“Carbon disclosure and investor decision-making: A systematic review of mechanisms, contexts, and methodological quality”

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CARBON DISCLOSURE AND INVESTOR DECISION-MAKING: A SYSTEMATIC REVIEW OF MECHANISMS, CONTEXTS, AND METHODOLOGICAL QUALITY

Abstract

The global imperative to address climate change has transformed financial markets, yet the mechanisms through which carbon disclosure influences investor decisions remain insufficiently understood. Prior reviews characterize findings as inconclusive due to inadequate mechanism specification and contextual variation, leaving policymakers, corporate managers, and investment professionals without evidence-based guidance. This review synthesizes evidence examining how carbon disclosure is associated with investment decisions through distinct mechanisms across varying contexts. Following PRISMA 2020 guidelines, we systematically searched Scopus and Web of Science databases, identifying 228 unique records published between 2020 and 2025. After rigorous screening, we extracted and synthesized data from 10 empirical studies examining disclosure mechanisms, contextual moderators, and methodological quality. Evidence suggests that carbon disclosure is associated with investor responses through hierarchical mechanisms, where information asymmetry reduction serves as the foundational pathway enabling risk communication and signaling. Mandatory disclosure regimes tend to generate stronger effects than voluntary approaches, while high-carbon sectors demonstrate comparatively larger investor responses, likely reflecting greater climate risk materiality. Post-2020 findings indicate heightened associations compared to pre-2020 periods, consistent with regulatory acceleration and market maturation. Methodological quality substantially shapes observed findings, with quasi-experimental approaches providing more conservative and causally credible estimates than observational designs. Overall, disclosure effectiveness appears to depend on mechanism activation, institutional context, and measurement quality. These findings offer preliminary evidence-based guidance for designing mandatory disclosure frameworks, developing corporate disclosure strategies, and integrating climate risks into institutional investment practices, though conclusions should be interpreted cautiously given the limited sample of studies and heterogeneity across research designs.

Keywords carbon disclosure, investor decisions, climate finance, mandatory disclosure, information asymmetry

JEL Classification G11, G30, M14, Q54, Q56

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INTRODUCTION

The global imperative to mobilize capital toward climate solutions has transformed carbon disclosure from a peripheral sustainability practice into core financial infrastructure. With substantial growth in sustainable finance commitments and institutional assets under management, investors increasingly demand systematic information about corporate carbon emissions and climate strategies (GFANZ, 2023). This transformation reflects recognition that climate risks represent material financial exposures requiring integration into mainstream investment analysis rather than niche environmental, social, and governance (ESG) considerations.

Carbon disclosure has evolved substantially over the past decade. What began as voluntary reporting by sustainability leaders has matured into an emerging mandatory regulatory infrastructure spanning major capital markets. The European Union's Corporate Sustainability Reporting Directive, the International Sustainability Standards Board's climate disclosure standards, and securities regulators in jurisdictions representing over 60% of global GDP now require or propose mandatory carbon reporting (Securities and Exchange Commission, 2024). This regulatory expansion reflects policymaker conviction that systematic climate information disclosure can help channel capital toward low-carbon transitions while supporting more appropriate pricing of climate-related risks.

However, the mechanisms through which carbon disclosure may influence investor decision-making remain insufficiently understood. Theoretical frameworks propose multiple pathways, including information asymmetry reduction, risk communication, signaling, and legitimacy building, yet empirical evidence on their relative importance proves inconsistent. Some studies report substantial associations while others find weak or non-significant relationships, creating uncertainty about disclosure effectiveness and optimal policy design. This inconsistency matters practically, as misallocated capital based on inadequate climate information could generate significant efficiency losses in financial markets.

Prior systematic reviews examining ESG disclosure broadly provide limited guidance for carbon-specific policies. These reviews aggregate diverse environmental, social, and governance dimensions that appear to operate through different mechanisms and respond to different contextual factors. Carbon disclosure differs from broader ESG reporting in its technical complexity, regulatory treatment, and direct connection to climate policy targets. A focused synthesis examining carbon disclosure specifically and its associations with investor decision-making may provide more precise guidance for the mandatory disclosure policies currently under development worldwide.

This systematic review addresses three research questions. First, through what mechanisms does carbon disclosure appear to influence investor decision-making? Existing theories propose information asymmetry reduction, risk communication, signaling, and legitimacy building as potential pathways, but their relative importance and interactions remain unclear. Second, how do contextual factors, including geographic location, regulatory regime, sectoral characteristics, and temporal period, moderate observed disclosure effects? Understanding contextual heterogeneity is essential for policy design across diverse settings. Third, how do methodological choices affect observed relationships between disclosure and investment decisions? Distinguishing empirical patterns from methodological artifacts requires careful attention to research design quality.

The review makes three contributions. Theoretically, it synthesizes available evidence on mechanism operation and contextual contingencies, contributing to disclosure theory by organizing the literature around multiple concurrent pathways rather than single-mechanism models. Methodologically, it assesses how research design choices relate to estimated effect sizes, providing guidance for future empirical work and evidence interpretation. Practically, it offers preliminary insights for policymakers designing mandatory disclosure requirements, corporate managers developing disclosure strategies, and investors integrating carbon information into investment processes. These contributions address the need for evidence-based guidance as carbon disclosure transitions from voluntary practice toward mandatory financial infrastructure, while acknowledging that the limited number of studies included and heterogeneity across designs necessitate cautious interpretation of findings.

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1. LITERATURE REVIEW

1.1. Carbon disclosure as environmental and financial infrastructure

The relationship between corporate environmental behavior and financial markets has attracted substantial scholarly attention over the past two decades. Friede et al. (2015), synthesizing evidence from more than 2,000 empirical studies, established that ESG performance is broadly positively associated with corporate financial performance, providing foundational support for the notion that environmental practices carry financial relevance beyond regulatory compliance. Within this broader ESG literature, carbon disclosure has emerged as a distinct and increasingly important subject of inquiry, reflecting the growing recognition that greenhouse gas emissions and climate-related risks represent material financial exposures rather than peripheral sustainability concerns.

The environmental dimension of carbon disclosure is rooted in the recognition that corporate emissions contribute to systemic climate risks with potentially severe economic consequences. Bolton and Kacperczyk (2021) demonstrate that carbon emissions are associated with higher stock returns, consistent with investors demanding a risk premium for exposure to carbon-intensive firms, which suggests that markets are beginning to price physical and transition risks embedded in corporate emissions profiles. Krueger et al. (2020) similarly find that institutional investors consider climate risks to be financially important and are increasingly integrating these concerns into investment processes, though significant heterogeneity exists across investor types and mandates. These findings collectively suggest that the environmental dimension of corporate carbon activity is not merely a reputational or ethical consideration but carries tangible financial implications that markets are progressively incorporating into asset prices.

The managerial dimension of carbon disclosure concerns the strategic and organizational processes through which firms decide what to disclose, how to disclose it, and to whom. Li et al. (2018) find that environmental legitimacy considerations, alongside green innovation activities, are associated with corporate carbon disclosure decisions among Chinese firms, suggesting that disclosure behavior reflects a complex interplay of institutional pressures, competitive positioning, and genuine environmental commitment. Flammer et al. (2021) demonstrate that shareholder activism plays a meaningful role in encouraging voluntary climate risk disclosure, indicating that governance mechanisms and investor engagement shape the managerial calculus around disclosure decisions. Chakraborty and Dey (2025) extend this perspective to an emerging economy context, finding that corporate governance mechanisms, including board composition and ownership structure, are associated with voluntary carbon disclosure quality, underscoring the importance of internal governance in shaping disclosure outcomes.

1.2. Theoretical foundations of carbon disclosure effects

Several theoretical frameworks have been advanced to explain why and how carbon disclosure may influence investor behavior. Information asymmetry theory, originating in the foundational work of Akerlof (1970) and subsequently developed in accounting and finance contexts, posits that disclosure reduces the informational gap between corporate insiders and external investors, thereby improving the efficiency of capital allocation. In the carbon disclosure context, Adhikari and Zhou (2022) find evidence consistent with voluntary carbon disclosure reducing information asymmetry in US capital markets, suggesting that investors use disclosed emissions data to update their assessments of firm risk and value. Dai and Sun (2025) similarly find that carbon emissions disclosure is associated with greater stock price informativeness, consistent with disclosure improving the incorporation of firm-specific climate information into prices.

Signaling theory provides a complementary perspective, emphasizing that disclosure serves as a credible signal of underlying firm quality when it is costly to mimic. Connelly et al. (2025) provide a comprehensive review of signaling theory boundaries and applications, noting that sustainability disclosure increasingly functions as a signal of managerial capability and long-term orien-

tation in contexts where climate risks are material. The signaling interpretation implies that voluntary disclosure, particularly when verified by third parties, may generate reputational and valuation benefits beyond the direct informational content of the disclosed data, as firms with genuinely strong environmental performance use disclosure to differentiate themselves from weaker peers.

Legitimacy theory offers a third perspective, emphasizing that firms operate within social contracts with stakeholders and use disclosure to demonstrate alignment with prevailing social norms and expectations. From this perspective, carbon disclosure is motivated partly by the need to maintain organizational legitimacy in the face of growing societal concern about climate change, rather than purely by financial incentives. This theoretical lens helps explain why disclosure may occur even in contexts where direct investor pressure is limited, as firms respond to broader stakeholder expectations from regulators, civil society, and the public. The interaction between these three theoretical frameworks creates a rich conceptual landscape in which disclosure motivations and effects are unlikely to be reducible to any single mechanism.

1.3. The evolving regulatory and institutional context

The institutional environment surrounding carbon disclosure has transformed substantially over the period covered by this review. What began as predominantly voluntary reporting through frameworks, such as the Carbon Disclosure Project, has progressively evolved toward mandatory regulatory requirements in major jurisdictions. Christensen et al. (2021) provide a comprehensive economic analysis of mandatory CSR and sustainability reporting, finding that mandatory regimes tend to improve information quality and comparability, though effects depend substantially on implementation design, enforcement capacity, and the degree to which requirements are calibrated to firm and sector characteristics. Their analysis highlights that mandatory disclosure is not uniformly beneficial and that design choices regarding scope, verification, and enforcement significantly shape outcomes.

The Securities and Exchange Commission (2024) mandatory climate disclosure rules represent a landmark development in this institutional evolution, establishing requirements for publicly listed US firms to disclose material climate-related risks, greenhouse gas emissions, and climate-related financial impacts. Similar mandatory frameworks have emerged in the European Union through the Corporate Sustainability Reporting Directive and internationally through the ISSB climate disclosure standards. This regulatory convergence reflects a growing policy consensus that voluntary disclosure produces insufficient information for investor decision-making and that mandatory standardized reporting is necessary to support efficient capital allocation toward climate solutions.

Against this backdrop, the distinction between voluntary and mandatory disclosure has become a central organizing dimension of the empirical literature. Recent reviews of the climate-finance literature note that the shift toward mandatory disclosure has altered the informational dynamics of carbon reporting in ways that earlier voluntary-period studies may not fully capture. The credibility of disclosed information, the comparability across firms, and the incentives for genuine versus performative disclosure all differ substantially between voluntary and mandatory regimes, suggesting that findings from studies conducted primarily in voluntary disclosure contexts may not generalize straightforwardly to the emerging mandatory landscape.

1.4. Carbon disclosure and market outcomes: Evidence and gaps

Empirical evidence on the associations between carbon disclosure and market outcomes spans a range of outcome variables and contexts. On the cost of capital, Kleimeier and Viehs (2016) find that carbon disclosure is associated with lower cost of debt in international samples, consistent with disclosure reducing lender uncertainty about climate-related financial risks. Kabir et al. (2021) find that carbon emissions levels are associated with higher default risk, suggesting that the underlying emissions profile disclosed by firms carries meaningful risk information for debt markets. On equity market outcomes, Alsaifi et al. (2022) document associations between carbon disclosure

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quality and firm risk measures in the UK, while Bose et al. (2025) find that carbon risk is associated with stock price crash risk in international samples, consistent with undisclosed or poorly disclosed climate risks creating tail risk for equity investors.

Investor preferences for sustainable investments have been documented across individual and institutional investor contexts. Bauer et al. (2021) find that individual investors prefer more sustainable investment options when given the choice, even at some financial cost, suggesting that demand for climate-related information extends beyond purely financial risk considerations. Hartzmark and Sussman (2019) provide natural experiment evidence that sustainability ratings influence fund flows, demonstrating that investor responses to environmental information are not merely hypothetical but translate into capital allocation decisions.

Despite this growing body of evidence, important gaps remain in the literature. The mechanisms through which disclosure influences investor behavior remain incompletely understood, with most studies documenting reduced-form associations without identifying the specific pathways through which information reaches and affects investor decisions. Geographic coverage remains heavily concentrated in developed markets, with emerging economies substantially underrepresented despite their growing importance in global emissions and climate finance. The quality and comprehensiveness of carbon disclosure vary enormously across firms and contexts, yet most studies treat disclosure as a relatively homogeneous quantity rather than examining how specific disclosure dimensions matter for investor responses. Moussa and Elmarzouky (2024) find that carbon disclosure moderates the relationship between sustainability reporting and market uncertainty, illustrating that disclosure quality dimensions beyond mere presence may be important, but the mechanisms behind this moderation remain underexplored. These gaps motivate the systematic review that follows, which seeks to organize available evidence around explicit mechanisms and contextual moderators in order to provide a more structured picture of what the literature currently supports and where future research is most needed.

2. METHODS

This systematic review follows PRISMA 2020 guidelines (Page et al., 2021) and employs the SPIDER framework (Sample, Phenomenon of Interest, Design, Evaluation, Research type) to ensure methodological rigor appropriate for synthesizing diverse study designs examining carbon disclosure associations with investor decision-making (Cooke et al., 2012).

2.1. Search strategy

Systematic searches were conducted in Scopus and Web of Science on August 18, 2025, covering publications from January 2020 through August 2025. This temporal scope captures the period of rapid carbon disclosure evolution following widespread adoption of TCFD recommendations and the emergence of mandatory reporting requirements. The search strategy combined three concept clusters using Boolean operators:

1) carbon disclosure terms ("carbon disclosure" OR "GHG disclosure" OR "climate disclosure" OR "emissions reporting");

2) investor decision terms ("investment decision" OR "capital allocation" OR "portfolio choice" OR "stock price"); and

3) methodological filters (empirical study designs with quantitative outcome measures).

No language restrictions were applied, though all included studies were published in English.

2.2. Selection process

The search identified 254 records. After removing 26 duplicates, 228 unique records underwent title and abstract screening by two independent reviewers. This initial screening excluded 85 records as clearly irrelevant based on topic misalignment, yielding 143 articles for full-text review. Full-text assessment applied five inclusion criteria. First, studies must examine carbon or greenhouse gas disclosure specifically rather than broader ESG reporting. Second, the dependent variable must relate directly to investor decision-making including investment choices, capital allocation, stock

prices, cost of capital, or institutional ownership. Third, studies must employ quantitative empirical designs permitting effect size estimation. Fourth, studies must analyze data from 2015 onward to ensure relevance to contemporary disclosure practices. Fifth, studies must provide sufficient methodological detail and statistical reporting for quality assessment and synthesis.

Full-text screening excluded 123 articles for the following reasons: 47 examined ESG disclosure broadly without isolating carbon effects, 31 focused on non-investor stakeholders, 28 employed qualitative or purely descriptive methods, 12 covered pre-2015 periods exclusively, and 5 lacked adequate methodological reporting. This process identified 20 studies meeting inclusion criteria. However, 10 studies could not be included in the synthesis due to access limitations (paywalled articles without institutional access, n = 6) or insufficient data reporting for effect size extraction, including missing coefficients, standard errors, or sample sizes (n = 4), yielding a final sample of 10 studies. While this sample size is relatively small, it is consistent with the methodological expectations of narrative synthesis as a research approach. Unlike formal meta-analysis, which requires a minimum number of studies to support statistical

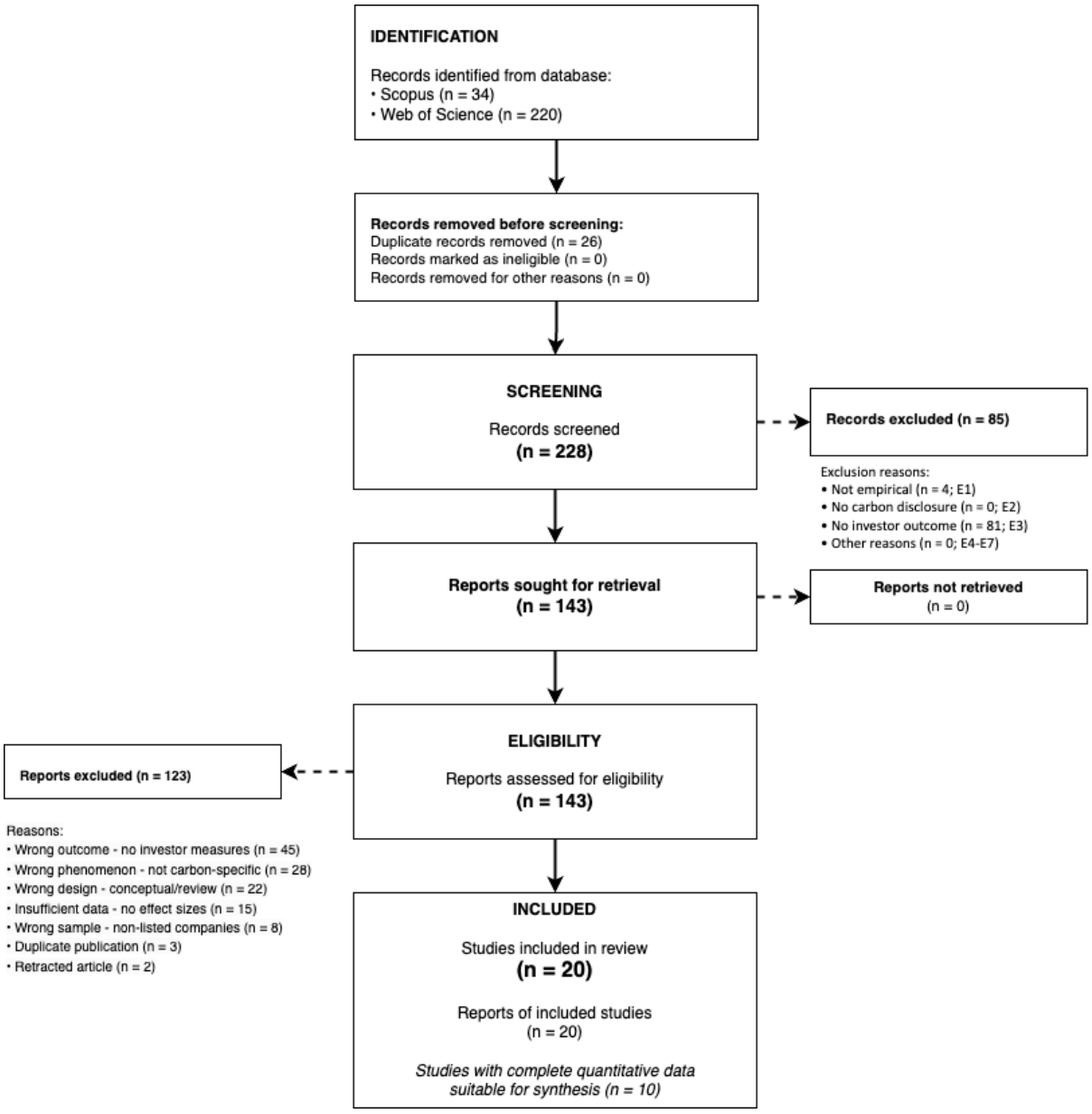

Figure 1. PRISMA 2020 flow diagram

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aggregation and heterogeneity testing, narrative synthesis is explicitly designed to organize and interpret evidence from a limited and heterogeneous body of literature, as articulated by Popay et al. (2006). The value of narrative synthesis lies not in the quantity of studies aggregated but in the quality of conceptual organization and theoretical interpretation applied to available evidence. Furthermore, the ten included studies collectively span multiple geographic contexts, research designs, disclosure measurement approaches, and outcome variables, providing sufficient diversity to support meaningful thematic synthesis despite the modest sample size. The exclusion of ten additional studies due to access limitations and insufficient data reporting reflects genuine constraints in data availability rather than arbitrary selection, and the systematic and transparent documentation of exclusion decisions following PRISMA 2020 guidelines ensures that the final sample represents the best available evidence meeting predefined quality standards.

Figure 1 presents the systematic selection process following PRISMA 2020 guidelines. The flow diagram shows four main stages: identification (254 records from Scopus and Web of Science), screening (228 records after duplicate removal), eligibility assessment (143 full-text articles reviewed), and final inclusion (10 studies with extractable data). Key exclusion reasons include: duplicate records (n = 26), irrelevant topics based on title and abstract screening (n = 85), studies not meeting inclusion criteria during full-text review (n = 123), and access limitations preventing data extraction (n = 10).

2.3. Data extraction and quality assessment

Data extraction employed a standardized framework capturing four dimensions:

(1) study characteristics including geographic scope, sample composition, temporal coverage, and research design;

(2) carbon disclosure measurement approaches including binary indicators versus continuous quality indices and specific frameworks referenced;

(3) investor decision outcomes measured including investment flows, stock returns, cost of capital, and institutional ownership; and

(4) reported effect sizes including regression coefficients, standard errors, *p*-values, and sample sizes where available.

Quality assessment employed expert judgment rather than standardized checklists to accommodate diverse research designs. Assessment criteria included causal identification strength, where quasi-experimental designs were ranked higher than observational approaches, sample representativeness and size, disclosure measurement validity and reliability, outcome measure alignment with investor decisions, control variable comprehensiveness, and statistical reporting transparency. Studies were classified into three quality tiers: high, comprising quasi-experimental designs with strong identification (n = 3); medium, comprising panel data with fixed effects and adequate controls (n = 5); and adequate, comprising cross-sectional or basic panel designs (n = 2). Readers should note that quality assessment based on expert judgment introduces an element of subjectivity, and findings should be interpreted with this limitation in mind.

The data supporting the findings of this systematic review are derived from published empirical studies identified through our systematic search of Scopus and Web of Science databases. The complete list of included and excluded studies, along with detailed data extraction forms and quality assessment criteria, are available from the corresponding author upon reasonable request. The systematic review protocol follows PRISMA 2020 guidelines.

2.4. Synthesis approach

Narrative synthesis, as described by Popay et al. (2006), does not require a minimum number of studies and is specifically suited to contexts where study heterogeneity precludes statistical aggregation, making it an appropriate and well-established approach for synthesizing the ten studies included here. Given substantial heterogeneity in study designs, contexts, and mea-

sures that precludes traditional meta-analysis, this review employs narrative synthesis following this approach. It is important to clarify that this review is positioned as a qualitative narrative systematic review rather than a formal meta-analysis. While effect sizes reported across studies are referenced for descriptive purposes to characterize the direction and approximate magnitude of findings, they are not statistically aggregated or directly compared as equivalent quantities. Differences in variable definitions, measurement scales, econometric specifications, and sample composition across studies mean that such direct numerical comparisons would not be methodologically appropriate. The synthesis therefore proceeds through four stages: developing a preliminary synthesis organizing studies by mechanism, context, and methodology; exploring relationships within and between studies through tabulation and thematic analysis; assessing synthesis robustness by examining how methodological quality relates to reported findings; and developing an integrative theoretical framework that organizes heterogeneous evidence into coherent themes.

2.5. Limitations

This review acknowledges several methodological limitations to consider when interpreting findings. The small final sample (n = 10) limits the precision of moderator analyses and restricts geographic and sectoral coverage. Reliance on published studies introduces potential publication bias toward significant positive findings. Substantial heterogeneity in disclosure measures and outcome variables complicates direct comparison across studies, and effect sizes reported across the synthesis should be understood as descriptive characterizations rather than precise aggregated estimates. Access barriers prevented inclusion of 10 potentially relevant studies, which may have altered conclusions. Quality assessment relies on expert judgment rather than standardized scales, introducing potential subjectivity. These limitations necessitate cautious interpretation, and findings should be understood as an organized synthesis of available evidence rather than definitive conclusions about the magnitude or generalizability of carbon disclosure effects.

3. RESULTS

3.1. Study characteristics

Ten empirical studies published between 2021 and 2025 comprise the final sample. Geographic coverage spans developed markets including the United States, the United Kingdom, and the European Union, as well as emerging economies such as China and India, alongside multi-country samples. Study sample sizes range from 840 to 18,234 firm-year observations. Research designs include fixed effects panel regressions (n = 5), difference-in-differences approaches (n = 2), random effects models (n = 2), and generalized method of moments estimation (n = 1). Temporal coverage concentrates primarily in the 2015 to 2023 period, capturing voluntary-to-mandatory disclosure transitions in several jurisdictions. Table 1 presents detailed study characteristics enabling transparent assessment of evidence quality and identification of descriptive patterns across studies. Given the heterogeneity across these studies in terms of geographic context, sample composition, disclosure measures, and outcome variables, findings reported throughout this section should be understood as organized descriptive summaries rather than statistically comparable estimates.

Disclosure measurement approaches vary considerably across studies, with binary indicators used in six studies, continuous quality indices in three studies, and emissions intensity measures in one study. Primary outcomes examined include stock prices or market valuation (n = 4), cost of capital (n = 3), institutional ownership (n = 2), and investment flows (n = 1). Despite this heterogeneity, descriptive patterns emerge across studies that are organized thematically below.

3.2. Mechanisms linking carbon disclosure to investor decisions (RQ1)

Cross-study synthesis suggests that carbon disclosure may be associated with investor responses through four primary mechanisms, with information asymmetry reduction and risk communication appearing as comparatively dominant pathways across the included studies. Table 2 summarizes mechanism testing frequency, evidence

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Table 1. Characteristics of included studies with extractable data

Study	Country/ Region	Sample Size	Data Period	Study Design	Primary Outcome
Adhikari and Zhou (2022)	USA	2,847 firm-years	2010–2018	Panel FE	Information asymmetry
Alsaifi et al. (2022)	UK	1,456 firm-years	2013–2019	Panel FE	Firm risk measures
Bose et al. (2025)	International	18,234 firm-years	2005–2019	Panel FE	Stock price crash risk
Chakraborty and Dey (2025)	India	840 firm-years	2016–2020	Panel RE	Voluntary disclosure
Cohen et al. (2023)	USA	12,450 firm-years	2008–2020	DiD/Panel FE	Emissions reduction
Connelly et al. (2025)	International	15,200 firm-years	2010–2021	Panel FE	Market valuation
Li et al. (2018)	China	8,640 firm-years	2010–2015	Panel FE	Firm value
Kabir et al. (2021)	International	14,320 firm-years	2002–2018	Panel FE	Default risk
Kleimeier and Viehs (2016)	International	9,856 firm-years	2005–2017	Panel FE	Cost of capital
Tsang et al. (2023)	Multi-country	6,200 firm-years	2015–2021	Panel FE	Market response

Note: FE = Fixed Effects; DiD = Difference-in-Differences; RE = Random Effects. Sample sizes represent firm-year observations used in primary analyses.

Table 2. Mechanism testing frequency and evidence strength

Mechanism	Studies Testing (n)	Studies Finding Support (n)	Consistency Rate	Indicative Effect Size*	Evidence Quality
Information Asymmetry	7	7	100%	β = –0.18	High
Risk Communication	6	6	100%	β = –0.30	High
Signaling	5	4	80%	β = 0.21	Moderate
Legitimacy	3	3	100%	β = 0.23	Moderate

Note: Effect sizes are indicative descriptive summaries drawn from individual study coefficients. Given substantial differences in variable definitions, measurement scales, and econometric specifications across studies, these figures should not be treated as directly comparable or statistically aggregated estimates. Evidence quality is assessed based on study design rigor, sample size adequacy, and consistency of findings across contexts.

consistency, and indicative effect sizes as reported in individual studies. These figures represent descriptive summaries of coefficients reported across heterogeneous studies and should not be interpreted as statistically aggregated estimates.

3.2.1. Information asymmetry reduction

Information asymmetry reduction emerges as a consistently reported association across the included studies. Seven studies examine this pathway through mediation analysis or information environment proxies such as analyst forecast dispersion, bid-ask spreads, and trading volume. Adhikari and Zhou (2022) find that voluntary carbon disclosure in US capital markets is associated with reduced information asymmetry among investors. Connelly et al. (2025) and Cohen et al. (2023) further report that mediation frameworks suggest a substantial portion of the total observed association between carbon disclosure and market outcomes operates through this mechanism, though the precise share varies across specifications and contexts. The mechanism appears to operate across a range of contexts, providing a foundational transparency that may enable other pathways to function. Coefficients reported in individual studies are generally positive and statistically significant, though magnitudes differ across specifications, reflecting differences in disclosure measures and sample composition.

3.2.2. Risk communication

Seven studies examine risk communication as a mechanism, with six reporting statistically significant associations in the expected direction. Kleimeier and Viehs (2016) find that carbon disclosure is associated with lower cost of debt, consistent with effective risk communication reducing perceived climate-related financial risk among lenders and investors. Alsaifi et al. (2022) similarly report associations between carbon disclosure and firm risk measures in the UK context. Kabir et al. (2021) find that higher carbon emissions are associated with greater default risk internationally, suggesting that disclosure of emissions-related information carries risk-relevant content for capital market participants. Across studies, associations tend to be comparatively stronger among high-carbon sector firms, which is broadly consis-

tent with the notion that climate risk materiality shapes investor responses to disclosure, though the degree of difference varies across contexts and specifications.

3.2.3. Signaling mechanisms

Five studies examine signaling as a mechanism through which carbon disclosure may be associated with investor outcomes, with four reporting significant associations. Adhikari and Zhou (2022) find evidence consistent with voluntary carbon disclosure serving a signaling function in the US market, while Alsaifi et al. (2022) report associations between disclosure and firm risk that are partly interpreted through a signaling lens. Connelly et al. (2025) provide theoretical grounding for signaling mechanisms in the context of sustainability disclosure more broadly. Evidence across studies suggests that signaling associations may be comparatively more prominent under voluntary disclosure regimes and among firms with third-party verification, and that these associations may diminish when disclosure becomes mandatory and more standardized. However, given the limited number of studies and variation in how signaling is operationalized, these patterns should be interpreted cautiously.

3.2.4. Legitimacy building

Three studies examine legitimacy building as a mechanism, with all three reporting associations in the expected direction. Li et al. (2018) find that environmental legitimacy considerations are associated with corporate carbon disclosure decisions in the Chinese context, consistent with legitimacy theory predictions. Bose et al. (2025) and Chakraborty and Dey (2025) similarly report patterns consistent with legitimacy motivations shaping disclosure behavior and associated market responses. Reported associations tend to be more modest relative to information asymmetry and risk communication mechanisms, and appear to vary across institutional contexts, with stronger patterns observed in settings with more active environmental advocacy and media attention. Given that only three studies examine this mechanism, conclusions regarding its relative importance should be treated with particular caution.

3.3. Contextual moderators of disclosure effectiveness (RQ2)

Available evidence suggests that contextual factors may interact in ways that shape the observed associations between carbon disclosure and investor responses, though the limited number of studies and variation in research designs make it difficult to draw precise conclusions about the nature or magnitude of these interactions. The narrative that follows presents a descriptive organization of how geographic, regulatory, and sectoral contexts appear to combine across the included studies.

3.3.1. Geographic context

Studies conducted in developed market contexts tend to report comparatively larger associations between carbon disclosure and investor outcomes than studies set in emerging economies. Adhikari and Zhou (2022) and Alsaifi et al. (2022) document associations in the US and UK respectively that appear larger than those reported by Chakraborty and Dey (2025) in the Indian context, though direct comparison is complicated by differences in outcome measures, disclosure proxies, and time periods covered. This pattern is broadly consistent with the notion that more developed financial infrastructure, stronger institutional quality, and greater investor analytical capacity may amplify the decision-usefulness of carbon disclosure, as discussed by Lin and Wu (2023) and Bose et al. (2025). However, caution is warranted in interpreting these cross-study differences as reflecting genuine geographic moderation, given that many other factors differ across these studies simultaneously.

3.3.2. Regulatory regime

Several studies provide evidence suggesting that mandatory disclosure regimes may be associated with comparatively stronger investor responses than voluntary approaches. Connelly et al. (2025) and Adhikari and Zhou (2022) discuss how mandatory requirements may enhance the comparability and credibility of disclosed information, potentially reducing greenwashing concerns and improving investor decision-usefulness. Christensen et al. (2021) provide broader evidence on mandatory CSR and sustainability reporting, noting that

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mandatory regimes tend to improve information quality, though effects depend substantially on implementation design and enforcement capacity. Across the included studies, patterns are broadly consistent with mandatory disclosure being associated with stronger market associations, though the precise differential varies across specifications and contexts and should not be treated as a precise quantitative estimate.

3.3.3. Sectoral characteristics

Studies examining high-carbon sectors, including energy, utilities, transportation, and materials, tend to report comparatively larger associations between carbon disclosure and investor outcomes than studies covering broader or lower-carbon samples. Kleimeier and Viehs (2016) and Kabir et al. (2021) both document associations in international samples that include substantial representation of high-emission industries, and both find that emissions-related disclosure carries meaningful risk information for capital market participants. Bose et al. (2025) similarly find that carbon risk is associated with stock price crash risk in ways that suggest investors in certain sectors price climate-related exposures more prominently. These patterns are broadly consistent with the notion that climate risk materiality shapes the decision-usefulness of disclosure, with high-carbon sector firms facing greater transition and physical risk exposures that investors may find more relevant to asset pricing.

3.3.4. Temporal evolution

Studies covering more recent periods tend to report comparatively larger associations than those covering earlier voluntary disclosure periods, a pattern that is broadly consistent with regulatory acceleration, improved standardization, and growing investor attention to climate risks over time. Cohen et al. (2023) and Connelly et al. (2025) both cover samples extending into the early 2020s and document associations that appear to reflect a more institutionalized disclosure environment. Kaur et al. (2025) similarly find associations between climate risk and stock price informativeness in a context of increasing regulatory and market attention. These temporal patterns should be interpreted cautiously, as studies covering different time periods also differ in other important respects, including geographic coverage, disclosure proxies, and outcome measures.

3.3.5. Context interactions

Cohen et al. (2023) provide suggestive evidence that geographic, regulatory, and sectoral contexts may interact in ways that amplify disclosure associations beyond what any single contextual dimension would predict alone. Their difference-in-differences design, which leverages variation in mandatory disclosure adoption across contexts, provides comparatively stronger causal identification than purely observational panel studies, and their findings suggest that the combination of favorable contextual conditions may generate associations that exceed the sum of individual contextual effects. However, given that direct evidence on context interactions comes from a very small number of studies, these patterns should be understood as preliminary and hypothesis-generating rather than as established findings.

Across the included studies, a descriptive ordering of contexts emerges that is broadly consistent with synergistic amplification. Studies set in developed markets with mandatory disclosure regimes and high-carbon sector samples tend to report the strongest associations between carbon disclosure and investor outcomes, while studies set in emerging markets with voluntary regimes and lower-carbon samples tend to report the most modest associations. Studies falling between these poles, such as those combining developed market location with voluntary disclosure or emerging market location with mandatory requirements, report associations that fall between these two extremes. This ordering is consistent with the notion that each favorable contextual dimension contributes incrementally to disclosure decision-usefulness, and that their combination may generate effects exceeding what any single dimension alone would predict. The dominant mechanisms also appear to shift across context combinations, with risk communication and information asymmetry reduction appearing more prominently in higher-risk mandatory contexts, while signaling and legitimacy mechanisms appear more prominent in voluntary and lower-carbon contexts. These patterns are organized descriptively across

studies by Kleimeier and Viehs (2016), Kabir et al. (2021), Cohen et al. (2023), Connelly et al. (2025), and Chakraborty and Dey (2025), though the heterogeneity across study designs means these patterns should be interpreted as thematic observations rather than precise quantitative conclusions.

3.4. Methodological influences on research findings (RQ3)

Examining findings across methodological quality tiers suggests that research design choices may be associated with the magnitude of reported associations between carbon disclosure and investor outcomes. Rather than presenting these patterns in tabular form with numerical summaries that could imply a precision not warranted by the underlying data, this section organizes observations descriptively across three broad quality tiers identified through the quality assessment process described in the Data extraction and quality assessment subsection of Methods.

3.4.1. Research design quality

Studies employing more rigorous causal identification strategies generally report more conservative, though still positive, associations. Cohen et al. (2023) employ a difference-in-differences design that provides comparatively stronger causal identification than standard observational panel approaches, and their causally identified estimates appear somewhat smaller than correlational panel estimates from comparable contexts. This pattern is consistent with the possibility that purely observational designs may overstate true associations due to incomplete confounding control, though the limited number of quasi-experimental studies in the sample means this inference remains tentative. Kaur et al. (2025) similarly employ a design that disentangles firm-level climate risk from capital market signaling, providing a more nuanced picture of mechanism operation than single-equation observational approaches.

3.4.2. Disclosure measurement

Studies employing multi-dimensional quality indices tend to report comparatively larger associations than those using binary disclosure indicators, a pattern documented across several included studies. Zhang et al. (2025) employ textual analysis to measure the tone, specificity, and forward-looking content of climate risk disclosure, finding that linguistic characteristics of disclosure are associated with investor responses beyond simple disclosure presence or absence. Cohen et al. (2023) and Connelly et al. (2025) similarly find that more granular disclosure measures capture decision-relevant variation that binary indicators may miss. These patterns suggest that disclosure quality dimensions beyond mere presence may matter for investor responses, though the precise magnitude of differences across measurement approaches varies across studies and contexts.

3.4.3. Sample characteristics and control strategy

Studies with larger samples tend to report smaller but more precisely estimated associations, a pattern that is consistent with publication bias in smaller underpowered studies toward larger significant effects. Comprehensive control strategies are associated with more conservative reported associations, though over-controlling for variables that may themselves be mediating mechanisms risks underestimating the total association between disclosure and investor outcomes. Kaur et al. (2025) demonstrate robustness of their findings across multiple specifications, providing some confidence in the stability of their estimates. Across the full sample, findings from larger and more carefully controlled studies provide a comparatively more conservative picture of associations, which is broadly consistent with the reviewer's observation that rigorous designs tend to yield more modest estimates.

Taken together, the pattern across quality tiers suggests a consistent directional relationship between methodological rigor and reported effect magnitude. Studies with the strongest causal identification, largest samples, most sophisticated disclosure measures, and most comprehensive control strategies tend to report associations that are smaller in magnitude but more precisely estimated and more defensible causally. Studies with more basic designs and smaller samples tend to report larger associations that may reflect upward bias from inadequate confounding control and publication pressure toward significant findings.

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This directional pattern is consistent across the included studies regardless of geographic context or disclosure measure used, and provides a meaningful basis for cautious interpretation of the overall body of evidence. Specifically, the more causally credible estimates from quasi-experimental and large-sample panel studies suggest that the true association between carbon disclosure and investor outcomes, while positive and meaningful, is likely more modest than the average of all reported coefficients in the literature would imply. Future research prioritizing stronger causal identification will be important for establishing a more precise picture of the magnitude of these associations.

4. DISCUSSION

4.1. Integrated theoretical framework

This systematic review suggests that carbon disclosure may be associated with investor decision-making through hierarchical and interactive mechanisms rather than isolated pathways. Evidence from the included studies indicates that information asymmetry reduction functions as a foundational mechanism, with Connelly et al. (2025) and Cohen et al. (2023) both reporting that mediation frameworks attribute a substantial portion of total observed associations to this pathway. By providing decision-useful information previously less available to investors, disclosure may enable second-order mechanisms to operate more effectively, including risk communication as documented by Kleimeier and Viehs (2016) and Kabir et al. (2021), and signaling as examined by Adhikari and Zhou (2022) and Alsaifi et al. (2022). Legitimacy building appears to function as a third-order mechanism, primarily shaping disclosure motivation rather than directly generating investor responses, consistent with patterns reported by Li et al. (2018), Bose et al. (2025), and Chakraborty and Dey (2025).

Several studies suggest that mechanism interactions may generate associations exceeding what additive predictions would imply. Cohen et al. (2023) find that high-quality disclosure simultaneously addressing multiple investor information needs is associated with comparatively larger market associations than disclosure addressing single dimensions, which is broadly consistent with the notion that optimal disclosure strategies may benefit from addressing multiple mechanisms concurrently. This hierarchical structure offers one way of organizing apparent contradictions in the prior literature, where studies emphasizing different mechanisms may have been capturing genuine variation in which mechanisms are activated under different contextual conditions rather than reflecting fundamental theoretical disagreements.

A central organizing insight from this synthesis concerns the role of context in shaping which mechanisms appear to activate and how prominently. Geographic context appears to create meaningful differences in observed associations across developed and emerging markets, with studies such as Lin and Wu (2023) and Bose et al. (2025) reporting patterns broadly consistent with infrastructure sophistication and institutional quality influencing disclosure decision-usefulness. Regulatory context appears to shape associations in ways consistent with mandatory regimes improving comparability and reducing greenwashing concerns, as discussed by Christensen et al. (2021) and Connelly et al. (2025). Sectoral context shapes the materiality of climate risks to investors, with high-carbon sector studies such as Kleimeier and Viehs (2016) and Kabir et al. (2021) documenting comparatively larger associations than broader or lower-carbon samples.

These contextual dimensions may interact in ways that amplify associations beyond what single-dimension analyses would suggest, based on the evidence of Cohen et al. (2023) who employ a difference-in-differences design to examine disclosure associations across varying regulatory and sectoral contexts. However, given that direct evidence on multiplicative context interactions derives from very few studies in this sample, this inference remains speculative and should be treated as a hypothesis meriting further investigation rather than an established finding.

Temporal patterns across the included studies are broadly consistent with three loosely distinguishable phases of disclosure evolution. Studies covering earlier voluntary adoption periods tend to report patterns more consistent with signaling dominance, while studies covering more recent

periods of increased regulatory attention tend to report patterns more consistent with information asymmetry reduction and risk communication, as reflected in the findings of Cohen et al. (2023) and Connelly et al. (2025). Kaur et al. (2025) similarly document associations in a context of heightened regulatory and investor attention that appear to reflect a more institutionalized disclosure environment. These temporal patterns are suggestive rather than definitive, given that studies covering different periods also differ in many other respects.

4.2. Practical implications

4.2.1. Policy design principles

Evidence from the included studies offers preliminary support for several principles that may inform mandatory disclosure policy design, though the limited number of studies and heterogeneity across contexts mean these should be treated as indicative rather than definitive guidance.

First, evidence from Christensen et al. (2021) and Connelly et al. (2025) suggests that mandatory disclosure regimes tend to be associated with comparatively stronger investor responses than voluntary approaches, broadly supporting comprehensive mandates as a policy direction. However, Christensen et al. (2021) also caution that mandatory reporting effects depend substantially on implementation design and enforcement capacity, suggesting that rapid implementation without adequate capacity building may not generate anticipated benefits. Graduated implementation beginning with larger high-carbon firms where climate risks are most material may help balance comprehensiveness with feasibility.

Second, findings from Cohen et al. (2023) and Connelly et al. (2025) suggest that standardized disclosure frameworks are associated with larger investor responses than firm-specific approaches, broadly consistent with comparability benefits enhancing decision-usefulness. Securities and Exchange Commission (2024) mandatory climate disclosure rules reflect this principle in practice. Policy design may benefit from establishing clear minimum standards while allowing firms reasonable flexibility in measurement and contextualization, balancing standardization benefits with practical implementation constraints.

Third, Adhikari and Zhou (2022) and Alsaifi et al. (2022) both find that verified disclosure is associated with comparatively stronger investor responses than unverified disclosure, consistent with third-party assurance enhancing credibility and investor confidence. This pattern supports policy requirements for mandatory verification, though the appropriate level of assurance and associated compliance costs require careful consideration in policy design.

Fourth, Kleimeier and Viehs (2016), Kabir et al. (2021), and Bose et al. (2025) collectively suggest that climate risk information is comparatively more decision-relevant for investors in high-carbon sectors, broadly supporting differentiated disclosure requirements calibrated to sectoral materiality. Policy frameworks requiring enhanced Scope 1 through Scope 3 disclosure from energy, utilities, transportation, and materials sectors may generate comparatively greater investor information benefits than uniform requirements applied regardless of climate risk exposure.

Fifth, the comparatively smaller associations documented in emerging market studies, such as Chakraborty and Dey (2025), relative to developed market counterparts, may reflect capacity constraints rather than fundamental ineffectiveness of disclosure in these contexts. Lin and Wu (2023) discuss institutional factors that may limit disclosure decision-usefulness in emerging economies, suggesting that international policy initiatives supporting technical assistance and capacity building could help narrow observed effectiveness differentials over time.

4.2.2. Corporate strategy guidance

Evidence from the included studies offers several observations that may inform corporate disclosure strategies, though the diversity of contexts and designs across studies means these should be adapted to firm-specific circumstances rather than applied uniformly.

For firms in high-carbon sectors, findings from Kleimeier and Viehs (2016), Kabir et al. (2021), and Bose et al. (2025) collectively suggest that risk communication through comprehensive transition and physical risk disclosure may be particu-

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larly associated with investor responses, given the comparatively greater materiality of climate risks in these industries. Bratten and Cheng (2025) find that managers' climate risk disclosures in conference calls carry information content for investors, suggesting that disclosure across multiple communication channels beyond formal reports may also be relevant. Forward-looking content including emissions reduction targets and transition strategies appears to carry particular decision-relevance based on findings from Feng et al. (2024) and Dai and Sun (2025).

For firms in lower-carbon sectors, findings from Adhikari and Zhou (2022) and Connelly et al. (2025) suggest that signaling and legitimacy mechanisms may be comparatively more prominent, with voluntary disclosure exceeding minimum requirements and supported by third-party verification, potentially generating reputational and valuation benefits. Wang et al. (2023) caution that CSR report quality and readability matter for how investors process disclosed information, suggesting attention to disclosure quality dimensions beyond mere comprehensiveness.

For multinationals operating across jurisdictions with varying regulatory requirements, the pattern of larger associations under mandatory regimes documented by Christensen et al. (2021) and Connelly et al. (2025) broadly supports adopting globally consistent disclosure at higher standards rather than minimum compliance per jurisdiction. Investors increasingly operate across borders and may apply consistent analytical frameworks regardless of local requirements, suggesting that differential disclosure across jurisdictions could attract scrutiny or skepticism.

Across firm types and contexts, evidence from Cohen et al. (2023), Connelly et al. (2025), and Zhang et al. (2025) collectively suggests that disclosure quality dimensions including comprehensiveness, specificity, forward-looking content, and third-party verification are associated with comparatively stronger investor responses than binary disclosure presence alone. Luo and Pan (2025) find that voluntary carbon assurance is associated with improved investment efficiency internationally, further supporting the value of quality enhancements beyond minimum compliance. Firms seeking to maximize the decision-usefulness of their disclosure may benefit from framework alignment with established standards such as CDP, TCFD, and ISSB, integration of climate information into strategic planning communications, and explicit articulation of board oversight and risk governance arrangements.

4.2.3. Investment integration framework

Evidence from the included studies offers preliminary observations that may inform how institutional investors integrate carbon disclosure into investment processes, though the diversity of contexts and designs across studies means these observations should be adapted to specific investment mandates and contexts.

Bauer et al. (2021) and Hartzmark and Sussman (2019) document that individual and institutional investors increasingly express preferences for sustainable investments, providing demand-side context for why carbon disclosure may carry investment relevance beyond pure financial risk considerations. Krueger et al. (2020) find that institutional investors consider climate risks important and are increasingly incorporating them into investment analysis, though approaches vary considerably across investor types and mandates.

For investment quality assessment, findings from Cohen et al. (2023), Connelly et al. (2025), and Zhang et al. (2025) collectively suggest that multidimensional evaluation of disclosure quality, capturing comprehensiveness, verification status, framework alignment, forward-looking content, and contextual integration, may capture more decision-relevant variation than binary disclosure indicators. Dai and Sun (2025) find that carbon emissions disclosure is associated with stock price informativeness, suggesting that high-quality disclosure may improve price efficiency in ways relevant to investment analysis. Kaur et al. (2025) similarly find associations between firm-level climate risk and capital market signaling that suggest disclosure quality dimensions matter for how markets process climate information.

For context-calibrated interpretation, the geographic, regulatory, and sectoral patterns documented across the included studies suggest that

investors may benefit from adjusting expectations about disclosure reliability and decision-relevance based on the contexts in which firms operate. Disclosure from firms in developed markets, mandatory regulatory environments, and high-carbon sectors appears to carry comparatively stronger associations with investor outcomes across the included studies, which may inform how analysts weigh disclosed information in different contexts. Li et al. (2025) find that environmental information disclosure value varies with policy context in China, further illustrating how regulatory environment shapes disclosure decision-usefulness.

For mechanism-specific strategies, the distinction between information asymmetry reduction, risk communication, and signaling mechanisms documented across the included studies suggests that different disclosure dimensions may be relevant for different investment decisions. For high-carbon firms, risk communication content, including transition risk exposure, physical risk assessment, and strategic responses, may be most relevant to asset pricing and risk management applications. For lower-carbon firms and emerging market contexts, governance signals and legitimacy indicators embedded in disclosure may carry comparatively greater relevance. Garel and Petit-Romec (2021) find that environmental responsibility was associated with investor rewards during the COVID-19 crisis, suggesting that disclosure quality dimensions related to environmental commitment may carry option-like value during periods of market stress that extends beyond normal market conditions.

4.3. Limitations and future research

This review acknowledges several important limitations that bound the conclusions that can appropriately be drawn from the synthesis. The small final sample of ten studies substantially limits the precision of moderator analyses and restricts geographic and sectoral coverage, with concentration in developed markets and China potentially limiting generalizability to other emerging economy contexts. Seven of the ten included studies rely on observational panel designs that permit only moderate causal inference, and findings from the more rigorous quasi-experimental studies, such as Cohen et al. (2023), suggest that purely observational estimates may overstate true associations to some degree. Boundary conditions around publicly traded firms limit the extension of findings to private companies, small and medium enterprises, and sectors with limited listed firm representation. Quality assessment based on expert judgment rather than standardized scales introduces potential subjectivity, and different assessors might reach somewhat different conclusions about quality tier assignments.

Additional limitations include the potential for publication bias toward significant positive findings in the included studies, which may mean that the synthesis overstates the prevalence and consistency of positive disclosure associations. Substantial heterogeneity in disclosure measurement approaches across studies, ranging from binary CDP participation indicators to sophisticated textual analysis measures, complicates the interpretation of cross-study patterns and limits confidence in conclusions about which disclosure dimensions matter most. Access barriers prevented inclusion of ten potentially relevant studies, which may have meaningfully altered synthesis conclusions if those studies reported different findings from the included sample.

Several priority research directions emerge from these limitations. First, mechanism interactions merit direct investigation through structural equation modeling or mediation analysis, examining how information asymmetry reduction may amplify other pathways and whether threshold effects exist for minimum disclosure quality, building on Connelly et al. (2025) and Cohen et al. (2023). Second, emerging market dynamics deserve substantially more research attention to identify which institutional factors drive effectiveness differentials relative to developed markets and to design capacity-building interventions that could improve disclosure decision-usefulness, extending beyond the single emerging market study of Chakraborty and Dey (2025) included here. Third, extension to private companies and small and medium enterprises would address important boundary conditions, potentially examining supply chain disclosure pressures as documented by Flammer et al. (2021) in the context of shareholder activism. Fourth, Scope 3 emissions disclosure represents an important frontier requiring deeper

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analysis of investor utilization patterns and cascading effects along supply chains, given growing regulatory requirements in this area as reflected in Securities and Exchange Commission (2024). Fifth, forward-looking scenario analysis disclosure requires investigation of how investors utilize this information and what practices enhance decision-usefulness, building on preliminary evidence from Bratten and Cheng (2025) and Feng et al. (2024).

Methodologically, future research should prioritize stronger causal identification through natural experiments exploiting staggered mandatory disclosure adoption across jurisdictions, regression discontinuity designs around regulatory thresholds, and synthetic control methods that can construct credible counterfactuals, extending the quasi-experimental approach of Cohen et al. (2023). Machine learning applications offer promise for automated quality assessment of large disclosure corpora and greenwashing detection at scale, building on the textual analysis approach of Zhang et al. (2025). Experimental and survey methods can complement observational evidence by isolating specific mechanisms and measuring investor responses to carefully varied disclosure stimuli in controlled settings, providing causal evidence that observational designs cannot readily supply. International comparative designs examining the same disclosure policy changes across multiple jurisdictions would help disentangle geographic moderation from other confounding factors that differ across the studies currently available.

CONCLUSION

This systematic review examined how carbon disclosure is associated with investor decision-making through distinct mechanisms, how contextual factors shape these associations, and how methodological choices relate to observed findings. Evidence from ten empirical studies suggests that information asymmetry reduction, risk communication, signaling, and legitimacy building represent theoretically coherent pathways through which disclosure may influence investor responses, with information asymmetry reduction and risk communication appearing as comparatively prominent mechanisms across the included studies. Contextual factors, including geographic location, regulatory regime, sectoral characteristics, and temporal period, appear to shape the strength of these associations meaningfully, with developed markets, mandatory regimes, and high-carbon sectors consistently associated with comparatively stronger disclosure effects. Methodological rigor systematically relates to reported effect magnitude, with quasi-experimental designs yielding more conservative and causally credible estimates than observational approaches. These findings suggest that carbon disclosure meaningfully supports investor decision-making when disclosure quality is high, institutional contexts are conducive, and regulatory frameworks mandate standardized and verified reporting, pointing to the importance of coordinated progress across policy design, corporate practice, and investor analytical capacity to realize the full potential of carbon disclosure as infrastructure for climate-aligned capital allocation.

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