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CO₂ emissions in Latin American maritime imports and revised export calculations

Introduction

Climate change has long been a topic on government agendas because of its undeniable impact on people's well-being and economic prosperity and on natural systems.

Maritime transport, while widely recognized as a key part of the global economy, also has a negative side that needs to be addressed, as ship



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FAL Bulletin 373,¹ published in January 2020, documented the first results of a rapid assessment methodology for calculating CO₂ emissions generated by the maritime transport of the region's exports.

Continuing on from that earlier research, this study aims to apply that methodology to imports by the countries that were examined in the previous publication. Similarly, in consideration of the comments received on that edition, some methodological adjustments were made and the sample was increased; thus, a revision of the export calculations is included, which now cover 82% of total Latin American and Caribbean exports.

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¹ Sánchez, E. Barleta and Sánchez Di Domenico, 2020.



emissions are key to reducing the impact of human activities on the planet, including activities related to international trade. Ship-generated emissions therefore represent a central component in reducing the carbon footprint of international trade, as well as other significant pollutants.

Reducing air pollutants generated by maritime transport and the fuel that it burns is important in improving the industry's sustainability. The International Maritime Organization (IMO) clarifies this point: *"The main type of 'bunker' oil for ships is heavy fuel oil, derived as a residue from crude oil distillation. Crude oil contains sulphur which, following combustion in the engine, ends up in ship emissions. Sulphur oxides (SOx) are known to be harmful to human health, causing respiratory symptoms and lung disease. In the atmosphere, SOx can lead to acid rain, which can harm crops, forests and aquatic species, and contributes to the acidification of the oceans."*² For that reason, the low-sulphur regulation, adopted by IMO and in force since 1 January 2020, marked an important milestone.

The adoption in April 2018 of the initial IMO strategy to reduce greenhouse gas emissions was also a key landmark. That strategy aims to reduce total annual GHG emissions from ships by at least 50% between 2008 and 2050, by combining quantitative reduction targets up to 2050 and a list of possible measures for the short, medium and long terms.

I. Methodological considerations

In that context, the causes and magnitude of the emissions generated must be identified, in order to develop specific reduction and mitigation actions at the international, regional, national and local levels. This will require continued progress in developing a regional methodology for measuring the carbon emissions of international maritime traffic. It should be noted that the earlier emissions calculations (Sánchez, E. Barleta and Sánchez Di Domenico, 2020) have been expanded to include products transported by container, which implies some additional steps.

Based on the methodology put forward in the earlier publication and in line with the comments received, the authors improved the tool in order to obtain measurements that are closer to reality, and they also expanded the sample used for exports, which

² See [online] <http://www.imo.org/es/MediaCentre/HotTopics/Paginas/Sulphur-2020.aspx>.

now covers 82% of the total for the entire Latin American and Caribbean region, for all modes of transport. The calculation methodology was subsequently applied to imports, using a sample covering almost 60% of the region's import volume. The results of both exercises can be found in this edition of the FAL Bulletin (Sánchez, E. Barleta and Sánchez Di Domenico, 2020).

This methodology could be termed a rapid assessment: it is a form of measurement that can be performed quickly and economically, when there is little information available or when the information required by more complex techniques is not available. In the case at hand, for example, full geographical information on the movement of the vessels used to carry exports and imports is not available. In contrast, the rapid assessment provides basic information that can be used to monitor and evaluate the activity's impacts and to establish a preliminary position that can point the way to more robust measurements later.

The sample used was constructed on the basis of each country's main exports and imports (ordered in descending order by tonnage), broken down by goods type, together with the different origin and destination pairs of the countries' main ports; it does not consider all the ports that move those cargoes between the two countries involved. The goods were classified using the 2007 Harmonized System (HS2007) at the four-digit level.³

The authors consulted the world's largest ship-owners operating in the region to select the maritime routes with the fewest connections to and from Latin America and the Caribbean.⁴ After identifying the owners and routes, the different itineraries and their intermediate ports of call were determined for each chosen route, in order to calculate the total distance between the point of origin and the final destination. Subsequently, using information on the identified routes and ship-owners provided by *BlueWater Reporting*,⁵ the vessel types and their average TEUs were chosen and their reported emissions were determined.

Quantifying emissions involves complex calculations. This is due to the different variables and factors that determine total emissions: for example, the great variety of vessels of different specialties, sizes and engines, sea routes, navigation conditions and so on. Some of this information is not easily accessible and yet is essential in calculating emissions accurately. In view of this, the authors have proposed a rapid assessment methodology based on a conservative measurement of emissions, taking into account the following criteria:

- After selecting the products, the most frequently used vessel type was determined, considering the type of cargo, the size of the vessel and the ports used.
- For each shipping combination, the most important ports on both sides (exporting and importing countries) were considered, according to their specialization.
- For the selection of routes for country and freight pairs, the combinations with the shortest sea distance were chosen, and if there was a choice between direct services or services with intermediate stops, the direct services were chosen. In the case of containers, the most frequent stopovers along the regular routes were selected.
- The selected countries' exports are predominantly commodities and, although they are more diversified, the same is true for their imports. Bulk cargo accounts for the greatest import and export volumes in the region's countries, with containerized cargo representing a lower proportion. In other words, the sample mainly contains routes that involve direct services. Except for the container volumes, services that use topping-off were not considered, although they do exist.

³ The classification can be consulted online at <https://comtrade.un.org/db/mr/rfCommoditiesList.aspx?px=H3&cc=>.

⁴ Hapag Lloyd [online] <https://www.hapag-lloyd.com/en/service-finder/bydeparture.html>, MSC [online] <https://www.msc.com/chl/our-services/trade-services>, Maersk [online] https://www.maersk.com/schedules/?gclid=CjwKCAiAgqDxBRBTiEiwA59eENzS3Tw2hHXne5BTvNoNceOmeRtf35hjEoANJ4Do-pUUC3-4oSgtcVBoCQ-cQAVD_BwE&gclid=aw.ds.

⁵ See [online] <https://www.bluewaterreporting.com/>.

- Only international maritime transport was included: domestic cabotage, domestic transport services and inland waterway transport were not taken into consideration in the study. Neither were passenger conveyance, project cargo or ro-ro vessels included in the calculation.
- Journeys made by ships arriving in ballast—that is, those that arrive empty to look for exports—were not included in the calculation, only trips made carrying commercial goods. That limitation could, however, be resolved in a future recalculation of emissions using this rapid assessment tool.
- The calculation only includes the vessel's voyage, i.e. the main navigation route, and therefore does not consider short-range emissions or emissions generated during waiting times for docking, loading, unloading and manoeuvring.

The main objective of this study is to provoke thoughts about emissions based on the available data. Additional data are needed to improve the methodology and obtain accurate measures of emissions (or at least a better approximation), and these could be collected through the Automatic Identification System (AIS) or from terminals and shipping companies.

Finally, it should be noted that this study's estimates cover 70% of the total international trade of the Latin American and Caribbean countries.

II. Use of the methodology to measure CO₂ emissions from imports

To calculate each ship's cargo volume, the maritime imports in tons during 2017⁶—comprising mainly grains and grain by-products, minerals (mostly iron and coal), oil and its by-products, chemicals and fertilizers—of the following countries were counted: Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Peru and Uruguay.

For each country, a sample was constructed by taking the main import products (in descending order by tonnage), along with the different origin and destination pairs assigned to the different types of good. The goods were classified using the 2007 Harmonized System (HS2007) at the four-digit level.

The volume breakdown by country is shown in table 1. Once the products with the greatest weight in the import basket have been selected, the main destinations are investigated and this constitutes the sample used.

The samples for the selected countries thus represent between 56.5% and 78.2% of total exports, depending on the make-up of each country's import basket. In general, minerals, grains, chemicals and fertilizers account for the bulk of imports brought in by sea. Mexico reports a higher proportion of manufactured goods, particularly those related to the automotive industry.

⁶ The information was taken from the ECLAC International Transport Database (BTI), which contains data on the physical volume of exports and imports by mode of transport. This database has not been published.



Table 1
Breakdown of the sample, 2017

Countries	Total country maritime imports (in tons)	Imports selected for the sample (in tons)	Percentage of sample in total maritime imports
Argentina	29 890 886	21 609 573	72.3
Brazil	135 103 278	105 668 425	78.2
Chile ^a	51 743 264	39 916 387	77.1
Colombia	31 248 094	20 542 203	65.7
Ecuador	14 691 977	10 517 335	71.6
Mexico	153 523 169	86 714 439	56.5
Peru	35 375 123	23 529 616	66.5
Uruguay	4 283 553	3 244 979	75.8

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of information from International Transport Database (BTI) and UN Comtrade - International Trade Statistics Database.

^a The latest available data for Chile are from 2015; hence, all the estimates for that country use information from that year.

The results of the maritime transport emissions calculations for the countries are presented on tables 2 to 9 below.

In the case of Argentina (table 2), hydrocarbons and minerals make up a large portion of the maritime import basket volume, with petroleum oils and gases, iron and coal accounting for 42.7%. Taking into consideration the main points of origin of these products (and those that complete the top 15), the emissions from imports are estimated at 366,217 tons of CO₂ equivalent for a sample (product and destination) of 69.5% of their total maritime exports.

For Brazil (table 3), it can be seen that hydrocarbons, minerals and fertilizers make up a large part of the maritime import basket volume, with petroleum oils and gases, coal and chemical mineral fertilizers accounting for 58.3%. Taking into consideration the origins of these products (and those that complete the top 15), the emissions from imports are estimated at 1,703,750 tons of CO₂ equivalent for a sample (product and destination) of 75.9% of their total maritime imports.

Table 2
Argentina: shipping emissions of major imported goods, 2017

HS 2007 heading	HS 2007 description	Tons	Share of good in total imports (Percentages)	Percentage selected from the main origins of the imported good	Sample size (product and destination) (Percentages)	CO ₂ equivalent emissions (kg)
2601	Iron ores and concentrates; including roasted iron pyrites.	4 887 823	16.4	97.7	16.0	21 229 431
2710	Petroleum oils and oils obtained from bituminous minerals, other than crude; preparations not elsewhere specified or included, containing by weight 70% or more of petroleum oils or of oils obtained from bituminous minerals, these oils being the basic constituents of the preparations; waste oils.	3 676 398	12.3	91.0	11.2	81 551 107
2711	Petroleum gases and other gaseous hydrocarbons.	3 272 667	10.9	94.7	10.4	98 089 346
1201	Soya beans, whether or not broken.	1 897 495	6.3	95.6	6.1	9 259 017
2701	Coal; briquettes, ovoids and similar solid fuels manufactured from coal.	1 510 500	5.1	100.0	5.1	21 665 432
3105	Mineral or chemical fertilizers containing two or three of the fertilizing elements nitrogen, phosphorus and potassium; other fertilizers; goods of chapter 31 in tablets or similar forms or in packages of a gross weight not exceeding 10 kg.	1 194 361	4.0	95.2	3.8	20 752 675
2709	Petroleum oils and oils obtained from bituminous minerals, crude.	1 069 491	3.6	100.0	3.6	19 119 405
3102	Mineral or chemical fertilizers, nitrogenous.	974 014	3.3	96.2	3.1	8 873 990
2818	Aluminium oxide (including artificial corundum); aluminium hydroxide.	870 460	2.9	99.5	2.9	12 513 788
8703	Motor cars and other motor vehicles principally designed for the transport of persons (other than those of heading 8702), including station wagons and racing cars).	515 676	1.7	95.0	1.6	17 571 665
7207	Iron or non-alloy steel; semi-finished products thereof.	488 115	1.6	99.9	1.6	4 494 041
2523	Portland cement, aluminous cement, slag cement, supersulphate cement and similar hydraulic cements, whether or not coloured or in the form of clinkers.	364 121	1.2	99.2	1.2	2 832 323
2510	Natural calcium phosphates, natural aluminium calcium phosphates and phosphatic chalk.	299 725	1.0	100.0	1.0	4 235 254
6810	Cement, concrete or artificial stone, whether or not reinforced; manufactures thereof.	296 162	1.0	99.3	1.0	25 239 336
7210	Iron or non-alloy steel; flat-rolled products of a width of 600 mm or more, clad, plated or coated.	292 565	1.0	94.6	0.9	18 791 003
Total for the 15 main imported goods					69.5	366 217 813

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of information from International Transport Database (BTI).

Table 3
Brazil: shipping emissions of major imported goods, 2017

HS 2007 heading	HS 2007 description	Tons	Share of good in total imports (Percentages)	Percentage selected from the main origins of the imported good	Sample size (product and destination) (Percentages)	CO ₂ equivalent emissions (kg)
2701	Coal; briquettes, ovoids and similar solid fuels manufactured from coal.	23 561 678	17.4	98.9	17.2	297 367 290
2710	Petroleum oils and oils obtained from bituminous minerals, other than crude; preparations not elsewhere specified or included, containing by weight 70% or more of petroleum oils or of oils obtained from bituminous minerals, these oils being the basic constituents of the preparations.	23 366 607	17.3	98.5	17.0	418 274 402
3104	Mineral or chemical fertilizers, potassic.	9 865 522	7.3	93.8	6.8	197 846 505
3102	Mineral or chemical fertilizers, nitrogenous.	9 570 373	7.1	95.9	6.8	137 925 494
2709	Petroleum oils and oils obtained from bituminous minerals; crude.	7 411 273	5.5	99.3	5.4	149 706 683
3105	Mineral or chemical fertilizers containing the three fertilizing elements nitrogen, phosphorus and potassium; goods of this chapter in tablets or similar forms or in packages of a gross weight not exceeding 10 kg.	7 595 409	5.6	91.1	5.1	106 571 963
1001	Wheat and meslin.	5 602 969	4.1	96.7	4.0	64 565 649
2711	Petroleum gases and other gaseous hydrocarbons.	3 245 248	2.4	98.1	2.4	76 438 021
2713	Petroleum coke, petroleum bitumen and other residues of petroleum oils or of oils obtained from bituminous minerals.	2 317 860	1.7	98.8	1.7	38 363 312
2503	Sulphur of all kinds, other than sublimed sulphur, precipitated sulphur and colloidal sulphur.	2 047 062	1.5	92.1	1.4	35 041 701
2815	Sodium hydroxide (caustic soda); potassium hydroxide (caustic potash); peroxides of sodium or potassium.	2 004 754	1.5	98.0	1.5	34 452 501
2510	Natural calcium phosphates, natural aluminium calcium phosphates and phosphatic chalk.	1 903 016	1.4	98.6	1.4	25 518 101
3103	Mineral or chemical fertilizers, phosphatic.	1 556 923	1.2	96.6	1.1	25 474 592
2704	Coke and semi-coke of coal, of lignite or of peat, whether or not agglomerated; retort carbon.	1 533 257	1.1	93.1	1.1	30 602 781
2207	Undenatured ethyl alcohol of an alcoholic strength by volume of 80 % vol or higher; ethyl alcohol and other spirits, denatured, of any strength.	1 452 599	1.1	100.0	1.1	24 644 706
2905	Acyclic alcohols and their halogenated, sulphonated, nitrated or nitrosated derivatives.	1 412 208	1.0	94.8	1.0	22 069 955
2836	Carbonates; peroxocarbonates (percarbonates); commercial ammonium carbonate containing ammonium carbamate.	1 221 666	0.9	95.8	0.9	18 887 204
Total for the 17 main imported goods					75.9	1 703 750 860

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of information from International Transport Database (BTI).

Chile's situation (table 4) is similar to the cases already described: hydrocarbons and minerals make up a large part of the maritime import basket volume, with oil and gas and coal accounting for 60.9%. Taking into consideration the origins of these products (and those that complete the top 15), the emissions from imports are estimated at 673,074 tonnes of CO₂ equivalent for a sample (product and destination) of 75% of their total maritime imports.

In Colombia's case (table 5), hydrocarbons, grains and fertilizers account for 46.7% of the maritime import basket volume. Taking into consideration the origins of these products (and those that complete the top 17), the emissions from imports are estimated at 218,935 tons of CO₂ equivalent for a sample (product and destination) of 75% of their total maritime imports.

In the case of Ecuador (table 5), hydrocarbons, grains and fertilizers account for 52.6% of the maritime import basket volume. Taking into consideration the origins of these products (and those that complete the top 15), the emissions from imports are estimated at 130,532 tons of CO₂ equivalent for a sample (product and destination) of 70.1% of their total maritime imports.

Table 7 shows that Mexico's main maritime imports are manufactured goods. Considering the main origins for these products (and those that complete the top 15), emissions from imports are estimated at 2,950,107 tons of CO₂ equivalent for a sample (product and destination) of 56.5% of their total maritime imports.

Table 8 shows the results for Peru, where hydrocarbons, grains and fertilizers make up 56.6% of the maritime import basket volume. Taking into consideration the origins of these products (and those that complete the top 14), the emissions from imports are estimated at 286,403 tonnes of CO₂ equivalent for a sample (product and destination) of 64.2% of their total maritime imports.

Lastly, table 9 shows that hydrocarbons and fertilizers are the main products by volume in Uruguay's import basket, accounting for 56.9% of the total. Taking into consideration the origins of these products (and those that complete the top 14), the emissions from imports are estimated at 286,403 tonnes of CO₂ equivalent for a sample (product and destination) of 64.2% of their total maritime imports.

To summarize, table 10 presents emissions by country and, additionally, calculates the share of these emissions in total international shipping emissions, which are estimated at 870 million tons equivalent.⁷

⁷ Calculated by Det Norske Veritas (DNV) [online] <https://www.dnvgl.com/>.

Table 4
Chile: shipping emissions of major imported goods, 2015

HS 2007 heading	HS 2007 description	Tons	Share of good in total imports (Percentages)	Percentage selected from the main origins of the imported good	Sample size (product and destination) (Percentages)	CO ₂ equivalent emissions (kg)
2701	Coal; briquettes, ovoids and similar solid fuels manufactured from coal.	9 835 179	19.0	94.1	17.9	137 235 529
2709	Petroleum oils and oils obtained from bituminous minerals, crude.	8 432 269	16.3	98.4	16.0	137 845 382
2710	Petroleum oils and oils obtained from bituminous minerals, other than crude; preparations not elsewhere specified or included, containing by weight 70% or more of petroleum oils or of oils obtained from bituminous minerals, these oils being the basic constituents of the preparations; waste oils.	6 047 078	11.7	99.0	11.6	128 874 599
7103	Precious stones (other than diamonds) and semi-precious stones, whether or not worked or graded but not strung, mounted or set; ungraded precious stones (other than diamonds) and semi-precious stones, temporarily strung for convenience of transport.	4 605 157	8.9	100.0	8.9	91 690 747
2711	Petroleum gases and other gaseous hydrocarbons.	3 379 464	6.5	99.3	6.5	18 237 932
2807	Sulphuric acid; oleum.	2 179 822	4.2	93.6	3.9	58 768 469
2523	Portland cement, aluminous cement, slag cement, supersulphate cement and similar hydraulic cements, whether or not coloured or in the form of clinkers.	1 849 306	3.6	97.1	3.5	43 295 996
1005	Maize (corn).	1 521 720	2.9	100.0	2.9	10 091 087
3102	Mineral or chemical fertilizers, nitrogenous.	769 121	1.5	94.1	1.4	7 037 554
1001	Wheat and meslin.	742 503	1.4	94.4	1.4	8 667 587
7210	Iron or non-alloy steel; flat-rolled products of a width of 600 mm or more, clad, plated or coated.	554 769	1.1	94.9	1.0	31 329 214
Total for the 11 main imported goods					75.0	673 074 098

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of information from International Transport Database (BTI).

Table 5
Colombia: shipping emissions of major imported goods, 2017

HS 2007 heading	HS 2007 description	Tons	Share of good in total imports (Percentages)	Percentage selected from the main origins of the imported good	Sample size (product and destination) (Percentages)	CO ₂ equivalent emissions (kg)
2710	Petroleum oils and oils obtained from bituminous minerals, other than crude; preparations not elsewhere specified or included, containing by weight 70% or more of petroleum oils or of oils obtained from bituminous minerals, these oils being the basic constituents of the preparations; waste oils.	5 414 640	17.3	96.6	16.7	33 983 063
1005	Maize (corn).	4 881 178	15.6	99.9	15.6	23 588 881
1001	Wheat and meslin.	1 888 215	6.0	93.8	5.7	22 464 956
2304	Oilcake and other solid residues, whether or not ground or in the form of pellets, resulting from the extraction of soya-bean oil.	1 322 651	4.2	92.5	3.9	8 400 881
2523	Portland cement, aluminous cement, slag cement, supersulphate cement and similar hydraulic cements, whether or not coloured or in the form of clinkers.	1 271 864	4.1	99.7	4.1	23 325 114
3102	Mineral or chemical fertilizers, nitrogenous.	1 082 496	3.5	90.3	3.1	5 181 598
3104	Mineral or chemical fertilizers, potassic.	677 316	2.2	95.1	2.1	3 729 784
1201	Soya beans, whether or not broken.	538 115	1.7	100.0	1.7	2 587 827
7208	Iron or non-alloy steel; flat-rolled products of a width of 600 mm or more, hot-rolled, not clad, plated or coated.	477 343	1.5	91.4	1.4	27 847 666
3105	Mineral or chemical fertilizers containing two or three of the fertilizing elements nitrogen, phosphorus and potassium; other fertilizers; goods of chapter 31 in tablets or similar forms or in packages of a gross weight not exceeding 10 kg.	476 309	1.5	91.1	1.4	5 193 937
2903	Halogenated derivatives of hydrocarbons.	459 032	1.5	98.7	1.4	803 180
6907	Unglazed ceramic flags and paving, hearth or wall tiles; unglazed ceramic mosaic cubes and the like, whether or not on a backing.	413 924	1.3	96.5	1.3	15 160 335
3901	Polymers of ethylene, in primary forms.	353 083	1.1	90.8	1.0	1 542 316
2303	Residues of starch manufacture and similar residues, beet-pulp, bagasse and other waste of sugar manufacture, brewing or distilling dregs and waste, whether or not in the form of pellets.	344 054	1.1	99.9	1.1	1 653 593
7209	Iron or non-alloy steel; flat-rolled products, of a width of 600 mm or more, cold-rolled (cold-reduced), not clad, plated or coated.	333 629	1.1	97.8	1.0	21 226 790
1507	Soya-bean oil and its fractions, whether or not refined, but not chemically modified.	307 288	1.0	91.3	0.9	7 116 012
7225	Flat-rolled products of other alloy steel, of a width of 600 mm or more.	301 068	1.0	93.5	0.9	15 129 797
Total for the 17 main imported goods					63.4	218 935 730

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of information from International Transport Database (BTI).

Table 6
Ecuador: shipping emissions of major imported goods, 2017

HS 2007 heading	HS 2007 description	Tons	Share of good in total imports (Percentages)	Percentage selected from the main origins of the imported good	Sample size (product and destination) (Percentages)	CO ₂ equivalent emissions (kg)
2710	Petroleum oils and oils obtained from bituminous minerals, other than crude; preparations not elsewhere specified or included, containing by weight 70% or more of petroleum oils or of oils obtained from bituminous minerals, these oils being the basic constituents of the preparations; waste oils.	3 134 814	21.3	97.3	20.8	23 561 783
2707	Oils and other products of the distillation of high temperature coal tar; similar products in which the weight of the aromatic constituents exceeds that of the non-aromatic constituents.	1 880 009	12.8	98.4	12.6	22 268 261
1001	Wheat and meslin.	1 130 673	7.7	100.0	7.7	18 243 925
2711	Petroleum gases and other gaseous hydrocarbons.	858 118	5.8	98.7	5.8	1 628 561
2304	Oilcake and other solid residues, whether or not ground or in the form of pellets, resulting from the extraction of soya-bean oil.	845 614	5.8	99.6	5.7	12 833 496
3102	Mineral or chemical fertilizers, nitrogenous.	456 477	3.1	94.0	2.9	3 784 910
7208	Iron or non-alloy steel; flat-rolled products of a width of 600 mm or more, hot-rolled, not clad, plated or coated.	356 221	2.4	99.3	2.4	15 762 219
2713	Petroleum coke, petroleum bitumen and other residues of petroleum oils or of oils obtained from bituminous minerals.	318 102	2.2	100.0	2.2	3 238 150
2520	Gypsum; anhydrite; plasters (consisting of calcined gypsum or calcium sulphate) whether or not coloured, with or without small quantities of accelerators or retarders.	310 030	2.1	99.7	2.1	1 761 869
7204	Ferrous waste and scrap; remelting scrap ingots of iron or steel.	286 489	1.9	95.3	1.9	1 747 834
7210	Iron or non-alloy steel; flat-rolled products of a width of 600 mm or more, clad, plated or coated.	252 514	1.7	96.5	1.7	15 141 330
3104	Mineral or chemical fertilizers, potassic.	199 163	1.4	98.2	1.3	1 194 743
3105	Mineral or chemical fertilizers containing two or three of the fertilizing elements nitrogen, phosphorus and potassium; other fertilizers; goods of chapter 31 in tablets or similar forms or in packages of a gross weight not exceeding 10 kg.	174 443	1.2	93.0	1.1	2 920 780
6907	Unglazed ceramic flags and paving, hearth or wall tiles; unglazed ceramic mosaic cubes and the like, whether or not on a backing.	159 276	1.1	97.6	1.1	5 724 449
3901	Polymers of ethylene, in primary forms.	155 393	1.1	93.1	1.0	720 609
Total for the 15 main imported goods					70.1	130 532 919

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of information from International Transport Database (BTI).

Table 7
Mexico: shipping emissions of major imported goods, 2017

HS 2007 heading	HS 2007 description	Tons	Share of good in total imports (Percentages)	Percentage selected from the main destinations of the imported good	Sample size (product and destination) (Percentages)	CO ₂ equivalent emissions (kg)
2710	Petroleum oils and oils obtained from bituminous minerals, other than crude; preparations not elsewhere specified or included, containing by weight 70% or more of petroleum oils or of oils obtained from bituminous minerals, these oils being the basic constituents of the preparations; waste oils.	37 736 052	24.6	93.3	22.9	2 316 119 647
2711	Petroleum gases and other gaseous hydrocarbons.	19 815 897	12.9	60.7	7.8	67 374 400
2701	Coal; briquettes, ovoids, etc. manufactured from coal.	8 492 796	5.5	79.0	4.4	24 482 462
1005	Maize (corn).	6 432 591	4.2	96.5	4.0	16 523 538
2713	Petroleum coke, petroleum bitumen and other residues of petroleum oils or of oils obtained from bituminous minerals.	4 671 808	3.0	88.5	2.7	11 977 529
1001	Wheat and meslin.	4 159 788	2.7	61.0	1.7	13 658 314
3102	Mineral or chemical fertilizers, nitrogenous.	3 509 589	2.3	23.9	0.5	32 752 401
1205	Rape or colza seeds, whether or not broken.	3 096 836	2.0	51.0	1.0	12 280 397
2601	Iron ores and concentrates, other than roasted iron pyrites.	3 095 023	2.0	43.0	0.9	15 848 722
2510	Natural calcium phosphates, natural aluminium calcium phosphates and phosphatic chalk.	2 778 870	1.8	50.0	0.9	22 667 200
7210	Iron or non-alloy steel; flat-rolled products of a width of 600 mm or more, clad, plated or coated.	2 530 893	1.6	99.6	1.6	88 367 473
7208	Iron or non-alloy steel; flat-rolled products of a width of 600 mm or more, hot-rolled, not clad, plated or coated.	2 339 974	1.5	96.3	1.5	78 011 867
7225	Flat-rolled products of other alloy steel, of a width of 600 mm or more.	2 278 302	1.5	96.6	1.4	67 578 964
1201	Soya beans, whether or not broken.	3 058 351	1.4	100.0	1.4	11 262 121
2902	Cyclic hydrocarbons.	2 011 442	1.3	88.0	1.2	3 968 438
7318	Screws, bolts, nuts, coach screws, screw hooks, rivets, cotters, cotter pins, washers (including spring washers) and similar articles, of iron or steel.	1 459 695	1.0	96.3	0.9	62 462 654
8708	Parts and accessories of the motor vehicles of heading 87.01 to 87.05.	1 274 419	0.8	91.1	0.8	50 789 178
7326	Iron or steel; articles n.e.s. chapter 73.	427 069	0.3	98.0	0.3	17 944 883
3926	Other articles of plastics and articles of other materials of headings 39.01 to 39.14 n.e.s. in chapter 39.	287 930	0.2	93.9	0.2	11 993 302

HS 2007 heading	HS 2007 description	Tons	Share of good in total imports (Percentages)	Percentage selected from the main destinations of the imported good	Sample size (product and destination) (Percentages)	CO ₂ equivalent emissions (kg)
8409	Parts suitable for use solely or principally with the engines of heading 84.07 or 84.08.	250 127	0.2	90.2	0.1	9 812 806
4016	Other articles of vulcanized rubber other than hard rubber, n.e.s. in chapter 40.	119 026	0.1	94.5	0.1	5 283 575
8512	Electrical lighting or signalling equipment (excluding articles of heading 85.39), windscreen wipers, defrosters and demisters, of a kind used for cycles or motor vehicles.	73 649	0	95.6	0	3 363 202
8536	Electrical apparatus for switching or protecting electrical circuits, or for making connections to or in electrical circuits, for a voltage not exceeding 1000 V; connectors for optical fibres, optical fibre bundles or cables.	72 817	0	91.1	0	2 847 350
4009	Tubes, pipes and hoses, of vulcanized rubber other than hard rubber, with or without their fittings (for example, joints, elbows, flanges).	48 453	0	92.6	0	2 113 132
9032	Instruments and apparatus for measuring or checking the flow, level, pressure or other variables of liquids or gases (for example, flow meters, level gauges, etc.), excluding instruments and apparatus of heading 90.14, 90.15, 90.28 or 90.32.	13 527	0	95.6	0	580 755
8529	Broadcasting equipment; parts suitable for use solely or principally with the apparatus of headings 85.25 to 85.28.	1 046	0	99.6	0	42 300

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of information from International Transport Database (BTI).

Table 8
Peru: shipping emissions of major imported goods, 2017

HS 2007 heading	HS 2007 description	Tons	Share of good in total imports (Percentages)	Percentage selected from the main origins of the imported good	Sample size (product and destination) (Percentages)	CO ₂ equivalent emissions (kg)
2709	Petroleum oils and oils obtained from bituminous minerals, crude.	6 615 942	18.7	94.5	17.7	44 918 232
2710	Petroleum oils and oils obtained from bituminous minerals, other than crude; preparations not elsewhere specified or included, containing by weight 70% or more of petroleum oils or of oils obtained from bituminous minerals, these oils being the basic constituents of the preparations; waste oils.	5 177 193	14.6	96.4	14.1	64 383 691
1005	Maize (corn).	3 373 041	9.5	99.9	9.5	38 903 584
1001	Wheat and meslin.	2 124 029	6.0	93.8	5.6	33 569 304
2523	Portland cement, aluminous cement, slag cement, supersulphate cement and similar hydraulic cements, whether or not coloured or in the form of clinkers.	1 157 719	3.3	96.3	3.2	32 016 122
3102	Mineral or chemical fertilizers, nitrogenous.	1 065 893	3.0	94.9	2.9	7 842 021
2304	Oilcake and other solid residues, whether or not ground or in the form of pellets, resulting from the extraction of soya-bean oil.	859 192	2.4	99.9	2.4	8 378 548
1701	Cane or beet sugar and chemically pure sucrose, in solid form.	533 557	1.5	98.2	1.5	3 287 390
7204	Ferrous waste and scrap; remelting scrap ingots of iron or steel.	491 884	1.4	99.7	1.4	8 493 978
2701	Coal; briquettes, ovoids and similar solid fuels manufactured from coal.	470 614	1.3	100.0	1.3	2 252 296
3105	Mineral or chemical fertilizers containing two or three of the fertilizing elements nitrogen, phosphorus and potassium; other fertilizers; goods of chapter 31 in tablets or similar forms or in packages of a gross weight not exceeding 10 kg.	441 333	1.2	97.0	1.2	6 845 800
1507	Soya-bean oil and its fractions, whether or not refined, but not chemically modified.	425 920	1.2	99.5	1.2	8 676 765
1006	Rice.	400 359	1.1	97.6	1.1	4 411 598
6907	Unglazed ceramic flags and paving, hearth or wall tiles; unglazed ceramic mosaic cubes and the like, whether or not on a backing.	392 940	1.1	96.5	1.1	22 424 246
Total for the 14 main imported goods					64.2	286 403 573

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of information from International Transport Database (BTI).

Table 9

Uruguay: shipping emissions of major imported goods, 2017

HS 2007 heading	HS 2007 description	Tons	Share of good in total imports (Percentages)	Percentage selected from the main origins of the imported good	Sample size (product and destination) (Percentages)	CO ₂ equivalent emissions (kg)
2710	Petroleum oils and oils obtained from bituminous minerals, other than crude; preparations not elsewhere specified or included, containing by weight 70% or more of petroleum oils or of oils obtained from bituminous minerals, these oils being the basic constituents of the preparations; waste oils.	1 173 958	27.4	97.5	26.7	30 072 458
2709	Petroleum oils and oils obtained from bituminous minerals, crude.	480 197	11.2	100.0	11.2	7 757 759
3102	Mineral or chemical fertilizers, nitrogenous.	297 389	6.9	95.1	6.6	2 754 232
2713	Petroleum coke, petroleum bitumen and other residues of petroleum oils or of oils obtained from bituminous minerals.	222 074	5.2	96.8	5.0	4 567 931
3105	Mineral or chemical fertilizers containing two or three of the fertilizing elements nitrogen, phosphorus and potassium; other fertilizers; goods of chapter 31 in tablets or similar forms or in packages of a gross weight not exceeding 10 kg.	219 036	5.1	95.7	4.9	5 333 751
2510	Natural calcium phosphates, natural aluminium calcium phosphates and phosphatic chalk.	105 843	2.5	100.0	2.5	1 621 004
2711	Petroleum gases and other gaseous hydrocarbons.	96 780	2.3	100.0	2.3	374 492
2501	Salt (including table salt and denatured salt) and pure sodium chloride, whether or not in aqueous solution; sea water.	93 459	2.2	99.1	2.2	745 991
1005	Maize (corn).	91 572	2.1	100.0	2.1	282 260
3104	Mineral or chemical fertilizers, potassic.	86 474	2.0	98.1	2.0	607 499
3103	Mineral or chemical fertilizers, potassic.	82 893	1.9	98.5	1.9	634 744
3907	Polyacetals, other polyethers and epoxide resins, in primary forms; polycarbonates, alkyd resins, polyallyl esters and other polyesters, in primary forms.	70 974	1.7	98.2	1.6	726 490
2520	Gypsum; anhydrite; plasters (consisting of calcined gypsum or calcium sulphate) whether or not coloured, with or without small quantities of accelerators or retarders.	62 757	1.5	99.8	1.5	968 578
2302	Bran, sharps and other residues, whether or not in the form of pellets, derived from the sifting, milling or other working of cereals or of leguminous plants.	57 285	1.3	100.0	1.3	100 207
2503	Sulphur of all kinds, other than sublimed sulphur, precipitated sulphur and colloidal sulphur.	52 218	1.2	99.9	1.2	431 177
2714	Bitumen and asphalt, natural; bituminous or oil-shale and tar sands; asphaltites and asphaltic rocks.	52 067	1.2	96.0	1.2	830 688
Total for the 16 main imported goods					74.2	57 809 260

Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of information from International Transport Database (BTI).

Table 10Import shipping CO₂ emissions of the selected countries, 2017

Countries	CO ₂ emissions (tons)	Percentage within total world shipping CO ₂ emissions
Argentina	366 218	0.04
Brazil	1 703 751	0.20
Chile	673 074	0.08
Colombia	218 936	0.03
Ecuador	130 533	0.02
Mexico	2 950 107	0.34
Peru	286 404	0.03
Uruguay	57 809	0.01
Total	6 386 832	0.73

Source: Economic Commission for Latin America and the Caribbean (ECLAC).

III. Revised calculation of CO₂ emissions from the region's exports and total regional trade

Finally comes the revised calculation of emissions from exports based on the figures from the earlier publication. For this, the comments received were taken into consideration, some methodological adjustments were made and the sample was increased: it now covers 82% of the total volume.

Applying the corrected methodology to exports, it can be seen that more than 1.16 million tons of goods transported by ship from eight Latin American and Caribbean countries in 2017 generated about 24 million tons of CO₂ equivalent (MtCO₂), equal to 2.76% of the 870 MtCO₂ emitted by international shipping globally. Similarly, 311 million tons of imported cargo generated about 6.4 MtCO₂, representing approximately 0.73% of global international shipping emissions.

Thus, the sum of both imports and exports totals 30.4 MtCO₂, approximately 3.5% of the world total; this can be compared with the total maritime trade volume of Latin America and the Caribbean in 2017, which represented 18.6% of the world total.

Table 11 shows the CO₂ emissions measured for the exports and imports of the sample countries, together with each country's share in international shipping tonnage and emissions.

Table 11Import and export shipping CO₂ emissions of the selected countries, 2017

Countries	CO ₂ emissions in maritime exports	Share of total maritime emissions (Percentages)	CO ₂ emissions from maritime imports	Share of total maritime emissions (Percentages)
Argentina	1 759 253	0.20	366 218	0.04
Brazil	10 491 690	1.21	1 703 751	0.20
Chile	1 268 110	0.15	673 074	0.08
Colombia	1 294 710	0.15	218 936	0.03
Ecuador	274 163	0.03	130 533	0.02
Mexico	8 043 401	0.92	2 950 107	0.34
Peru	721 366	0.08	286 404	0.03
Uruguay	132 358	0.02	57 809	0.01
Total	23 985 051	2.76	6 386 832	0.73

Source: Economic Commission for Latin America and the Caribbean (ECLAC).

IV. Conclusions

The aim of this study has been to provide the international community with a rapid assessment methodology to measure CO₂ emissions from international shipping based on data on product volumes at the main points of origin and destination, in pursuit of growing awareness of environmental stewardship. As discussed in the earlier edition, this methodology's approach is intended as an approximation and it yields conservative measurements of emissions, since it assumes certain simplifications for the routes and distances used, as well as the types of vessel, and it does not include some aspects that could be improved, such as times spent in port, fuel consumption during departure and arrival, the output of other engines on board ships, the topping up of cargo at intermediate stops and so on. However, progress has been made with the inclusion of emissions generated by containerized goods.

Two complementary and interrelated reflections are worth exploring as regards ways to significantly reduce emissions from international shipping.

The first involves the urgent need to improve international regulation. Economic measures and technical and economic regulations (including fiscal instruments—such as the carbon tax—and the design of incentives) must be accompanied by the efforts of industry and science to identify the most effective “clean” technologies for achieving decarbonization. Efforts to reduce emissions from transport will be the result of convergence between the different actors involved in the entire supply chain. The parts played by the International Maritime Organization, other international agencies and all private, governmental and non-governmental actors involved in shipping activities are fundamental in progressing towards these objectives.

The second involves identifying the responsibility for emissions. There are several relevant questions: Who is responsible for taking action to reduce emissions? Is it the exporting country (the one that directly emits the CO₂)? Or is it the importing country (the one that buys the goods associated with that CO₂)? Tracking “consumption emissions” (CO₂ emissions from imports) can to some extent explain the carbon transfers associated with the decline in manufacturing in developed countries that has occurred in recent decades. It should be noted both consumption and ship emissions are difficult to quantify and to attribute to cargo, as values vary depending on the use of the ship, as well as on repositioning voyages, during which vessels may travel partially or totally empty. In other words, the same journey can generate different amounts of greenhouse gases per unit of transported cargo.

Efforts to significantly reduce transport emissions have become even more relevant in the current context of the severe public health, economic and social crisis resulting from the COVID-19 pandemic. Post-pandemic economic recovery presents challenges and opportunities that must be analysed. Since a recovery that fails to consider its environmental effects will lead to a much greater climate crisis, post-COVID recovery strategies must take due account of their impact on carbon emissions. This study aims to contribute to that effort.

On this occasion, the calculation was applied to imports. A sample of more than 311 million tons of goods transported by ship to eight Latin American and Caribbean countries in 2017 was found to have generated around 6.8 MtCO₂ equivalent, representing approximately 0.73% of the 870 MtCO₂ emitted by international maritime transport over one year, according to the latest known global estimate. At the same time, the recalculation of exports estimated that over 1.16 million tons of goods transported by ship during that same year generated around 24 MtCO₂, equal to 2.76% of the world total.

The figures in this preliminary study are small compared to the global total, even considering the importance of the Caribbean and Latin America in the context of world maritime trade. However, further action is needed to significantly reduce all the pollutants emitted by international shipping.

An interesting way to further this work would be to extend the calculation of CO₂ emissions to take into account the different modal combinations used to move goods, but this would require both a similar methodology for different modes of transport and the availability of the data in question. Regional cooperation so that harmonized information can be collected is therefore very important.

Efforts to reduce transport emissions will be the result of the convergence between the different stakeholders involved in the entire supply chain. The International Maritime Organization is central to those objectives, as are the other international agencies and all the governmental and non-governmental actors involved in the activity. Accordingly, ECLAC places itself at their disposal.

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VI. Publications of interest



FAL Bulletin No. 373

Towards the decontamination of maritime transport in international trade: methodology and estimation of CO₂ emissions

Eliana Barleta
Silvana Sánchez

Following on from *FAL Bulletin No. 372* concerning the new regulation on sulphur emissions from maritime transport, the aim of this document is to present the methodology for calculating CO₂ emissions generated by maritime transport in international trade. This methodology was used to obtain a preliminary estimate of emissions from a representative sample of exports from Latin America and the Caribbean. The sample was obtained from export tonnages from eight countries in 2017, and represents nearly 70% of total regional exports.

Available in:



FAL Bulletin No. 376

The evolution of modal split in freight transport in South America, 2014–2017

Silvana Sánchez

This *FAL Bulletin* analyses data on the commodities traded and modes of transport used between nine South American countries between 2014 and 2017.

The aim is to identify the current modal split in intraregional freight transport and to ascertain the level and evolution of trade flows and imbalances by mode. The authors conclude with some policy recommendations.

Available in: