ERF 31ST Annual Conference
YOUTH
DEMOGRAPHIC DIVIDEND & MIGRATION IN MENA:
CHALLENGES & OPPORTUNITIES IN UNCERTAIN TIMES
reshaping the future

2025

# CBAM and Exporting Sectors in the MENA Region

Hoda Assem
and Aya Elewa

ECONOMIC RESEARCH FORUM
منتدى البحوث الاقتصادية

# CBAM and Exporting Sectors in the MENA Region

**Hoda Assem**[1] **Aya Elewa**[2]

**Abstract**

Global warming is a major global challenge, prompting many countries to adopt different environmental policies. However, differences in policy stringency have led to carbon leakage. To address the issue of carbon leakage, the European Commission adopted the Carbon Border Adjustment Mechanism (CBAM) in July 2021, which is gradually being implemented starting October 2023. The CBAM aims to prevent carbon leakage by ensuring that the carbon price of imports matches the carbon price of domestic production under the EU Emissions Trading System (ETS). This paper analyzes the impact of CBAM on Middle East and North Africa (MENA) countries. We examine how the carbon tax will influence exports and carbon emissions in the affected sectors in MENA countries. By using sector-country level data, the paper aims to shed light on what policy recommendations are key for these countries to maintain their exports to the EU given the new regulations.

[1] International Monetary Fund (IMF).
[2] Sciences Po, OFCE, Paris, France.

# Introduction

Global warming is one of the major challenges facing our planet. Several countries have adopted different policies to overcome the environmental risks associated with climate change. Given the disparity of the degree of stringency of the policies adopted across countries, there is a risk of carbon leakage. Therefore, in July 2021, the European Commission adopted its proposal for a Carbon Border Adjustment Mechanism (CBAM). Starting October 2023, the CBAM has been gradually introduced. The main objective of the CBAM is to prevent carbon leakage. Carbon leakage occurs when EU products are substituted with carbon intensive imports or when EU producers move their carbon-intensive production to countries with more flexible climate policies. In other words, the CBAM is a European regulation that the EU will use to correct the limit of $CO_2$ emissions released during the production of certain goods outside the EU. By imposing a carbon tax on certain products imported from non-EU and non-EFTA countries, the CBAM aims to ensure that the carbon price of imports is equivalent to the carbon price of domestic production under the EU Emissions Trading System (ETS).

The CBAM will be applied gradually starting with several goods whose production is carbon-intensive: cement, iron and steel, aluminum, fertilizers, electricity, and hydrogen. With this first phase, the CBAM will cover 50% of the emissions in ETS covered sectors. The full coverage of all ETS sectors is expected by 2030. Indeed, the CBAM will affect both the EU countries as well as their trading partners. This paper will focus on the impact of CBAM on MENA countries. Understanding how this carbon tax will affect exporting sectors in EU trading partners, specifically developing countries will allow us to draw some policy recommendations for these countries to continue to export to the EU.

MENA countries exposure to the CBAM increases with their dependence on carbon-intensive industries as a source of foreign currency. Among the products subject to the carbon tax, we can find that there is a high dependency for the aforementioned countries towards their exports to the EU countries. For example, in 2021, all the iron and steel income exports of Morocco comes from the EU. This percentage is 89.5% and 77% for Jordan and Egypt respectively. For the electrical energy, all the exports of Morocco go to the EU countries, for the mineral or chemical fertilizers, almost 40% of Egypt exports go to the EU. Given that, it would be interesting to analyze how this carbon tax will affect these countries.

Recently, many researchers were interested in studying how green transition will affect developing economies. Magacho et al. (2023) estimate developing countries macroeconomic exposure to the low carbon transition. They found that considering indirect impacts affects significantly how developing countries are affected by the green transition process.

In this paper, we contribute to this growing literature by studying how exporting sectors in MENA countries will respond to the CBAM.

The rest of the paper is organized as follows. Section 2 presents the data used. Section 3 offers a brief review of the theoretical framework and explains the empirical strategy used. Section 4 discusses the results obtained. Section 5 concludes.

# Data

In this paper, we use data that covers 19 MENA countries and their trade partners including 28 EU countries, over the 20-year period 2002 to 2021. We use trade and gravity-related data to estimate trade elasticities and data on carbon emissions, which will be explained in detail in this section.

First, we obtain bilateral trade data from the CEPII's BACII. Trade flows are identified by exporter, importer, product, and year. We will focus on exports from MENA countries. The data is disaggregated into 44 GTAP sectors. Second, we obtain data on bilateral weighted trade tariffs from the World Integrated Trade Solutions. Third, standard gravity variables are obtained from the CEPII's gravity data set. It gives information on variables such as GDP of importer and exporter countries, bilateral distance, common language, colonial link, etc. Merging these three data sets gives trade, and gravity data for 26 MENA countries and their trade partners for the period 2002-2021.

In addition, we obtain data on carbon dioxide embodied in the production for 44 sectors by country from the GTAP database. More specifically, emissions are measured in kg CO2 equivalent per 1 USD.

The detailed descriptive statistics of variables used are illustrated below:

Table 1: Descriptive Statistics

| Variable | Obs. | Mean | Std. dev. | Min | Max |
|---|---|---|---|---|---|
| Log Trade Flows | 1,011,566 | 0.057759 | 0.084558 | 0 | 3.433987 |
| Tariffs | 983,037 | 8.239273 | 0.817434 | 2.302585 | 9.88257 |
| Log Distance | 981,975 | 0.198272 | 0.398698 | 0 | 1 |
| Language | 983,037 | 0.03475 | 0.183145 | 0 | 1 |
| Contiguity | 1,011,566 | 0.057759 | 0.084558 | 0 | 3.433987 |

# Methodology

Following Zhao and Yarime (2022), we will estimate the impact of the carbon border tax on trade flows between the European Union and MENA countries.

Our estimation strategy is composed of two steps. In the first step we estimate the trade elasticities using a structural gravity model. In other words, we will use a structural gravity model to estimate how much a tariff affects trade flows. We will calculate industry level trade elasticities with respect to change in tariffs. The structural gravity model can be given by the following equation:

$$X_{ij} = Y_i \, E_j \, \frac{d_{ij}}{\Pi_i \, P_j} \quad (1)$$

where $X_{ij}$ represents bilateral trade flows between exporter $i$ and importer $j$ (Head and Mayer, 2014). The first term in equation (1) is the size term where $Y_i$ denotes total value of production in exporter $i$ and $E_j$ denotes total value of expenditure in importer $j$. The size term captures the hypothetical level of frictionless trade between $i$ and $j$, assuming no trade costs. The second term captures the effect of trade costs which drives a wedge between realized and frictionless trade (Beverelli et al., 2018). $d_{ij}$ denotes bilateral trade costs between i and j which can be decomposed into $d_{ij} = z_{ij}^{-\theta}(1 + t_{ij})^{-\theta}$ with $z_{ij}$ as iceberg trade costs and $t_{ij}$ as import tariffs. The standard practice is to proxy for the bilateral trade costs, $z_{ij}$ by using a series of observable variables such as distance, contiguity, and common language (Yotov et al., 2016). The structural terms $\Pi_i$ denotes the outward multilateral resistance terms and $P_j$ denotes the inward multilateral resistance terms. These terms capture the ease of market access for the exporter and the importer respectively (Anderson & Van Wincoop, 2003; Beverelli et al., 2018).

We will take the log of the structural gravity model and obtain the following equation:

$$lnX_{ij} = S_i + M_j + ln\, d_{ij} = S_i + M_j - \theta\, ln\, z_{ij} - \theta\, ln(1 + t_{ij}) \quad (2)$$

where $S_i$ and $M_j$ represent origin and destination fixed effects respectively. They are crucial to account for the multilateral resistance terms and failure to include them will lead to biased and inconsistent gravity estimates (Hummels, 2001; Anderson & Van Wincoop, 2003; Baldwin & Taglioni 2006; Feenstra, 2015). In addition, these fixed effects absorb the size variables as well as any other country-specific variable (Yotov et al., 2016). $z_{ij}$ includes all bilateral trade-cost variables. $e_{ijt}$ is the error term. We are interested in estimating the trade elasticity, $\theta$.

In the second step, we will use a simple method to translate a carbon border tax into a normal tariff (Zhao et al. 2022). We calculate the carbon equivalent tariff in industry $k$ in destination $j$, $\tau_k^j$as follows:

$$\tau_k^j = \frac{pE_k^j}{X_k^j} \quad (3)$$

where $p$ is the price in dollar per ton Co2, $E_k^j$ is the export emissions in industry $k$ in destination $j$ which is equal to the carbon intensity in industry k multiplied by volume of exports. $X_k^j$ is the total export in industry $k$ in destination $j$.

Everything else equal, a change rate of tariff $\frac{\Delta\tau}{\tau}$ will lead to a change rate of trade flows equal to $\frac{\theta_k \times \Delta\tau}{\tau}$ and $\Delta X_{ij}^k = X_{ij}^k \times \theta_k \times \frac{\Delta\tau}{\tau}$. Therefore, trade flows should respond to a carbon tariff as follows:

$$\Delta X_{ij}^k = X_{ij}^k \times \theta_k \times \frac{\Delta\tau_k^j}{\tau_k^j} = X_{ij}^k \times \theta_k \times \frac{pE_k^j}{X_k^j \tau_k^j} \quad (4)$$

# Results

Table 2 presents the elasticities for 44 industries in the dataset classified based on GTAP industry classification. The last column lists the industry level elasticities. The elasticities range from -39.8 to -0.67, with a mean of -9.21.

Industry trade elasticities measure how tariffs affect trade flows. Specifically, they represent the percentage change in trade flows within an industry resulting from a 1% increase in tariffs. When these elasticities are high, it indicates that the industry is particularly sensitive to tariff changes. Consequently, as trade flows adjust, the carbon emissions associated with trade also vary accordingly. For example, if the EU imposed an additional 1% tariff on Metal imports from MENA countries, the exports would decrease by -28.7%.

Table 2: Elasticity Estimates

| GTAP product code | GTAP Sector | GTAP Sector | Trade Elasticity |
|---|---|---|---|
| 46 | Electricity | ELY | -19 |
| 47 | Gas manufacture, distribution | GDT | -14 |
| 38 | Motor vehicules and parts | MVH | -12 |
| 38 | Metals nec | NFM | -12 |
| 16 | Oil | OIL | -11.934 |
| 33 | Chemical, rubber, plastic products | CRP | -10.5507 |
| 33 | Chemical products | CHM | -10.5507 |
| 37 | Ferrous metals | I_S | -9.80399 |
| 37 | Metal products | FMP | -9.80399 |
| 44 | Transport equipment nec | OTN | -9.60873 |
| 44 | Gas manufacture, distribution | GDT | -9.60873 |
| 18 | Other Extraction (formerly omn Minerals nec) | OXT | -9.27978 |
| 18 | Minerals n.e.c. | OMN | -9.27978 |
| 7 | Plant-based fibers | PFB | -8.43169 |
| 10 | Animal products nec | OAP | -7.99853 |
| 10 | Animal products n.e.c. | OAP | -7.99853 |
| 17 | Gas | GAS | -6.54516 |
| 36 | Mineral products nec | NMM | -6.17817 |
| 36 | Metals n.e.c. | NFM | -6.17817 |
| 34 | Mineral products n.e.c. | NMM | -5.81423 |
| 34 | Basic pharmaceutical products | BPH | -5.81423 |
| 13 | Forestry | FRS | -5.25114 |
| 29 | Leather products | LEA | -4.8307 |
| 32 | Petroleum, coal products | P_C | -4.79382 |

| | | | |
|---|---|---|---|
| 12 | Wool, silk-worm cocoons | WOL | -4.78578 |
| 30 | Wood products | GDT | -4.64941 |
| 25 | Food products nec | OFD | -4.43257 |
| 25 | Food products n.e.c. | OFD | -4.43257 |
| 21 | Vegetable oils and fats | VOL | -4.32554 |
| 39 | Transport equipment n.e.c. | OTN | -4.29433 |
| 39 | Metal products | FMP | -4.29433 |
| 41 | Electrical equipment | EEQ | -3.96948 |
| 41 | Machinery and equipment n.e.c. | OME | -3.96948 |
| 19 | Bovine meat products | CMT | -3.90238 |
| 19 | Bovine meat prods | CMT | -3.90238 |
| 27 | Textiles | TEX | -3.80683 |
| 42 | Machinery and equipment nec | OME | -3.69795 |
| 42 | Manufactures n.e.c. | OMF | -3.69795 |
| 14 | Fishing | FSH | -3.17604 |
| 20 | Meat products n.e.c. | OMT | -2.82406 |
| 20 | Meat products nec | OMT | -2.82406 |
| 35 | Rubber and plastic products | RPP | -2.78146 |
| 35 | Ferrous metals | I_S | -2.78146 |
| 45 | Manufactures nec | OMF | -2.47181 |
| 40 | Electronic equipment | ELE | -2.4235 |
| 40 | Computer, electronic and optical products | ELE | -2.4235 |
| 6 | Sugar cane, sugar beet | C_B | -1.87299 |
| 9 | Bovine cattle, sheep and goats, horses | CTL | -1.73167 |
| 28 | Wearing apparel | WAP | -1.30122 |
| 15 | Coal | COA | -1.23923 |
| 1 | Paddy rice | PDR | -1.09177 |
| 3 | Cereal grains n.e.c. | GRO | -0.96538 |
| 3 | Cereal grains nec | GRO | -0.96538 |
| 31 | Paper products, publishing | PPP | -0.93748 |
| 4 | Vegetables, fruit, nuts | V_F | -0.66141 |
| 5 | Oil seeds | OSD | -0.57896 |
| 22 | Dairy products | MIL | -0.56407 |
| 24 | Sugar | SGR | -0.53666 |
| 26 | Beverages and tobacco products | B_T | -0.53199 |
| 23 | Processed rice | PCR | -0.44138 |
| 8 | Crops n.e.c. | OCR | -0.21522 |
| 8 | Crops nec | OCR | -0.21522 |
| 2 | Wheat | WHT | 2.592079 |
| 43 | Motor vehicles and parts | MVH | 3.115862 |
| 43 | Electricity | ELY | 3.115862 |

Table 3 provides the results of the impact of carbon tariffs on trade flows and carbon emissions across industries affected by CBAM regulations. The third column $\tau k$ refers to the tariff equivalent of a one-dollar carbon tariff in industry k. The fourth column $\Delta Tk$ denotes the rate of change in tariffs following the imposition of a one-dollar carbon tariff in industry k. The fifth column $\theta_k$ refers to the trade elasticity and column 6 $\frac{\Delta X_k}{X_k}$ refers to the change in trade flows due to the carbon tariff. For example, $\tau k$ for chemicals is 0.549623%. In other words, a one-dollar carbon tariff on chemicals imports from MENA countries to the EU27 is equivalent to 0.549623% tariff. We can see that the change rate in trade flows and carbon emissions is equally very small. The last column shows the threshold carbon tariffs which would entail zero export and carbon emissions. As shown in table 3, these prices are still much lower than the current price of carbon.

Table 3: Detailed Results given Carbon Tariff

| Sector | Sector Code | $\tau_k$ | $\frac{\Delta T_k}{T_k}$ | $\theta_k$ | $\frac{\Delta X_k}{X_k}$ | Threshold p ($/ton CO2) |
|---|---|---|---|---|---|---|
| | | | | | | |
| Chemicals | chm | 0.549623 | 0.538146 | -9.61643 | -5.13303 | 0.194817 |
| Metal Products | fmp | 0.023358 | 0.023105 | -3.56701 | -0.11513 | 8.685591 |
| Ferrous metals | i_s | 1.089763 | 1.067229 | -4.02264 | -4.69992 | 0.212769 |
| Metals | nfm | 0.035597 | 0.034818 | -1.82777 | -0.04527 | 22.09086 |
| Mineral products | nmm | 1.773166 | 1.743985 | -2.43314 | -4.25614 | 0.234955 |
| Other Extraction | oxt | 0.173006 | 0.172939 | -1.57648 | -0.27273 | 3.666576 |
| | | | | | | |
| Total | | 0.370822 | 0.362993 | -7.29937 | -1.61135 | 2.799369 |

# Future Extensions

In a future extension of our paper, we plan to estimate a general equilibrium analysis of the structural gravity model following the methodology developed by Yotov et al. (2016). Such a general equilibrium analysis of the gravity model allows us to consider both the direct and indirect trade links within the global trade system such as possible trade creation and diversion. This analysis will provide a more complete understanding of the effect CBAM has on the MENA countries relative to global trade network.

# Conclusion

The European Union has started to adopt the CBAM in October 2023 to avoid carbon leakage. This mechanism will affect both EU countries and their trading partners. In this paper, we analyze how exports in MENA countries will be affected by these regulations. The main contribution of this paper is the focus on the impact of CBAM on MENA countries. This would allow us to draw some policy recommendations to these MENA countries to maintain their exports to the EU countries.

# References


Anderson, J. E., & Van Wincoop, E. (2003). Gravity with gravitas: A solution to the border puzzle. *American economic review*, *93*(1), 170-192.

Baldwin, R., & Taglioni, D. (2006). Gravity for dummies and dummies for gravity equations.

Beverelli, C., Keck, A., Larch, M., & Yotov, Y. V. (2018). Institutions, trade and development: A quantitative analysis.

Chepeliev, M., and Corong, E. 2022. "Revisiting the environmental bias of trade policies based on an environmentally extended GTAP MRIO Data Base." Center for Global Trade Analysis, Purdue University.

Chepeliev, M., Aguiar, A., Farole, T., Liverani, A., and van der Mensbrugghe, D. 2022. "EU Green Deal and Circular Economy Transition: Impacts and Interactions." Paper presented at the 25th Annual Conference on Global Economic Analysis (Virtual Conference).

Elliott, J., Foster, I., Kortum, S., Munson, T., Cervantes, F. P., & Weisbach, D. (2010). Trade and carbon taxes. *American Economic Review*, *100*(2), 465-469.

Magacho, G., Espagne, E., Godin, A., Mantes, A., & Yilmaz, D. (2023). Macroeconomic exposure of developing economies to low-carbon transition. *World Development*, *167*, 106231.

Yotov, Y. V., Piermartini, R., & Larch, M. (2016). *An advanced guide to trade policy analysis: The structural gravity model*. WTO iLibrary.

Zhao, B., & Yarime, M. (2022). The impacts of carbon tariffs on international trade flows and carbon emissions: An analysis integrating trade elasticities with an application to US-China trade. *Energy Economics*, *115*, 106337.