Carbon Border Adjustment Mechanism: A Systematic Literature Review of the Latest Developments

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# Supplementary Material

Figure A1. Number of publications centered around CBAM topics by journal (Top 10 are listed)

Note: The final search was conducted on September 5, 2021.

Table A1. Most cited studies (top 10 are listed)

|  |  |
| --- | --- |
| Articles | Times cited |
| Böhringer et al. (2012) | 133 |
| Kuik & Hofkes (2010) | 126 |
| Atkinson et al. (2011) | 86 |
| van Asselt & Brewer (2010) | 85 |
| Alton et al. (2014) | 85 |
| Weber & Peters (2009) | 83 |
| Bao, Tang, Zhang, & Wang (2013) | 62 |
| Monjon & Quirion (2011) | 60 |
| Monjon & Quirion (2010) | 60 |
| Branger & Quirion (2014) | 54 |

Note: The final search was conducted on September 5, 2021.

Table A2. Number of publications by methodology.

|  |  |  |  |
| --- | --- | --- | --- |
| **Method** | | **Count** | **Share (%)** |
| **Mathematical & simulation modelling** | | **60** | **61.22** |
|  | CGE | 41 |  |
|  | IO | 7 |  |
|  | Partial equilibrium framework | 5 |  |
|  | Theoretical model with numerical simulations | 4 |  |
|  | Others (structural optimization model; structural gravity model) | 3 |  |
| **Theory** | | **35** | **35.71** |
|  | Qualitative analysis | 21 |  |
|  | Game-theoretical model | 13 |  |
|  | Structural Optimization model | 2 |  |
| **Review** | | **2** | **2.04** |
|  | Meta-analysis | 1 |  |
|  | Narrative review | 1 |  |

Note: For the classification of research methods, we follow the classification model of Kube, Löschel, Mertens, & Requate (2018) concerning environmental and resource economics research. IO stands for input-output techniques, and CGE refers to computable general equilibrium models.

Table A3. List of CBAM-related studies with key features

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Authors** | **Article Title** | **Journal** | **Year** | **Method** |
| 1 | Xu, QY; Hobbs, BF | Economic efficiency of alternative border carbon adjustment schemes: A case study of California Carbon Pricing and the Western North American power market | Energy Policy | 2021 | Partial equilibrium framework |
| 2 | Banerjee, S | Conjugation of border and domestic carbon adjustment and implications under production and consumption-based accounting of India's National Emission Inventory: A recursive dynamic CGE analysis | Struct. Change and Econ. Dyn. | 2021 | CGE |
| 3 | Bohringer, C; Schneider, J; Asane-Otoo, E | Trade in Carbon and Carbon Tariffs | Environ. Resour. Econ. | 2021 | CGE |
| 4 | Huang X., Tan T., Toktay L.B. | Carbon Leakage: The Impact of Asymmetric Regulation on Carbon-Emitting Production | Production and Operations Management | 2021 | Partial equilibrium framework |
| 5 | Evans S., Mehling M.A., Ritz R.A., Sammon P. | Border carbon adjustments and industrial competitiveness in a European Green Deal | Climate Policy | 2021 | Qualitative analysis |
| 6 | Al Khourdajie, A; Finus, M | Measures to enhance the effectiveness of international climate agreements: The case of border carbon adjustments | Eur. Econ. Rev. | 2020 | Game-theoretic model |
| 7 | Bistline, JET; Merrick, J; Niemeyer, V | Estimating Power Sector Leakage Risks and Provincial Impacts of Canadian Carbon Pricing | Environ. Resour. Econ. | 2020 | Others (r.27.Structural Optimization model) |
| 8 | Fang, Y; Yu, YG; Shi, Y; Liu, J | The effect of carbon tariffs on global emission control: A global supply chain model | Transp. Res. Pt. e-Logist. Transp. Rev. | 2020 | Theoretical model with numerical simulations |
| 9 | Cosbey, A; Droege, S; Fischer, C; Munnings, C | Developing Guidance For Implementing Border Carbon Adjustments: Lessons, Cautions, And Research Needs From The Literature | Rev. Env. Econ. Policy | 2019 | Review |
| 10 | Balistreri, EJ; Kaffine, DT; Yonezawa, H | Optimal Environmental Border Adjustments Under the General Agreement on Tariffs and Trade | Environ. Resour. Econ. | 2019 | Theoretical model with numerical simulations |
| 11 | Hecht, M; Peters, W | Border Adjustments Supplementing Nationally Determined Carbon Pricing | Clim. Chang. Econ. | 2019 | Game-theoretic model |
| 12 | Porterfield M.C. | Border adjustments for carbon Taxes, PPMS, and the WTO | University of Pennsylvania Journal of International Law | 2019 | Qualitative analysis |
| 13 | Winchester, N | Can tariffs be used to enforce Paris climate commitments? | World Econ. | 2018 | CGE |
| 14 | Sanctuary, M | Border carbon adjustments and unilateral incentives to regulate the climate | Rev. Int. Econ. | 2018 | Game-theoretic model |
| 15 | Rocchi, P; Serrano, M; Roca, J; Arto, I | Border Carbon Adjustments Based on Avoided Emissions: Addressing the Challenge of Its Design | Ecol. Econ. | 2018 | IO |
| 16 | McKibbin, WJ; Morris, AC; Wilcoxen, PJ; Liu, WF | The Role of Border Carbon Adjustments in a U.S. Carbon Tax | Clim. Chang. Econ. | 2018 | CGE |
| 17 | Bohringer, C; Carbone, JC; Rutherford, TF | Embodied Carbon Tariffs | Scand. J. Econ. | 2018 | CGE |
| 18 | Baatz C. | Climate adaptation finance and justice. A criteria-based assessment of policy instruments | Analyse und Kritik | 2018 | Qualitative analysis |
| 19 | Larch, M; Wanner, J | Carbon tariffs: An analysis of the trade, welfare, and emission effects | J. Int. Econ. | 2017 | Others (r.27.Structural Optimization model) |
| 20 | Bohringer, C; Bye, B; Faehn, T; Rosendahl, KE | Targeted carbon tariffs: Export response, leakage and welfare | Resour. Energy Econ. | 2017 | CGE |
| 21 | Zhang, ZK; Zhu, KF; Hewings, GJD | The effects of border-crossing frequencies associated with carbon footprints on border carbon adjustments | Energy Econ. | 2017 | IO |
| 22 | Kortum, S; Weisbach, D | The Design of Border Adjustments for Carbon Prices | Natl. Tax J. | 2017 | Qualitative analysis |
| 23 | Trachtman, JP | WTO Law Constraints on Border Tax Adjustment and Tax Credit Mechanisms to Reduce the Competitive Effects of Carbon Taxes | Natl. Tax J. | 2017 | Qualitative analysis |
| 24 | Dai, R; Zhang, JX | Green process innovation and differentiated pricing strategies with environmental concerns of South-North markets | Transp. Res. Pt. e-Logist. Transp. Rev. | 2017 | Theoretical model with numerical simulations |
| 25 | Allevi E., Oggioni G., Riccardi R., Rocco M. | Evaluating the carbon leakage effect on cement sector under different climate policies | Journal of Cleaner Production | 2017 | Partial equilibrium framework |
| 26 | Antimiani, A; Costantini, V; Kuik, O; Paglialunga, E | Mitigation of adverse effects on competitiveness and leakage of unilateral EU climate policy: An assessment of policy instruments | Ecol. Econ. | 2016 | CGE |
| 27 | Sakai, M; Barrett, J | Border carbon adjustments: Addressing emissions embodied in trade | Energy Policy | 2016 | IO |
| 28 | Foure, J; Guimbard, H; Monjon, S | Border carbon adjustment and trade retaliation: What would be the cost for the European Union? | Energy Econ. | 2016 | CGE |
| 29 | Bohringer, C; Carbone, JC; Rutherford, TF | The Strategic Value of Carbon Tariffs | Scand. J. Econ. | 2016 | Game-theoretic model |
| 30 | Michalek G. | Progressive Optimal Technology-based Border Carbon Adjustment (POT BCA) - A New Approach to an Old Carbon Problem | Environmental Modeling and Assessment | 2016 | Qualitative analysis |
| 31 | Liang Q.-M., Wang T., Xue M.-M. | Addressing the competitiveness effects of taxing carbon in China: Domestic tax cuts versus border tax adjustments | Journal of Cleaner Production | 2016 | CGE |
| 32 | Siriwardana M., Meng S., McNeill J. | Border adjustments under unilateral carbon pricing: The case of Australian carbon tax | Journal of Economic Structures | 2016 | CGE |
| 33 | Anoulies, L | The Strategic and Effective Dimensions of the Border Tax Adjustment | J. Public. Econ. Theory. | 2015 | Game-theoretic model |
| 34 | Bohringer, C; Muller, A; Schneider, J | Carbon Tariffs Revisited | J. Assoc. Environ. Resour. Econ. | 2015 | CGE |
| 35 | Mason, CF; Barbier, EB; Umanskaya, VI | On the strategic use of border tax adjustments as a second-best climate policy measure | Environ. Dev. Econ. | 2015 | Game-theoretic model |
| 36 | Dong, YL; Ishikawa, M; Hagiwara, T | Economic and environmental impact analysis of carbon tariffs on Chinese exports | Energy Econ. | 2015 | CGE |
| 37 | Helm, C; Schmidt, RC | Climate cooperation with technology investments and border carbon adjustment | Eur. Econ. Rev. | 2015 | Game-theoretic model |
| 38 | Irfanoglu Z.B., Sesmero J.P., Golub A. | Potential of border tax adjustments to deter free riding in international climate agreements | Environmental Research Letters | 2015 | Theoretical model with numerical simulations |
| 39 | López L.-A., Cadarso M.-A., Gómez N., Tobarra M.-A. | Food miles, carbon footprint and global value chains for Spanish agriculture: Assessing the impact of a carbon border tax | Journal of Cleaner Production | 2015 | IO |
| 40 | Keen, M; Kotsogiannis, C | Coordinating climate and trade policies: Pareto efficiency and the role of border tax adjustments | J. Int. Econ. | 2014 | Game-theoretic model |
| 41 | Bohringer, C; Fischer, C; Rosendahl, KE | Cost-effective unilateral climate policy design: Size matters | J.Environ.Econ.Manage. | 2014 | CGE |
| 42 | Schinko, T; Bednar-Friedl, B; Steininger, KW; Grossmann, WD | Switching to carbon-free production processes: Implications for carbon leakage and border carbon adjustment | Energy Policy | 2014 | CGE |
| 43 | Branger, F; Quirion, P | Would border carbon adjustments prevent carbon leakage and heavy industry competitiveness losses? Insights from a meta-analysis of recent economic studies | Ecol. Econ. | 2014 | Review |
| 44 | Eyland, T; Zaccour, G | Carbon tariffs and cooperative outcomes | Energy Policy | 2014 | Game-theoretic model |
| 45 | Alton T., Arndt C., Davies R., Hartley F., Makrelov K., Thurlow J., Ubogu D. | Introducing carbon taxes in South Africa | Applied Energy | 2014 | CGE |
| 46 | Li, AJ; Zhang, AZ; Cai, HB; Li, XF; Peng, SS | How large are the impacts of carbon-motivated border tax adjustments on China and how to mitigate them? | Energy Policy | 2013 | CGE |
| 47 | Jakob, M; Marschinski, R; Hubler, M | Between a Rock and a Hard Place: A Trade-Theory Analysis of Leakage Under Production- and Consumption-Based Policies | Environ. Resour. Econ. | 2013 | Game-theoretic model |
| 48 | Mattoo, A; Subramanian, A; van der Mensbrugghe, D; He, JW | Trade effects of alternative carbon border-tax schemes | Rev. World Econ. | 2013 | CGE |
| 49 | Antimiani, A; Costantini, V; Martini, C; Salvatici, L; Tommasino, MC | Assessing alternative solutions to carbon leakage | Energy Econ. | 2013 | CGE |
| 50 | Bao, Q; Tang, L; Zhang, ZX; Wang, SY | Impacts of border carbon adjustments on China's sectoral emissions: Simulations with a dynamic computable general equilibrium model | China Econ. Rev. | 2013 | CGE |
| 51 | Dissou, Y; Siddiqui, MS | Regional Trade Agreements, Emissions Bubbles, and Carbon Tariff Harmonization | Energy J. | 2013 | CGE |
| 52 | Burniaux, JM; Chateau, J; Duval, R | Is there a case for carbon-based border tax adjustment? An applied general equilibrium analysis | Appl. Econ. | 2013 | CGE |
| 53 | Bednar-Friedl, B; Schinko, T; Steininger, KW | The relevance of process emissions for carbon leakage: A comparison of unilateral climate policy options with and without border carbon adjustment | Energy Econ. | 2012 | CGE |
| 54 | Bohringer, C; Carbone, JC; Rutherford, TF | Unilateral climate policy design: Efficiency and equity implications of alternative instruments to reduce carbon leakage | Scand. J. Econ. | 2012 | CGE |
| 55 | Bohringer, C; Balistreri, EJ; Rutherford, TF | The role of border carbon adjustment in unilateral climate policy: Overview of an Energy Modeling Forum study (EMF 29) | Energy Econ. | 2012 | CGE |
| 56 | Bohringer, C; Bye, B; Faehn, T; Rosendahl, KE | Alternative designs for tariffs on embodied carbon: A global cost-effectiveness analysis | Resour. Energy Econ. | 2012 | CGE |
| 57 | Caron, J | Estimating carbon leakage and the efficiency of border adjustments in general equilibrium - Does sectoral aggregation matter? | Energy Econ. | 2012 | CGE |
| 58 | Ghosh, M; Luo, DM; Siddiqui, MS; Zhu, YF | Border tax adjustments in the climate policy context: CO2 versus broad-based GHG emission targeting | Energy Econ. | 2012 | CGE |
| 59 | Lanzi, E; Chateau, J; Dellink, R | Alternative approaches for levelling carbon prices in a world with fragmented carbon markets | Energy Econ. | 2012 | CGE |
| 60 | Springmann, M | A look inwards: Carbon tariffs versus internal improvements in emissions-trading systems | Energy Econ. | 2012 | CGE |
| 61 | Weitzel, M; Hubler, M; Peterson, S | Fair, optimal or detrimental? Environmental vs. strategic use of border carbon adjustment | Energy Econ. | 2012 | CGE |
| 62 | Hubler, M | Carbon tariffs on Chinese exports: Emissions reduction, threat, or farce? | Energy Policy | 2012 | CGE |
| 63 | Fischer, C; Fox, AK | Comparing policies to combat emissions leakage: Border carbon adjustments versus rebates | Energy Econ. | 2012 | CGE |
| 64 | Li, AJ; Zhang, AZ | Will carbon motivated border tax adjustments function as a threat? | Energy Policy | 2012 | CGE |
| 65 | Helm, D; Hepburn, C; Ruta, G | Trade, climate change, and the political game theory of border carbon adjustments | Oxf. Rev. Econ. Policy | 2012 | Game-theoretic model |
| 66 | Das, K | How Vulnerable is India's Trade to Possible Border Carbon Adjustments in the EU? | J. World Trade | 2012 | Others (theory) |
| 67 | Ladly, SD | Border carbon adjustments, WTO-law and the principle of common but differentiated responsibilities | Int. Environ. Agreem.-Polit. Law Econom. | 2012 | Qualitative analysis |
| 68 | Winchester, N | The Impact of Border Carbon Adjustments Under Alternative Producer Responses | World Econ. | 2012 | CGE |
| 69 | Messerlin, PA | Climate and trade policies: from mutual destruction to mutual support | World Trade Rev. | 2012 | Qualitative analysis |
| 70 | Eyland T., Zaccour G. | Strategic effects of a border tax adjustment | International Game Theory Review | 2012 | Game-theoretic model |
| 71 | Dong Y., Walley J. | How large are the impacts of carbon motivated border tax adjustments? | Climate Change Economics | 2012 | CGE |
| 72 | Lingling Z., Alun G., Fei T., Jiankun H. | Influences of border carbon adjustments on China’s foreign trade | Chinese Journal of Population Resources and Environment | 2012 | IO |
| 73 | Spassov Y. | EU ETS: Upholding the carbon price without incidence of carbon leakage | Journal of Environmental Law | 2012 | Qualitative analysis |
| 74 | Dong, Y; Whalley, J | Carbon motivated regional trade arrangements: Analytics and simulations | Econ. Model. | 2011 | CGE |
| 75 | Moore, MO | Implementing Carbon Tariffs: A Fool's Errand? | J. World Trade | 2011 | Qualitative analysis |
| 76 | Kaufmann, C; Weber, RH | Carbon-related border tax adjustment: mitigating climate change or restricting international trade? | World Trade Rev. | 2011 | Qualitative analysis |
| 77 | Monjon, S; Quirion, P | Addressing leakage in the EU ETS: Border adjustment or output-based allocation? | Ecol. Econ. | 2011 | Partial equilibrium framework |
| 78 | Bassi, AM; Yudken, JS | Climate policy and energy-intensive manufacturing: A comprehensive analysis of the effectiveness of cost mitigation provisions in the American Energy and Security Act of 2009 | Energy Policy | 2011 | Others (r.27.Structural Optimization model) |
| 79 | Dissou, Y; Eyland, T | Carbon control policies, competitiveness, and border tax adjustments | Energy Econ. | 2011 | CGE |
| 80 | Winchester, N; Paltsev, S; Reilly, JM | Will Border Carbon Adjustments Work? | B E J. Econ. Anal. Policy | 2011 | CGE |
| 81 | Atkinson G., Hamilton K., Ruta G., Van Der Mensbrugghe D. | Trade in 'virtual carbon': Empirical results and implications for policy | Global Environmental Change | 2011 | IO |
| 82 | Keting S. | Controversy of international carbon-motivated border tax adjustment and its impact on china’s manufacturing industries | Chinese Journal of Population Resources and Environment | 2011 | CGE |
| 83 | Gros D., Egenhofer C. | The case for taxing carbon at the border | Climate Policy | 2011 | Qualitative analysis |
| 84 | Voituriez T., Wang X. | Getting the carbon price right through climate border measures: A Chinese perspective | Climate Policy | 2011 | Qualitative analysis |
| 85 | Lin B., Li A. | Impacts of carbon motivated border tax adjustments on competitiveness across regions in China | Energy | 2011 | CGE |
| 86 | Holmes P., Reilly T., Rollo J. | Border carbon adjustments and the potential for protectionism | Climate Policy | 2011 | Qualitative analysis |
| 87 | Monjon, S; Quirion, P | How to design a border adjustment for the European Union Emissions Trading System? | Ecol. Econ. | 2010 | Qualitative analysis |
| 88 | Lockwood, B; Whalley, J | Carbon-motivated Border Tax Adjustments: Old Wine in Green Bottles? | World Econ. | 2010 | Qualitative analysis |
| 89 | Kuik, O; Hofkes, M | Border adjustment for European emissions trading: Competitiveness and carbon leakage | Energy Policy | 2010 | CGE |
| 90 | van Asselt, H; Brewer, T | Addressing competitiveness and leakage concerns in climate policy: An analysis of border adjustment measures in the US and the EU | Energy Policy | 2010 | Qualitative analysis |
| 91 | McKenzie M. | Emissions reduction policies and the WTO | Asia Pacific Journal of Environmental Law | 2010 | Qualitative analysis |
| 92 | Izard C.F., Weber C.L., Matthews H.S. | Primary and embedded steel imports to the U.S.: Implications for the design of border tax adjustments | Environmental Science and Technology | 2010 | IO |
| 93 | Clarke H. | Carbon Leakages, Consumption-based Carbon Taxes and International Climate Change Agreements | Economic Papers | 2010 | Game-theoretic model |
| 94 | Ireland R. | Implications for Customs of climate change mitigation and adaptation policy options: A preliminary examination | World Customs Journal | 2010 | Qualitative analysis |
| 95 | Curran L. | The potential impacts of border tax adjustments on imports of energy-intensive goods in the EU and USA markets | International Journal of Sustainable Society | 2010 | Qualitative analysis |
| 96 | Weber, CL; Peters, GP | Climate change policy and international trade: Policy considerations in the US | Energy Policy | 2009 | Qualitative analysis |
| 97 | Mathiesen, L; Maestad, O | Climate policy and the steel industry: Achieving global emission reductions by an incomplete climate agreement | Energy J. | 2004 | Partial equilibrium framework |

Note: IO stands for input-output techniques, and CGE refers to computable general equilibrium models.