenge this implication. Because borrowing and hedging both involve promises to pay that must be collateralised, firms face a trade-off between financing investment and managing risk; in their dynamic model, risk management is limited, and the most constrained firms hedge least or not at all. This perspective matters for the interpretation of empirical value premia. If the capacity to hedge depends on financial strength, differences in value between hedgers and non-hedgers may partly reflect differences in underlying financial health rather than an effect of hedging itself.

2.3 The system-level perspective

At the level of the financial system, derivatives link institutions through networks of counterparty exposures. Using data on the Brazilian banking system, Cont et al. (2013) show that an institution's contribution to systemic risk depends on the structure and concentration of its exposures, not only on its size. Central clearing reshapes these networks by interposing a central counterparty (CCP) between the original counterparties. Duffie and Zhu (2011) show, however, that clearing one class of derivatives through a dedicated CCP can raise rather than lower expected counterparty exposures, because it breaks up bilateral netting across classes; whether clearing reduces exposure depends on the balance between multilateral netting gains within the cleared class and the netting lost across classes.

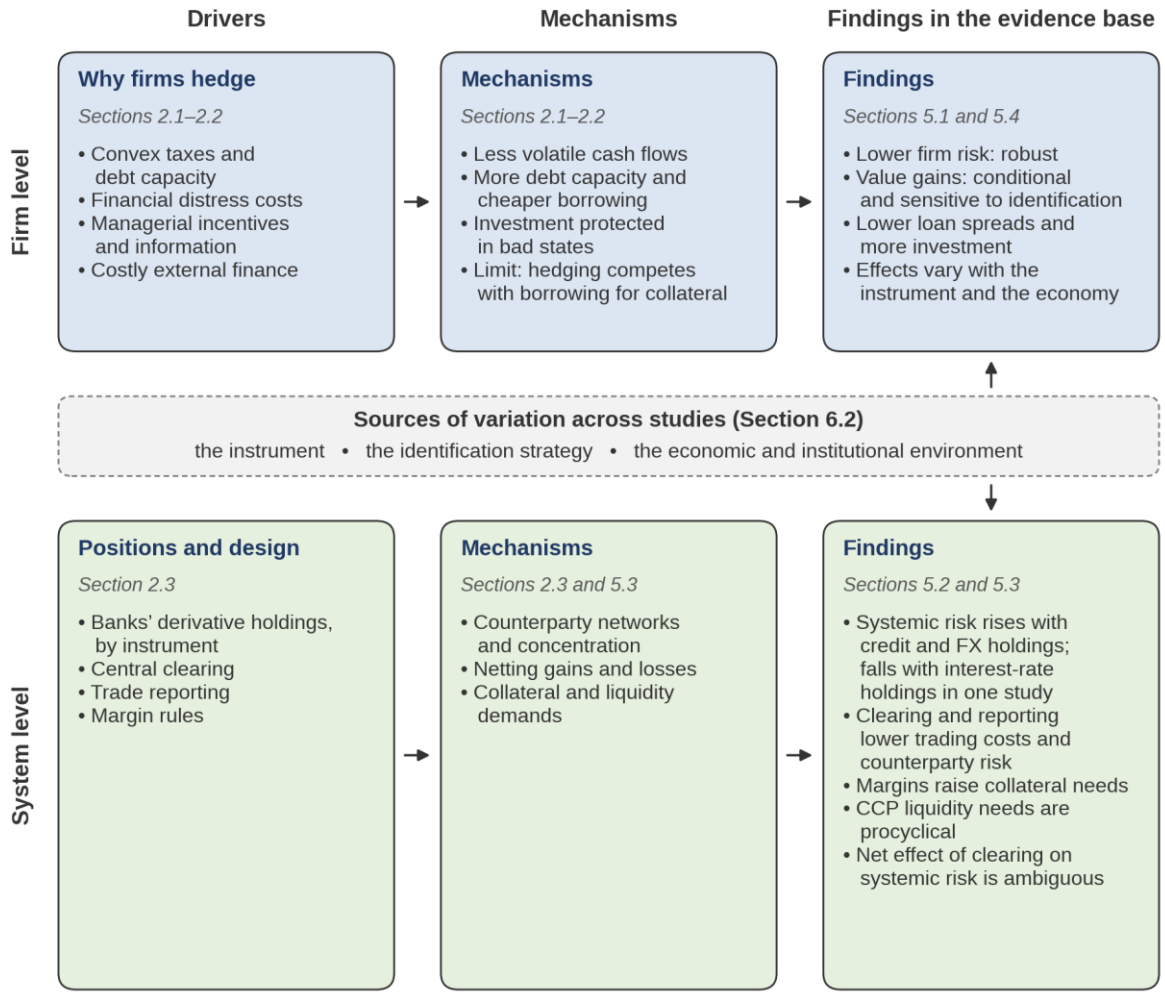
2.4 Implications for the synthesis

These perspectives generate four expectations that structure Section 5. First, value effects should be strongest where distress costs or underinvestment frictions bind. Second, hedging should be associated with cheaper external finance and higher investment. Third, because hedging consumes collateral,

constrained firms may hedge less, which complicates the interpretation of value premia. Fourth, the systemic effects of derivatives and of clearing should depend on network structure, netting and the resilience of central nodes. Figure 1 summarises the resulting framework, which links the frictions that motivate hedging and the system-level mechanisms to the findings examined in Sections 5 and 6.

Figure 1

Conceptual Framework of the Review



Note. The framework summarises the arguments in Section 2 and the findings synthesised in Sections 5 and 6. Arrows indicate the mechanisms examined in the evidence base, not established causal effects. CCP = central counterparty; FX = foreign exchange.

3. Methodology

3.1 Review design

This study is a structured integrative review. It is not a systematic review in the sense of the PRISMA 2020 statement (Page et al., 2021), because the search was not registered in a protocol, did not use the Scopus or Web of Science interfaces and was not screened independently by two reviewers. Reporting instead follows the six criteria of the Scale for the Assessment of Narrative Review Articles (SANRA): justification of the review's importance, statement of concrete aims, description of the literature search, referencing, scientific reasoning and appropriate

presentation of data (Baethge et al., 2019). The design suits a field whose studies differ widely in outcome measures, samples and identification strategies, which limits the value of quantitative pooling.

3.2 Search strategy

Searches were conducted in September 2026 using a general web search engine and the search interfaces and article pages of scholarly publishers and bibliographic services, including ScienceDirect, Wiley Online Library, SpringerLink, Taylor & Francis Online, Cambridge Core, IDEAS/RePEc, SSRN and the National Bureau of Economic Research, together with institutional repositories. Queries combined a block of instrument terms (derivatives, hedging, swaps, futures, forwards, options and credit default swaps) with a block of outcome and context terms (firm value, firm risk, systemic risk, central clearing, counterparty risk and emerging markets), and free-text queries also included the author names and publication years of seed studies. Backward and forward citation tracing, using the reference and citation lists indexed in IDEAS/RePEc, was applied to seed studies in each domain, including Carter et al. (2006), Bartram et al. (2011), Loon and Zhong (2014) and Bartram (2019). Because the searches were iterative and were not run in a single bibliographic database, record counts were not captured in a form that would support a screening flow diagram, and none is reported. The full search strategy, together with strings for replicating the search in Scopus and Web of Science, is available from the corresponding author on request.

3.3 Eligibility criteria

Table 1 summarises the eligibility criteria. The evidence base comprises peer-reviewed journal articles published between 2010 and 2025 that report primary empirical, quasi-experimental, network or simulation evidence in one of four domains. Pre-2010 studies that established the empirical benchmarks for the corporate literature are retained as reference points and are labelled as such; they are not counted in the evidence base. Prior reviews and meta-analyses are treated as syntheses and are used to position the review and to triangulate its findings. Statistics and statements from BIS, ISDA, the Financial Conduct Authority (FCA) and the Financial Stability Board (FSB) are used only to describe the market and regulatory context. Working papers, conference papers, theses and pricing-only studies were excluded, as were retracted articles and studies whose bibliographic details or findings could not be verified against the publisher record or an authoritative index.

Table 1

Eligibility criteria

Criterion	Included	Excluded
Publication type	Peer-reviewed journal articles	Working papers, conference papers and theses; book chapters are cited only for theoretical background
Publication period	2010–2025	Earlier studies, except benchmark studies, which are labelled as such
Evidence type	Primary empirical, quasi-experimental, network or simulation evidence	Pricing or valuation models without risk-management implications; commentary
Domain	(a) Firm value, risk or financing effects of derivative use; (b) derivatives and bank systemic risk; (c) effects of clearing, transparency or margin reforms; (d) derivative use or disclosure in emerging and newly industrialised economies	Studies outside these domains
Verification	Bibliographic details and findings confirmed against the publisher record, DOI metadata or IDEAS/RePEc	Records that could not be verified; retracted articles
Language	English	Other languages

Note. Prior reviews and meta-analyses are treated separately as syntheses. Institutional statistics (BIS, ISDA) and regulatory statements (FCA, FSB) are used only for context.

3.4 Verification and data extraction

Candidate studies were screened on their titles and abstracts against these criteria. For every included study, the authors, year, title, journal, volume, issue, pages and digital object identifier (DOI) were checked against the publisher record, DOI metadata or IDEAS/RePEc. The sample, setting, period, design and main findings were extracted from the published abstract and, where openly available, from the full text or an openly accessible version of the article, and were recorded in original wording (see the Appendix). Screening and extraction were performed once, without independent duplicate coding.

3.5 Quality appraisal

Each primary study was appraised against the four criteria in Table 2. The first, and the most influential for the synthesis, is the credibility of identification. Studies that exploit arguably exogenous variation, such as a natural experiment or an instrumental variable, are rated strong; studies that use event-based comparisons, matching or dynamic-panel estimators are rated moderate; studies that rely on regressions with controls are rated limited; and network, simulation and analytical studies, which do not estimate causal effects from observational data, are rated not applicable. Sample breadth, period coverage and robustness reporting are recorded descriptively. Appraisal was used to weight findings in the synthesis, not to exclude studies.

Table 2

Quality appraisal criteria

Criterion	What was assessed	Rating or recording
Identification	The source of variation used to estimate the effect of hedging, holdings or reform	Strong: natural experiment or instrumental variable. Moderate: event-based comparison, matching or dynamic-panel estimator. Limited: regression with controls. Not applicable: network, simulation or analytical design
Sample breadth	Number and type of firms, banks or contracts; number of countries	Recorded descriptively (see the Appendix)
Period coverage	Sample period and whether it includes a stress episode such as the 2007–2009 crisis	Recorded descriptively (see the Appendix)
Robustness	Whether alternative specifications, samples or measures are reported in the published record	Recorded descriptively and taken into account in the synthesis

3.6 Analytical framework

Findings are synthesised thematically by domain and are then mapped onto the TCCM framework (Paul & Rosado-Serrano, 2019), which organises a literature by the theories it invokes, the contexts it studies, the characteristics (constructs and variables) it measures and the methodologies it employs. The framework is used in Section 6.4 to derive the research agenda.

3.7 Synthesis procedure

Findings were integrated in three steps. First, the results of each study were assigned to the research questions they address, so that a single study could inform more than one question. Second, within each question, agreement and disagreement among studies were identified, and results from studies with stronger identification were given more weight than associational results; counts of significant and insignificant findings were not used as a measure of evidence, because the studies differ in sample size, measurement and design. Third, the prior syntheses discussed in Section 6.3 were used to check whether the conclusions drawn from the primary studies are consistent with the quantitative literature. Where the evidence conflicts, the review reports the conflict together with the differences in design or sample that may explain it.

4. Profile of the evidence base

Table 3 profiles the 20 primary studies, and the Appendix reports their details. By domain, six studies concern corporate hedging and firm value, three concern banks' derivative holdings and systemic risk, five concern post-crisis market-structure reform and six concern emerging and newly industrialised economies. Publication is spread across the period, with seven studies from 2010–2014, five from 2015–2019 and eight from 2020–2025. Eight studies use US data, three use multi-country samples, six are single-country studies from China, India (two studies), Korea, South Africa and Turkey, and three rely on market-wide data, simulation or analysis of clearing houses. Four studies appear in the *Journal of Financial Economics*

and two each in the *Journal of Finance* and *Borsa Istanbul Review*.

Table 3

Profile of the 20 primary studies

Dimension	Category	Number of studies
Domain	Corporate hedging, firm value and firm risk	6
	Derivatives and bank systemic risk	3
	Post-crisis market-structure reform	5
	Emerging and newly industrialised economies	6
Publication period	2010–2014	7
	2015–2019	5
	2020–2025	8
Setting	United States	8
	Multi-country samples	3
	Single emerging or newly industrialised economy	6
	Market-wide data, simulation or clearing-house analysis	3
Identification	Strong (natural experiment or instrumental variable)	2
	Moderate (event-based, matching or dynamic panel)	5
	Limited (regression with controls)	10
	Not applicable (network, simulation or analytical)	3
Total		**20**

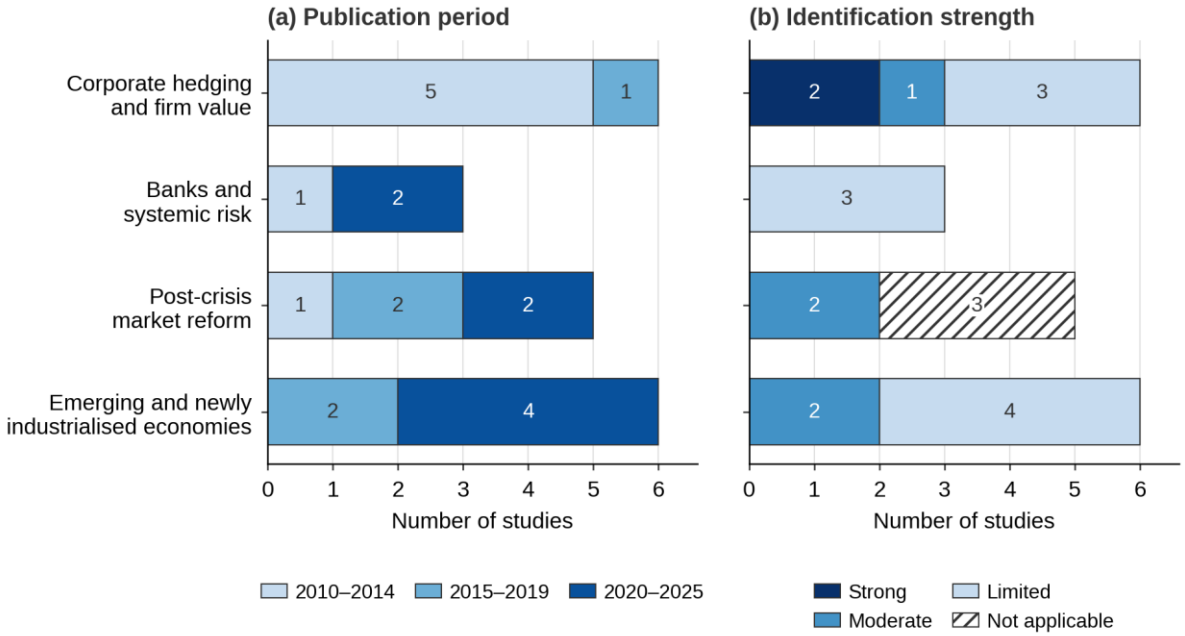
Note. Each study is counted once in each dimension. Study-level details are reported in the Appendix.

The distribution of identification strategies is the most consequential feature of the profile. Only two studies exploit arguably exogenous variation, and both concern US firms (Campello et al., 2011; Pérez-González & Yun, 2013). Five use event-based, matching or dynamic-panel designs, ten rely on regressions with controls and three are network, simulation or analytical studies. The most credible designs are therefore concentrated in US corporate settings, while conclusions on bank systemic risk and on emerging markets rest mainly on associational evidence.

Figure 2 shows how these features combine across domains. The corporate evidence is concentrated in 2010–2014, with no study published after 2019, whereas four of the six emerging-market studies appeared in 2020–2025. Two of the five market-structure studies have moderate identification and the other three use network, simulation or analytical designs, while all three bank studies rely on regressions with controls.

Figure 2

Primary Studies by Domain, Publication Period and Identification Strength



Note. N = 20 primary studies. Identification ratings follow the criteria in Table 2. Counts are drawn from the coded study data set used for Table 3.

The reference points outside the evidence base have a similar profile. The three benchmark studies all use US data and predate the 2007–2009 crisis (Allayannis & Weston, 2001; Carter et al., 2006; Jin & Jorion, 2006). The five prior syntheses comprise a narrative review of corporate hedging (Aretz & Bartram, 2010), three meta-analyses of its determinants or value effects (Arnold et al., 2014; Bachiller et al., 2021; Bessler et al., 2019) and a survey of central clearing (Menkveld & Vuillemey, 2021). None of these syntheses is devoted to bank systemic risk or to emerging markets, which is one reason for the integrative design adopted here.

5. Thematic findings

5.1 Corporate hedging, firm value and firm risk

Three pre-2010 studies define the benchmarks against which the post-2010 evidence is read. Allayannis and Weston (2001) report that large US firms exposed to exchange-rate risk that use currency derivatives are valued at a premium averaging 4.87% of firm value. Studying US airlines between 1992 and 2003, Carter et al. (2006) find a larger premium for jet-fuel hedging, above the roughly 5% of the earlier study and possibly as high as 10%, and trace most of it to the interaction between hedging and capital investment, which is consistent with the underinvestment channel of Froot et al. (1993). Jin and Jorion (2006), by contrast, find that hedging by US oil and gas producers reduces the sensitivity of their share prices to commodity prices but has no discernible effect on market value. One interpretation is that exposures which investors can observe and hedge for themselves leave little value for the firm to add.

A large cross-country study, Bartram et al. (2011), compares derivative users and non-users across 47 countries using propensity-score matching. Derivative use is robustly associated with lower total and systematic risk, but the estimated gain in value, although positive, is less robust and depends on how endogeneity and omitted variables are handled.

Because the data predate the 2007–2009 crisis, the results describe hedging in a relatively calm environment rather than under stress. Using a large international sample, Bartram (2019) finds that non-financial firms use derivatives to hedge rather than to speculate: evidence of speculation is confined to marginally higher net commodity exposure among users of commodity derivatives, and risk reduction is greater in countries with weak creditor rights or easy access to derivatives.

Two studies with stronger identification clarify the channels through which hedging matters. Campello et al. (2011) instrument hedging with tax-based variation and find that firms that hedge borrow at lower interest spreads and are less likely to have their capital spending restricted by loan covenants, which lets them invest more. Pérez-González and Yun (2013) treat the arrival of weather derivatives as a shock to the capacity of US energy firms to hedge weather risk; firms better able to hedge subsequently show higher valuations, investment and leverage. The rise in leverage is consistent with the debt-capacity channel identified by Graham and Rogers (2002). Both results support the view that hedging creates value by relaxing financing frictions, and both identify effects on investment and financing rather than on market valuation alone.

Evidence from airlines qualifies this view. Rampini et al. (2014) show that airlines with less financial slack hedge less, both when compared with other airlines and relative to their own history, and that hedging drops steeply as distress approaches and is rebuilt only gradually. Treanor et al. (2014) find that airlines hedge more when their exposure to fuel prices is high or rising and confirm a positive hedging premium; however, airlines that increase hedging because their exposure has risen are not valued more highly than airlines with more stable hedging policies. Taken together, the airline evidence implies that hedging capacity follows financial strength and that reactive increases in hedging earn no premium over stable hedging policies.

Prior syntheses point in the same direction. Aretz and Bartram (2010) conclude that empirical support for the rationales for hedging is mixed and that derivative use should be seen as one component of a wider financial strategy that depends on the risks a firm faces, the risk-management tools available to it and its operating environment. In a meta-analysis of 51 studies, Bachiller et al. (2021) conclude that currency derivatives, used alone or together with other derivatives, raise firm value, and Bessler et al. (2019) provide a further meta-analysis of 47 studies of the value effects of hedging.

The corporate evidence therefore separates into a robust result and a conditional one. Derivative use reliably reduces firm-level risk, and the best-identified studies show that hedging lowers financing costs and supports investment. Market-value premia are reported in several settings, most consistently for currency hedging, and one natural experiment confirms a valuation gain (Pérez-González & Yun, 2013); elsewhere, however, premia are sensitive to how endogeneity is treated and are absent in some samples, including those examined in Section 5.4.

5.2 Derivatives, bank risk and systemic stability

Evidence on banks shifts attention from an institution's own risk to its contribution to the risk of the system. Mayordomo et al. (2014) compare several measures of individual banks' contributions to systemic risk for 95 US bank holding companies between 2002 and 2011 and find that a measure based on the Net Shapley Value performs best. Aggregate derivative holdings have no significant effect on these contributions, but their composition matters: foreign-exchange and credit derivatives increase a bank's contribution, whereas interest-rate derivatives reduce it. Non-performing loan ratios and leverage, however, affect systemic risk far more strongly than any class of derivatives, which places derivatives in

a secondary role relative to traditional banking risks.

Halili et al. (2021) focus on credit derivatives among US bank holding companies between 2006 and 2018 and find that rising holdings are followed by higher systemic risk, a result that holds across a range of controls, and they point out that the larger banks fall into a higher-risk group. The most extensive study, Wang et al. (2025), analyses 493 listed banks in 28 countries and finds that derivative holdings significantly raise systemic risk through three channels: higher asset risk, higher leverage risk and higher operational risk. The effect is stronger during economic downturns and periods of accommodative monetary policy and among banks with high leverage and low liquidity, and the study also examines how the effect varies across types of derivatives.

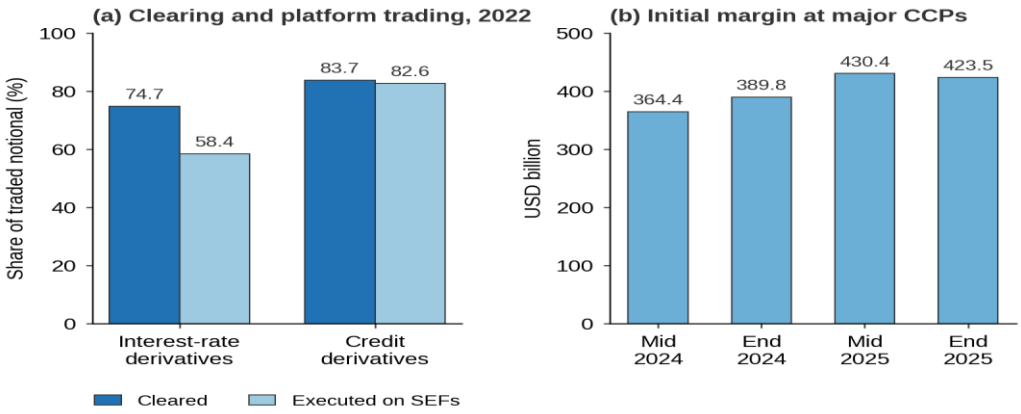
The three studies are not directly comparable, because they use different measures of systemic risk, different samples and different periods, and the cross-country study finds a significant aggregate effect where the US study does not. They nonetheless share a conditional picture. Derivatives most clearly add to systemic risk through credit exposures, through leverage and in stressed conditions, and the one study that compares derivatives with traditional risks finds the latter more important.

5.3 Post-crisis reform: clearing, transparency and collateral

Following the crisis of 2007–2009, central clearing became compulsory for most interest-rate and credit derivatives (Menkveld & Vuillemey, 2021). In the United States, mandatory real-time public reporting of swap trades began at the end of 2012 (Loon & Zhong, 2016), and margin rules extended initial-margin requirements to non-cleared trades between dealers, a change whose collateral implications Duffie et al. (2015) estimate. Market structure has changed accordingly. In US-reported swaps data for 2022, cleared transactions accounted for 74.7% of interest-rate derivative traded notional and 83.7% of credit derivative traded notional, while trades executed on swap execution facilities accounted for 58.4% and 82.6% respectively (ISDA, 2023). Initial margin posted at major CCPs for cleared interest-rate derivatives and credit default swaps (CDS) reached USD 423.5 billion at end-2025, up from USD 389.8 billion a year earlier (ISDA, 2026b; see Figure 3).

Figure 3

Clearing, Platform Trading and Initial Margin After the Post-Crisis Reforms



Note. Panel (a) shows the shares of interest-rate and credit derivative traded notional in US-reported swaps data for 2022 that were cleared and that were executed on swap execution facilities (SEFs); data from ISDA (2023). Panel (b) shows initial margin posted at major central counterparties (CCPs) for cleared interest-rate derivatives and credit default swaps, in USD billion; mid-year values are from ISDA (2026a) and year-end values from ISDA (2026b).

Theory gives no presumption that clearing reduces risk: as Section 2.3 noted, a CCP dedicated to one class of derivatives can increase counterparty exposure by fragmenting netting sets (Duffie & Zhu, 2011). The empirical evidence from CDS markets is nonetheless favourable on counterparty risk and liquidity. Loon and Zhong (2014) study single-name CDS contracts that were cleared voluntarily and find that spreads rise when clearing begins and lie below the settlement spreads published by the clearing house, a pattern consistent with a reduction in the counterparty risk borne by protection buyers. Loon and Zhong (2016) use the real-time trade reports introduced under the Dodd-Frank Act to measure transaction costs in index CDS. Effective spreads average 0.27% of the price level, equivalent to 2.73% of the CDS spread, and liquidity improved once trade reports became public. Cleared trades, trades on exchange-like platforms, trades with end-users and customised trades all carry lower costs, smaller price impact and less dispersion in prices.

Collateral is the price of these gains. Using bilateral CDS positions reported to the Depository Trust & Clearing Corporation (DTCC), Duffie et al. (2015) show that requiring dealers to post initial margin substantially increases the collateral that the system needs, whether trades are cleared or not. Once such margins are in place, however, making clearing mandatory reduces rather than increases the total, as long as the number of CCPs stays small, although the burden falls unevenly across market participants.

The concentration of risk in CCPs is the main concern of more recent work. King et al. (2023) argue that CCPs reduce credit risk but, in doing so, generate demands for liquidity that rise with market volatility; margin calls are therefore procyclical and press on clearing members when markets are stressed, and the authors call for stress testing that captures this liquidity risk. Nowaczyk and O'Halloran (2024) represent the financial system as a network of trading and risk relationships among banks and find that whether clearing raises or lowers systemic risk cannot be settled in general: the outcome turns on how creditworthy the clearing house is, whether netting gains outweigh netting losses, and how concentrated exposures become. Menkveld and Vuillemey (2021) survey the theory and evidence on these mechanisms, including multilateral netting, margin setting and the allocation of default losses.

The benchmark transition is the other structural change of the period. The final LIBOR panel, for the US dollar, ended on 30 June 2023; its overnight and 12-month settings ceased, and three synthetic US dollar settings were scheduled to cease at the end of September 2024 (Financial Conduct Authority [FCA], 2023; Financial Stability Board [FSB], 2023). The FSB (2023) urges market participants to rely on robust reference rates and robust contractual fallbacks and to confine term rates derived from risk-free rates to limited uses. None of the studies in the evidence base assesses how the move to risk-free rates has affected hedge effectiveness or basis risk, a gap taken up in Section 6.4.

5.4 Evidence from emerging and newly industrialised economies

Evidence from emerging and newly industrialised economies is growing but consists of single-country studies. Gupta et al. (2025) observe that most evidence on corporate hedging comes from developed economies, where data are easier to obtain, whereas emerging markets combine greater asset-price volatility and illiquidity with less uniform regulation and accounting standards, which complicates both hedging and its measurement.

For China, Luo and Wang (2018) examine quarterly data on listed firms from 2000 to 2013 and find that firms hedging currency exposure with derivatives have higher values. The effect is stronger for profitable firms with investment opportunities and during periods of currency depreciation and economic expansion, while it weakens in crisis periods

and varies across industries. For India, Gupta et al. (2025) hand-collect data on derivative use by non-financial firms in the BSE-100 index between 2010 and 2017. All types of derivatives except interest-rate derivatives are associated with higher firm value, through lower earnings volatility and greater tax-advantaged leverage. Interest-rate derivatives benefit firms with high leverage, except those whose earnings are highly volatile, and firms with long-term foreign-currency debt; the authors argue that relaxing restrictions on derivative transactions could help firms in fast-growing emerging economies.

The only study in the evidence base that covers the pandemic is also from India. Samarakoon et al. (2025) compare non-financial firms during the COVID-19 crisis of 2020–2021, with 712 firm-year observations, and the preceding stable period of 2015–2019, with 1,735 observations. Currency and interest-rate derivatives are associated with higher firm value in both periods, whereas the association for commodity derivatives becomes markedly negative during the pandemic, which suggests that the value of hedging depends jointly on the instrument and on economic conditions. The positive result for interest-rate derivatives contrasts with the narrower benefit found by Gupta et al. (2025), a difference that may reflect the two studies' different samples and periods.

Other evidence is less favourable. Among Turkish non-financial firms between 2007 and 2013, only about 36% used derivatives, and Ayturk et al. (2016) find no significant hedging premium or discount except in system-GMM estimates of Tobin's q; most of their results indicate no effect on value. For Korea, Bae and Kwon (2021) compare firms whose currency exposure changed sharply around the 2007–2009 crisis with firms whose exposure did not. The former were more numerous, used more derivatives and had lower values, particularly when hedging financing rather than operating risk, which the authors trace to how hard it is to hedge foreign-currency borrowing when the domestic currency falls steeply.

Measurement is itself a constraint. For South Africa, Toerien et al. (2024) analyse the disclosure of derivative use among the 200 largest non-financial firms listed on the Johannesburg Stock Exchange (JSE) between 2005 and 2017. Disclosure is more likely among larger and more leveraged firms, firms with better growth prospects and firms with lower information asymmetry; conventional determinants of hedging apply in part, but local conditions also matter. Because many emerging-market studies must infer hedging from disclosures, the quality of disclosure regimes limits what can be learned about hedging effectiveness.

The emerging-market evidence thus mirrors the conditional value effects found in Section 5.1, but it adds two features. First, the benefit of hedging depends on the macroeconomic state and on the instrument: the currency-hedging premium weakens in crisis periods in China (Luo & Wang, 2018), Korean firms whose exposure shifted sharply in the 2007–2009 crisis had lower values (Bae & Kwon, 2021), and during the pandemic the value association of commodity derivatives in India turned negative while that of currency and interest-rate derivatives did not (Samarakoon et al., 2025). Second, institutional constraints such as restrictions on derivative transactions shape which instruments add value (Gupta et al., 2025).

6. Discussion

6.1 Answers to the research questions

RQ1. The evidence supports a robust risk-reduction effect and a conditional value effect. Derivative use is associated with lower total and systematic risk across 47 countries (Bartram et al., 2011), and firms use derivatives mainly to hedge rather than to speculate (Bartram, 2019). The two best-identified studies show that hedging lowers the cost of credit and relaxes investment restrictions (Campello et al., 2011) and that an exogenous

expansion of hedging opportunities raises valuations, investment and leverage (Pérez-González & Yun, 2013). Market-value premia appear in several settings, most consistently for currency hedging (Bachiller et al., 2021; Luo & Wang, 2018; Samarakoon et al., 2025), but they are sensitive to identification (Bartram et al., 2011) and absent in some samples (Ayturk et al., 2016; Jin & Jorion, 2006). The evidence is therefore more consistent on risk than on value, and more consistent where identification is credible than where it is not.

RQ2. Three studies relate banks' derivative holdings to systemic risk. In US data, credit derivatives are associated with higher systemic risk in two studies (Halili et al., 2021; Mayordomo et al., 2014), and foreign-exchange derivatives are associated with higher, and interest-rate derivatives with lower, contributions to systemic risk (Mayordomo et al., 2014). In cross-country data, aggregate holdings raise systemic risk through asset, leverage and operational channels, especially in downturns and among highly leveraged, less liquid banks (Wang et al., 2025). The direction of the credit-derivative result is consistent, the aggregate result is not, and traditional balance-sheet risks dominate where the two are compared.

RQ3. Post-crisis reforms have reduced counterparty risk and trading costs in CDS markets (Loon & Zhong, 2014, 2016), and mandatory clearing need not raise collateral demand if CCPs do not proliferate (Duffie et al., 2015). At the same time, clearing concentrates procyclical liquidity risk in clearing houses (King et al., 2023), and model-based evidence finds its net effect on systemic risk ambiguous (Nowaczyk & O'Halloran, 2024). The reforms are therefore better described as transforming and concentrating risk than as removing it. The empirical evidence is dominated by CDS and US data, and comparable evidence for interest-rate derivatives and other jurisdictions is absent from the evidence base.

RQ4. Evidence from emerging and newly industrialised economies shows value effects that depend on firm characteristics, the type of instrument, the macroeconomic state and regulatory constraints, and that are absent in at least one setting. It comes from single-country studies, often based on disclosure data; only one sample, for India, extends into the COVID-19 period (Samarakoon et al., 2025), and the others end no later than 2017. The gaps that remain across the field are set out in Section 6.4.

6.2 Cross-domain synthesis

Read together, the four domains converge on one theme: derivatives transform risk more reliably than they eliminate it. At the firm level, hedging converts volatile cash flows into more stable ones and, where financing frictions bind, into cheaper credit and higher investment. At the bank level, derivative books can convert institution-specific exposures into contributions to system-wide risk, particularly through credit derivatives and leverage. At the market level, clearing converts bilateral credit exposures into liquidity demands on clearing members and concentrates them in CCPs.

Three moderators account for much of the apparent inconsistency across studies. The first is the instrument. Currency hedging shows the most consistent value effects and credit derivatives the most consistent systemic-risk effects, whereas the effects of interest-rate derivatives vary across settings: they reduce banks' contributions to systemic risk in one US study (Mayordomo et al., 2014), add value mainly for highly leveraged firms and firms with long-term foreign-currency debt in one Indian sample (Gupta et al., 2025) and are associated with higher value more generally in another (Samarakoon et al., 2025). The second is identification. Market-value associations are sensitive to how endogeneity is treated (Bartram et al., 2011), whereas both designs based on exogenous variation find effects on financing or investment, and one also finds higher valuations (Pérez-González & Yun, 2013). The third is the economic and

institutional environment. Hedging benefits weaken in crisis periods in China (Luo & Wang, 2018), hedging capacity shrinks as firms approach distress (Rampini et al., 2014) and the systemic-risk effects of bank holdings intensify in downturns (Wang et al., 2025), although in India currency and interest-rate derivatives remained associated with higher value during the pandemic (Samarakoon et al., 2025). The common implication, which deserves direct testing, is that for several instruments the benefits of derivatives are least secure precisely when they are most needed.

The evidence can also be read against the four expectations derived in Section 2.4. The first, that value effects are strongest where distress and underinvestment frictions bind, receives qualified support: the premium among airlines is concentrated in the interaction between hedging and investment (Carter et al., 2006), and currency hedging adds more value among Chinese firms with investment opportunities (Luo & Wang, 2018). The second, that hedging lowers the cost of external finance and raises investment, is the best-supported expectation, because it rests on the two studies with the strongest identification (Campello et al., 2011; Pérez-González & Yun, 2013). The third, that constrained firms hedge less, is supported by the airline evidence (Rampini et al., 2014) but has not been tested in the other settings reviewed here, so its implications for the interpretation of value premia remain largely unexamined. The fourth, that systemic effects depend on network structure, netting and the resilience of central nodes, is consistent with the finding that clearing lowers collateral demand only when CCPs do not proliferate (Duffie et al., 2015) and with model evidence that the net effect of clearing depends on the credit quality of the clearing house and on concentration (Nowaczyk & O'Halloran, 2024).

6.3 Positioning relative to prior syntheses

The review complements rather than replaces earlier syntheses. Aretz and Bartram (2010) review the corporate evidence available at the start of the period, and meta-analyses quantify the determinants of corporate hedging (Arnold et al., 2014) and its value effects (Bachiller et al., 2021; Bessler et al., 2019). Menkveld and Vuillemey (2021) survey the theory and evidence on central clearing. This review differs in three respects. It connects firm-level, bank-level and market-structure evidence within one appraisal framework; it grades each primary study by the credibility of its identification rather than pooling effect sizes; and it anchors the market context in primary institutional data for 2025 (BIS, 2025; ISDA, 2026a, 2026b). It does not claim to be exhaustive, and its conclusions should be read alongside the quantitative syntheses cited above.

6.4 Research agenda

Mapping the evidence base onto the TCCM framework shows where knowledge is thin. On theory, frictions-based explanations dominate, while the collateral-constraint view of Rampini et al. (2014) and network theories of systemic risk have been tested in few settings. On context, the best-identified firm-level evidence and most bank-level evidence come from the United States, and emerging-market evidence is single-country. On characteristics, several studies measure hedging with indicators of derivative use or disclosure rather than hedge ratios or notional amounts, and systemic risk is measured in ways that are not directly comparable. On methodology, quasi-experimental designs are rare outside US corporate settings, and research on clearing houses relies on analytical and simulation work. Table 4 translates these observations into eight gaps, each with a testable question and a suggested design.

Table 4

Research agenda organised by the TCCM framework

Gap	TCCM dimension	Status in the evidence base	Testable question	Suggested data and design
Crisis-period hedging	Context	Only one firm-level study in the evidence base covers 2020 or later, for India (Samarakoon et al., 2025)	Did firms that entered the 2020 shock or the 2022 rate cycle with active hedging programmes suffer smaller disruptions to cash flow and investment?	Difference-in-differences using pre-shock hedge ratios from annual reports
Benchmark transition	Characteristics	No study in the evidence base assesses hedge effectiveness after the move to risk-free rates	Has the shift to instruments referencing risk-free rates changed hedge effectiveness or basis risk for firms with term-rate borrowing?	Loan and swap terms and hedge-accounting disclosures, compared before and after 2021–2024
Clearing-house resilience	Methodology	Evidence on CCPs is analytical or model-based (King et al., 2023; Nowaczyk & O'Halloran, 2024)	Do variation-margin calls during volatility spikes transmit liquidity stress to clearing members and their clients?	CCP public quantitative disclosures combined with member-level data; event studies of volatility episodes
Bank systemic risk by instrument and jurisdiction	Context; characteristics	Two of three studies use US data, and aggregate results conflict (Mayordomo et al., 2014; Wang et al., 2025)	Does the systemic-risk contribution of derivatives differ between hedging and trading books and across jurisdictions with different clearing coverage?	Supervisory filings and trade-repository data; common systemic-risk measures across countries
Emerging markets	Context	Single-country studies; only one sample extends beyond 2017 (Samarakoon et al., 2025)	Do restrictions on derivative transactions and market depth moderate the value of hedging?	Multi-country panel with hand-collected notional data and country-level institutional variables

Gap	TCCM dimension	Status in the evidence base	Testable question	Suggested data and design
Small and unlisted firms	Context	All firm-level studies in the evidence base use listed firms	Do small firms that hedge currency risk have lower probabilities of financial distress than comparable non-hedgers?	Bank or credit-registry data with matched samples
Climate-related and sustainability-linked derivatives	Theory; characteristics	The only climate-related evidence concerns weather derivatives (Pérez-González & Yun, 2013)	Do weather, carbon or sustainability-linked derivatives reduce firms' exposure to climate-related cash-flow risk?	Weather-sensitive and emissions-intensive sectors; position data where disclosed
State-dependent effectiveness	Methodology	Effects vary with the economic cycle and exchange-rate conditions (Luo & Wang, 2018), and hedging falls near distress (Rampini et al., 2014)	Is hedging more or less valuable in stress periods, and does hedging capacity collapse when it is most needed?	Regime-dependent panel models with measures of distance to distress

Note. TCCM = Theory–Context–Characteristics–Methodology (Paul & Rosado-Serrano, 2019); CCP = central counterparty.

Two of these gaps are beginning to attract attention. One study in the evidence base already examines hedging during the COVID-19 crisis (Samarakoon et al., 2025), and the literature on clearing houses has moved from theory towards the analysis of liquidity risk (King et al., 2023). Neither line of work is yet sufficient to answer the questions in Table 4.

7. Practical and policy implications

For corporate treasurers, the evidence favours hedging identifiable exposures where doing so protects the capacity to invest. The best-identified studies link hedging to cheaper credit, fewer investment restrictions and higher investment (Campello et al., 2011; Pérez-González & Yun, 2013). Because hedging draws on collateral and declines as firms approach distress (Rampini et al., 2014), hedging capacity is best secured while balance sheets are strong, and reactive increases in hedging earn no premium over stable policies (Treanor et al., 2014).

For investors and analysts, the evidence cautions against treating the mere use of derivatives as a signal of value. The value premium is sensitive to identification (Bartram et al., 2011), and the capacity to hedge reflects financial strength (Rampini et al., 2014). Information on the extent and stability of a firm's hedging, and on the exposures it covers, relates more closely to the channels that the evidence identifies than a simple indicator of derivative use.

For bank risk managers and supervisors, credit and foreign-exchange derivative books warrant particular attention when contributions to systemic risk are monitored, especially in banks with high leverage and low liquidity and during downturns (Mayordomo et al., 2014; Wang et al., 2025). Where the two have been compared,

loan quality and leverage remain the larger drivers of systemic risk (Mayordomo et al., 2014), so the monitoring of derivatives should complement rather than displace these traditional measures.

For regulators and clearing-house supervisors, the evidence supports stress testing that captures liquidity risk and the procyclicality of margin calls (King et al., 2023), attention to concentration in clearing, and caution about a proliferation of CCPs, which erodes the collateral savings that clearing can deliver (Duffie et al., 2015; Nowaczyk & O'Halloran, 2024).

For policymakers in emerging economies, one Indian study suggests that relaxing restrictions on derivative transactions may benefit firms (Gupta et al., 2025). The limited and uneven disclosure of derivative use, reflected in the need for hand-collected data in India (Gupta et al., 2025) and in the study of disclosure itself in South Africa (Toerien et al., 2024), also limits the assessment of hedging effectiveness; more consistent disclosure standards would support both market discipline and research.

8. Limitations

Several limitations qualify the conclusions. First, the search did not use the Scopus or Web of Science interfaces and was iterative rather than protocol-driven, so relevant studies may have been missed, and no screening counts are reported, although strings for replicating and extending the search in these indexes are available on request. Second, screening and data extraction were performed once, without independent duplicate coding. Third, extraction relied mainly on published abstracts and publisher records, supplemented by full texts where openly available, so some design details are reported only at the level that the published record supports. Fourth, the evidence base is limited to peer-reviewed articles in English, which may under-represent research from emerging economies and exposes the synthesis to publication bias. Fifth, the heterogeneity of outcome measures, samples and systemic-risk metrics precluded quantitative pooling; the conclusions are qualitative and should be read alongside the meta-analyses discussed in Section 6.3.

9. Conclusion

This review has synthesised 20 peer-reviewed primary studies published between 2010 and 2025, read against three pre-2010 benchmark studies and five prior syntheses, to assess derivatives as risk-management instruments at the level of the firm, the bank and the market. Four conclusions follow. First, derivative use reliably reduces firm risk, and the most credible studies show that hedging creates value by lowering financing costs and supporting investment, whereas market-value premia are conditional and sensitive to identification. Second, in banking, credit derivatives in particular are associated with higher systemic risk, and cross-country evidence links aggregate holdings to systemic risk through asset, leverage and operational channels, although traditional balance-sheet risks remain the larger driver where the two are compared. Third, post-crisis reforms have reduced counterparty risk and trading costs in credit derivative markets but concentrate procyclical liquidity risk in clearing houses, leaving their net systemic effect ambiguous. Fourth, evidence from emerging and newly industrialised economies confirms that the benefits of hedging depend on the type of instrument, the macroeconomic state, institutional constraints and the quality of disclosure.

The overarching lesson is that derivatives transform risk more reliably than they remove it, and the evidence suggests that, for several instruments, their benefits are least secure in the stressed conditions in which they matter most. Research that tests this proposition directly, across crisis periods, benchmark regimes, clearing-house stress events and emerging markets, would do most to resolve the questions that remain.

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Appendix. Studies included in the review

Table A1

Studies included in the review

Study	Journal	Setting and sample	Design	Main finding	Identification
Allayannis and Weston (2001) †	*Review of Financial Studies*	United States; 720 large non-financial firms, 1990–1995	Tobin's q regressions	Firms exposed to exchange-rate risk that use currency derivatives are valued at a premium averaging 4.87% of firm value.	Limited
Carter et al. (2006) †	*Financial Management*	United States; airlines, 1992–2003	Firm-value regressions on fuel-hedging measures	Fuel hedging is positively related to value, with a premium above about 5% and possibly up to 10%, concentrated in the interaction of hedging with capital investment.	Limited
Jin and Jorion (2006) †	*Journal of Finance*	United States; oil and gas producers	Firm-value regressions	Hedging reduces the sensitivity of share prices to oil and gas prices but has no discernible effect on market value.	Limited
Bartram et al. (2011)	*Journal of Financial and Quantitative Analysis*	47 countries; non-financial firms; pre-crisis data	Propensity-score matching of users and non-users	Derivative use is linked to lower total and systematic risk; the estimated value gain is positive but less robust to the treatment of endogeneity.	Moderate
Campello et al. (2011)	*Journal of Finance*	United States; hand-collected hedging data and loan contracts	Tax-based instrumental variables	Firms that hedge borrow at lower spreads and face fewer limits on capital spending, so they invest more.	Strong
Pérez-González and Yun (2013)	*Journal of Finance*	United States; energy firms	Natural experiment: introduction of weather derivatives	Greater ability to hedge weather risk leads to higher valuations, investment and leverage.	Strong

Study	Journal	Setting and sample	Design	Main finding	Identification
Rampini et al. (2014)	*Journal of Financial Economics*	United States; airlines' fuel hedging	Dynamic model with panel evidence	Airlines with less financial slack hedge less, both across firms and over time; hedging drops steeply near distress and is rebuilt slowly.	Limited
Treanor et al. (2014)	*International Review of Financial Analysis*	United States; airlines	Exposure estimation and firm-value regressions	Airlines hedge more when fuel-price exposure is high or rising; a positive premium is found, but exposure-driven increases in hedging are not valued more highly.	Limited
Mayordomo et al. (2014)	*Journal of Banking & Finance*	United States; 95 bank holding companies, 2002–2011	Regressions of systemic-risk contributions (Net Shapley Value)	Aggregate holdings have no significant effect; foreign-exchange and credit derivatives raise, and interest-rate derivatives lower, contributions to systemic risk; non-performing loans and leverage matter more.	Limited
Loon and Zhong (2014)	*Journal of Financial Economics*	United States; voluntarily cleared single-name CDS	Event-based comparison around the start of clearing	Spreads rise when clearing begins and lie below the clearing house's settlement spreads, consistent with lower counterparty risk.	Moderate
Duffie et al. (2015)	*Journal of Financial Economics*	Bilateral CDS positions reported to DTCC	Network-based estimation of collateral demand under alternative regimes	Initial margin for dealers raises the system's collateral needs, cleared or not; with such margin in place, mandatory clearing lowers total needs unless CCPs multiply, but the burden is uneven.	Not applicable
Ayturk et al. (2016)	*Borsa Istanbul Review*	Turkey; non-financial firms, 2007–2013	Tobin's q panel models including system GMM; Fama–French time series; sector analysis	About 36% of firms use derivatives; apart from system-GMM estimates, no significant hedging premium or discount is found.	Moderate

Study	Journal	Setting and sample	Design	Main finding	Identification
Loon and Zhong (2016)	*Journal of Financial Economics*	United States; index CDS trades, December 2012–December 2013	Transaction costs from real-time trade reports matched to quotes	Liquidity improved once trades were publicly reported; cleared, platform-executed, end-user and customised trades were cheaper, with smaller price impact.	Moderate
Luo and Wang (2018)	*Journal of Multinational Financial Management*	China; listed firms, quarterly data, 2000–2013	Panel regressions with robustness tests	Currency-derivative users have higher value, more so for profitable firms with investment opportunities and during depreciation and expansion; the link weakens in crises.	Limited
Bartram (2019)	*Journal of Corporate Finance*	International sample of non-financial firms	Regressions of risk and exposure on derivative use	Firms use derivatives to hedge rather than speculate; risk reduction is greater where creditor rights are weak or derivatives are easily accessible.	Limited
Bae and Kwon (2021)	*Journal of Futures Markets*	Korea; firms around the 2007–2009 crisis	Comparison of firms with and without significant changes in currency exposure	Firms with sharp exposure changes hedged more but had lower values, especially when hedging financing rather than operating risk.	Limited
Halili et al. (2021)	*Finance Research Letters*	United States; bank holding companies, 2006–2018	Regressions of systemic risk on credit-derivative use	Rising credit-derivative holdings precede higher systemic risk; the result holds across a range of controls.	Limited
King et al. (2023)	*International Journal of Central Banking*	Central counterparties	Analysis of CCP liquidity risk and stress testing	CCPs reduce credit risk but create liquidity demands that rise with volatility, so margin calls are procyclical.	Not applicable
Nowaczyk and O'Halloran (2024)	*Frontiers in Artificial Intelligence*	Simulated network of bank trade and risk relations	Graph model, stylised case studies and simulation	Whether clearing raises or lowers systemic risk depends on the clearing house's creditworthiness, the balance of netting gains and losses, and concentration.	Not applicable

Study	Journal	Setting and sample	Design	Main finding	Identification
Toerien et al. (2024)	*South African Journal of Accounting Research*	South Africa; 200 largest non-financial JSE-listed firms, 2005–2017	Binomial logistic regression of derivative disclosure	Disclosure is more likely for larger, more leveraged firms with better growth prospects and lower information asymmetry; local conditions also matter.	Limited
Gupta et al. (2025)	*Review of Quantitative Finance and Accounting*	India; BSE-100 non-financial firms, 2010–2017	Hand-collected usage data; panel analysis with matched-sample checks	All derivative types except interest-rate derivatives raise value via lower earnings volatility and tax-advantaged leverage; leveraged firms benefit from interest-rate derivatives unless earnings are volatile.	Moderate
Samarakoon et al. (2025)	*Asia-Pacific Financial Markets*	India; non-financial firms, 2015–2019 (1,735 firm-years) and 2020–2021 (712 firm-years)	Comparison of firm value across pre-pandemic and pandemic periods	Currency and interest-rate derivatives are associated with higher value in both periods; the association for commodity derivatives turns markedly negative during the pandemic.	Limited
Wang et al. (2025)	*Borsa Istanbul Review*	28 countries; 493 listed banks	Cross-country bank panel with robustness checks	Holdings raise systemic risk via asset, leverage and operational risk, more so in downturns, under accommodative policy and in highly leveraged, less liquid banks.	Limited

Note. † Pre-2010 benchmark study; not counted in the evidence base of 20 studies. Identification ratings follow the criteria in Table 2. CCP = central counterparty; CDS = credit default swap; DTCC = Depository Trust & Clearing Corporation; GMM = generalised method of moments; JSE = Johannesburg Stock Exchange.