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The Effectiveness of Carbon Taxes in Reducing Carbon Emissions: A Systematic Literature Review

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A R T I C L E I N F O

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A B S T R A C T

This systematic literature review examines the effectiveness of carbon taxes in reducing national and cross-country carbon emissions. Using PRISMA 2020, 11 Scopus-indexed journal articles published between 2015 and 2026 were selected from 119 records and synthesized qualitatively. The findings show that carbon taxes can reduce emissions, but their effectiveness depends on revenue recycling, tax rates, sectoral coverage, exemptions, economic structure, trade exposure, and emissions accounting. The review also highlights the limited availability of ex post evidence, as existing studies remain dominated by CGE, GTAP, and scenario-based models.

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INTRODUCTION

Climate change is a defining policy challenge for contemporary economies because it affects environmental sustainability, fiscal resilience, production systems, social welfare, and long-term development. International mitigation assessments emphasize that deep and sustained reductions in greenhouse gas emissions are necessary to align economic activity with global temperature goals (Intergovernmental Panel on Climate Change [IPCC], 2022). Carbon dioxide emissions are especially central to this debate because they are closely connected with fossil-fuel-based energy use, industrial production, transportation, trade, and consumption.

Carbon pricing has therefore become a major instrument in climate policy. Among carbon pricing instruments, carbon taxes are widely discussed because they apply an explicit price to carbon-intensive activities and create incentives for firms and households to reduce emissions, improve energy efficiency, substitute toward cleaner energy sources, or invest in low-carbon technologies. In economic terms, a carbon tax follows the Pigouvian logic of internalizing a negative externality: when emitters pay for part of the social cost of emissions, private decisions become more closely aligned with social welfare (OECD, 2023).

Despite this strong theoretical rationale, the practical effectiveness of carbon taxes remains a contested empirical question. A tax may be introduced, but its impact on emissions depends on how the policy is designed, which sectors are covered, whether exemptions are granted, how revenues are used, how firms pass costs through to prices, how consumers respond, and whether production relocates through international trade. Recent evidence on carbon pricing suggests that implemented policies can reduce emissions, but the magnitude of reduction varies across contexts and policy designs (Döbbeling-Hildebrandt et al., 2024; Khan & Johansson, 2022).

The existing literature is broad but uneven. Some studies examine carbon pricing as a general category that combines carbon taxes with emissions trading systems. Other studies focus on firm-level, household-level, or sector-specific outcomes rather than national or cross-country emission effects. A further group of studies relies on simulations of potential policies rather than observed ex post evidence. These contributions are valuable, but they create difficulty for readers who want to understand the specific effectiveness of carbon taxes as national fiscal-climate instruments.

This article addresses that gap through a systematic literature review focused on the effectiveness of carbon taxes in reducing carbon emissions at the national and cross-country levels. The review is deliberately narrow. It focuses on Scopus-indexed journal articles published from 2015 to 2026 within Business, Management, and Accounting, and it includes only studies that explicitly examine carbon taxes or closely comparable carbon-tax mechanisms and assess emissions-related outcomes. By applying this narrow scope, the article aims to isolate carbon tax from broader carbon pricing debates and to synthesize the policy conditions under which carbon taxes appear more or less effective.

The review is guided by three research questions. RQ1 asks: To what extent have carbon taxes been effective in reducing carbon emissions at the national or

cross-country level? RQ2 asks: What factors influence the effectiveness of carbon taxes across countries? RQ3 asks: What methodological approaches, variables, and research gaps characterize the literature on carbon tax effectiveness? The article contributes to the literature by providing a transparent selection process, a study-quality appraisal, and a thematic synthesis of the determinants that shape carbon tax performance.

LITERATURE REVIEW

Carbon Tax as a Fiscal-Climate Instrument

Carbon tax is widely recognized as a market-based climate policy instrument because it prices the negative externality associated with carbon emissions and, in doing so, encourages lower-carbon production and consumption decisions. In theoretical terms, this mechanism is closely linked to the Pigouvian principle that taxation can align private decisions with social costs (Goulder, 1995; OECD, 2023; Timilsina, 2022). By increasing the relative cost of carbon-intensive goods and activities, carbon tax is expected to promote energy efficiency, fuel substitution, and low-carbon technological transition.

However, the literature also makes clear that carbon tax effectiveness cannot be explained by the price mechanism alone. Actual outcomes depend on tax coverage, exemption rules, revenue use, administrative capacity, and the structure of the domestic economy (Khan & Johansson, 2022; Köppl & Schratzenstaller, 2023). This means that carbon tax should be understood not simply as a fiscal penalty on emissions, but as a broader climate-fiscal instrument whose performance depends on how it is embedded in the surrounding policy system.

What Determines the Effectiveness of Carbon Tax?

The empirical literature generally supports the argument that carbon tax can reduce emissions, but it also shows that effectiveness varies across countries and policy settings. Ex-post and comparative evidence suggests that carbon pricing can generate meaningful emission reductions, although the magnitude of these effects is uneven across jurisdictions (Andersson, 2019; Döbbeling-Hildebrandt et al., 2024; Green, 2021; Kumar, 2024). The same conditional pattern appears in country-level studies. In South Africa, China, Chile, Egypt, Indonesia, and Morocco, carbon tax is generally found to contribute to emission reduction, but the strength of the effect depends on tax design, economic structure, trade exposure, and complementary policy measures (Ait Faraji & Zaoujal, 2025; Eldeep et al., 2025; O'Ryan et al., 2023; Ramadhani & Koo, 2022; Van Heerden et al., 2016; Zhang et al., 2017; Zhu et al., 2020).

Three determinants are especially recurrent in the literature. First, revenue recycling shapes both macroeconomic costs and political feasibility. Studies from South Africa, China, Chile, and Morocco show that the environmental and economic effects of carbon tax are strongly influenced by whether revenues are used for compensation, tax reduction, clean-energy support, or broader fiscal stabilization (Ait Faraji & Zaoujal, 2025; O'Ryan et al., 2023; Van Heerden et al., 2016; Zhang et al., 2017). Second, policy design matters more than nominal

adoption alone. Tax rate, sectoral coverage, exemptions, and coordination with other carbon-pricing instruments influence whether the price signal is strong enough to change emissions behavior (Chai et al., 2023; Känzig & Konradt, 2024; Metcalf & Stock, 2023). Third, trade exposure and leakage complicate the interpretation of effectiveness. Carbon taxes may reduce territorial emissions while leaving consumption-based emissions relatively unchanged if carbon-intensive production is displaced through imports and global value chains (Ramadhani & Koo, 2022; Schroeder & Stracca, 2025; Zhu et al., 2020).

Methodological Pattern and Research Gap

Although the literature on carbon tax effectiveness has grown substantially, it remains methodologically uneven. Most studies rely on ex ante modelling approaches, particularly dynamic computable general equilibrium (CGE), GTAP-E, and scenario-based hybrid models, which are highly useful for exploring policy pathways and estimating economy-wide trade-offs under specified assumptions (Ait Faraji & Zaoujal, 2025; Chai et al., 2023; Eldeep et al., 2025; O'Ryan et al., 2023; Ramadhani & Koo, 2022; Van Heerden et al., 2016; Zhang et al., 2017; Zhu et al., 2020). By contrast, ex-post and comparative empirical studies remain relatively fewer, even though they are crucial for understanding how carbon tax performs after implementation in real policy environments (Andersson, 2019; Green, 2021; Känzig & Konradt, 2024; Kumar, 2024; Schroeder & Stracca, 2025).

This imbalance creates an important research gap. First, many studies examine carbon pricing broadly and do not always isolate carbon tax from emissions trading systems or other environmental fiscal instruments. Second, much of the literature remains simulation-based rather than observational. Third, determinants such as revenue recycling, competitiveness, leakage, and distributional consequences are often examined separately rather than synthesized within a single integrated framework. Accordingly, there remains a clear need for a focused systematic literature review that synthesizes the national and cross-country evidence on carbon tax effectiveness while also identifying the policy conditions and methodological limitations that shape current knowledge.

Table 1. Summary of Previous Literature and Research Gap

Study / Stream of Literature	Main Focus	Limitation in Existing Literature	Contribution of This Study
Green (2021)	Ex post evidence on carbon pricing effectiveness.	Discusses carbon pricing broadly and does not isolate carbon tax as the central fiscal-climate instrument.	Focuses specifically on carbon tax effectiveness at national and cross-country levels.
Timilsina (2022)	Theoretical and empirical discussion of carbon tax design.	Provides a broad review of carbon taxation but is not structured as a PRISMA-based SLR	Applies a transparent PRISMA 2020 procedure and structured quality appraisal.

		with explicit screening criteria.	
Köppl and Schratzenstaller (2023)	Carbon taxation, macroeconomic effects, and policy design.	Gives important policy synthesis but does not systematically compare national and developing-country evidence.	Synthesizes country-specific and comparative evidence, including developing-country cases.
Döbbeling-Hildebrandt et al. (2024)	Evidence on carbon pricing and emission reduction.	Combines different carbon pricing instruments, including emissions trading systems and carbon taxes.	Separates carbon tax and closely comparable carbon-tax mechanisms from broader carbon-pricing debates.
Current study	Carbon tax effectiveness in reducing carbon emissions.	-	Identifies conditional determinants of effectiveness: revenue recycling, policy design, trade exposure, leakage, distributional consequences, and evidence type.

Overall, the literature suggests that carbon tax effectiveness is shaped less by the formal existence of the tax than by the interaction between fiscal design, trade exposure, and institutional capacity. Across both developed and developing countries, studies consistently indicate that revenue recycling and sectoral coverage determine whether carbon taxation produces meaningful emission reductions without excessive macroeconomic or distributive costs. At the same time, the literature reveals divergence regarding leakage effects, consumption-based emissions, and long-term political feasibility. This indicates that carbon tax should be evaluated not merely as a price instrument, but as a policy package whose effectiveness depends on how the tax is implemented, how revenues are used, and how the policy interacts with trade, energy systems, and vulnerable groups.

METHODOLOGY

Review design

This study adopts a systematic literature review approach informed by PRISMA 2020 (Page et al., 2021). PRISMA was used to structure the identification, screening, eligibility assessment, and inclusion of studies. Because the final studies were heterogeneous in country coverage, modelling assumptions, emission indicators, and policy scenarios, the review employed qualitative thematic synthesis rather than meta-analysis.

Database, search strategy, and filters

The literature search was conducted in Scopus because the review sought peer-reviewed journal articles with international indexing and consistent bibliographic metadata. The search covered publications from 1 January 2015 to 1 April 2026. The review focused on the Scopus subject area of Business, Management, and Accounting in order to capture studies that treat carbon tax as a fiscal, economic, managerial, or policy instrument rather than as a purely technical energy or engineering issue.

The search was built around three concepts: the policy instrument, the emissions outcome, and the national or cross-country level of analysis. The search string was applied to title, abstract, and keywords as follows: TITLE-ABS-KEY (("carbon tax" OR "carbon taxation" OR "carbon levy") AND ("carbon emission*" OR "CO2 emission*" OR "carbon dioxide emission*" OR emissions) AND (country OR countries OR national OR nationwide OR "country-level" OR "national-level" OR "cross-country")). Filters were then applied for English language, article document type, journal source type, the selected subject area, and the specified publication period. The search retrieved 119 records.

Screening and eligibility

The screening process followed two stages. First, titles and abstracts were assessed against the inclusion and exclusion criteria. Second, full texts were assessed to determine whether each article directly examined carbon tax effectiveness in relation to emissions outcomes at the national or cross-country level. Articles that discussed environmental taxes or carbon pricing only in broad terms were retained only when the carbon tax component was sufficiently explicit for synthesis.

Data extraction and synthesis

For each included study, information was extracted on author, year, country or region, method, policy scenario, emission indicator, principal findings, policy design factors, and limitations. The extracted evidence was organized into thematic categories: overall effectiveness, revenue recycling, policy design, trade exposure and carbon leakage, distributional consequences, and methodological approach. Because the included studies used different models, datasets, policy assumptions, and outcome measures, statistical aggregation was not appropriate. The synthesis therefore emphasizes patterns of convergence and divergence across studies.

Quality appraisal

A simple quality appraisal was conducted to improve transparency. Each included study was assessed using five criteria: topic relevance, methodological transparency, clarity of the emissions indicator, clarity of policy-design assumptions, and reporting of limitations or robustness concerns. Each criterion was scored from 0 to 2, producing a maximum score of 10. Studies scoring 8 to 10 were classified as high quality, 5 to 7 as moderate quality, and below 5 as low

quality. The appraisal was not used to exclude studies from the final synthesis; rather, it was used to interpret the strength of evidence.

Table 2. Search strategy and review filters

Element	Description
Database	Scopus
Search field	Title, abstract, and keywords (TITLE-ABS-KEY)
Core search string	(("carbon tax" OR "carbon taxation" OR "carbon levy") AND ("carbon emission*" OR "CO2 emission*" OR "carbon dioxide emission*" OR "greenhouse gas emission*" OR "GHG emission*") AND ("country" OR "national" OR "cross-country" OR "economy-wide" OR "general equilibrium"))
Publication period	1 January 2015 to 1 April 2026
Document and source type	Journal articles only
Language	English
Subject area	Business, Management, and Accounting
Records identified	119

Table 3. Inclusion and exclusion criteria

Criterion	Inclusion criteria	Exclusion criteria
Database and source	Scopus-indexed journal article	Non-Scopus source, non-journal item, book chapter, editorial, note, or conference paper
Publication period	Published between 1 January 2015 and 1 April 2026	Published outside the specified period
Language	English	Non-English publication
Policy focus	Explicit focus on carbon tax, carbon taxation, or carbon levy	General environmental tax or carbon pricing without clear carbon-tax component
Outcome focus	Assesses CO2, carbon, or greenhouse gas emissions	No emissions-related outcome
Unit of analysis	National, economy-wide, country-level, or cross-country evidence	Primarily firm, household, city, or narrow sector level without national relevance
Evidence type	Empirical, modelling, simulation, or scenario-based evaluation of effects	Purely conceptual, descriptive, or normative policy discussion
Accessibility	Full text accessible for eligibility assessment	Full text not accessible

RESEARCH RESULT

Study selection

The initial Scopus search identified 119 records. Because the records were retrieved from a single database, no duplicates were removed. All 119 records were screened by title and abstract, and 98 were excluded because they did not directly address carbon tax effectiveness, did not assess emissions outcomes, were outside the national or cross-country scope, or focused on broader carbon pricing without sufficient carbon-tax specificity. Twenty-one reports were sought for retrieval, one of which was not accessible in full text. The remaining 20 full-text reports were assessed for eligibility. Nine reports were excluded because they were primarily conceptual, lacked primary evaluative evidence, focused on non-national units of analysis, or did not isolate the carbon tax mechanism sufficiently. The final evidence base consisted of 11 journal articles.

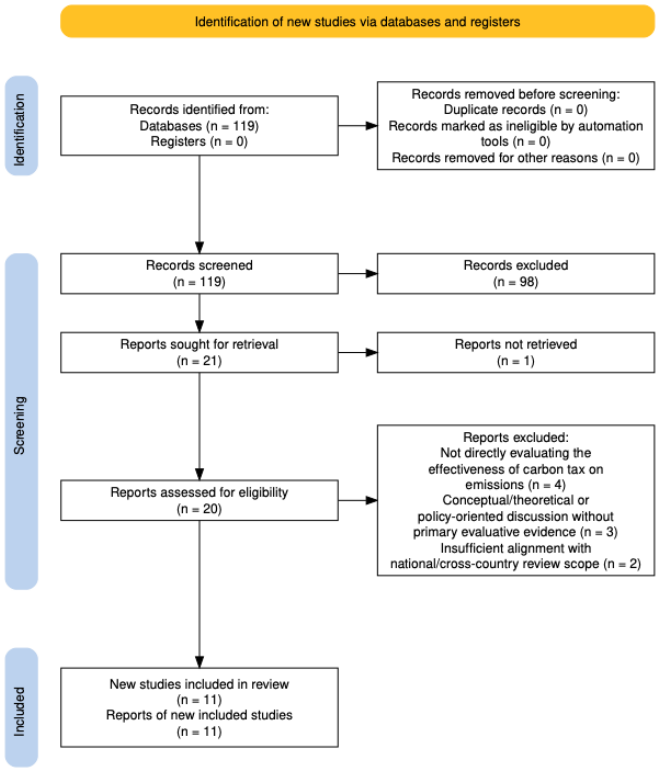

Figure 1. PRISMA 2020 flow diagram of study selection.

Descriptive profile of the included studies

The final set of studies covered both country-specific and comparative contexts. Country-level studies focused on South Africa, China, Indonesia, Chile, Egypt, and Morocco. Comparative studies examined Europe or cross-country datasets. The publication years ranged from 2016 to 2025, with a concentration of recent studies after 2022. This pattern suggests that carbon tax effectiveness has become increasingly connected to debates on net-zero transition, border carbon adjustment, fiscal reform, and trade competitiveness.

The included literature is methodologically diverse but dominated by model-based approaches. Dynamic computable general equilibrium models, multi-country CGE models, GTAP-E simulations, WITCH scenario modelling, and other general equilibrium frameworks account for most of the evidence base. A smaller number of studies use international panel analysis or panel local

projections. As a result, the literature is stronger in projecting possible effects under specified assumptions than in establishing long-term observed effects after implementation.

Table 4. Characteristics of the included studies

Study	Context	Method	Main finding
Van Heerden et al. (2016)	South Africa	Dynamic CGE	Carbon tax reduces GHG emissions, but GDP and emissions outcomes depend on exemptions and revenue recycling.
Zhang et al. (2017)	China	Multi-country CGE	Integrated policy mixes using revenue recycling improve cost-effectiveness and emissions performance relative to carbon tax alone.
Zhu et al. (2020)	China	GTAP-E simulation	A differentiated domestic carbon tax can reduce emissions while limiting welfare and GDP losses under carbon tariff pressure.
Ramadhani and Koo (2022)	Indonesia	Multi-region CGE / GTAP-E	A low domestic carbon tax can partly mitigate adverse trade and economic effects of border carbon adjustment.
Chai et al. (2023)	China	WITCH scenario model	Carbon tax contributes to mitigation goals, but policy mixes create different trade-offs between emission reduction and economic cost.
O'Ryan et al. (2023)	Chile	Dynamic CGE	Carbon tax can support NDC-related targets, but feasibility depends on economy-wide, sectoral, and distributive impacts.
Kumar (2024)	Cross-country	International panel analysis	Carbon tax initiatives show a statistically significant negative association with per capita CO2 emissions.
Kaenzig and Konradt (2024)	Europe	Comparative empirical analysis	Carbon taxes and the EU carbon market reduce emissions, but economic costs differ across instruments.
Eldeep et al. (2025)	Egypt	Dynamic CGE	Carbon tax is more effective than energy subsidy removal in reducing CO2 emissions, with important gender and distributional effects.
Ait Faraji and Zaoujal (2025)	Morocco	Dynamic CGE	Carbon tax effectiveness depends on recycling design and interaction with regional trade liberalization.
Schroeder and Stracca (2025)	Cross-country	Panel local projections	Carbon taxes reduce territorial emissions but not consumption-based emissions, highlighting leakage risks.

Overall evidence on effectiveness

The reviewed studies generally support the claim that carbon taxes can reduce emissions, but they do not support the stronger claim that carbon taxes are always effective regardless of design. In South Africa, Van Heerden et al.,

(2016) show that carbon taxation can produce substantial greenhouse gas emission reductions, but the economic and environmental outcomes depend heavily on exemption schedules and revenue recycling. In China, Zhang et al., (2017), Zhu et al., (2020), and Chai et al., (2023) demonstrate that carbon taxation can support mitigation goals, but its performance depends on competitiveness effects, carbon leakage, policy mixes, and whether revenues are used to support clean energy or reduce other taxes.

The developing-country cases show the same conditional pattern. Ramadhani & Koo, (2022) find that a domestic carbon tax can mitigate some trade distortions created by border carbon adjustment in Indonesia. O'Ryan et al., (2023) show that a carbon tax can support Chile's mitigation targets, but policy feasibility depends on economy-wide, sectoral, and distributive trade-offs. Eldeep et al., (2025) find that carbon taxation is more effective than energy subsidy removal in reducing CO2 emissions in Egypt, while also producing distributional and gendered consequences. Ait Faraji & Zaoujal, (2025) show that carbon taxation in Morocco can reduce emissions, but its broader economic performance depends on the design of fiscal recycling and regional trade policy.

Comparative studies reinforce this conclusion. Kumar, (2024) reports a statistically significant negative relationship between carbon tax initiatives and per capita CO2 emissions in an international dataset. Känzig & Konradt, (2024) show that European carbon pricing initiatives, including national carbon taxes, have reduced emissions, although the macroeconomic costs differ between carbon taxes and emissions trading. Schroeder & Stracca, (2025) add an important qualification: national carbon taxes reduce territorial emissions over time, but they do not significantly reduce consumption-based emissions. This finding suggests that effectiveness depends partly on how emissions are measured and whether trade-mediated leakage is considered.

Quality appraisal results

The quality appraisal indicates that most included studies provide moderate to high-quality evidence for the purpose of this review. Higher-scoring studies tend to have clear policy scenarios, transparent modelling or econometric methods, explicit emissions indicators, and direct relevance to carbon tax effectiveness. Moderate-scoring studies remain useful but require more cautious interpretation, usually because they rely on simulation assumptions, have limited robustness discussion, or focus on carbon pricing designs that partially overlap with carbon taxes.

Table 5. Quality appraisal of included studies

Study	Rel.	Meth.	Ind.	Design	Limit.	Total	Rating
Van Heerden et al. (2016)	2	2	2	1	1	8	High
Zhang et al. (2017)	2	2	2	2	1	9	High
Zhu et al. (2020)	2	1	2	2	1	8	High
Ramadhani and Koo (2022)	2	2	1	2	1	8	High
Chai et al. (2023)	2	2	2	2	1	9	High
O'Ryan et al. (2023)	2	2	2	2	1	9	High

Study	Rel.	Meth.	Ind.	Design	Limit.	Total	Rating
Kumar (2024)	2	1	2	1	1	7	Moderate
Känzig and Konradt (2024)	2	2	2	2	1	9	High
Eldeep et al. (2025)	2	2	2	2	1	9	High
Ait Faraji and Zaoujal (2025)	2	1	2	2	1	8	High
Schroeder and Stracca (2025)	2	2	2	2	2	10	High

Note. Criteria: relevance, method transparency, emissions indicator clarity, policy-design clarity, and limitation/robustness reporting. Each criterion was scored 0-2. Total score: 8-10 = high; 5-7 = moderate; below 5 = low.

Thematic determinants of effectiveness

Across the evidence base, five determinants recur most frequently. First, revenue recycling affects both emissions outcomes and macroeconomic costs. Second, policy design matters: tax rates, exemptions, coverage, and complementary measures influence effectiveness more than nominal adoption alone. Third, trade openness and leakage can weaken the global mitigation effect of national carbon taxes. Fourth, distributional consequences shape political feasibility and long-term durability. Fifth, methodological approach affects the interpretation of evidence because simulation-based studies estimate potential outcomes under assumptions, while ex post econometric studies estimate observed associations or causal effects after policy introduction.

Table 6. Main determinants of carbon tax effectiveness

Determinant	Role in effectiveness	Supporting studies
Revenue recycling	Determines whether carbon-tax revenue reduces macroeconomic costs, supports clean investment, compensates households, or improves acceptability.	Van Heerden et al. (2016); Zhang et al. (2017); Ait Faraji and Zaoujal (2025)
Policy design	Tax rate, coverage, exemptions, escalation path, and complementary instruments shape the strength of the price signal.	Chai et al. (2023); O'Ryan et al. (2023); Känzig and Konradt (2024)
Trade exposure and leakage	Open economies may reduce territorial emissions while shifting embodied emissions through imports and production relocation.	Ramadhani and Koo (2022); Zhu et al. (2020); Schroeder and Stracca (2025)
Distributional design	Household, gender, sectoral, and regional impacts influence political feasibility and long-term durability.	Eldeep et al. (2025); O'Ryan et al. (2023); Ait Faraji and Zaoujal (2025)
Evidence type	Simulation-based evidence estimates potential effects under assumptions; ex post evidence is still comparatively limited.	Kumar (2024); Känzig and Konradt (2024); Schroeder and Stracca (2025)

DISCUSSION

Carbon Tax Effectiveness as a Conditional Policy Outcome

The reviewed literature supports the conclusion that carbon tax can reduce emissions, but only under specific policy and institutional conditions. In theoretical terms, this finding is consistent with the Pigouvian view that pricing

carbon internalizes the social cost of emissions and alters relative prices in favor of lower-carbon production and consumption choices (Goulder, 1995; Timilsina, 2022). Ex-post evidence also points in the same direction. Andersson, (2019), using a quasi-experimental design for Sweden, finds that carbon taxation reduced transport-related CO_2 emissions by almost 11%, while Green, (2021) shows that most ex-post studies identify positive but heterogeneous emission-reduction effects. The same pattern appears in the more recent literature reviewed here. Kumar (2024) finds a statistically significant negative association between carbon pricing initiatives and per capita CO_2 emissions, while Känzig and Konradt (2024) show that both carbon taxes and the European carbon market reduce emissions, albeit with different macroeconomic consequences. At the country level, studies on South Africa, Chile, China, Egypt, Indonesia, and Morocco likewise indicate that carbon tax can contribute to emission reduction, but the magnitude of the effect depends heavily on design features, domestic structure, and implementation context (Ait Faraji & Zaoujal, 2025; Eldeep et al., 2025; O'Ryan et al., 2023; Van Heerden et al., 2016; Zhang et al., 2017; Zhu et al., 2020). Taken together, the literature suggests that carbon tax is not a universally self-executing instrument; rather, it is an effective but conditional policy mechanism.

Revenue Recycling and the Double Dividend Problem

A second major finding concerns the importance of revenue recycling, which directly connects the reviewed evidence with the *double dividend* hypothesis. Theoretically, carbon taxation may generate a first dividend through lower emissions and a second dividend if revenues are used to reduce distortionary taxes, fund low-carbon investment, or protect vulnerable households (Goulder, 1995; Timilsina, 2022). Recent empirical reviews also suggest that carbon taxes can reduce emissions without necessarily harming growth or employment when recycling is appropriately designed (Köppl & Schratzenstaller, 2023; Metcalf & Stock, 2023). The studies included in this SLR strongly reinforce that point. In South Africa, Van Heerden et al. (2016) show that carbon tax can reduce greenhouse gas emissions substantially, but the size of the GDP loss depends on how revenues are recycled. In China, Zhang et al. (2017) demonstrate that recycling carbon tax revenue through capital tax reduction or clean-energy support improves both cost-effectiveness and environmental performance relative to carbon tax alone. In Morocco, Ait Faraji and Zaoujal (2025) also show that alternative recycling schemes produce different combinations of emissions reduction, fiscal sustainability, and trade competitiveness. This suggests that the environmental performance of carbon tax cannot be separated from the fiscal strategy attached to it. Revenue use is not a secondary implementation detail but one of the core determinants of overall effectiveness.

At the same time, the reviewed literature shows that revenue recycling also creates a policy dilemma. Recycling can lower macroeconomic costs and improve political acceptability, but some forms of recycling may stimulate economic activity and thereby soften part of the emissions contraction induced

by the tax. Van Heerden et al. (2016) explicitly note that recycling reduces the extent of emissions reduction because it supports growth. Similarly, studies from Chile and Morocco imply that policy feasibility often requires balancing climate goals against broader economic and distributive considerations (Ait Faraji & Zaoujal, 2025; O'Ryan et al., 2023). The implication is that the double dividend should not be treated as automatic. Rather, policymakers need to define the principal objective of recycling—whether it is to reduce regressivity, protect competitiveness, fund green transition, or preserve macroeconomic stability—because different choices produce different environmental and welfare outcomes.

Why Policy Design Matters More Than Formal Adoption

The reviewed studies repeatedly show that formal adoption of a carbon tax is not enough. Policy design determines whether the price signal is strong enough to change behavior in a meaningful and durable way. This point is also emphasized in broader syntheses of carbon taxation, which note that the environmental and macroeconomic effects of carbon taxes depend strongly on tax architecture, sectoral coverage, compensation mechanisms, and administrative feasibility (Köppl & Schratzenstaller, 2023; Timilsina, 2022). In the European context, Metcalf and Stock (2023) find that carbon taxes are associated with cumulative emissions reductions of roughly 4% to 6% for a \$40/tCO_2 tax covering 30% of emissions, while also showing no robust negative effect on GDP or employment growth. Importantly, they note that broader coverage would likely enhance mitigation because many European taxes omit sectors with relatively low marginal abatement costs. Känzig and Konradt (2024) further show that macroeconomic differences between carbon taxes and ETS prices can be traced to differences in pass-through, sectoral coverage, revenue use, and spillovers.

The Chinese studies make this point especially clearly because they compare multiple policy designs rather than treating carbon tax as a single homogeneous instrument. Zhang et al. (2017) show that carbon tax performance depends on competitiveness effects, carbon leakage, and how revenues are recycled. Chai et al. (2023) similarly show that the combination of carbon tax and carbon market instruments yields the strongest mitigation effect but also the highest economic cost, making it less suitable as a long-run isolated arrangement. In Chile, O'Ryan et al. (2023) also frame carbon taxation as a policy instrument whose feasibility depends on balancing mitigation objectives with economy-wide, sectoral, and distributive consequences. These findings suggest that carbon tax should not be evaluated simply as present or absent, but as a design-dependent policy package whose effectiveness is shaped by rates, coverage, exemptions, escalation, and complementary measures.

Trade Openness, Carbon Leakage, and Emissions Accounting

A further theme running through the literature is the role of trade openness and carbon leakage. In theoretical and empirical terms, this issue complicates any simple reading of carbon tax effectiveness because national

policies are implemented in internationally integrated production systems. Green (2021) notes that ex-post studies of carbon pricing often remain concentrated in Europe and reveal considerable variation across sectors, which is consistent with the idea that trade exposure and market structure mediate outcomes. The European evidence also emphasizes spillovers and leakage as central explanations for why carbon pricing instruments generate different macroeconomic consequences (Känzig & Konradt, 2024).

This problem becomes even clearer in studies directly examining border effects and emissions accounting. Ramadhani and Koo (2022) show that carbon border tax adjustment produces negative trade and economic impacts while delivering only a small reduction in global carbon emissions. Zhu et al. (2020) show that a differentiated domestic carbon tax can help China reduce emissions while containing GDP and welfare losses under U.S. carbon tariff pressure. Most importantly, Schroeder and Stracca (2025) find that carbon taxes reduce territorial emissions over time but have no significant effect on consumption-based emissions, suggesting that domestic emission gains may be offset through imports and production relocation in more open economies. This distinction is crucial. If policymakers assess effectiveness only through territorial emissions, they may overstate the global mitigation value of national carbon taxation. The literature therefore suggests that national carbon taxes are more credible when evaluated alongside trade exposure, consumption-based accounting, and complementary mechanisms such as border carbon adjustment or international coordination.

Distributional, Gendered, and Political-Economy Constraints

The reviewed studies also make clear that carbon tax effectiveness should not be judged through emissions metrics alone. Carbon taxation is simultaneously an environmental, fiscal, and political-economy instrument. Recent review literature emphasizes that empirical studies increasingly pay attention not only to environmental effectiveness, but also to competitiveness, distributional consequences, and public acceptance (Köppl & Schratzenstaller, 2023; Timilsina, 2022). This broader lens is strongly reflected in the selected studies. In Egypt, Eldeep et al. (2025) show that carbon tax is more effective than energy subsidy removal in reducing CO_2 emissions, yet the two instruments generate different gender and distributional consequences. In Morocco, Ait Faraji and Zaoujal (2025) show that sector-specific and hybrid recycling schemes produce different combinations of emissions reduction, fiscal balance, and distributive effects. In Chile, O'Ryan et al. (2023) emphasize that stricter carbon tax policy must be evaluated against economy-wide, sectoral, and distributive trade-offs. These findings suggest that a tax may be environmentally efficient yet politically fragile if it imposes concentrated short-term costs on vulnerable households, labor groups, or trade-exposed sectors without credible compensation.

This political-economy dimension has direct implications for durability. Carbon taxes that are perceived as unfair, poorly targeted, or administratively opaque may provoke resistance even if they are technically efficient. Conversely,

taxes that visibly recycle revenues, protect vulnerable groups, and align climate goals with economic adjustment are more likely to remain politically viable. Therefore, the literature implies that carbon tax effectiveness in practice is inseparable from distributional legitimacy and institutional trust, not merely from price elasticity or modelled abatement potential.

Methodological Imbalance and the Risk of Over-Optimistic Policy Conclusions

A final issue concerns the structure of the evidence base itself. Green (2021) notes that only a limited number of ex-post studies directly assess the emissions effects of carbon pricing, and that the majority of these focus on Europe. By contrast, the selected studies in this SLR are dominated by ex ante simulation models, especially dynamic CGE, GTAP-E, and hybrid integrated models such as WITCH. This dominance is understandable because carbon tax is often proposed or expanded in contexts where long-run real-world policy evaluation is still difficult. Simulation models are highly useful for comparing policy scenarios, estimating economy-wide transmission channels, and testing alternative recycling or policy-mix designs before implementation (Ait Faraji & Zaoujal, 2025; Chai et al., 2023; Eldeep et al., 2025; O'Ryan et al., 2023; Ramadhani & Koo, 2022; Van Heerden et al., 2016; Zhang et al., 2017; Zhu et al., 2020).

However, this methodological concentration also introduces an important epistemic risk. Ex ante models are informative about what carbon tax could do, but they do not fully capture what carbon tax actually does under administrative constraints, uneven enforcement, lobbying pressure, compliance costs, or political reversals. Many such models assume relatively smooth adjustment, coherent implementation, and predictable behavioral responses. As a result, a simulation-dominated literature may unintentionally generate policy conclusions that are more optimistic than real implementation conditions justify. The ex-post and quasi-experimental literature therefore remains crucial. Andersson (2019) provides a rare causal estimate of carbon tax effectiveness in Sweden, while Metcalf and Stock (2023), Kumar (2024), and Schroeder and Stracca (2025) offer complementary comparative evidence on emissions, macroeconomic outcomes, and leakage. Future research should therefore aim to rebalance the literature by combining model-based analysis with more longitudinal, ex-post, and cross-country empirical designs.

Theoretical and Empirical Implications

Overall, the reviewed studies support a more refined interpretation of carbon tax effectiveness. The Pigouvian logic remains valid in that pricing carbon tends to reduce emissions. Yet the literature also shows that actual effectiveness is mediated by the double dividend problem, policy design, sectoral coverage, trade openness, leakage risks, and distributional legitimacy. In other words, carbon tax works neither as a purely technical fiscal instrument nor as a universally self-sufficient climate solution. Its effectiveness is produced through the interaction between price incentives, fiscal architecture, institutional capacity, and the broader national and international policy environment. Future research

should therefore move beyond the narrow question of whether carbon tax reduces emissions and instead investigate how implementation quality, monitoring systems, and transparent revenue use shape environmental outcomes over time.

CONCLUSIONS, POLICY IMPLICATIONS AND FUTURE RESEARCH

This systematic literature review examined the effectiveness of carbon taxes in reducing carbon emissions at national and cross-country levels. Based on 11 included studies identified from a 2015–2026 search window, the review finds that carbon taxes generally contribute to emission reduction or are associated with lower emissions. However, the effect is conditional rather than automatic. The most important determinants are tax design, sectoral coverage, exemption rules, revenue recycling, trade exposure, domestic economic structure, and the way emissions are measured.

The answer to RQ1 is therefore cautious but positive: the reviewed evidence supports carbon tax as a potentially effective mitigation instrument, especially when the policy is broad, credible, and integrated with complementary fiscal or climate measures. The answer to RQ2 is that effectiveness depends on revenue recycling, policy architecture, economic structure, trade exposure, and distributional design. The answer to RQ3 is that the literature is dominated by modelling-based evidence, while ex post and longitudinal comparative studies remain limited.

For policymakers, the implication is clear. A carbon tax should not be designed only as an emissions price. It should be embedded in a broader policy package that includes transparent revenue use, protection for vulnerable households, careful treatment of trade-exposed sectors, and coordination with other climate instruments. Particular attention should be given to the difference between territorial and consumption-based emissions, because national reductions may not fully represent global mitigation if leakage occurs.

For developing countries, carbon tax implementation requires particular attention to fiscal capacity, energy affordability, and industrial competitiveness. Unlike advanced economies with stronger institutional and compensatory systems, many developing countries face higher political sensitivity toward energy-price increases, greater dependence on carbon-intensive sectors, and more limited capacity to compensate affected households and firms. Therefore, carbon tax policies in developing economies are more likely to succeed when introduced gradually, supported by transparent revenue recycling, and combined with targeted compensation for vulnerable households. Revenues can also be directed toward renewable energy, public transportation, energy-efficiency programs, and green industrial transition so that the tax is perceived not only as an additional fiscal burden but also as a mechanism for financing inclusive low-carbon development. In trade-exposed developing economies, policymakers should also consider complementary measures to reduce competitiveness losses and carbon leakage, including sectoral transition support, clear exemption rules, and coordination with emerging border carbon adjustment mechanisms.

This review has limitations. It relies on a single database, Scopus, and restricts the subject area to Business, Management, and Accounting. It also excludes non-English publications, non-journal sources, and studies without accessible full text. These choices improve focus and replicability but may omit relevant evidence from environmental science, energy policy, public economics, and grey literature. Future research should expand database coverage, incorporate additional disciplinary areas, and develop stronger comparative evidence on actual post-implementation outcomes.

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