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The circular flow of CO_2 emissions embodied in international trade

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Abstract

Production or consumption-based greenhouse gases (GHG) inventories are two approaches used to measure an agent's responsibility on climate change. These consider direct and upstream embodied emissions, respectively, and that the agent benefiting from the CO_2 emissions is either the producer or the consumer, but never both. In the circular flow of economies, goods and services flow in one direction and associated payments flow in the opposite direction. The production of a good generates upstream emissions (from the production processes), whereas its payment generates downstream emissions (from the consumption processes). In this paper we compute both upstream and downstream emissions embodied in international trade. Quantification of these emissions, for the year 2001, reveals that a large proportion of CO_2 (~20% of the world total) is traded internationally. Three world regions concentrate 80% of the emissions: Developed Economies, Asia and Fossil Fuels Exporters. Developed economies import ~54% and ~42% of world's total upstream and downstream emissions embodied in international trade, mainly from Fossil Fuel exporters and Asia. At the downstream level, the flow of emissions from Developed economies to Fossil Fuel exporters is also relevant (~32% or world's total downstream emissions embodied in international trade). Sectoral breakdown of these flows highlights the importance of the manufacture products and fossil fuels sectors.

Our results indicate that the process of economic decoupling from CO_2 emissions is just apparent, at the upstream and downstream level.

In the context of global climate policy, if both upstream and downstream emissions are considered, policy design can become more effective and equitable, and thus perceived

as fairer. This will potentiate the worldwide acceptance and compliance of climate policies.

Keywords: international trade, upstream embodied CO_2 emissions, downstream embodied CO_2 emissions, circular flow, multi-regional input-output model (MRIO).

Introduction:

There is a broad scientific and political consensus that climate change is taking place and that anthropogenic emissions of greenhouse gases (GHG) are the main driver of that change (Pachauri and Reisinger, 2007, Raupach *et al.*, 2007, Meinshausen *et al*., 2009). Mainstream climate policy (such as the Copenhagen Treaty or the Kyoto Protocol) is focused on the reduction of national GHG inventories, defined as the emissions produced within a country's geographical boundaries (IPCC, 1996). Some authors suggest that the use of geographically defined GHG inventories has led to the lack of commitment from several nations that have been put in evidence in international fora (such as the Copenhagen Accord or the Kyoto Protocol) (Whalley and Walsh, 2009). An alternative to the geographically defined or "production-based" inventories are "consumption-based" inventories, i.e., the sum of the upstream emissions embodied in the final consumption of a country (Davis and Caldeira, 2010, Peters and Hertwhich, 2009). Consumption-based inventories solve several shortcomings of production-based inventories, but create other problems, that may also impair their acceptance (Peters, 2008).

The upstream embodied emissions of a good or service are the total amount of GHG emissions that took place during the production cycle of that good or service. The computation of consumption-based GHG inventories requires, besides the data on direct emissions (also required for production-based inventories), a substantial amount of economic data, more complex calculations and therefore higher uncertainty (Peters, 2008). Besides these practical matters, there are political issues to be taken into consideration.

Consumption-based inventories include trading partners in GHG inventories and therefore may face political resistance, as countries may have different opinions on

climate change, which may lead to frictions in environmental and trade policy (Peters and Hertwich, 2008).

In general, the acceptance and compliance with any measure depends on the extent to which that measure is perceived as fair (Albin, 2003). In the context of climate policy, it is intuitive that if an agent benefits from an economic transaction, then it should be responsible for some of the emissions generated by that transaction (Caney, 2009). An economic transaction benefits two agents: the consumer or buyer who receives the good or services, and the producer or seller who receives the payment thereof. Consumption-based GHG inventories are calculated by summing upstream embodied emissions, that is, by assigning to an agent the emissions associated with the production chains leading to the transactions in which he/she benefited as a final consumer.

In standard economic textbooks, there is always a depiction of the circular flow in the economy, in which goods and services flow in one direction, and associated payments flow in the opposite direction. There is an obvious symmetrical view of a consumption-based inventory, the emissions associated with the benefit that an agent has as a seller or producer in economic transactions. These are downstream indirect emissions, and they account for the emissions occurring in the consumption cycle of a good or service. For example, consider a farmer that sells milk that will be transported to a factory where it will be bottled. In this case, the downstream emissions of the milk, when sold by the farmer, are the emissions associated with the transport and bottling processes.

It is possible to report GHG inventories based on upstream and downstream emissions, but many possibilities exist. Several types of GHG consumption-based inventories have been presented. A GHG inventory is a particular type of environmental indicator, and it should possess some characteristics in order to be meaningful (scale invariance, normalization and monotonicity) (Ebert & Welsch, 2004, Rodrigues et al., 2006). We proposed a type of GHG inventory called GHG responsibility, based on a set of six properties (scale invariance, normalization, monotonicity, total indirect effects, economic causality and symmetry) (Rodrigues et al., 2006). The set of six properties was chosen by trying to understand what an agent would consider essential in the measurement of its impact on the environment, if he was behind of the "veil of ignorance" (Rawls, 1971). This led to a unique, axiomatically derived, indicator of

GHG responsibility that should not allow suspicious or value judgments from policy makers. The GHG responsibility consists on the arithmetic mean of total upstream emissions embodied in final demand and total downstream emissions embodied in primary inputs (Rodrigues et al., 2006).

There are many studies that report full world coverage of GHG consumption-based inventories and environmental impacts embedded in international trade (Peters and Hertwich, 2008, Peters and Hertwich, 2009, Davis and Caldeira, 2010). Their main findings are that a significant amount of CO_2 is embodied in international trade, and thus not included in production-based inventories. Major transfers of CO_2 occur from developing to developed economies. When accounted these transfers decrease differences between economies' carbon intensities.

In a recent book (Rodrigues *et al.*, 2010) we have reported total upstream and downstream embodied emissions of 87 regions and 57 sectors and a statistical analysis on the fraction of total embodied emissions that result from domestic and international indirect effects, and on the uncertainty from the estimation of international trade flows. We have concluded that international indirect effects are on average less important than domestic indirect effects, but still significant, and that the magnitude of the uncertainty is much smaller than that of international indirect effects, showing that a full MRIO model should be used to account for total embodied emissions. The results of upstream and downstream embodied emissions, aggregated into 6 world regions, show that developed economies import upstream and downstream emissions, Asia and Eastern Europe export upstream and downstream emissions and Fossil Fuel exporters export upstream emissions and import downstream emissions. Africa and Central and Latin America do not display noticeable differences between these quantities and direct emissions.

In this paper, we contribute to this literature by reporting empirical findings on both upstream and downstream embodied emissions in international trade. We explore the carbon content of bilateral trade by industry sectors and identify main transfers of carbon between world regions. The focus will be on downstream embodied emissions in international trade since these have not been reported elsewhere.

We have analysed the GTAP 6 database, using a full multi-regional input-output (MRIO) model. Our model allocates CO_2 emissions to final demand and primary inputs of countries and industry sectors.

Results:

To construct the MRIO model monetary data from GTAP 6 database and CO_2 emissions data corrected by Glen Peters and previously used on Peters and Hertwich (2008) were used. We computed embodied emissions, for the year 2001, for a full model with 87 regions and 57 sectors, and aggregated the results to a model with 6 world regions and 11 sectors, as described in *SI*. The main objective in this paper is to understand the fluxes of embodied CO_2 emissions between world regions, therefore intra-regional trade was not considered in the calculations.

In what follows, upstream emissions (UE) refer to the direct and indirect emissions generated in the production of goods and services, and downstream emissions (DE) to the direct and indirect emissions generated in the payment of those goods and services. For every international transaction, there is a flow of upstream embodied emissions, from the exporter to the importer; and a flow of downstream emissions, from the importer to the exporter.

The results obtained for UE are in accordance recent published work (Peters and Hertwich, 2008a, Nakano et al., 2009, Peters and Hertwich, 2009, Davis and Caldeira, 2010). Therefore, we will focus our attention on the DE embodied in international trade, and the comparison between upstream and downstream emissions.

Emissions embodied in intra-regional trade.

In 2001, the amount of carbon emissions embodied in international trade was ~20% of world total emissions. Approximately 5050 Mt of CO_2 were emitted in the production processes of goods and services that were consumed in a different region; 4360 Mt of CO_2 were emitted in the consumption processes of goods and services that came from a different region.

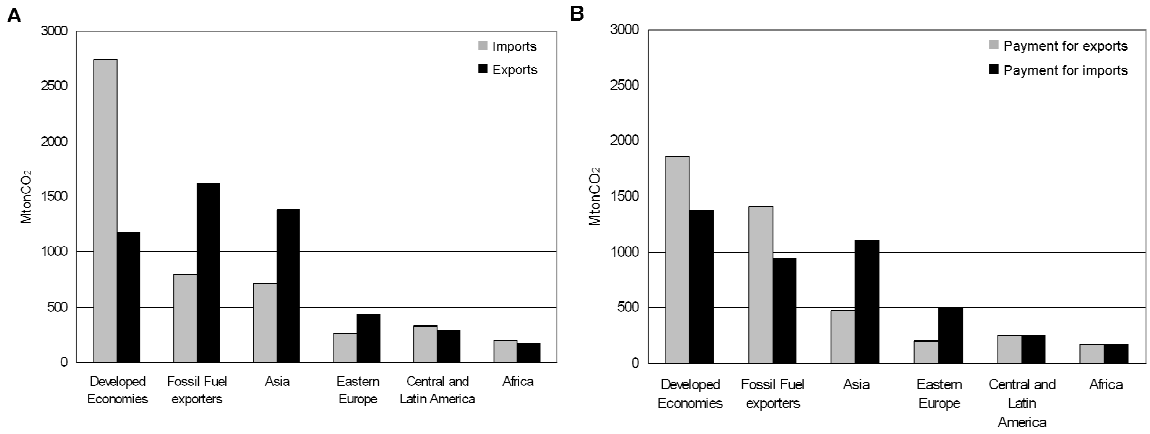

Figure 1 – CO_2 emissions embodied in trade, upstream (A) and downstream (B), by world region (Mt of CO_2).

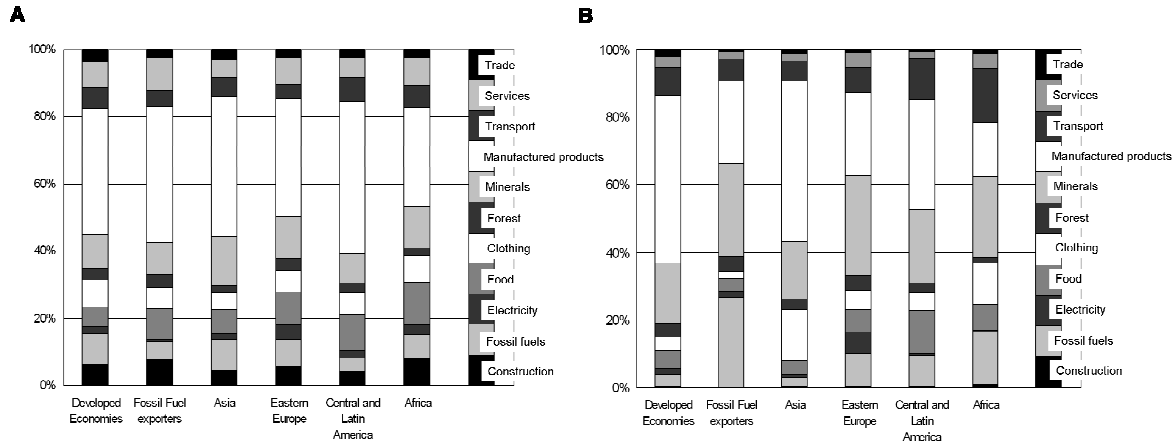

Figure 2 – Sectoral distribution of world regions upstream emissions embodied in imports (A) and exports (B) (%).

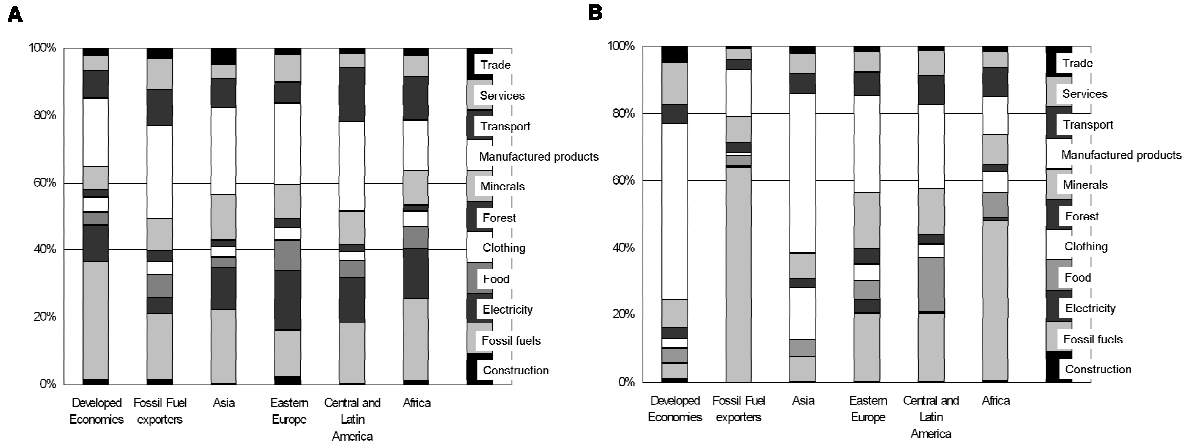

Figure 3 – Sectoral distribution of world regions downstream emissions embodied in payment for imports (A) and payment for exports (B) (%).

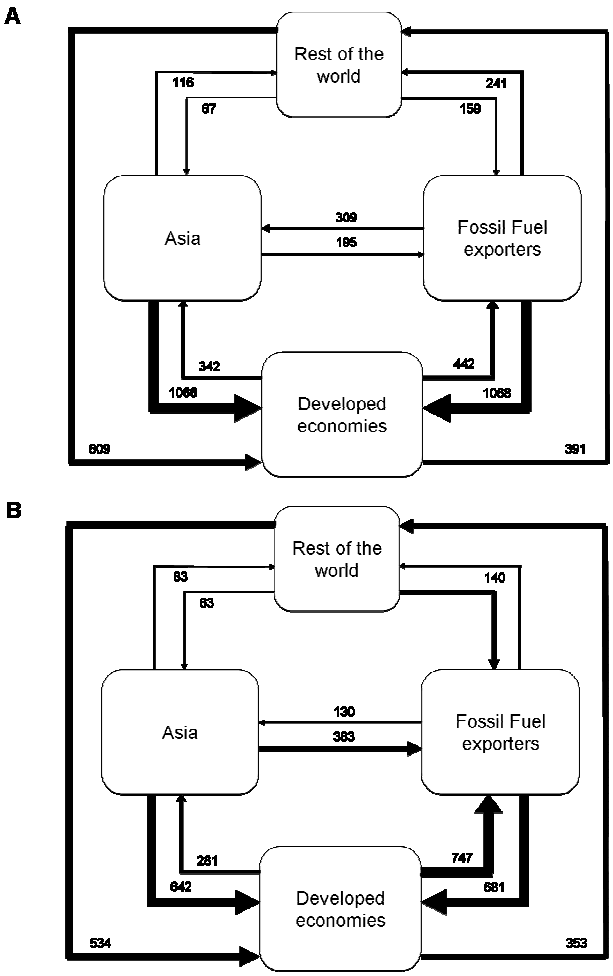

Figure 3 - Upstream (A) and downstream (B) emissions embodied in trade between Developed Economies, Fossil Fuel Exporters, Asia and the Rest of the world. (Mt of CO_2).

In Fig.1 are presented the upstream emissions embodied in trade (UEET), respectively upstream emissions embodied in economic imports and exports, and the downstream emissions embodied trade (DEET), respectively downstream emissions embodied in the payment for economic exports and imports for each world region. The downstream emissions embodied in the payment for economic exports are the emissions resulting from the consumption process in the importing region these are, in other words, the emissions that enable the payment to the primary factors of production, thus they benefit and therefore are exported to the economic exporting region. The opposite situation occurs for DEEE. From Fig.1 it is possible to see upstream and downstream carbon trade balance of emissions embodied in trade (UCTB and DCTB) (data presented in *SI*). A positive UCTB implies that a region is importing UE embodied in goods and services to satisfy its final demand needs, a negative UCTB indicates that a

region is exporting UE. A positive DCTB implies that a region imports DE embodied in the payments of the goods and services exported. This means that the payment for the primary factors of production is dependent on CO_2 emissions occurring in another region. A negative DCTB indicates that a region exporting DE.

Developed economies have a positive UCTB and DCTB, respectively 1569 and 477 Mt of CO_2. Fossil fuel exporters have a negative UCTB and a positive DCTB, respectively -821 and 458 Mt of CO_2. Asia and Eastern Europe have a negative UCTB and DCTB; -659 and -634 Mt of CO_2 for Asia and -163 and -199 Mt of CO_2 for Eastern Europe. The UCTB and DCTB for Africa and Central and Latin America are negligible.

In Fig.2 is presented the relative importance of each sector in UEET and DEET. Developed economies' UCTB is mainly obtained through economic imports of manufactured products (38%), minerals and metals (10%) and fossil fuels (9%) (Fig. 2A), while DCTB is mainly obtained through the payments for this region economic exports of (resulting from consumption processes in another region and being imported by Developed economies) manufactured products (52%), services (13%) and minerals (8%) (Fig. 2B). Fossil fuels exporters' negative UCTB is a consequence of exports of minerals and metals (27%), fossil fuels (27%) and manufactured products (24%); the positive DCTB is a consequence of the payment of these region economic exports of fossil fuels (64%), manufactured products (14%) and minerals and metals (7%). The sectors exporting more UE do not need to be the same importing more DE. Fossil fuel exporters export 27% of UE through international trade of fossil fuels; however the DE embodied in the payments made to this sector represents 64% of DE imports. This indicates that there are much more emissions needed to generate fossil fuel payments than production. This result is intuitive since fossil fuel consumption processes normally imply their combustion. Asia's UCTB is mainly obtained through the exports of manufactured products (47%), minerals and metals (17%) and clothing (15%), the DCTB is obtained through the payments that these region makes to the economic imports of manufactured products (26%), fossil fuels (22%) and minerals and metals (14%). Eastern Europe's UCTB is mainly obtained through economic exports of minerals and metals (29%), manufactured products (25%) and fossil fuels (10%); its DCTB is mainly obtained through the exports of CO_2 embodied in the payments for economic imports of manufactured products (24%), electricity (18%) and fossil fuels (14%).

Transfer of emissions between world regions.

The distribution of embodied emissions traded between regions is highly uneven. Around 80% of total emissions embodied in trade take place between three regions: Developed Economies, Fossil Fuel Exporters and Asia. In Fig. 3 are shown the flows of embodied carbon emissions between the three main regions and the rest of the world. Developed economies import ~54% of world's total UEET (Fig. 3A). The more important flows occur from Fossil Fuel exporters and Asia to Developed Economies, respectively 1068 and 1066 Mt of CO_2. Fossil fuel exporters' UE exports to Developed economies are mainly embodied on manufactured products (33%), fossil fuels (18%) and minerals and metals (13%), Asia's UE exports to Developed economies are mostly embodied in manufactured products (50%), minerals and metals (11%) and services (7%) (full dataset presented on *SI*).

Developed economies import ~42% of world's total DEET, and Fossil Fuel exporters ~32%. The more important flows occur from Fossil Fuel exporters and Asia to Developed economies, respectively 681 and 642 Mt of CO_2; and from Developed economies to Fossil Fuel exporters, 747 Mt of CO_2. Fossil fuel exporters export DE to Developed economies through payments for economic imports of manufactured products (29%), fossil fuels (20%) and transport (12%). Asia exports DE to Developed economies through payments for economic imports of manufactured products (35%), minerals and metals (14%) and electricity (13%). Developed economies export DE to Fossil Fuel exporters through payments made to this region fossil fuels sector (49%), electricity (14%) and manufactured products (13%) sectors.

Discussion and conclusion:

The quantification of upstream and downstream embodied emissions enables the assignment of responsibilities according to the circular flow of economies. World regions/countries benefit from importing goods and services, since their welfare is increased by an expanded consumption possibilities frontier. Current consumption-based GHG inventories account these transfer of CO_2 emissions and assign them to the consumer region. However, in this approach, the benefit obtained through monetary payments, that the exporting regions receive, is not considered. This can be done

through the accounting of the CO_2 emissions embodied in the payments of goods and services traded.

Quantification of upstream and downstream CO_2 emissions, for the year 2001, reveals that a large proportion of CO_2 (~20% of the world total) emissions are traded internationally, and therefore not accounted in the traditional production-based accounting. Developed economies is the region that receives more upstream CO_2 emissions through the imports of goods and services, ~54% of UEET. This implies that, if Developed economies were to internally produce everything they consume, they would be responsible for more than their current direct CO_2 emissions. Since Developed economies upstream imports of CO_2 are mainly from Fossil Fuel exporters and Asia, than the later regions would be responsible for less than their direct emissions. This upstream panorama suggests than Developed economies would be net exporters of downstream CO_2 emissions. In fact, Developed economies are also net importers of downstream CO_2 emissions, ~42% of DEET. The pattern is similar than the one described for UEET. Fossil Fuel exporters and Asia export downstream emissions to Developed economies. A possible explanation to this pattern lies in the fact that the consumption processes, occurring in Fossil fuel exporters and Asia, of the goods imported from Developed economies are much more carbon intensive than the consumption processes, occurring in Developed economies, from the goods imported from Fossil fuel exporters and Asia. Possibly, this is reflected in the downstream carbon intensity of each region: Developed economies with lower intensities, Fossil Fuel exporters and Asia with higher intensities. Fossil fuel exporters also import a considerable amount of CO_2 emissions, ~32% of DEET. This region receives the majority of downstream emissions embodied in the payments for the fossil fuels sector (64%). This reflects the importance of the accounting of CO_2 emissions, if for some reason the consumption process of CO_2 emissions would be forbidden, than imports would not happen, and the exporting region would become worse off. Therefore some of the emissions occurring in the consumption process of fossil fuels should be assigned to the exporting region.

If applied to global climate policy, this accounting procedure may aid the development of an economically viable shared responsibility approach, more widely accepted. Rodrigues *et al.*, 2010 propose a shared responsibility approach where the total responsibility of a region is the average between their upstream and downstream embodied emissions. Under this approach, and compared to direct emissions,

Developed economies responsibility increases and Asia and Fossil Fuel exporters responsibility decreases. If both upstream and downstream emissions are considered than the responsibility distribution can more equitable and fairer, but also the information provided more close to reality.

Materials and Methods:

We use a full environmental multi-regional input-output (MRIO) model based on the GTAP 6 database (87 regions, 57 sectors) (Dimaranan, 2006). We used the emissions data processed by Glen Peters and previously used on Peters and Hertwich (2008a). Upstream and downstream embodied emissions were calculated through upstream and downstream intensities.

Upstream intensities were calculated using the following equation:

$$\mathbf{m}^{\mathbf{U}} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{b}$$

where, $\mathbf{m}^{\mathbf{U}}$ is the column vector where each entry m_i is the upstream carbon intensity of a sector i, $\mathbf{I}$ is the identity matrix, $\mathbf{A}$ is the Leontief matrix, $(\mathbf{I} - \mathbf{A})^{-1}$ is the Leontief inverse matrix and $\mathbf{b}$ is the column vector whose i-entries are (direct emissions of sector i/monetary data of sector i).

Downstream intensities were calculated using the following equation:

$$\mathbf{m}^{\mathbf{D}} = \mathbf{b}^{\mathbf{T}} (\mathbf{I} - \mathbf{A}^{\mathbf{T}})^{-1}$$

where, $\mathbf{m}^{\mathbf{D}}$ is the row vector where each entry m_j is the downstream carbon intensity of a sector j, $\mathbf{A}^{\mathbf{T}}$ is the transpose of Leontief matrix, and $\mathbf{b}^{\mathbf{T}}$ is the row vector transpose of the row vector $\mathbf{b}$. Complete methodological procedure can be found in Rodrigues *et al.* (2006) and Rodrigues *et al.* (2010).

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The circular flow of CO_2 emissions embodied in international trade - Supplementary Information

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Supplementary Methods:

Table M1 List of GTAP 6 regions that form the six world regions	
World region	**GTAP 6 region**
Developed Economies	United States, Japan, Germany, United Kingdom, France, Italy, Spain, The Netherlands, Belgium, Greece, Finland, Denmark, rest of Europe, Portugal, Austria, Sweden, Hong Kong, Switzerland, Singapore, Ireland, New Zealand, Luxembourg, Cyprus, rest of Oceania, Malta, rest of North America.
Fossil Fuel exporters	Rest of EFTA, Russian Federation, rest of Middle East, Canada, Australia, South Africa, Indonesia, rest of North Africa, Venezuela, Malaysia, Colombia.
Asia	China, India, Korea, Taiwan, Thailand, rest of South Asia, rest of East Asia, Philippines, Vietnam, Bangladesh, rest of South-east Asia, Sri Lanka.
Eastern Europe	Rest of Former Soviet Union, Poland, Czech Republic, Romania, Hungary, Bulgaria, Slovakia, Croatia, Slovenia, Estonia, Lithuania, Latvia, Albania.
Central and Latin America	Mexico, Brazil, Argentina, rest of FTAA, Chile, rest of the Caribbean, Central America, rest of Andean Pact, Peru, rest

	of South America, Uruguay.
Africa	Turkey, rest of Sub-Saharan Africa, Morocco, Tunisia, rest of SADC, Zimbabwe, Tanzania, Rest of South African CU, Uganda, Botswana, Madagascar, Zambia, Mozambique, Malawi.

Table M2 List of GTAP 6 regions that form the eleven sectors (nec – not elsewhere considered).

Sector	GTAP 6 sector
Construction and dwellings	Contruction, dwellings
Fossil Fuels	Coal, oil, gas, petroleum/coal products, Gas manufacture/distribution
Electricity	Electricity
Food (Agriculture and food processing and water)	Paddy rice, wheat, cereal grains nec, vegetables/fruits/nuts, oil seeds, sugar cane/sugar beet, plant-based fibers, crops nec, cattle (sheep, goats, horses), animal products nec, raw milk, fishing, meat (cattle: sheep, goats, horse), meat products nec, vegetable oils and fats, dairy products, processed rice, sugar, food products nec, beverages and tobacco products, water
Clothing	Wool, silk-worm cocoons. textiles, wearing apparel, leather products
Forest and forest products	Forestry, wood products, paper products/publishing
Minerals and metals	Minerals nec, mineral products nec, ferrous metals, metals nec, metal products
Manufatcured products	Motor vehicles and parts, transport equipment nec, electronic equipment, machinery and equipment, manufactures nec
Transport	Transport nec, sea transport, air transport
Services	Communication, financial services nec, insurance, business services nec, recreation and other services,

	pub(admin/defence/health/educat
Trade	Trade

Supplementary Results:

Table R1 Upstream and downstream CO_2 emissions embodied in economic imports and exports and carbon trade balance (CTB) (MtonCO_2).

	Upstream			**Downstream**		
	Exports	**Imports**	**CTB**	**Payment for imports**	**Payment for exports**	**CTB**
Developed Economies	1175	2744	1569	1381	1858	477
Fossil Fuel exporters	1618	797	-821	951	1409	458
Asia	1378	719	-659	1109	475	-634
Eastern Europe	429	266	-163	499	200	-299
Central and Latin America	281	333	52	250	248	-2
Africa	166	201	35	169	170	1
Inter-regional total	**5047**	**5058**		**4359**	**4360**	

Table R2 Sectoral distribution of upstream emissions embodied in each region imports (%).											
	Contruc. Dweel.	**Fossil fuel**	**Electricity**	**Food**	**Clothing**	**Forest**	**Min. and met.**	**Manuf. Prod.**	**Transport**	**Services**	**Trade**
Developed Economies	6	9	2	6	8	3	10	38	6	8	4
Fossil Fuel exporters	8	5	1	9	6	4	10	40	5	10	2
Asia	4	9	2	7	5	2	15	42	5	5	3
Eastern Europe	6	8	4	10	6	4	12	35	4	8	2
Central and Latin America	4	4	2	11	7	3	9	45	7	6	2
Africa	8	7	3	13	8	2	12	29	7	8	3

Table R3 Sectoral distribution of upstream emissions embodied in each region exports (%).											
	Contruc. Dweel.	**Fossil fuel**	**Electricity**	**Food**	**Clothing**	**Forest**	**Min. and met.**	**Manuf. Prod.**	**Transport**	**Services**	**Trade**
Developed Economies	0	4	2	5	4	4	18	50	8	3	2
Fossil Fuel exporters	0	27	2	4	2	5	27	24	7	2	1
Asia	0	3	1	4	15	3	17	47	6	2	1
Eastern Europe	0	10	6	7	6	5	29	25	7	5	1
Central and Latin America	0	9	1	13	5	3	22	32	12	2	0
Africa	1	15	1	8	12	2	24	16	16	5	1

Table R4 Sectoral distribution of downstream emissions embodied in each region payments for exports (%).											
	Contruc. Dweel.	**Fossil fuel**	**Electricity**	**Food**	**Clothing**	**Forest**	**Min. and met.**	**Manuf. Prod.**	**Transport**	**Services**	**Trade**
Developed Economies	1	4	0	4	3	3	8	52	6	13	5
Fossil Fuel exporters	0	64	0	3	1	3	7	14	3	3	1
Asia	0	7	0	5	16	2	8	47	6	6	2
Eastern Europe	0	20	4	6	5	5	17	29	7	6	2
Central and Latin America	0	20	1	16	4	3	14	25	9	8	1
Africa	0	48	1	8	6	2	9	11	8	5	2

Table R5 Sectoral distribution of downstream emissions embodied in each region payments for imports (%).											
	Contruc. Dweel.	**Fossil fuel**	**Electricity**	**Food**	**Clothing**	**Forest**	**Min. and met.**	**Manuf. Prod.**	**Transport**	**Services**	**Trade**
Developed Economies	2	35	11	4	4	3	7	20	8	4	2
Fossil Fuel exporters	1	20	5	7	4	3	10	28	11	9	3
Asia	0	22	13	3	3	2	14	26	9	4	5
Eastern Europe	2	14	18	9	4	3	10	24	6	8	2
Central and Latin America	0	18	13	5	3	2	10	26	16	4	2
Africa	1	24	15	7	4	2	10	15	13	6	2

Table R6 Upstream carbon emissions embodied in the international trade between Developed Economies, Fossil Fuel Exporter and Asia, by sectoral importance (%).

		IMPORTS		
		Asia	**Developed Economies**	**Fossil Fuel exporters**
EXPORTS	**Asia**		Manufactured products (44) Clothing (13) Services (9) Construction (8)	Manufactured products (40) Clothing (13) Services (9) Construction (8)
	Developed Economies	Manufactured products (50) Electricity (11) Services (7) Food (7)		Manufactured products (44) Services (11) Minerals and Metals (9) Food (8)
	Fossil Fuel Exporters	Manufactured products (35) Fossil Fuels (18) Electricity (18) Food (6)	Manufactured products (33) Fossil Fuels (18) Minerals and metals (13) Transport (7)	

Table R7 Downstream carbon emissions embodied in the international trade between Developed Economies, Fossil Fuel Exporter and Asia, by sectoral importance (%).

		PAYMENT FOR IMPORTS		
		Asia	**Developed Economies**	**Fossil Fuel exporters**
PAYMENT FOR EXPORTS	**Asia**		Manufactured products (38) Clothing (11) Transport (9) Services (7)	Manufactured products (29) Electricity (18) Clothing (12) Minerals and metals (9)
	Developed Economies	Manufactured products (35) Minerals and Metals (14) Electricity (13) Transport (11)		Manufactured products (29) Fossil Fuels (20) Transport (12) Services (10)
	Fossil Fuel Exporters	Fossil Fuels (49) Electricity (13) Manufactured products (13) Minerals and metals (11)	Fossil Fuels (49) Electricity (14) Manufactured products (13) Transport (7)	