The Impact of the EU CBAM on Thai Exporting Firms: Analysis of Firm-level Data

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Preliminary Results

This version: May 2025

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Motivations

- With stringent climate policies in the EU, there is a **risk of carbon leakage** as EU-based companies relocate their production outside the EU to avoid the EU's climate regulation costs.
- **After the ETS was introduced**, there has been divergence, namely, the value of imports has increased much more in the ETS than in the non-ETS sectors. In addition, **the carbon content of the ETS sector imports has moderately increased**, while in the non-ETS sector the decline has continued, albeit at a slower pace.
- Carbon Border Adjustment Mechanism (CBAM) is the EU's tool to put a fair price on the carbon emitted during the production of carbon intensive goods that are entering the EU.
- CBAM will ensure the carbon price of imports is equivalent to the carbon price of domestic production.

Goods in the CBAM scope (CBAM goods)

Source: Wang and Kuusi (2024)

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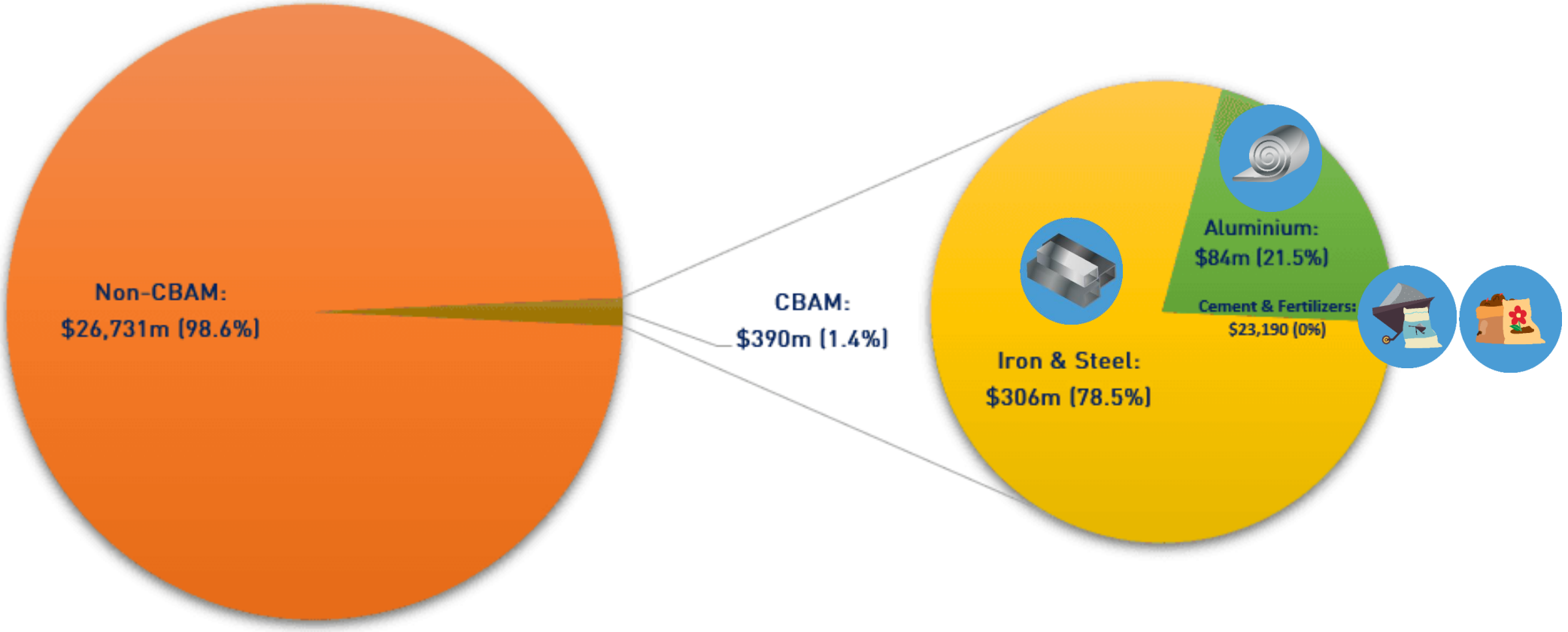
Thailand's Export Goods in CBAM Scope to EU

In 2023, Thailand's total exports to the EU amounted to approximately 27,121 million USD, placing it 4th among all of Thailand's export destinations.



Source: Data from UN Comtrade

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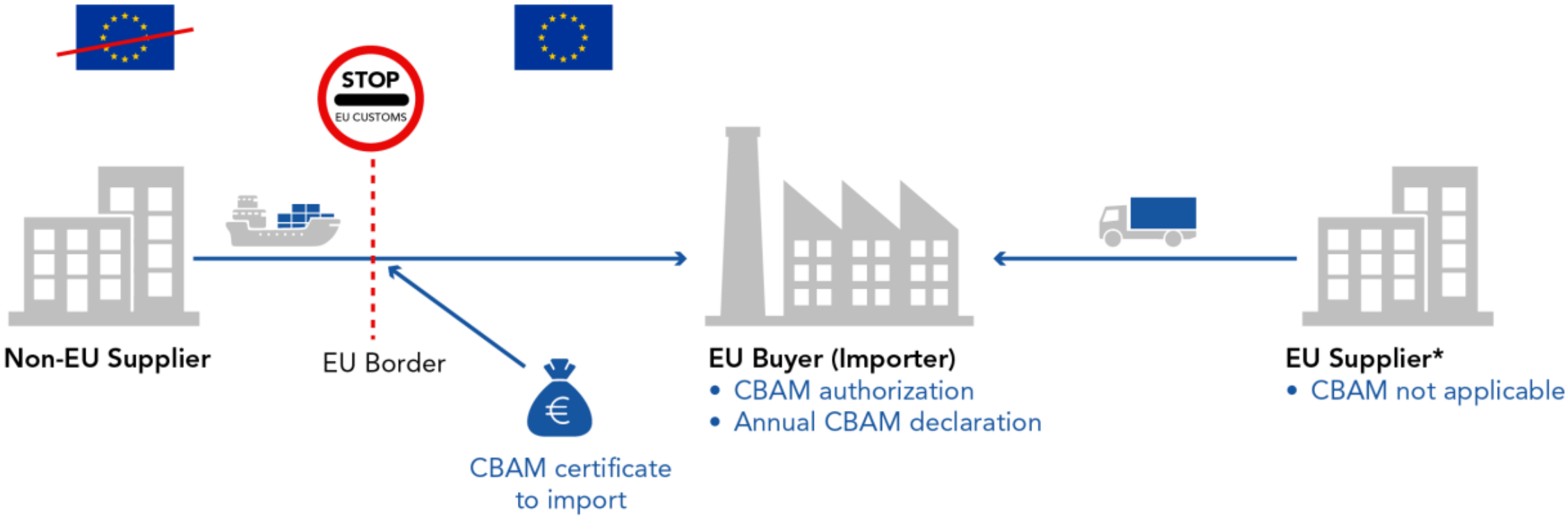
Illustration of CBAM



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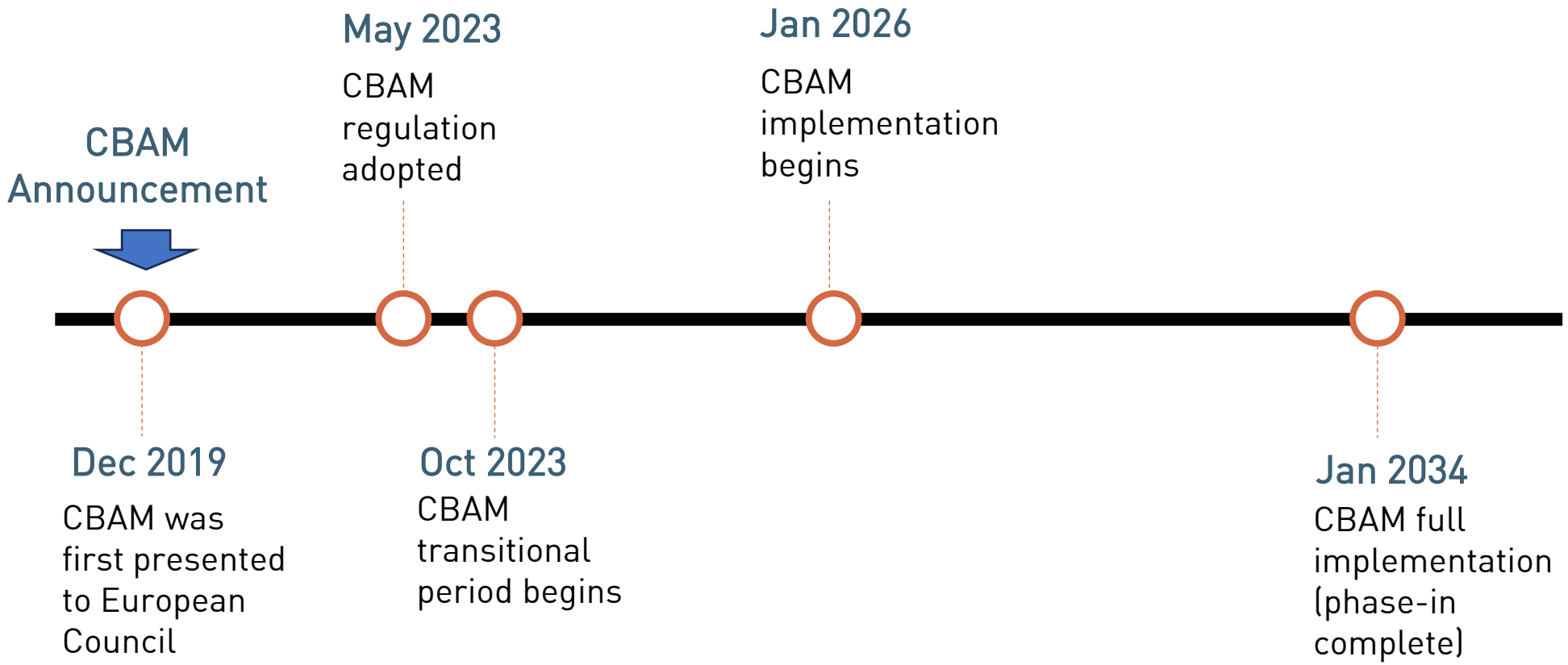
CBAM Implementation Timeline



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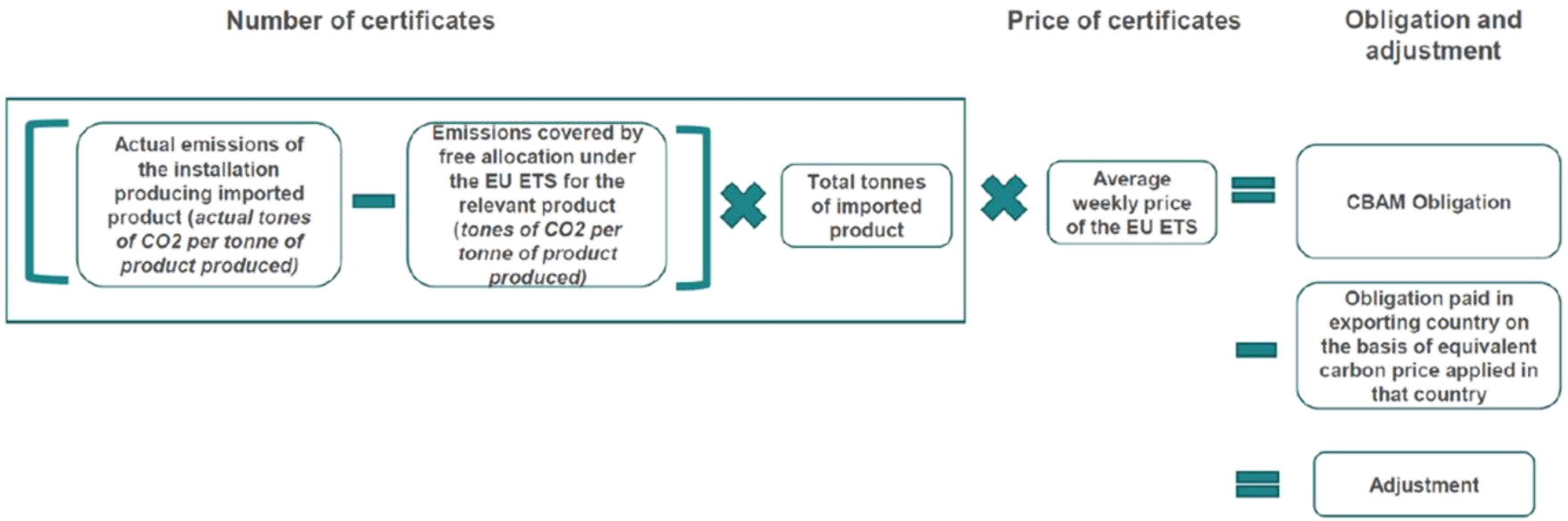
How the price of CBAM certificate determined?

With CBAM, EU importers will have to pay the same amount per tonne of CO_2 emitted, as if the goods had been made in the EU. The price of the certificate will be defined by the weekly average auction costs of emission allowances under the ETS.



Source: Wood Mackenzie, European Parliament

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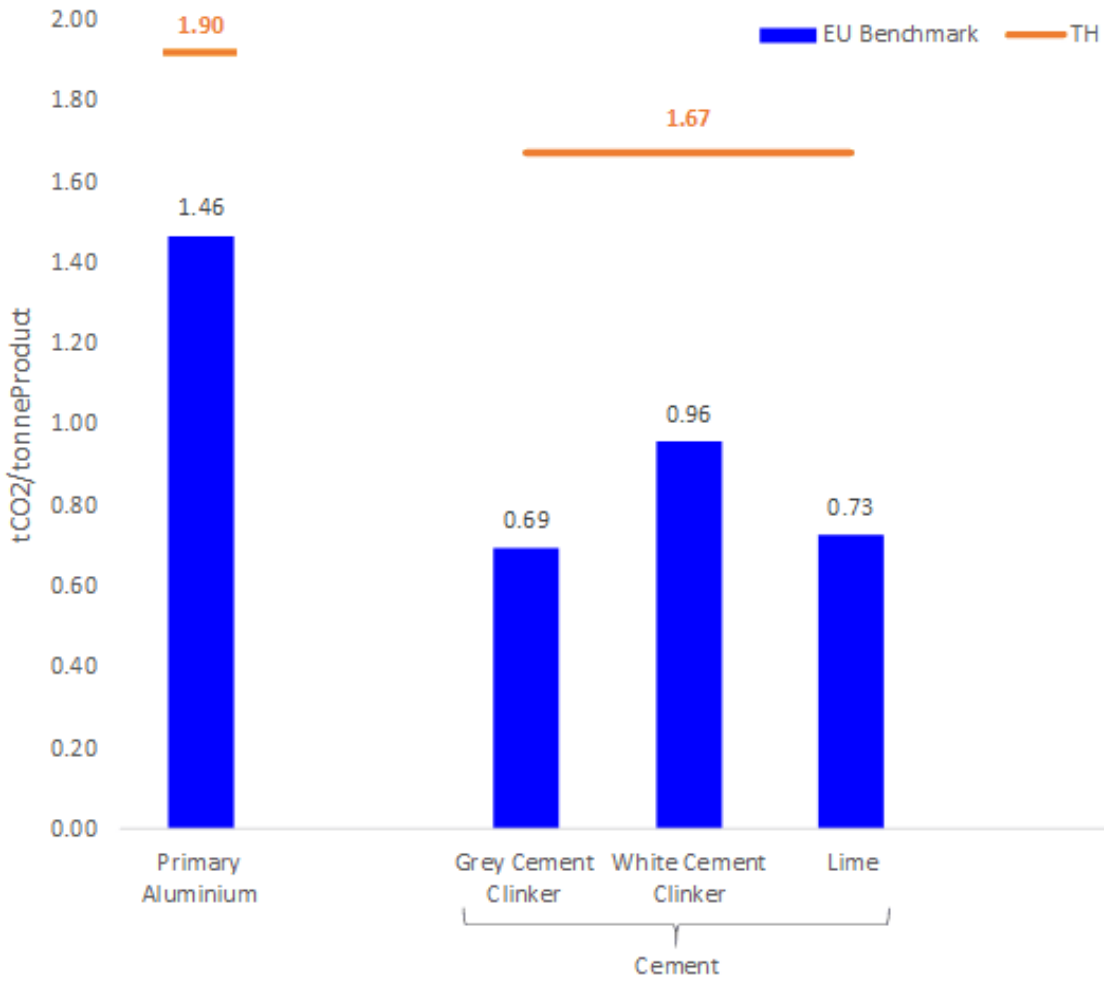
Thailand's GHG Intensities vs. EU Benchmark Values



Source: European Commission (2021), ERCST (2021)

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Literature Review

- No paper that directly studies the impact of CBAM on the exporting firms in developing countries.

- Some related literature:

1) Literature that study the distributional impact of CBAM on trade and GDP.
   - Country-level data and an equilibrium trade model or elasticities from other papers.
     - Farrokhi, F. & Lashkaripour, A. (2024); Rocchi et al., (2024); Bellora et al., (2023); Shapiro, Joseph (2021).
   - Multi-Regional Input-Output (MRIO) matrices.
     - Amendola (2025); Magacho et al., (2024); Ren et al., (2023)

2) Literature that employed the difference-in-difference approach to study the impact of EU ETS on European firms (Colmer et al.,2025; HKIMR, 2024; and Löschel et al., 2019)
   - EU ETS adoption benefits regulated manufacturing firms and reduces global emission without causing economic harm.

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Literature Review (cont.)

3) Bolton and Kacperczyk (2021 & 2023) find that carbon-intensive firms experience higher cost of financiang and poor financial performance during post-carbon pricing policies adoption.

4) In response to CBAM or related measures, there are some potential solutions for firms as suggested by OECD (2025); HKIMR (2024); and Ren el at., (2023):

- Firms should diversify trade portfolios and increase share of domestic market. Moreover, local carbon pricing schemes should be considered to prove that carbon price has been effectively paid in the exporting countries.

Gap in the literature: Lack micro-level analysis on the impacts of CBAM on exporting firms in the developing countries, using the firm-level data.

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This Paper

- **Focus on causal impacts of announcement of CBAM on Thailand's exporting firms during 2016-2023.**
  - Evaluate the causal impacts of EU CBAM on Thailand firms that export goods to the EU
  - Explore whether treated firms can diversify their products and export destinations after announcement of CBAM by the EU
- **Data and methods**
  - Construct firm-level panel for export values, product and country diversification and firms' characteristics (e.g. firm size, financial health, etc.)
  - Dynamic difference-in-difference with fixed effects to evaluate the causal impacts on firms' exports and product and country diversification.

Main Findings

- In general, the announcement of the CBAM adversely affects treated firms (i.e. firms that exported CBAM goods to EU) export revenues and the proportion of export revenues relative to their total income.

- Concerning the effects on product diversification, treated firms exported less products after announcement of CBAM.

- Concerning the export destination diversification, treated firms exported less CBAM goods to EU and find it challenging to switch to other trading partners.

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Firm-level Data

- Thailand Customs Data
  - Yearly firm-level export data (volume and value) by export destination by products' HS code during 2016-2023.
  - **Focus on all firms that export to the EU** during 2016-2023.
  - Information on industry (business type ISIC code), product in CBAM scope vs. outside CBAM scope (6-digit products' HS code), product diversification (count of product firms export), country diversification (count of export destination)

- Corporate Profile and Financial Statement (CPFS) data
  - Yearly firm-level financial statement data (income statement and balance sheet) during 2015-23
  - Information on sales, total revenue, total asset (firm size), EBIT and other variables needed for calculation of leverage, altman z-score (financial health), RBI (financial constraints), and cash conversion cycle.

- **Criteria:** All Thai exporting firms that registered before 2020. Firm exclusion criteria:
  - Firms that did not export during 2016-2019
  - Firms that have annual export revenue less than 30,000 THB
  - Firms that have annual total revenue less than 100,000 THB
  - Firms that have total asset less than 100,000 THB

Identification Strategies

1) Difference-in-difference with firm fixed effect:

$$y_{it} = \delta_i + \gamma_t + \alpha_{it} + \beta_1 Post_t + \beta_2 Treat_i + \beta_3 (Treat \times Post)_{it} + \theta X_{it} + \varepsilon_{it}$$

where

y_{it} is outcome variables

δ_i firm fixed effect

γ_t time fixed effect

$Post_t$ represents period post announcement of CBAM ($Post_t$=1 if $t \geq 2020$)

$Treat_{it}$ reflect firms that export CBAM goods to the EU

X_{it} other time varying controls to get rid of non-parallel time trend (e.g. firm size, financial health, financial constraint, etc.)

α_{it} industry x time fixed effect

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Identification Strategies (cont.)

2) Firms' exposure to CBAM: $Treat$ = 1 if Three years average of export revenues from CBAM goods during 2016-2018 over total revenue greater than 0

3) Outcome variables:

- ln(Export revenue)
- share of export revenue to total revenue
- product diversification (i.e. count of total number of products exported by firms)
- export destination diversification (i.e. count of total number of country that firms export to)

Identification Strategies (cont.)

5) Difference-in-difference regression with leads and lags

- Including leads into the difference-in-difference model is used to analyze pre-trends.
- Lags are included to analyze whether the treatment effect changes over time after treatment.
- The estimated regression would be:

$$y_{it} = \delta_i + \gamma_t + \alpha_{it} + \sum_{t=2016}^{2023} \beta^t Post^t Treat_{it} + \gamma X_{it} + \varepsilon_{it}$$

where

treatment occurs in 2020,

leads refer to 2016-2018 with 2019 as base year

lags refer to 2021-2023 to capture post treatment effects.

Preliminary results

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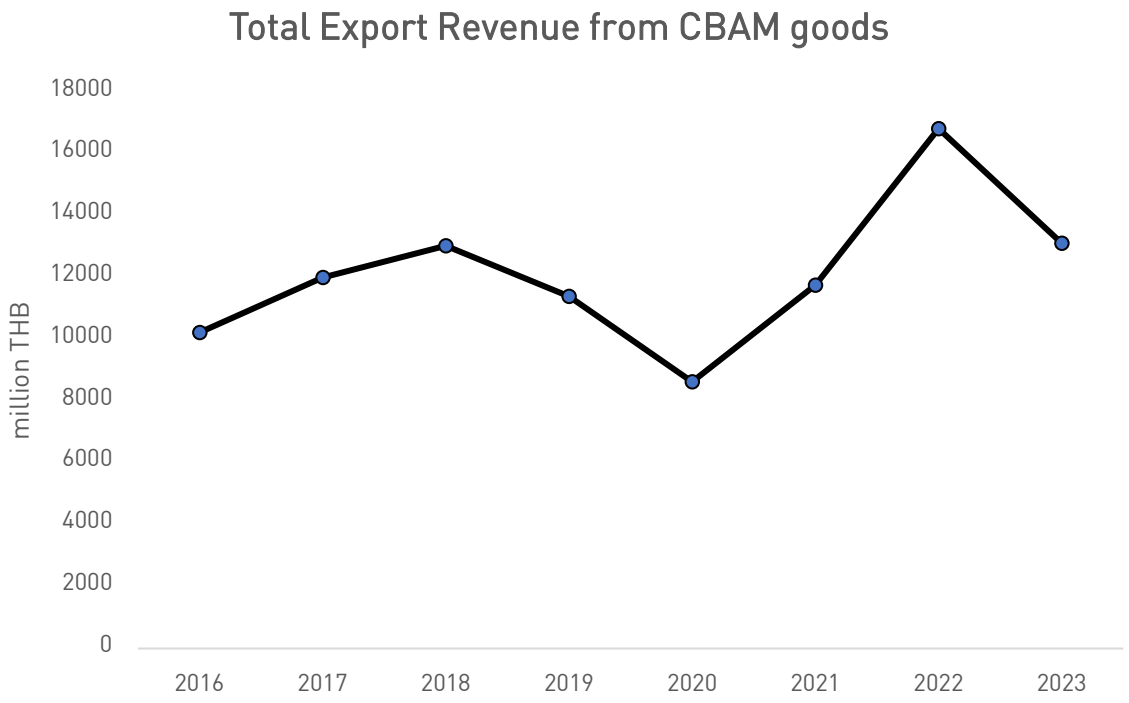
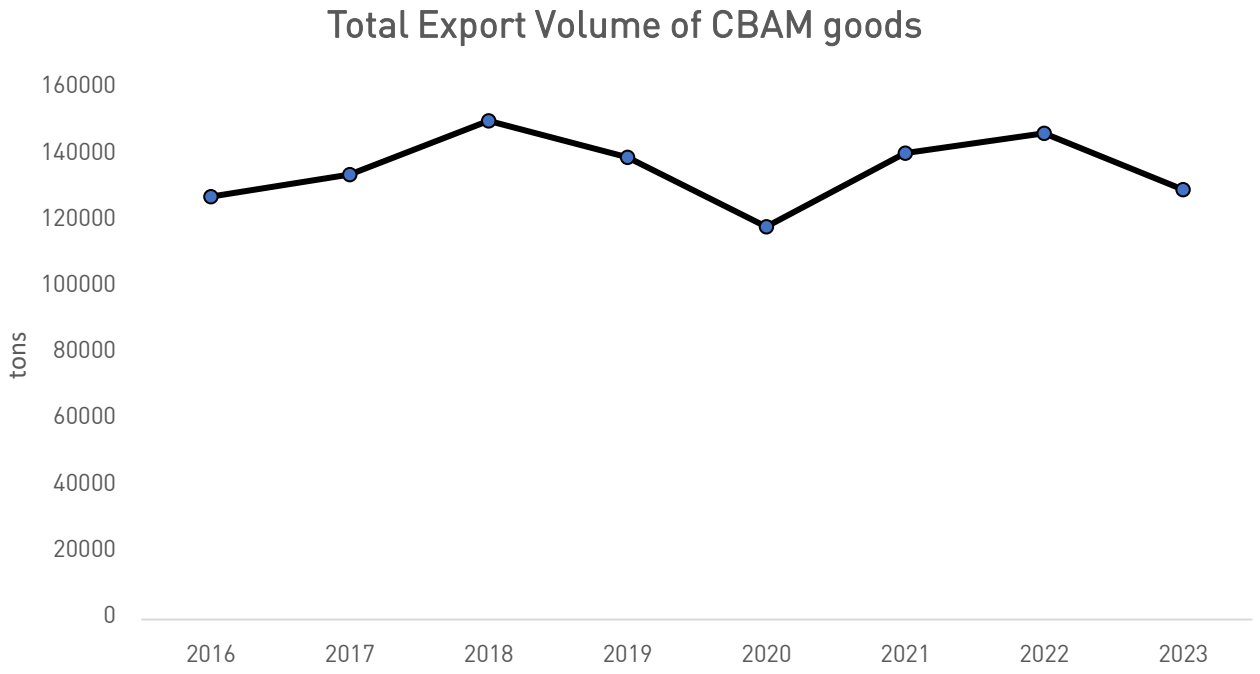
Export values and volume of CBAM products to EU





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Number of Firms that Exported to EU in the Panel

Samples: All exporting firms in Thailand that exported to the EU during 2016-2023

	2016	2017	2018	2019	2020	2021	2022	2023	Total
Control	5,230	5,130	5,130	5,091	4,747	4,458	4,422	4,435	38,643
Treated	1,137	1,174	1,150	1,058	990	943	898	901	8,251
Total	6,367	6,304	6,280	6,149	5,737	5,401	5,320	5,336	46,894

Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Total_revenue	44,037	2,490,000,000	24,800,000,000	100,200	2,170,000,000,000
Total_export_revenue	46,582	1,060,000,000	6,480,000,000	30,025	234,000,000,000
Export_revenue_to_eu	46,542	112,000,000	754,000,000	30,025	39,900,000,000
Export_revenue_to_nonEU	40,866	1,080,000,000	6,400,000,000	30,093	232,000,000,000
lnassets (firm size)	44,168	18.72	2.42	3.04	27.74
Firm_age	46,498	20.25	11.69	1	91
Altman Z score (financial health)	43,665	5.82	8.39	-0.28	34.94
RBI (financial constraint)	44,035	-2.83	0.66	-3.88	1.95
Cash_Conversion_Cycle	49,718	1.13	13.37	-91.82	191.47
Leverage	24,784	0.28	0.27	0.01	0.89
EBIT/total revenue	44,036	0.03	0.14	-0.74	0.30
EBIT/total asset	44,086	0.04	0.18	-1.30	0.58

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Main results (1/3)

Outcome variables: ln export revenue to EU and share of export revenue to EU to total revenue

	lnexport_revenue_EU		share_exportrevenue_EU_to_totalrevenue	
	(1)	(2)	(3)	(4)
treat x post	-0.141***	-0.124**	-0.015***	-0.023***
	(0.039)	(0.044)	(0.004)	(0.004)
Constant	Yes	Yes	Yes	Yes
Adjusted R^2	0.841	0.850	0.791	0.839
Obs	43315	39777	43355	39815
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry x Year FE		Yes		Yes
Altman Z-score RBI (financial constraint) Cash Conversion Cycle FE		Yes		Yes
Leverage EBIT/total revenue EBIT/total asset FE		Yes		Yes

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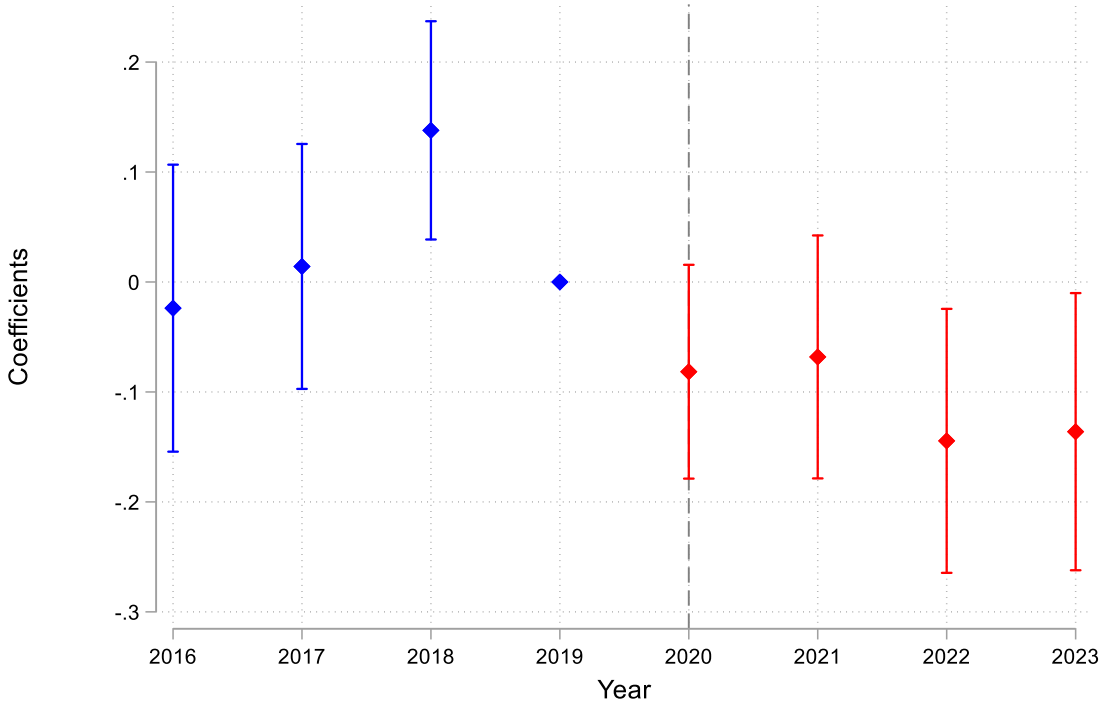
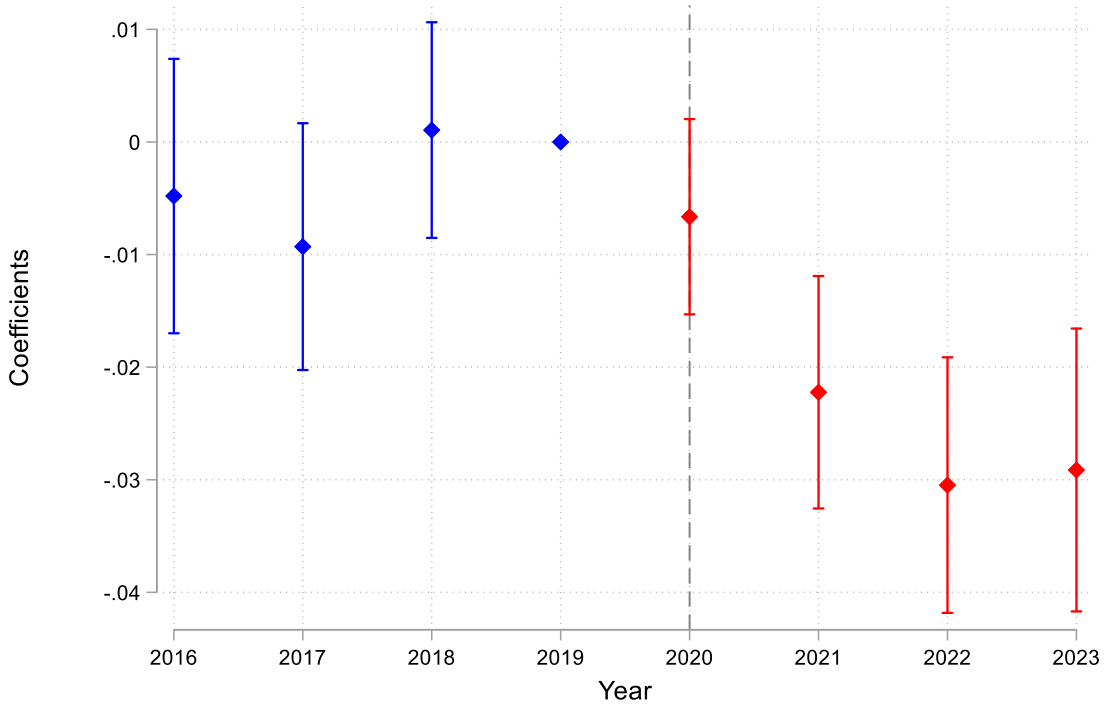
Event Study Plots

Outcome variables: ln export revenue to EU and share of export revenue to EU to total revenue

ln export revenue to EU



Share of export revenue to EU to total revenue



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Robustness Checks #1

Outcome variables: ln total export revenue and share of total export revenue to total revenue

	ln total_export_revenue		share_total_exportrevenue_to_totalrevenue	
	(1)	(2)	(3)	(4)
treat x post	-0.010	-0.070*	0.014	-0.020**
	(0.027)	(0.029)	(0.008)	(0.007)
Constant	Yes	Yes	Yes	Yes
Adjusted R^2	0.929	0.940	0.788	0.857
Obs	45936	42234	45940	42236
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry x Year FE		Yes		Yes
Altman Z-score RBI (financial constraint) Cash Conversion Cycle FE		Yes		Yes
Leverage EBIT/total revenue EBIT/total asset FE		Yes		Yes

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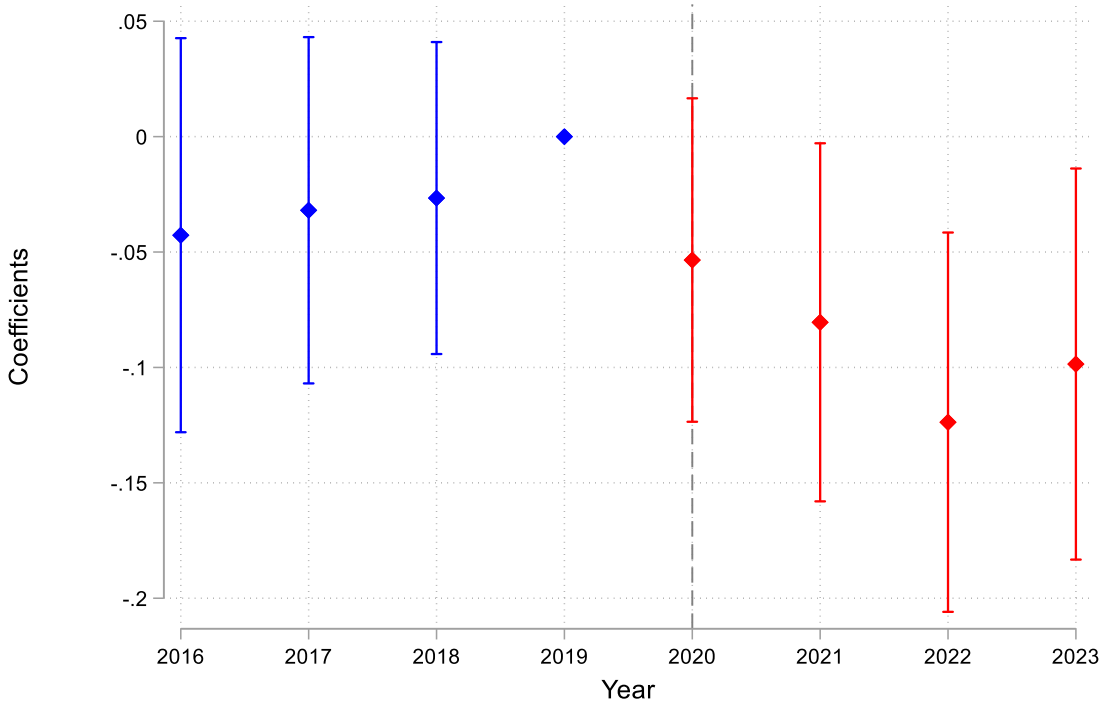
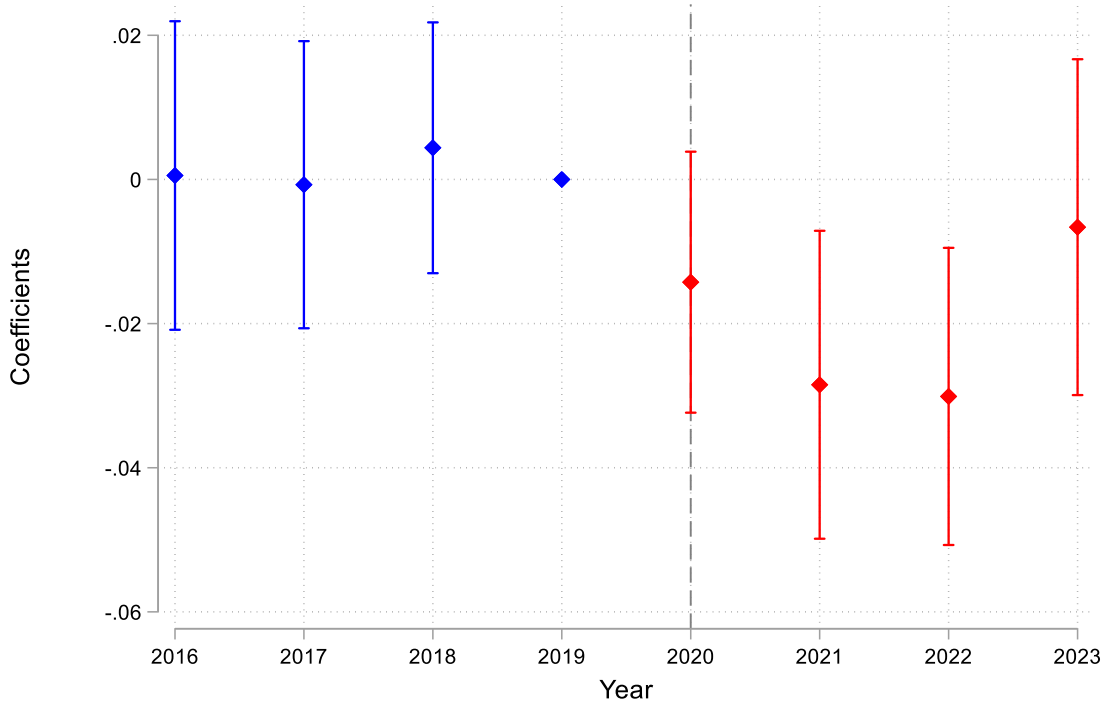
Event Study Plots

Outcome variables: ln total export revenue and share of total export revenue to total revenue

ln total_export_revenue



share_total_exportrevenue_to_totalrevenue



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Robustness Checks #2

Outcome variables: ln export revenue to nonEU and share of export revenue to nonEU to total revenue

	lnexport_revenue_nonEU		share_exportrevenue_nonEU_to_totalrevenue	
	(1)	(2)	(3)	(4)
treat x post	0.058*	-0.006	0.023***	0.003
	(0.029)	(0.032)	(0.005)	(0.005)
Constant	Yes	Yes	Yes	Yes
Adjusted R^2	0.922	0.932	0.823	0.877
Obs	40618	37429	46127	42392
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry x Year FE		Yes		Yes
Altman Z-score RBI (financial constraint) Cash Conversion Cycle FE		Yes		Yes
Leverage EBIT/total revenue EBIT/total asset FE		Yes		Yes

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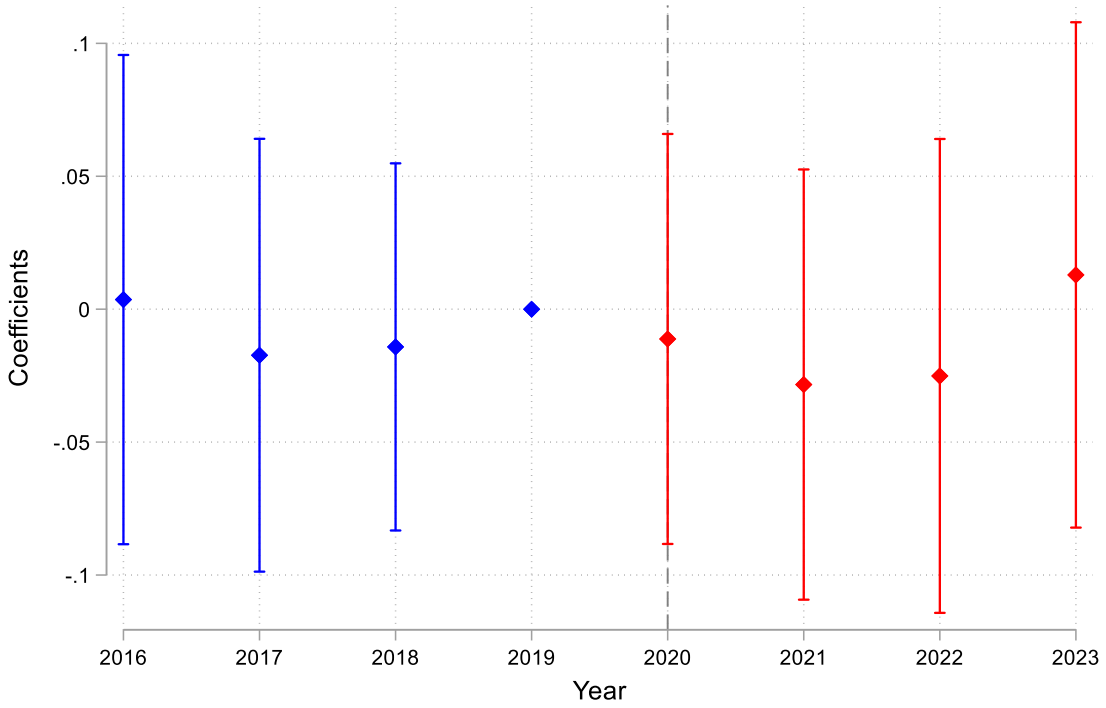
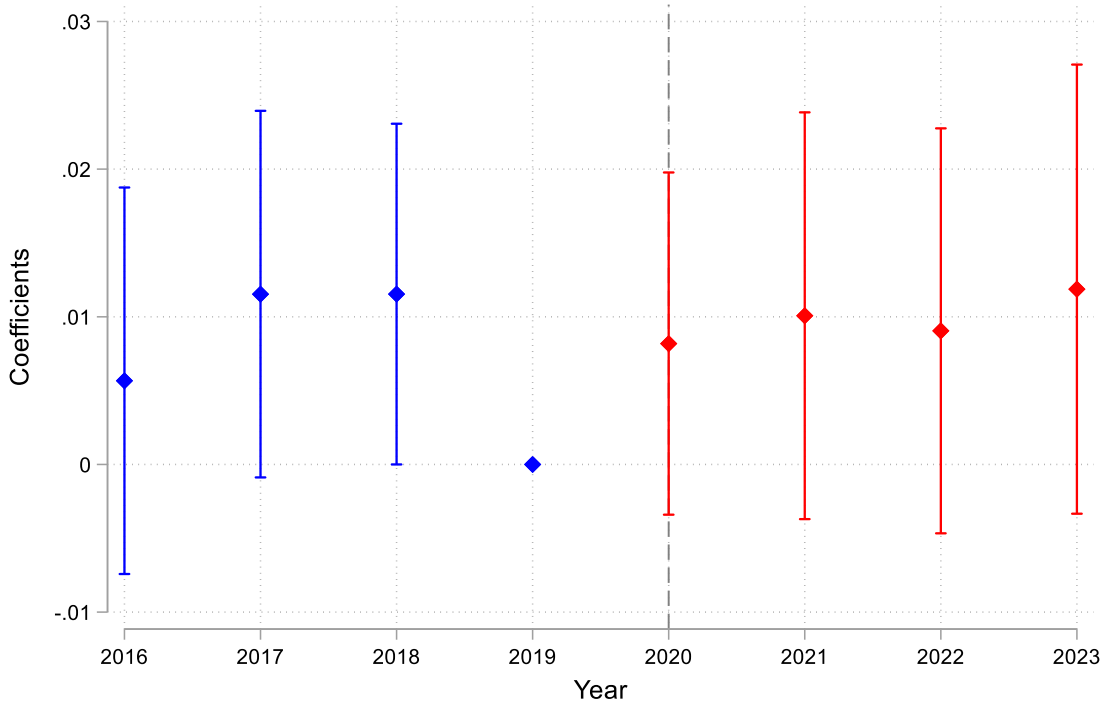
Event Study Plots

Outcome variables: ln export revenue to nonEU and share of export revenue to nonEU to total revenue

ln export revenue to nonEU



share of export revenue to nonEU to total revenue



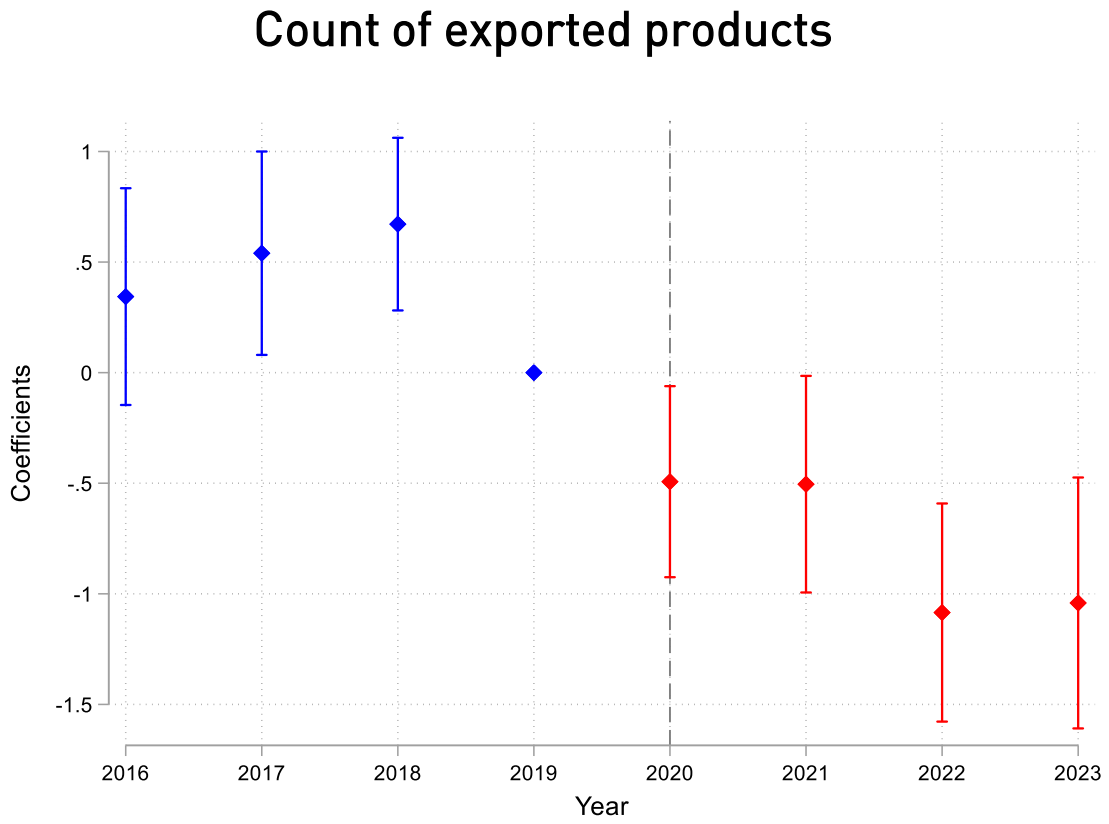
Main results (2/3)

Outcome variables: product diversification

	total_product_count	
	(1)	(2)
treat x post	-1.300***	-1.059***
	(0.166)	(0.187)
Constant	Yes	Yes
Adjusted R^2	0.913	0.916
Obs	34234	31234
Firm FE	Yes	Yes
Year FE	Yes	Yes
Industry x Year FE		Yes
Altman Z-score RBI (financial constraint) Cash Conversion Cycle FE		Yes
Leverage EBIT/total revenue EBIT/total asset FE		Yes

Event Study Plots

Outcome variables: product diversification



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Main results (3/3)

Outcome variables: export destination diversification

	number of country exclude EU		number of country include EU	
	(1)	(2)	(3)	(4)
treat x post	-0.216**	-0.094	-0.434***	-0.341***
	(0.069)	(0.073)	(0.085)	(0.091)
Constant	Yes	Yes	Yes	Yes
Adjusted R^2	0.924	0.925	0.924	0.925
Obs	34234	31234	34234	31234
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry x Year FE		Yes		Yes
Altman Z-score RBI (financial constraint) Cash Conversion Cycle FE		Yes		Yes
Leverage EBIT/total revenue EBIT/total asset FE		Yes		Yes

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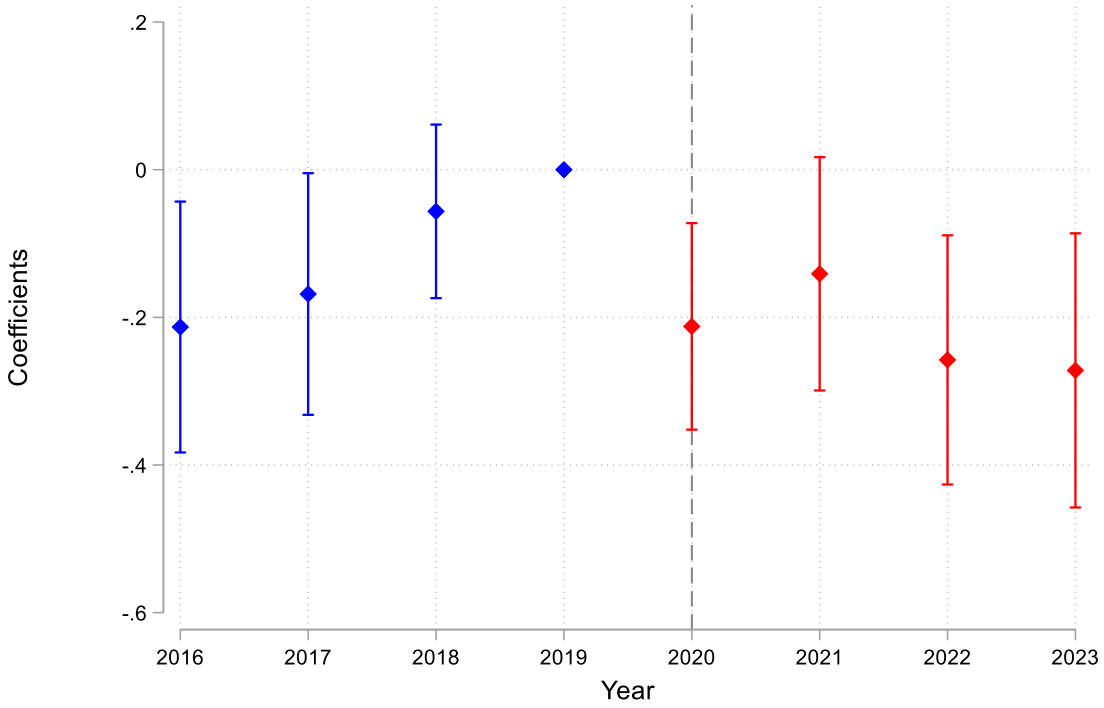
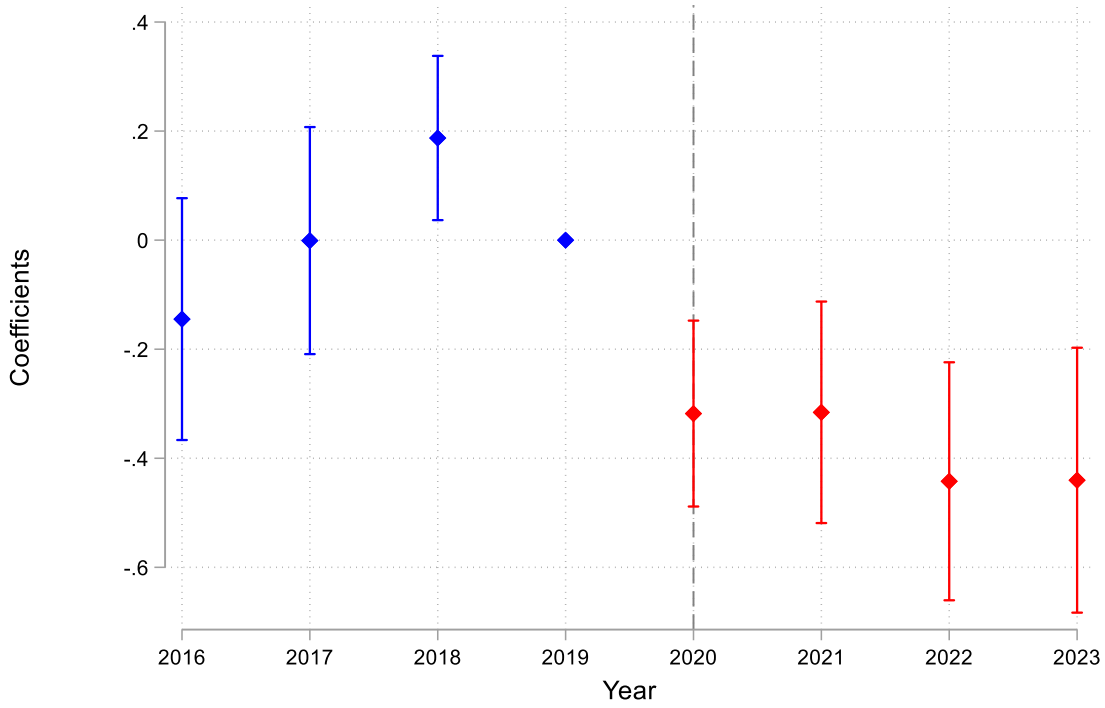
Event Study Plots

Outcome variables: export destination diversification

Count of country (Exclude EU)



Count of country (Include EU)



Conclusion

- The announcement of the CBAM has a detrimental impact on the EU export revenues of treated firms, as well as the proportion of these export revenues in relation to their total revenue. These treated firms cannot shift to other trading partners, which results in a decrease in their total export revenue.

- Regarding the effects on product diversification, treated firms exhibit a lack of diversification in their product offerings.

- Treated firms exported less CBAM goods to the EU market and cannot switch to other trading partners.

- **Key implications:**

  - With the CBAM imposing a carbon price on imports, EU importers are likely to prefer exporters capable of supplying products aligned with the CBAM framework that exhibit low carbon intensity, assuming all other conditions are constant. This preference aims to reduce their obligations and costs related to obtaining CBAM certificates.

  - Consequently, it is essential for Thai exporting firms to disclose the carbon intensity of their exports and undertake initiatives to green their production process, such as investing in low-carbon technologies and utilizing greener inputs.

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Possible Further Works (1/2)

- Conduct further analysis on product diversification (instead of counting number of product exported by firms)
  - Running regressions for 4 outcome variables:
    - Share of export revenue from CBAM goods to EU to total export revnenue
    - Share of export revenue from CBAM goods to non-EU to total export revenue
    - Share of export revenue from non-CBAM goods to EU to total export revenue
    - Share of export revenue from non-CBAM goods to non-EU to total export revenue
  - Explore using the Herfindahl index to capture firms' product diversification and run regression to examine whether firms' product diversification change after announcement of CBAM
- Conduct further analysis on export destination concentration (instead of counting number of country firms exported to)
  - Explore using the Hefindahl index to capture the country concentration by firm and run regression to examine whether firms' export destination concentration change after announcement of CBAM

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Possible Further Works (1/2)

- Conduct further analysis to check whether EU importers indeed switch to other trading partners that have lower carbon intensity embedded in the export goods
  - Classify countries into tiers based on the carbon intensity
  - Using difference-in-difference approach to investigate whether EU import shift away from the countries with high carbon intensity after announcement of CBAM