Research Report 451

JANUARY 2021

Wanted! Free Trade Agreements in the Service of Environmental and Climate Protection

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This work was commissioned by the Austrian Federal Ministry for Digital and Economic Affairs.

Abstract

The effects of international trade on the planet's climate and environment are manifold and complex. This makes assessment of the impact of free trade agreements (FTAs) a delicate matter. This study provides an overview of the development of sustainability chapters in FTAs and discusses their potential and limitations. It highlights particular industry-specific environmental issues related to EU trade, especially with developing countries, and presents complementary policy options. In this vein, it zooms in on the EU-Mercosur FTA, for which a political agreement was reached in June 2019. It contrasts the estimated cost of increased CO_2 emissions attributable to intensified trade relations, as one element of the 'pains from trade', with the estimated 'gains from trade' arising from lower prices for consumers. The analysis suggests that the benefits outweigh the costs; yet, the result is sensitive to assumed prices for pollutants. Furthermore, the effectiveness of the incorporated sustainability chapter is limited by its enforceability. The latter provokes a discussion on the modernisation of the framework of the World Trade Organization, which currently does not allow environmental challenges to be tackled effectively.

Keywords: free trade agreements, trade policy, environment, sustainability, WTO, Mercosur

JEL classification: F13, F14, F18, F64, O13, Q56

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1. Introduction: the ambiguous relationship between trade and environmental sustainability

The European Union has concluded a large number of free trade agreements (FTAs). It has always been a major hub of institutionalised trade links. Yet, the number of bilateral and plurilateral FTAs being established globally is also increasing, not least due to the stalemate in negotiations at the level of the World Trade Organization (WTO). This trend might develop even more dynamically, as the multilateral trade rules of the WTO and the institution itself have recently come under harsh criticism from major trading economies.

The effects of international trade and investment on the planet's climate and environment are manifold and complex. Assessment of the potential contributions of FTAs is, therefore, a delicate matter that needs to take account of the benefits – the 'gains from trade' – as well as the associated costs, which we shall label the 'pains from trade'.

The gains from trade may include resource savings induced by improved resource allocation, an increased variety of more environment-friendly products, (regulatory) demonstration effects, as well as the diffusion of higher environmental standards (*California effect*) and *green technologies* to technologically less-advanced countries.

The pains from trade, on the other hand, include increased emissions associated with the transport of goods, the relocation of emission-intensive production from richer to poorer countries with lower environmental protection legislation (*carbon leakage, pollution havens*) and the specialisation of countries in a few primary commodities, which may have severe environmental consequences (e.g. monocultures, deforestation).

We do not pose the question of whether trade agreements are good or bad for the environment, but rather ask from a policy perspective how FTAs should be designed to maximise environmental gains and minimise the harmful ecological pains from trade. In order to inform the discussion on the appropriate design of FTAs to make them serve environmental and climate protection, the study proceeds in three stages.

Following this introduction, section 2 offers an overview of the prevalence and development of sustainability chapters in the EU's FTAs and its experiences with these provisions. The next section highlights a number of specific environmental issues related to trade with developing countries. And section 4 zooms in on the EU's FTA with Mercosur (*Mercado Común del Sur*; the Southern Common Market), comprising Argentina, Brazil, Paraguay and Uruguay. With a political agreement having been reached on 28 June 2019, EU-Brazil trade relations are taken as an example to contrast the expected cost of increased CO_2 emissions with the expected gains from trade. Finally, there is a conclusion.

2. Sustainability chapters in trade agreements and trade in green goods

This section provides an introduction to the development of FTAs with respect to their scope, depth and, in particular, their coverage of environmental issues, embedded within the context of international agreements. It offers an overview of when, to what extent and with which trading partners environmental protection has been part of negotiated FTAs.

2.1. DEVELOPMENTS AT THE INTERNATIONAL LEVEL

Bilateral and multilateral trade agreements typically build on existing international frameworks. The largest forum in terms of members is the United Nations (UN), with currently 193 members. Focusing on free trade agreements, the central international institution is the World Trade Organization (WTO), with 164 members. Significant efforts in the collection and analysis of environmental data have been undertaken by the Organisation for Economic Co-operation and Development (OECD), which encompasses 36 members, predominantly in Europe. Last but not least, a special focus is placed on the EU and its 27 post-Brexit members.

The key international agreement addressing the mitigation of greenhouse gas emissions (GHG) is the Paris Agreement. It entered into force on 4 November 2016, 30 days after 55 countries, accounting for at least 55% of global emissions, (a so-called *double threshold*) joined the agreement. The agreement is embedded in the United Nations Framework Convention on Climate Change (UNFCCC) and requires all parties to report regularly on emissions and implementation efforts. A global stocktake is envisaged every five years – as such, a first evaluation is due in 2021.

The overall goal is to keep the global temperature rise during this century at below 2°C above pre-industrial levels. In practical terms, pre-industrial levels refer to average levels for the period 1850-1900. In 2018, the Intergovernmental Panel on Climate Change (IPCC) of the UN reported that human activities are likely to have caused global warming of 1.0°C from pre-industrial times until 2017. In addition, anthropogenic (i.e. human-made) global warming based on past and ongoing emissions was estimated at 0.2°C per decade.

As of the end of February 2020,[1] 187 countries had ratified the Paris Agreement; two countries (Nicaragua and Syria) had acceded to the agreement; eight countries had signed it but had not yet ratified it;[2] and the United States of America was the only country to have notified its withdrawal from the agreement, with effect from 4 November 2020.

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1 Regularly updated United Nations Treaty Collection: https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-d&chapter=27&clang=_en

2 Angola, Eritrea, Iran, Iraq, Libya, South Sudan, Turkey and Yemen.

The *nationally determined contribution* (NDC) of the EU aims at reducing GHG by 2030 by at least 40% compared to 1990; this is enshrined in its 2030 climate and energy framework, which in addition sets targets for the share of renewable energy and the improvement in energy efficiency (EC, 2014). The European Green Deal, presented in December 2019, contains even more ambitious emission-reduction targets, which seek to achieve zero net emissions of greenhouse gases by 2050 (EC, 2019a). The roadmap laid out in the annex to the Communication on the European Green Deal envisages a comprehensive plan to 'increase the EU 2030 climate target to at least 50% and towards 55% in a responsible way' (EC, 2019b).[3]

The EU has further demonstrated its commitment to the Paris Agreement by, among other things, embedding it within the most recently negotiated FTAs. The EU-Japan Economic Partnership Agreement, which entered into force on 1 February 2019, was the first of the EU's FTAs to explicitly incorporate the Paris Agreement (see Box 1). It also features in EU agreements with Mercosur (concluded on 28 June 2019), Singapore (in force since 21 November 2019) and Vietnam (in force since 1 August 2020). Yet, it was already indirectly covered in, for example, the EU-Canada Comprehensive Economic and Trade Agreement (CETA), where article 24.4(2) states that each party 'reaffirms its commitment to effectively implement in its law and practices, in its whole territory, the multilateral environmental agreements to which it is party'.[4]

BOX 1 / THE PARIS AGREEMENT IN THE EU-JAPAN ECONOMIC PARTNERSHIP AGREEMENT

Chapter 16: Trade and Sustainable Development

Article 16.4: Multilateral environmental agreements

(4) The Parties recognise the importance of achieving the ultimate objective of the **United Nations Framework Convention on Climate Change**, done at New York on 9 May 1992 (hereinafter referred to as "UNFCCC"), in order to address the urgent threat of climate change, and the role of trade to that end. **The Parties reaffirm their commitments to effectively implement the UNFCCC and the Paris Agreement**, done at Paris on 12 December 2015 by the Conference of the Parties to the UNFCCC at its 21st session. The Parties shall **cooperate to promote the positive contribution of trade to the transition to low greenhouse gas emissions and climate-resilient development**. The Parties commit to working together to take actions to address climate change towards achieving the ultimate objective of the UNFCCC and the purpose of the Paris Agreement.

(5) Nothing in this Agreement prevents a Party from adopting or maintaining measures to implement the multilateral environmental agreements to which it is party, provided that such measures are not applied in a manner that would constitute a means of arbitrary or unjustifiable discrimination against the other Party or a disguised restriction on trade.

Note: Authors' emphasis.

3 Initially scheduled for summer 2020. The current Coronavirus crisis might well lead to a rescheduling.

4 Furthermore, in September 2018 the CETA joint committee (2018) explicitly recommended cooperation and joint action 'contributing to the purpose and goals of the Paris Agreement'.

Furthermore, the 2030 Agenda for Sustainable Development was adopted by all UN member states in 2015, with its 17 sustainable development goals (SDGs).[5] Trade is addressed in several of these goals, yet, it is most explicitly listed as a target in SDG 17 *'Strengthen the means of implementation and revitalise the global partnership for sustainable development'*.[6] With respect to developing economies, and in particular least-developed countries (LDCs),[7] trade targets aim at increasing the share of these economies in global exports, implementing duty-free and quota-free market access and establishing preferential rules of origin for LDCs. Furthermore, SDG 17 reinforces the need for a rules-based, open and *non-discriminatory* multilateral trading system under the WTO, and for additional efforts to successfully conclude the negotiations of the Doha Development Round.

In this context, 'non-discriminatory' refers, on the one hand, to the WTO principles of most-favoured nation treatment at the border or national treatment behind the border;[8] but on the other hand, it underscores non-discrimination against developing countries (DCs) within each economy's Generalised System (or Scheme) of Preferences (GSP). At the end of 2019, the GSP of the EU covered 71 beneficiary economies (EC, 2020a) and distinguished three types of preference scheme (Figure 1):[9]

1. The **general GSP arrangement** addresses low-income and lower-middle-income countries according to the World Bank classification, if they do not already benefit from other preferential access to the EU market. It grants tariff reductions for roughly two thirds of all tariff lines. While these benefits were enjoyed by 111 countries in 2011, by 2019 the number of beneficiary countries had dropped to 15 – either because they were reclassified by the World Bank or because they had concluded more far-reaching agreements with the EU (EC, 2019c).

   Countries that are classified as upper-middle-income economies by the World Bank in three consecutive years drop out of the EU schemes. Hence, three economies – Nauru, Samoa and Tonga – will lose their beneficiary status as of 1 January 2021. Armenia will be removed from the list of beneficiaries as of 1 January 2022 for the same reason. Vietnam will cease to benefit from its GSP status as of 1 January 2023, two years following the entry into force of its FTA with the EU on 1 August 2020[10]. However, the GSP report of the EU (2020a) notes that it will be able to use GSP duties in case these are more favourable.

2. While the general GSP allows for lower tariffs, the **GSP+ arrangement** cuts tariffs for the same 66% of tariff lines to zero. In addition to fulfilling the general GSP conditions, the eight countries that were eligible for GSP+ in January 2019 had to meet a) vulnerability and b) sustainability criteria: the former state that countries must not be major exporters among GSP beneficiaries and must show

5 These succeeded the eight Millennium Development Goals: https://www.un.org/millenniumgoals/

6 See: https://sustainabledevelopment.un.org/sdg17

7 As classified by the United Nations. Currently, there are 47 countries listed as LDCs. A review by the Committee for Development takes place every three years: https://www.un.org/development/desa/dpad/least-developed-country-category/ldc-criteria.html

8 The regulation of most-favoured nation treatment is anchored in GATT Art. 1, GATS Art. 2, and TRIPS Art. 4; national treatment is formulated in GATT Art. 3, GATS Art. 17, TRIPS Art. 3.

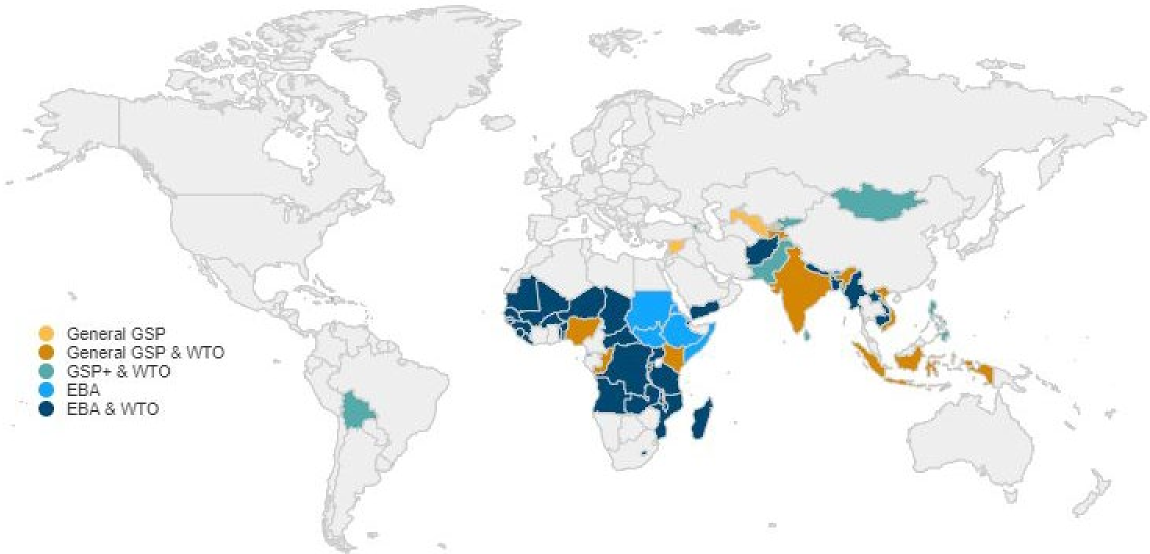
9 A list of beneficiary countries within each scheme is provided in the Appendix.

10 For the sake of simplicity and in line with past practice, the European Commission sets effective exit dates on the 1st of January of the following year. A delegated act on the amendment of annexes of beneficiary countries to regulation EU 978/2012 was adopted by the European Commission in September 2020 [C(2020) 6474 final]. No objections from the European Council or the European Parliament are expected.

little export diversification;[11] the latter require beneficiaries to implement 27 international conventions in the areas of human rights, labour standards, environmental protection and good governance. All beneficiaries of the GSP+ scheme have signed the Paris Agreement and the Kigali Amendment to the Montreal Protocol. An important feature of the GSP+ scheme is that the EU can withdraw trade preferences, if the beneficiary country does not comply with its commitments. The effectiveness of this clause depends on the monitoring process and the importance of the EU market for the country concerned. The Commission has acknowledged that there is still room for a greater focus on the environment in the monitoring process to increase the impact of the GSP+ scheme.

3. The most comprehensive arrangement is **'Everything But Arms' (EBA)**, which grants LDCs fully duty-free and quota-free access to the EU market for all products, except for arms and ammunition. In 2019, there were 48 beneficiary countries. One peculiarity is that LDCs do not lose their EBA status, even if they conclude an FTA with the EU.

Figure 1 / Beneficiaries of the GSP scheme, as per 1 January 2019



Note: Authors' illustration, based on data provided by the European Commission (EC, 2020a).

The EU can exert influence on beneficiaries' practices to protect the environment in the GSP+ arrangement, but its ability to do so in the general GSP arrangement and special provisions for least-developed economies is very limited. The potential for environmental protection of the GSP+ scheme is curbed by the low number of eligible countries: it currently only applies to eight trading partners (Armenia, Bolivia, Cape Verde, Kyrgyzstan, Mongolia, Pakistan, Philippines and Sri Lanka), out of which Armenia will lose its beneficiary status as of 1 January 2022. The European Parliament (EP, 2019a) welcomed the steps taken by the Commission to simplify the application process for GSP status,[12] in

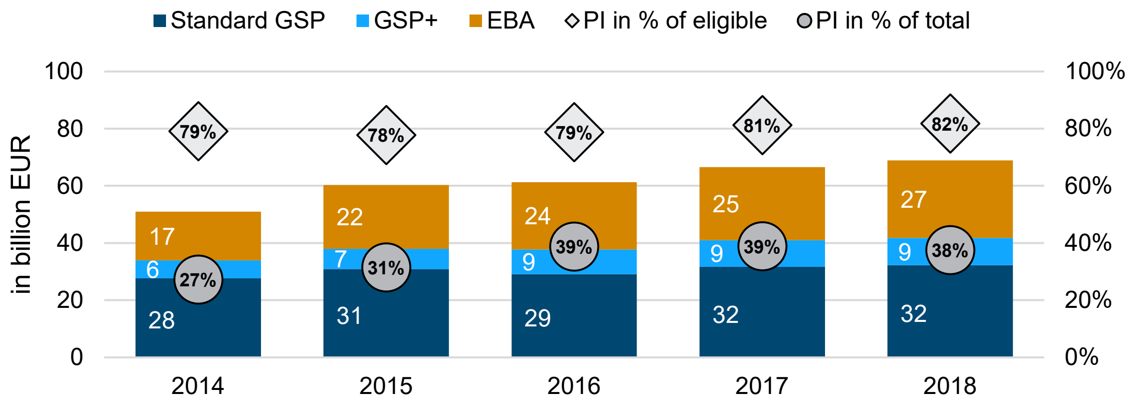
[11] The share of GSP-covered imports from a beneficiary country has to be lower than 6.5% of all GSP-covered imports of all economies within the GSP scheme. Furthermore, the seven largest sections of GSP-covered imports have to represent 75% of total GSP imports from that country. Both measures are calculated as averages over three-year periods.

[12] See EC (2018e).

order to make the GSP+ scheme more attractive to GSP beneficiary countries. Looking ahead, further simplifications might be possible for a potential GSP scheme to apply after 2023, when the current scheme expires.[13] Special arrangements for LDCs are not affected by the expiry.

Calculated over all three GSP schemes, the preference utilisation rate (i.e. preferential imports to the EU as a share of all eligible imports) is quite high, at above 82% (Figure 2). Yet, preferential imports represent less than 40% of total imports from the countries concerned. Hence, there is also room to increase the incentives for DCs to comply with environmental regulations through the share of products/imports that qualify for trade preferences.

Figure 2 / Preferential imports within the EU's GSP



Notes: PI = Preferential imports. Data source: EC (2016, 2018a, 2020a).

In a joint report by the WTO and UN Environment (2018), entitled *Making trade work for the environment, prosperity and resilience*, the main argument put forth in favour of international trade with respect to the environment is that open, predictable and equitable trade relations can help create and expand markets for sustainable products and accelerate the propagation of the so-called environmental goods and services sector (EGSS).

This sector covers products and services used to prevent, reduce and eliminate pollution or other forms of environmental degradation, including measures to restore already degraded ecosystems. The output may also serve resource management activities aimed at preventing the depletion of natural resources.[14] Economic activities captured in EGSS categories can be quite specific (e.g. research activities for resource management); but they may also represent large sectors of daily life, such as the management of waste and wastewater or the production of energy from renewable resources.

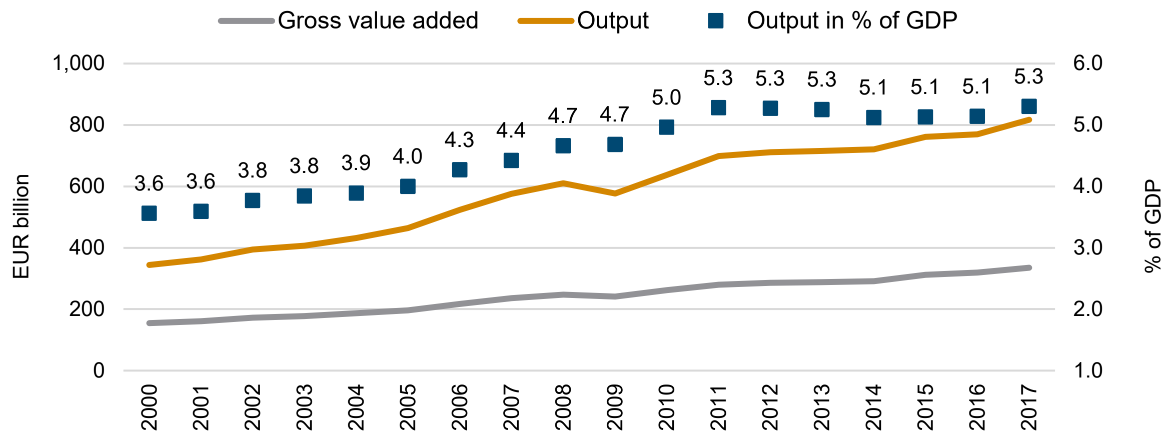
Leaving aside the period of the global financial and economic crisis, the output and value added generated by the EGSS of the EU28 have increased steadily (Figure 3). Gross value added increased

[13] The Inception Impact Assessment of the European Commission (2019d), presented for public consultation (11 March to 15 July 2020), describes multiple options for the future of the GSP scheme, ranging from the (unlikely) discontinuation of the scheme to a continuation of the current scheme (baseline), improving the scheme (e.g. with respect to the coherence between GSP and trade agreements), or significantly expanding the scheme (e.g. product coverage, product graduation).

[14] Product categories considered in Eurostat statistics are listed in the Appendix.

from EUR 155 billion in 2000 to EUR 335 billion in 2017, corresponding to an average growth rate of 4.7% per year. The output of the EGSS saw an even stronger average increase of 5.2% per year, from EUR 344 billion in 2000 to EUR 817 billion in 2017.[15] In GDP terms, the EU's output of environmental goods and services corresponded to 3.6% of GDP in 2000 and 5.3% in 2017. However, the ratio stagnated in 2011 at 5.3%, decreased slightly and only picked up again in 2017.

Figure 3 / EU28 value added and output of EGSS, 2000-2017



Data source: Eurostat [env_ac_egss2]; Last update: 31-01-2020.
Notes: EU aggregates calculated by Eurostat do not constitute the sum of available national data but are derived from estimates based on methods documented in the Eurostat EGSS practical guide.

Trade figures of the EGSS are available at the national level (Figure 4). With average EGSS exports of EUR 8.8 billion during the years 2014-2016, Austria ranked fourth, after Germany, the Netherlands and Denmark. The highest-ranked Central European economy is the Czech Republic, with EGSS exports worth EUR 4.3 billion, ahead of Italy (EUR 3.8 billion). The extent to which EGSS output is exported varies greatly among economies. There are eight member states where more than a quarter of EGSS output is destined for foreign markets: the Czech Republic (37%), Denmark (35%), Slovenia (32%), the Netherlands (29%), Belgium (29%), Austria (27%), Latvia (27%) and Romania (26%). Among the larger producers, France, the UK, Spain and in particular Italy primarily serve their own markets, with export shares close to or below 10%.

In fact, between January 2014 and December 2016, 18 parties,[16] representing 46 WTO members, participated in 18 rounds of negotiations for a comprehensive Environmental Goods Agreement (EGA). Referring to the goals of the 'Doha Development Round', the work of the Committee on Trade and Environment established at the WTO, the targets of the Paris Climate Agreement and the Sustainable Development Goals,[17] the parties sought to boost the EGSS by eliminating tariffs on important

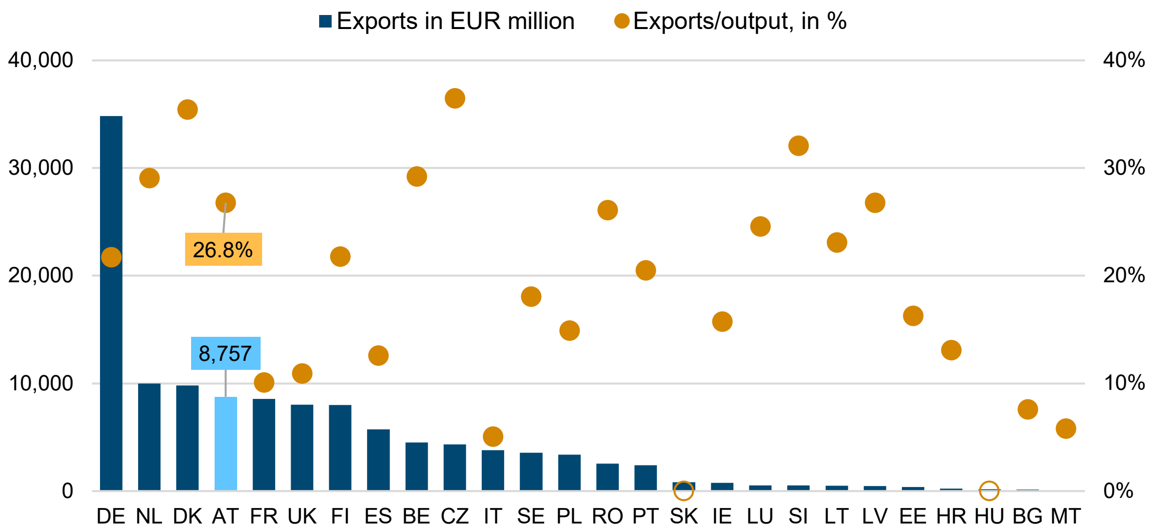
[15] The development is comparable when the United Kingdom is excluded from the figures. For the EU27, gross value added increased from EUR 130 billion to EUR 288 billion (4.8% growth p.a.), while output increased from EUR 294 billion to EUR 702 billion (5.2% growth p.a.).

[16] Australia, Canada, China, Costa Rica, European Union, Hong Kong, Iceland, Israel, Japan, South Korea, New Zealand, Norway, Singapore, Switzerland, Liechtenstein, Taiwan, Turkey, United States.

[17] In particular SDG 17 for the establishment of a global partnership for sustainable development, as outlined above, as well as SDG 7 to ensure access to affordable, reliable and modern energy and SDG 6 to ensure access to water and sanitation.

environmental goods. In 2016, when the European Commission published an impact assessment on the EGA, 90% of global trade in the EGSS was performed by the handful of negotiating parties. However, all WTO members would have benefited from improved conditions. In addition to boosting trade and investment in the EGSS, the assessment concluded that the agreement had the potential to cut 10 million tonnes of CO_2 emissions and to reduce the CO_2 intensity of GDP by 0.02% by 2030, compared to a baseline scenario without the multilateral agreement (Development Solutions, 2016). Although some parties expressed their readiness to resume negotiations at the 11th WTO Ministerial Conference in Buenos Aires (December 2017), no further negotiation round has taken place so far. Some reasons include disagreement on the scope of the agreement (reduction in tariffs or reduction in non-tariff barriers as well), the list of products affected and the possibility of free-riding on the agreement, in particular by large emerging markets, such as India or Brazil (EP, 2019b).

Figure 4 / Exports and output of EGSS, 2014-2016



Note: Missing output data for Hungary and Slovakia.
Data source: Eurostat [env_ac_egss2]; last update: 31-01-2020.

2.2. ENVIRONMENTAL PROVISIONS IN FTAS

There is great heterogeneity across free trade agreements with respect to the inclusion of environmental topics or sustainability chapters over time, across countries and regarding their enforceability. The EU has started to incorporate rules on trade and sustainable development in its new-generation FTAs, as well as in the deep and comprehensive free trade areas (DCFTAs) in its Eastern neighbourhood (Table 1). Following the 15-point action plan (EC, 2018j) on the way forward for improving and enforcing Trade and Sustainable Development (TSD) chapters in EU trade agreements, in its most recent trade agreements the EU has reinforced provisions such as the Paris Climate Agreement, as well as actions towards goals of the UNFCCC. Furthermore, the EU proposal for a new partnership with the United Kingdom after Brexit includes 'the fight against climate change, as elaborated in the UNFCCC process and in particular in the Paris Agreement' as *essential* element of the envisaged partnership, with autonomous measures allowed to be taken, including the suspension of provisions, in the case of a breach of essential elements (EC, 2020h).

Table 1 / Applied EU trade agreements with rules on sustainable development

	Trading partner	Applied since		Pref. utilisation: EU exports	Pref. utilisation: EU imports	UNFCCC & Paris
New-generation FTAs	Canada	21 Sep 2017		37%	50%	explicitly
	Colombia	1 Aug 2013	Andean Community	72%	98%	
	Costa Rica	1 Oct 2013	Central America	59%	86%	
	Ecuador	1 Jan 2017	Andean Community	68%	99%	
	El Salvador	1 Oct 2013	Central America	33%	91%	
	Guatemala	1 Dec 2013	Central America	33%	97%	
	Honduras	1 Aug 2013	Central America	55%	91%	
	Japan	1 Feb 2019		n.a.	n.a.	explicitly
	Nicaragua	1 Aug 2013	Central America	n.a.	88%	
	Panama	1 Aug 2013	Central America	n.a.	82%	
	Peru	1 Mar 2013	Andean Community	56%	96%	
	Singapore	21 Nov 2019		n.a.	n.a.	explicitly
	South Korea	1 Jul 2011		81%	88%	
	Vietnam	1 Aug 2020		n.a.	n.a.	explicitly
DCFTAs	Georgia	1 Sep 2014	In force 1 Jul 2016	83%	76%	
	Moldova	1 Sep 2014	In force 1 Jul 2016	n.a.	85%	
	Ukraine	1 Jan 2016	In force 1 Sep 2017	74%	80%	

Notes: Preference utilisation rates for the year 2018; n.a. = not available.
Sources: Preference utilisation rates from EC (2019e); country selection from the DG Trade website https://ec.europa.eu/trade/policy/policy-making/sustainable-development Similar provisions were included in the agreements concluded with Mexico and Vietnam.

The Trade Agreement Heterogeneity Database (TAHD) by Kohl et al. (2016) classifies trade agreements for the period from 1948 to 2011,[18] distinguishing provisions that are covered and those that are also enforceable in an international court across 17 trade-related policy domains. They provide information on whether provisions in trade agreements confirm or deepen multilateral commitments in line with the WTO, or whether they are not covered by the WTO's mandate – the latter include labour market and environmental regulations.

Of the 296 agreements covered by the dataset, 89 (30%) include environmental regulations; and of these, 66 (i.e. 74%) are also considered enforceable. Environmental provisions are agreements between trading partners 'to uphold environmental laws, provided that they are not used as disguised barriers to trade [and] commitments to enforce environmental laws so as not to attract (foreign) business activity that would exploit environmental resources' (Kohl et al, 2016).[19]

[18] Building on the Global Preferential Trade Agreements Database published by the World Bank (as of 18 December 2011): https://wits.worldbank.org/gptad.html

[19] See Appendix A.5. for an example of formulations considered to distinguish enforceable from non-enforceable environmental regulations in trade agreements.

Table 2 / Trade agreements encompassing environmental provisions, 1948-2011

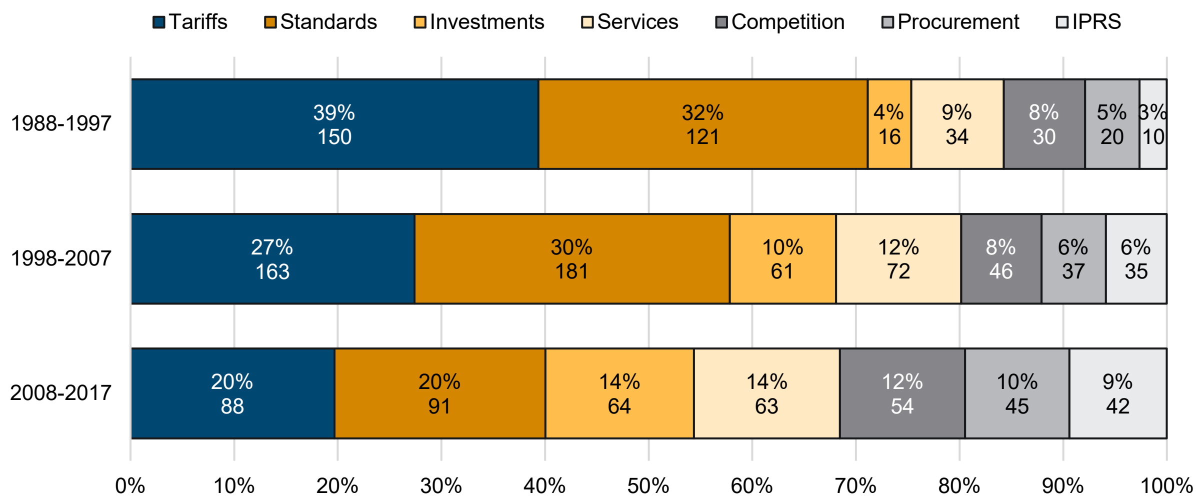
	1950s	1960s	1970s	1980s	1990s	2000s	Total	Thereof: EU	
Covered	0	0	2	1	5	15	**23**	17	74%
Enforceable	1	0	3	0	27	35	**66**	10	15%
Total	1	0	5	1	32	50	**89**	27	30%

Data source: Kohl et al. (2016) – TAHD database. Note: 2000s including the year 2011.

Almost a third of all FTAs incorporating environmental regulations are EU agreements.[20] However, the EU's share among FTAs with enforceable regulations amounts to only 15% (Table 2). Many enforceable environmental clauses of the EU concern agreements with countries that have subsequently become member states. Focusing on the 2000s, the EU accounts for 12 out of 50 FTAs with environmental provisions; however, only two of them appear enforceable. The US and Japan feature more prominently among agreements with enforceable clauses. It needs to be remembered, though, that the database ends in 2011: the current opposing trends, with the EU's stronger environmental focus (emphasised by its European Green Deal) and the denial of anthropogenic global warming by the US administration (underlined by its withdrawal from the Paris Agreement) are not covered by the data.

The Design of Trade Agreements Database (DESTA) covers trade agreements for the period 1945-2018[21] (Dür et al., 2014), and provides an index for the depth of FTAs, as well as information on components for each agreement. There is a clear shift in importance away from tariff cuts towards other components, including standards.

Figure 5 / Components of FTAs over time



Data source: Dür et al. (2014) – DESTA database; update April 2019; authors' computation and illustration. IPRS = intellectual property rights.

20 See Appendix A.4. for a list of all trade agreements with environmental regulations covered by the TAHD database.

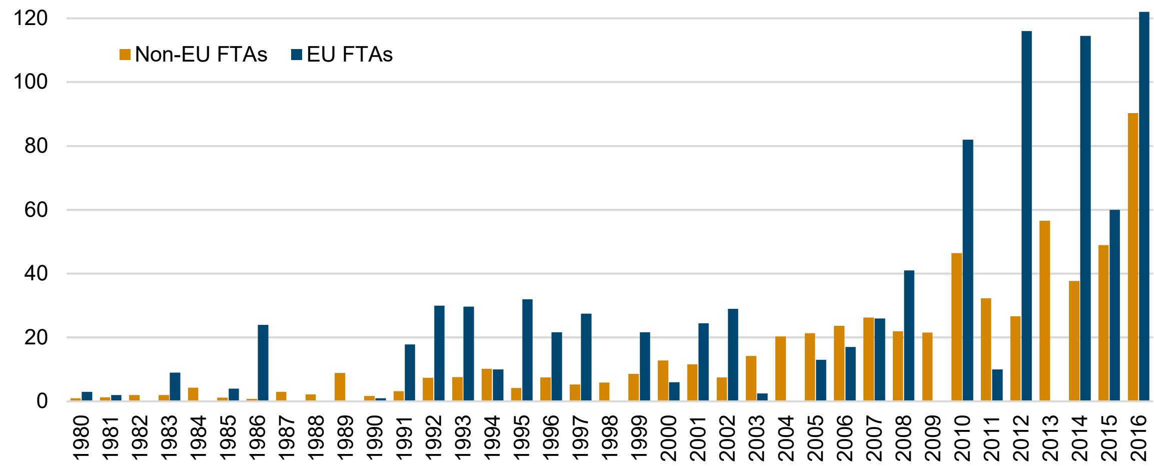
21 Latest data update released in April 2019.

In cooperation with DESTA, Morin et al. (2018) published the Trade and Environment Database (TREND), which allows, for example, different levels of environmental protection to be differentiated. The dataset provides information on 286 criteria for 691 agreements for the period 1947-2016. Each trade agreement is screened across these 286 criteria, for which a 0 or 1 is assigned, so that the score per trade agreement would range from 0 to 286 (theoretically).

The TREND data shows that after a first wave in the 1990s, environmental provisions picked up significantly in the 2000s, both for trade agreements concluded by the EU and for other FTAs worldwide. However, the number of environmental norms in the 2010s averaged 93 for EU trade agreements and 44 for non-EU FTAs (Figure 6).

In comparison to other FTAs, EU agreements feature a fewer provisions for the enforcement of domestic measures (TREND chapter 5) and specific trade-related measures (TREND chapter 8). The latter are, however, on the rise: in particular, specific trade-related measures regarding the life or health of animals and/or plants and/or humans without reference to the General Agreement on Tariffs and Trade (GATT) Art. XX.[22]

Figure 6 / Average number of environmental norms covered in FTAs

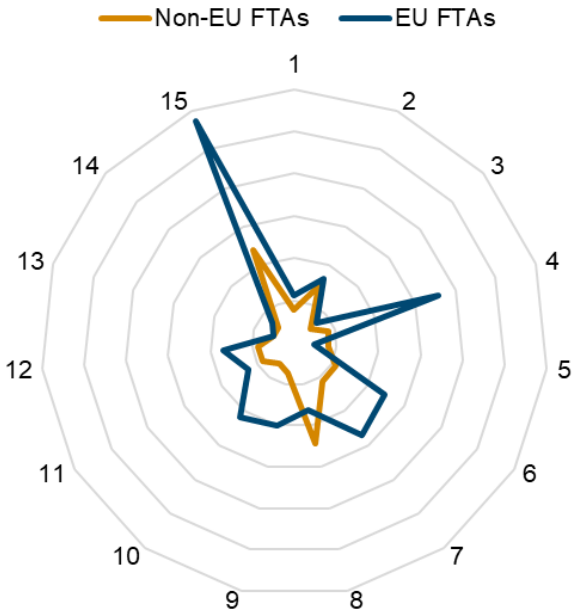


	1950s	1960s	1970s	1980s	1990s	2000s	2010s	Total
EU FTAs	5.00	0.75	1.97	7.50	23.06	24.56	93.09	**22.70**
Non-EU FTAs	0.44	0.94	2.59	3.00	6.79	17.90	43.79	**13.20**

Data source: Morin et al. (2018) – TREND database; authors' calculations.

22 TREND indicator (8.01.01.02): 'General exceptions for trade in goods; Life (or health) of animal and/or plant; Not necessary'. For example: 'The Agreement shall not preclude prohibitions or restrictions on imports, exports, goods in transit or trade in used goods justified on grounds of […] the protection of health and life of humans, animals or plants […] Such prohibitions or restrictions shall not, however, constitute a means of arbitrary or unjustifiable discrimination where the same conditions prevail or a disguised restriction on trade between the Parties.' In the EU agreement with South Africa (Art. 27). OJ L 311, 4.12.1999.

Figure 7 / Types of environmental provisions across EU and non-EU FTAs



TREND chapters

1. Principles
2. Level of environmental protection
3. Law making and policy making
4. Interaction between non-environmental issues and the environment
5. Enforcement of domestic measures
6. Means to encourage environmental protection
7. Other cooperation on environmental matters
8. Specific trade-related measures
9. Assistance
10. Specific environmental issues
11. Implementation of the agreement
12. Institutions
13. Dispute settlement
14. Relations with international institutions
15. Other environmental norms

Note: Average score per TREND chapter across FTAs, standardised by the number of indicators per chapter.
Data source: Morin et al. (2018) – TREND database; authors' calculations.

Employing bivariate tests, Morin et al. (2018) assessed the likelihood of environmental clauses being included in trade agreements. Countries are more likely to include them if (i) they have high levels of domestic environmental protection (and therefore face lower costs of compliance with (international) standards), (ii) they experience import competition – in particular developed countries with higher standards shielding domestic industries from competition from DCs with lower standards, and (iii) they are democracies, subject to pressure from lobbies, non-governmental organisations (NGOs) and civil society, in particular, in the run-up to elections. Morin et al. (2018) also refer to studies by Jinnah and Lindsay (2016) and Poletti and Sicurelli (2015), who found evidence that the US and the EU were seeking to spread their norms internationally, through the inclusion of environmental provisions in trade agreements. However, the EU follows a soft law approach through cooperation mechanisms and consultations,[23] while the US (and Japan) enforce environmental protection through state-to-state dispute settlement (Draper et al., 2017).

The decision whether or not to incorporate (enforceable) environmental clauses in trade agreements is not trivial. The greatest opportunity cost[24] of *no longer* following the EU Parliament's resolution of 2010[25] on environmental standards in international trade is missing out on the chance to push for high regional and eventually – in the long run – multilateral homogeneous sustainability standards. In this regard, it is worth noting that environmental provisions originating from intercontinental agreements seem to diffuse

[23] See Titievskaia (2019) for a discussion on EU procedures for TSD chapter disputes.

[24] Opportunity costs are costs that arise or benefits that are missed out on when choosing one alternative over another; we consider shallow and deep free trade agreements as the two alternatives.

[25] See: European Parliament resolution of 5 July 2016 on implementation of the 2010 recommendations of Parliament on social and environmental standards, human rights and corporate responsibility: http://www.europarl.europa.eu/doceo/document/TA-8-2016-0298_EN.html

faster (Morin et al., 2019). Furthermore, the link between international environmental agreements or preferential trade agreements and the adoption of domestic environmental legislation is found to be more pronounced for DCs (Brandi et al., 2019).

On the other hand, opportunity costs associated with pursuing deep and comprehensive agreements that include environmental standards, rather than shallow agreements that focus on tariff reductions, include higher costs arising from time-consuming negotiations, reduced transparency, increased bureaucracy and – not least – the risk that (developing) trading partners might prefer tighter trade links with other economies that are not so eager to embed environmental standards in trade agreements. The latter could result in trade diversion effects, decreasing the EU's market share in foreign markets.

Consider the following ordinal payoff matrix for the EU and the US that arises in the context of choosing between a 'shallow' approach and a 'deep' one (i.e. with substantial environmental sustainability provisions) in FTA negotiations with some other country (Table 3).

Table 3 / Payoffs of including environmental topics in FTAs

		EU FTAs	
		with *environmental provisions*	***without*** *environmental provisions*
US FTAs	***with*** *environmental provisions*	**EU 3** / **US 3**	EU 2 / US -1
US FTAs	***without*** *environmental provisions*	EU -1 / US 2	**EU 1** / **US 1**

Note: Payoffs represent illustrative ordinal rankings.

If both economies opt not to incorporate environmental sustainability into FTAs, there is no risk of a trade diversion from the EU to the US or vice versa. For a third country, e.g. India, an FTA with the US might be as attractive as an FTA with the EU. A payoff of 1 is assigned to the EU and the US, as both reap gains from trade which might partially be offset by environmental pains from trade.

If both economies incorporate environmental regulations into FTAs, there is also no risk of diversion from the EU to the US or vice versa (but there could potentially be diversion to another country, like China; this is not dealt with here). Again, a third country might have no preference one way or the other about concluding an FTA with the EU or the US (or both). However, assuming that environmental provisions in FTAs contribute to the mitigation of trade-related environmental damage, the payoffs are higher for the US and the EU economies (we assign a payoff of 3 for both).

What happens if only one economy pushes for more stringent environmental regulation? The implementation of environmental standards is associated with (partly substantial) costs for trading partners. In particular, Wilson et al. (2002) find that trade agreements on a common environmental standard cost a non-OECD country significantly more than an OECD country, with developing economies reducing exports of pollution-intensive products. Berger et al. (2020) find evidence that although preferential trade agreements generally do increase trade flows, if they contain a higher number of environmental regulations, then that reduces exports from developing to developed economies, presenting them with a trade-off. In 2016, each new trade agreement contained roughly 100 different environmental provisions (Morin et al., 2018).

Hence, trade diversion effects can be expected, if only the US incorporates environmental issues into its trade policy, while the EU does not – or vice versa, which is the more realistic scenario under the Trump administration. In that case, the EU might miss out on the opportunity to conclude an FTA with a third country and on the associated gains from trade, since it is economically more attractive for a third country to adhere to the lower, less cost-intensive standards of the US. In addition, the EU might still experience negative environmental effects occurring from increased trade between the third country and the US, as many pollutants do not remain local. Combining the economic opportunity cost with the additional environmental damage, we assign a payoff of -1 for the EU. The US would gain from institutionalised trade relations with the third country and trade diversion effects away from the EU towards the US, albeit at the cost of lower environmental standards, borne by society. We therefore assign a payoff of 2, which is higher than the payoff if both the EU and the US stick to low standards, but below the payoff if the two major economies were to implement high environmental standards.

The payoff matrix therefore shows a situation that results not in a dominant strategy (i.e. a strategy to follow irrespective of the actions of other actors), but rather in two Nash equilibria, where the US and the EU either both implement higher standards (3/3) or both even out at a low level (1/1). Higher payoffs are, however, to be expected when a race to the top is pursued by major economic partners.[26]

[26] Aisbett and Silberberger (2020) find that trade liberalisation tends to spur divergence between countries in their behaviour to regulate product and production standards: Economies with many sanitary and phytosanitary measures in place follow a race to the top after further trade liberalisation steps are taken, while countries with a lower level of regulation prior to trade liberalisation tend to decrease their rate of notifications to the WTO even further.

3. Recurring environmental issues with developing countries[27]

This section focuses on the environmental effects of EU imports from DCs for two main reasons.

First, in 2019, more than half of the extra-EU merchandise imports originated from DCs. Imports from big emerging markets, such as China, Russia, Turkey, India and Brazil, accounted for 33.2%, while 22.7% originated from the many other DCs. Thus, with 55.9% of extra-EU imports, DCs are important suppliers for the EU. On the export side, DCs are less important for the EU, with 39.3% of extra-EU exports destined for DCs.[28]

Second, as shown in Fernández-Amador et al. (2016) and Ritchie and Roser (2020), trade flows from DCs to developed countries embody more CO_2 emissions than flows in the opposite direction. Consequently, the EU's imports from DCs at present produce relatively more CO_2 emissions than imports from developed countries, and also more than the EU's exports to DCs.

We are aware, that international trade may contribute to the improvement in environmental standards. This may be facilitated by the export of environmental technologies from advanced economies to DCs, or it may come about as a result of demand from consumers in high-income countries for tighter regulations. These are certainly important ways in which DCs might benefit from trade with high-income countries in the longer term, and we return briefly to this point in subsequent sections.

It goes without saying that there is widespread consensus that international trade generally produces economic gains for both rich countries and DCs, and that it is an engine of growth and thus an important factor for economic development.

However, the development of DCs' exports – based on their competitive advantage and lower environmental standards, and promoted by FTAs – has contributed to an accumulation of negative environmental effects in DCs. Therefore, we think it is particularly important to analyse the environmental consequences of the EU's imports in developing producer countries in more detail, and to discuss what the EU trade policy can and does do to mitigate them.

27 The World Bank classifies countries into high-income, upper-middle-income, lower-middle-income and low-income countries. Apart from the high-income countries, all countries are considered developing countries. In 2019/2020 the threshold was Gross National Income per capita of USD 12,375. (The World Bank country groups, https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups, accessed 1 July 2020).

28 Shares calculated based on EC (2020g).

3.1. A CLOSER LOOK AT EU TRADE AGREEMENTS WITH DCS

As outlined in section 2, the EU grants products from DCs preferential access to its market under a Generalised Scheme (or System) of Preferences (GSP), which was first introduced in 1971. The lower- and lower-middle-income countries that benefit from the GSP are mainly located in Africa and Southeast Asia.

The EU's GSP differentiates between non-sensitive products (which enjoy duty-free access) and sensitive products. Sensitive products comprise many agricultural, textile, clothing, apparel and footwear products. However, these are typical products where DCs have a comparative advantage. They enjoy a tariff that is 3.5 percentage points lower than the most-favoured-nation tariff. Furthermore, the GSP recognises graduated products: once imports of a particular sector to the EU from a country reach a certain threshold (suggesting they are competitive on the EU market) those products fall out of the preference scheme (EC, 2012; 2015a; see also Box 2).

EU imports under the standard GSP amounted to EUR 124.4 billion in 2018 (i.e. 6.9% of total EU imports), EUR 19.3 billion under the GSP+ scheme (i.e. 1.1% of total EU imports), and EUR 39.8 billion under the EBA arrangement (i.e. 2.2% of total EU imports). Almost 50% of all GSP imports originate from India and Bangladesh. India accounts for the largest share of imports under the standard GSP (51% in 2018), followed by Vietnam and Indonesia. Pakistan benefits the most from GSP+ (62% of GSP+ imports in 2018), followed by the Philippines and Sri Lanka. Bangladesh is the most important beneficiary of the EBA arrangement (62% of the EU's imports under EBA), overtaking even India in terms of preferential imports in absolute figures (EUR 16.8 billion, compared to EUR 16.4 billion from India in 2018) (EC, 2018c; 2020a).

BOX 2 / GRADUATION OF COMPETITIVE SECTORS FROM GSP

Commission Delegated Regulation (EU) 2015/1978 of 28 August 2015 (Official Journal of the European Union L 289 of 5 November 2015) amends Article 8 listed in Annex VI of Regulation (EU) No. 978/2012:

ANNEX VI

Modalities for the application of Article 8

1. Article 8 shall apply when the percentage share referred to in paragraph 1 of that Article exceeds 57%.
2. Article 8 shall apply for each of the GSP sections S-2a, S-3 and S-5 of Annex V, when the percentage share referred to in paragraph 1 of that Article exceeds 17.5%.
3. Article 8 shall apply for each of the GSP sections S-11a and S-11b of Annex V, when the percentage share referred to in paragraph 1 of that Article exceeds 47.2%.

where S-2a includes live trees and plants, S-3 comprises oils and fats, S-5 refers to among others to cement and mineral fuels and S-11a and S-11b refer to selected textiles and clothing.

DCs which have other preferential agreements with the EU, like an economic partnership agreement (EPA) or another FTA, typically enjoy better market access conditions than under the GSP. However, the latter are negotiated reciprocally, while GSP preferences are granted unilaterally by the EU. Hence, for EPAs and FTAs, DCs also have to improve market access for EU exporters (though mostly at a much slower pace).

EPAs[29] were negotiated with a group of African, Caribbean and Pacific (ACP) countries when trade provisions under the Cotonou agreement expired in 2007[30]; they seek to promote sustainable development and poverty reduction in these predominantly low-income countries. EPAs require ACP countries to guarantee human rights, democratic principles, the rule of law and good governance, with the threat of possible suspension of the agreement if the guarantee is violated. The EPAs provide duty-free and quota-free access to EU markets for all products, and on the other side a gradual opening of the DCs' markets for EU products. ACPs can exclude sensitive agricultural products from market opening and can maintain export duties to protect their fledgling industries (EC, 2018h). Nevertheless, a number of ACP countries fear competition from EU industries, and therefore the signing, ratification and (consequently) implementation of EPAs is far from complete.

Trade with ACPs represents 5% of EU trade. Imports from ACP countries consist mainly of agricultural goods, minerals and oil. The EPAs are not negotiated bilaterally with individual countries, but are agreed with regions and generally speaking – although there are exceptions – cannot enter into force if one country of a region stays apart (EC, 2020e; 2020f):

› The first agreement was signed and implemented with 13 members of the Caribbean Community, the **CARIFORUM**-EU EPA in 2008, later extended to 15 partners. The EU imports mainly fuels, minerals, iron ore, bananas and sugar. The agreement foresees asymmetric opening in favour of CARIFORUM for sensitive products, with a transition period of 25 years. It is applied with independent Caribbean countries, except Cuba and Haiti, plus the French outermost regions and British, Dutch and French overseas territories.

› The EPA with several members of the **South African Development Community (SADC)** was agreed in 2014 with Botswana, Lesotho, Mozambique, Namibia, South Africa and Swaziland, with an option for Angola to join in. It has been provisionally in force since 2016, with ratification by a few EU members still pending.[31]

› Six **Eastern and Southern African countries (ESA)** concluded an interim EPA with the EU; this has been (provisionally) applied since 2012 for Madagascar, Mauritius, Seychelles and Zimbabwe, and since February 2019 for Comoros.

› An agreement with the **East African Community (EAC)** was negotiated by 2014, but has so far only been signed by Kenya and Rwanda; Burundi, Tanzania and Uganda fear competition from EU

[29] Unfortunately, the comprehensive FTA between the EU and Japan is also called an EPA; however, this is a completely different type of FTA and should therefore not be compared to the EPAs discussed in this section.

[30] The Cotonou agreement itself was extended until December 2020; the EU published a proposal for a new strategy with African economies in March 2020, with green transition and sustainable growth featuring among the five key areas.

[31] The EU has been operating an FTA with South Africa since 2000; this permitted the EU to increase its exports of machinery and appliances to South Africa, while giving the country ample access to EU markets in agricultural products (fruits, wine). While in the early days South African exports (agricultural and mining products) predominated, since 2014 the EU has exported more to South Africa than it imports (Chideme, 2016).

products, and so the outcome is unclear. The EU imports coffee, tea, cut flowers, vegetables and fish from the EAC. The EAC-EU EPA gives duty-free access to the EU for all goods, while the EAC is required to liberalise 82% of its imports from the EU over 15 years. Certain basic manufactures, such as textiles, will not be liberalised by the EAC. In addition, the EPA envisages EU support for sustainable fisheries and agriculture.

› An agreement with 16 **West African states** was negotiated in 2014, but has only been signed by 15 of those states, with Nigeria remaining apart. From 2016, the agreement was provisionally applied to Côte d'Ivoire and Ghana. The EU imports from West Africa are mainly fuels and fish, as well as cocoa from Côte d'Ivoire and Ghana.

› An EPA with eight **Central African countries** was signed in 2007, but has only been ratified by Cameroon, with which it is now provisionally in operation.

› The EU has negotiated an EPA with just a few of the ACP's **Pacific countries**. Among them is Papua New Guinea, with which an EPA was implemented in 2011. The EU primarily imports palm oil, copper and canned tuna. Papua New Guinea has been joined in the EPA by Fiji, Samoa and, most recently, by the Solomon Islands.[32]

Many other countries that are not subject to the GSP or an EPA have an FTA in place with the EU. The EU has implemented FTAs with a number of Latin American countries (Mexico in 2000,[33] Chile in 2003,[34] and the Andean Community[35]); as part of the association agreement with Central American countries in 2013;[36] with countries of the EuroMed group[37] (Morocco 2000, Algeria 2005, Tunisia 1998, Egypt 2004, Israel 2000, Jordan 2002, Lebanon 2006, Turkey 1995[38]); and with South Africa in 2000 (now replaced by the SADC-EU EPA).

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32 Most recent accession on 7 May 2020 – Press release: https://ec.europa.eu/taxation_customs/news/solomon-islands-provisionally-applies-eu-pacific-epa-1752020_en

33 Trade with Mexico shows a fairly advanced, diversified structure. The EU imports machinery, transport equipment and oil-related products from Mexico and exports machinery, automotive products and chemical products. The EU is Mexico's second largest trade partner. Exports to Mexico are consistently higher than imports (EC, 2018b).

34 Chile has been classified as a high-income country since 2012 (World Bank, 2020). Nevertheless, since the economy and trade relations are still characterised by DC features, we include EU-Chile trade relations in this section. The EU shows a trade deficit with Chile. Agricultural exports (grapes, apples, pears, salmon, wine) account for 30% of Chile's exports to the EU, but Chile's major export product is copper (EC, 2018b).

35 Colombia and Peru in 2013, joined by Ecuador in 2017; the EU exports machinery, vehicles and pharmaceuticals to the Andean Community, and it imports minerals, emeralds, gold, coffee and bananas (Colombia); minerals, copper, fish, avocados and asparagus (Peru); and minerals, tuna, shrimp and bananas (Ecuador). The EU imports more from Peru and Ecuador than it exports to them, but it has a positive trade balance with Colombia. Agricultural exports to the EU have a share of about 60% of total exports to the EU in Ecuador, 43% in Colombia and 35% in Peru (EC, 2018b).

36 Central American exports to the EU mainly consist of agri-food products (74% of all exports to the EU): bananas, pineapples (mainly Costa Rica), coffee (Honduras, Guatemala, Nicaragua), fish and crustaceans, palm oil (Guatemala), but recently also medical instruments and knitted textiles. The EU exports to the region machinery, vehicles and pharmaceuticals. The EU has a negative trade balance with the region (EC, 2018b).

37 The EU imports oil and gas from Algeria; mining products, textiles and agricultural products from Egypt; textiles, agricultural products and transport equipment from Morocco. Tunisian exports are more diversified, containing machinery sector products, textiles and clothing. The EU exports fuels and minerals, machinery, transport equipment and chemical to these countries (EC, 2018b).

38 The EU exports machinery, transport equipment and chemicals to Turkey and also imports from the first two product sectors, as well as textiles. Exports have constantly dominated over imports (EC, 2018b).

The long-awaited agreement with Mercosur (Brazil, Argentina, Uruguay,[39] Paraguay) was reached in 2019 for the trade pillar (as part of a wider association agreement including political dialogue and cooperation), but is still awaiting legal revision so that the final text can be settled and the agreement submitted for ratification. An agreement with Vietnam was signed in 2019, concluded in March 2020 by the European Council, ratified by Vietnam's parliament and entered into effect on August 1, 2020. Negotiations with some other Association of Southeast Asian Nations (ASEAN) countries (Malaysia, Thailand, Philippines) and with India – countries that are no longer covered by the GSP or have partly graduated products – have been initiated but are currently on hold.

In summary, DCs benefit from a wide range of EU free trade regimes, which has supported the growth of their exports to the EU. The issue, however, is how these exports are assessed from an environmental point of view. This fundamental question is addressed in three steps. First, the environmental provisions, specifically in EU FTAs with DCs, are reviewed. Second, we take a look at the intensity and sources of greenhouse gas emissions in DCs and in their trade flows. And third, we discuss specific environmental problems in certain economic sectors of DCs – problems that potentially arise from the growing international trade or that have intensified because of it.

3.2. ENVIRONMENTAL PROVISIONS IN EU TRADE AGREEMENTS WITH DEVELOPING COUNTRIES

The EU has introduced Trade and Sustainable Development (TSD) chapters in its new generation of comprehensive trade agreements (concluded since 2010), to address the situation of workers, human rights and environmental issues.

The EU's agreements with the Andean Community (Colombia, Peru, Ecuador) and with Central American countries (EU-CA FTA) contain such provisions; however, no particular environmental measures have been taken by the trading partners (EC, 2018b). As part of the revision of the EU-Mexico FTA, the inclusion of a TSD chapter was agreed by the parties in April 2018. The Commission's proposal includes acknowledgement of the importance of forest protection, biodiversity, sustainable aquaculture and the proper treatment of chemical waste. With some of the countries that make up the EuroMed Group, the EU has started to renegotiate FTAs to make them deep and comprehensive. So far, environmental issues have not been covered in the existing trade dialogue (EC, 2018b; 2018i).

A regular bilateral dialogue on environmental issues and a discussion on appropriate measures have started with some countries. For example, measures have been discussed with Colombia and Ecuador to monitor illegal deforestation. Reviewing the Commission's FTA implementation reports, one can clearly observe that, overall, social issues covered by the TSD chapter receive far more attention than environmental issues, which have largely not even been addressed yet.

The EPA agreements with ACP countries aim at sustainable development. The oldest EPA, the CARIFORUM EPA, is considered a role model in terms of environmental aspects. It refers to the 'promotion of capacities to encounter international labour and environmental standards' and states that 'the parties commit to promote trade in a way to assure sustainable management of the environment'.

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39 Uruguay has been classified as a high-income country since 2012 (World Bank, 2020). The same argument applies as with Chile.

The promotion of technical assistance for producers and for labelling is mentioned. Furthermore, European investors are obliged to observe sustainability (EC, 2008; Schmieg, 2015).

The EPA with the SADC is formulated in a similar way and suggests, as with the EU-Mexico agreement, cooperation in the field of biodiversity, forest management and fishing practices (IISD, 2020).

Negotiations on the deepening of the interim EPA with five ESA economies were launched in October 2019. In July 2020, the European Commission circulated a proposal for a legal text on a TSD chapter. The second round of negotiations with ESA took place in July 2020[40], where parties requested to discuss services and investment as well as TSD starting with the third round of negotiations.

Alongside the cooperation bodies maintained by the EU, individual EU members have more specific projects to address EPA sustainability issues – for example, the German Corporation for International Cooperation (GIZ) within the SADC EPA and the CARIFORUM EPA.

In summary, the comprehensive FTAs and the EPAs aim to promote environmental sustainability in DCs through discussion and technical assistance, but there are no clear obligations or timetables for the partner countries to implement environmental regulations.

With respect to unilaterally granted trade preferences within the EU's GSP,[41] the GSP+ arrangement is the only enforceable instrument with respect to environmental provisions. Under the GSP+ scheme, partner countries have to sign the following documents in the field of environment sustainability:

› Convention on International Trade in Endangered Species
› Montreal Protocol for the protection of the ozone layer, which bans certain chemical substances
› UN Convention on Biological Diversity
› Cartagena Protocol on Biosafety, which addresses the human health risk of biotechnology
› UN Framework Convention on Climate Change, which sets greenhouse gas emission limits
› Kyoto Protocol, with binding obligations for developed countries
› Basel Convention, which controls the transborder movement of hazardous waste
› Stockholm Convention on Persistent Organic Pollutants.

Furthermore, the GSP+ scheme requires beneficiary countries to accept long-term regular monitoring missions by EU officials. The EU has also launched capacity-building projects to assist countries in establishing and implementing environmental law.[42]

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[40] See: https://trade.ec.europa.eu/doclib/press/index.cfm?id=2165&title=Commission-publishes-report-on-negotiating-round-with-five-Eastern-and-Southern-African-countries

[41] See the previous chapter for details.

[42] In Pakistan, the signing of the Basel Convention resulted in regulations to ban hazardous waste imports and implementation of the Montreal Protocol. Pakistan regards the EU as a vehicle to close its gaps in environmental protection (Kakakhel, 2017).

One of the most important points to make is that GSP+ preferences can be suspended if a country violates its commitments (EC, 2018d).[43] Reporting on trade in endangered species has improved. It is expected that the UN Convention on Biological Diversity will allow new targets to be set (EC, 2020a).

Already in a 2007 report, the OECD argued that Canada, the EU, New Zealand and the US had incorporated the most comprehensive environmental provisions into their recent trade agreements. Chile's efforts were also considered noteworthy. The US was particularly singled out for placing trade and environmental issues on a par with one another. (OECD, 2007) However, although the EU has a major share in worldwide trade agreements with environmental provisions, it ranks low with those enforceable.[44]

Since the EU FTAs have been followed by an increase in economic investment by EU enterprises in the developing partner countries, it is important to include guidelines for responsible business, in accordance with the OECD's guidelines for multinationals (OECD, 2011). This should prevent EU enterprises from exploiting lower environmental or social standards in DCs.

3.3. HIGHER GREENHOUSE GAS INTENSITY IN DCS, SOURCES OF EMISSIONS AND IMPORT AND EXPORT PATTERNS OF GREENHOUSE GAS EMISSIONS

Most DCs have a higher greenhouse gas emission intensity than the EU. A convenient way of assessing this is to look at greenhouse gas emissions in relation to GDP, as reported in the World Bank's environment database. Figure 8 shows the emissions to GDP share in selected DCs in Asia, Latin America and Africa that are notable trade partners of the EU. The charts can be interpreted in such a way that USD 1,000 of GDP are generated with much higher CO_2 emissions in DCs than in the EU. What could explain the worse emission intensity of DCs? Theoretically, the cause could be lower energy efficiency in DCs, a different sector composition (with a predominance of more polluting sectors) or different production processes.

Table 4 sheds some more light on the patterns behind the higher emission intensity in DCs. It indicates the contribution of different sources to the CO_2 emissions of the selected DCs shown in Figure 8, reporting the percentage share of different sources.[45] For comparison, data for the EU and the US is also given. Energy generation is typically the biggest source of CO_2 emissions in high-income countries, and also in some upper-middle-income countries like China, Mexico and South Africa, but not in the other DCs.[46] The emission shares from manufacturing are higher than in the EU or US in those DCs that have a comparative advantage in manufactures, as revealed by the high share of manufactured goods in total merchandise exports. These are particularly Asian DCs, such as China, India, Vietnam,

[43] An example is Sri Lanka, which lost its GSP+ status in 2010 because the EU had concerns that the country would violate its commitment in the field of human rights, anti-torture and children's rights. As a consequence, the zero-tariff treatment for Sri Lanka's textiles was suspended, which meant a loss in competitiveness against other countries in the region (in particular Pakistan and Bangladesh), which could continue to operate under the zero-tariff scheme (Abayasekara, 2013).

[44] See Table 2 in chapter 2, as well as the list of agreements in Appendix A.4.

[45] Due to missing data, the composition of some countries cannot be reported.

[46] The high share of emissions from energy generation in South Africa results from the intensive use of coal for electricity generation.

Bangladesh and Pakistan, which have a manufacturing share in exports of over 70%. The combined CO_2 energy and process emissions in manufacturing are 39% in China, 30% in India and 30% in Pakistan, as against 19% in the EU and 17.5% in the US. Given that the EU also has a comparative advantage in manufactures (with an export share of 72.4%), this suggests that the manufacturing sector in some Asian countries produces at a higher emission intensity than in the EU.[47] The manufactures imports of the EU from these countries have to be considered as a contributor to these high emissions.

Furthermore, in a number of DCs the percentage of CO_2 emissions from 'land use change' and 'agriculture' is substantial. In the case of Indonesia, the extremely high share of emissions from 'land use change' derives from deforestation for palm oil. Deforestation is also a major emissions factor in Peru and Brazil, and notably in Southern and Eastern Africa. The percentage of agriculture CO_2 emissions itself is high in Latin America, Sub-Saharan Africa[48] and some Asian countries. In particular, Latin American countries, North Africa and Indonesia seem to have a comparative advantage in agricultural goods, as their agriculture export share is much higher than their agriculture share in gross value added (GVA) (see Table 4, penultimate column). From these figures, one gets the impression that – compared to the size of the sector – total agricultural emissions are significantly higher in those DCs than in the EU or US. As the EU imports agricultural goods from those countries, and as those countries produce agricultural goods for the export market rather than just for their own consumption, the EU should take an interest in how its agricultural imports are produced and should learn more about the environmental effects.

In addition, a look at net imports/net exports of CO_2 emissions on a world-wide scale also indicates a clear direction for discussion of the role of trade policies to mitigate environmental effects. Ritchie and Roser (2020) and Fernández-Amador et al. (2016) highlight the fact that the EU is a net importer of CO_2 emissions.

Figure 9 shows the position of countries as net importers or exporters of CO_2 emissions. Being a net importer of CO_2 emissions indicates that a country imports more CO_2-emitting goods than it exports. This status is found in highly developed economies, such as the US, Europe and Japan. This means that the country hosts relatively clean industries, and dirty industry products are imported.[49] By contrast, most Asian countries with a large manufacturing sector are net exporters of CO_2 emissions.

In summary, if one looks at greenhouse gases alone, there are considerable environmental effects in DCs that are linked to EU imports. Of course, to get a complete picture of the environmental effects in DCs, one also has to consider water and soil pollution, toxic waste, effects on biodiversity and people's health. GAHP (2017) points to the particularly high load of poisonous substances – lead, mercury, pesticides, chromium, etc. – that production in DCs sets free. This will be shown later in section 3.4.

In what follows, this section will scrutinise more closely the environmental effects in specific export sectors in DCs – agriculture, aquaculture, mining, waste recycling, the textile industry and the steel

[47] Of course, a strict comparison would require us to compare the emission intensity in manufacturing; but that would require much more research and is beyond the scope of this study.

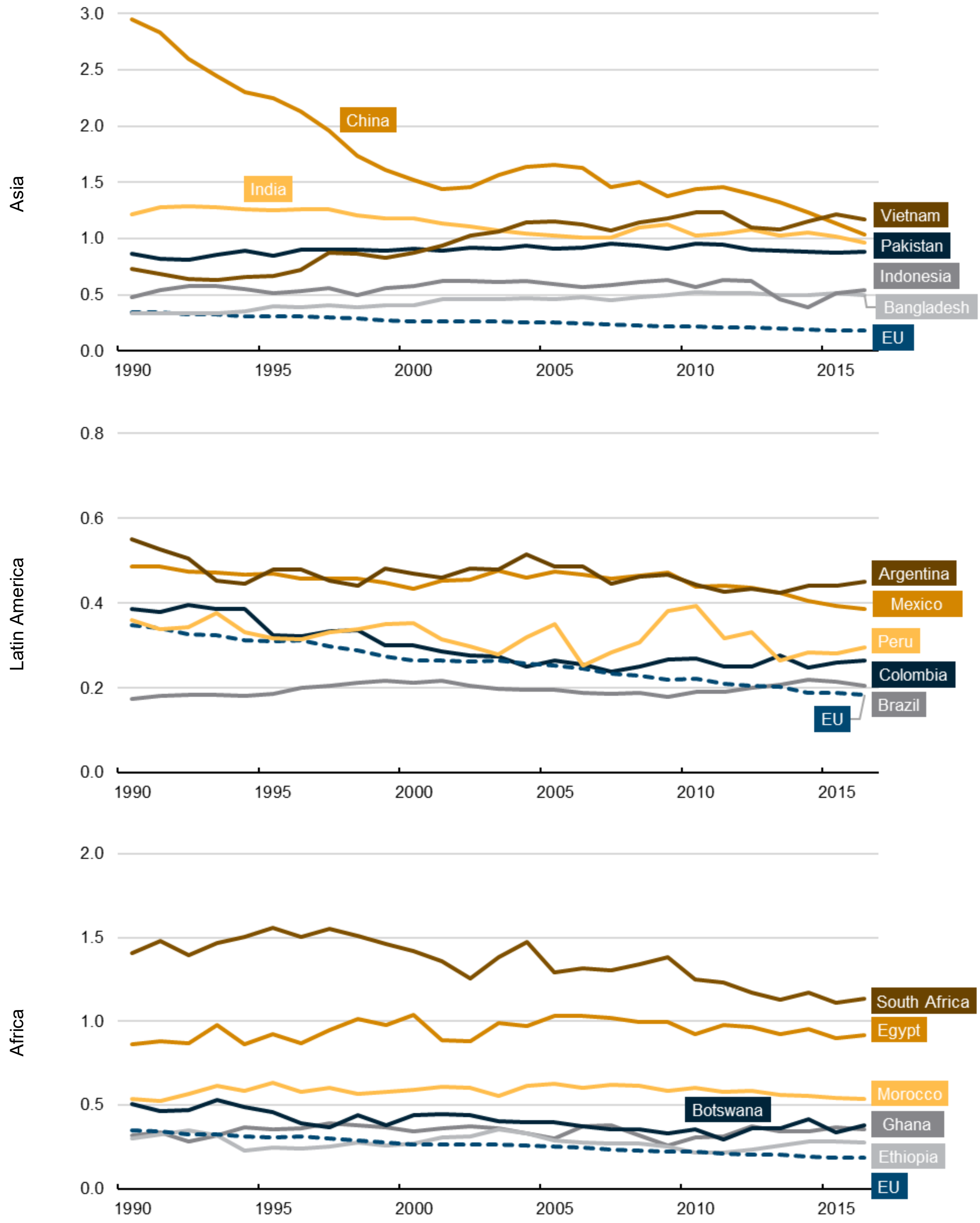
[48] The high share of energy in the Southern African region is attributable to South Africa and Angola and is not representative of the region as a whole.

[49] However, a number of primarily African developing countries are also net importers of CO_2, because most manufactured products have to be imported when agricultural production dominates in the country.

industry – and will make some proposals for how EU trade policy could mitigate environmental effects. Finally, the section will discuss the role of environmental goods exports from the EU to ameliorate the environmental situation in DCs.

Figure 8 / Development of CO2 emissions to GDP shares

CO_2 emissions in kg per 2010 US dollar GDP in selected DCs per continent and the EU



Source: The World Bank [indicator EN.ATM.CO2E.KD.GD], authors' visualisation.

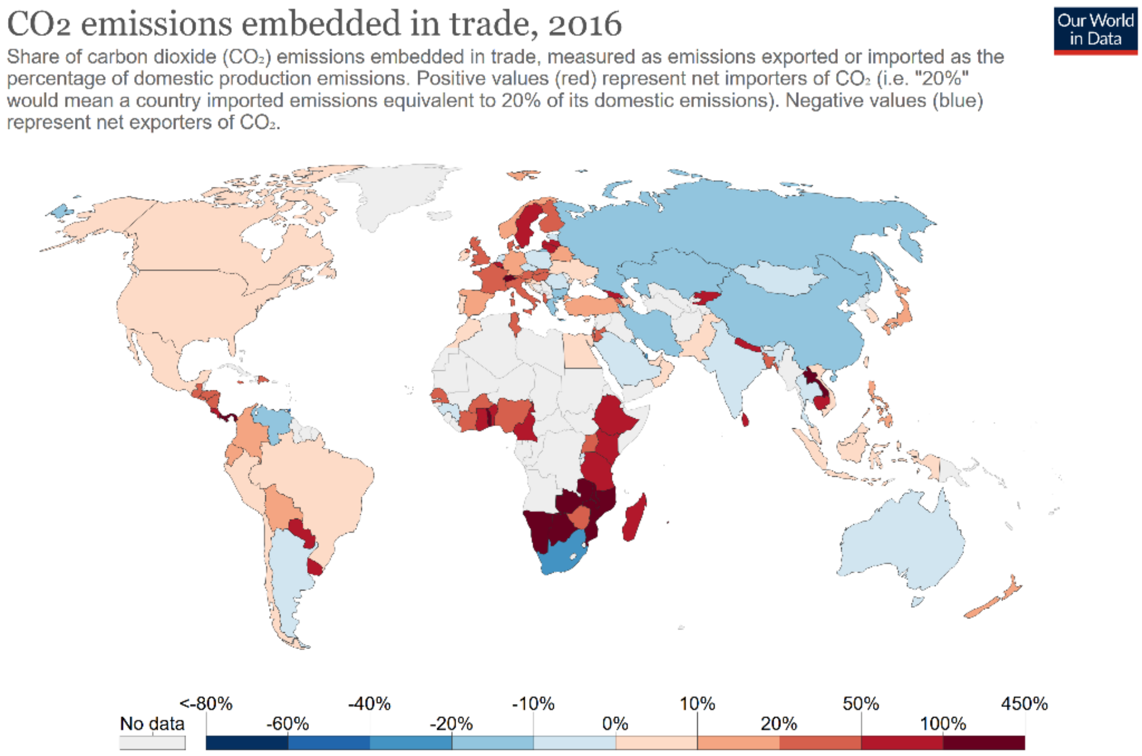
Table 4 / Source of greenhouse gas emissions

Selected trade partners of the EU; percentage of total emissions

	Energy (in manufacturing)	Agriculture	Land use change and forestry	Industrial process	Waste	Agriculture as percentage of gross value added (Agricultural exports as percentage of total exports 2019)**	Manufactures as percentage of total exports
Asia							
China (2012)*	78.5 (27)	8	-5	12	1.2	7 (3.3)	93.4
Bangladesh (2012)	33	39	17	2	10	13 (5.9)	91.7
Vietnam (2012)	66	23	-5	12	4	14 (11.5)	84.4
India (2014)	68 (24)	19	3.8	6	1.9	16 (11.4)	71.5
Pakistan (2012)	46 (25)	41	6	5	2	22 (21.6)	74.1
Indonesia (2013)	22.6	7.4	65.5	1.4	3	12.7 (25.4)	44.7
Latin America							
Mexico (2013)	70.8 (10)*	12.1	4.9	7.6	4.6	3.5 (7.7)	76.9
Colombia (2013)	49	30	10	7	4	6.7 (18.1)	20.7
Peru (2012)	30	16	45	6	3	6.9 (24.7)	11.3
Brazil (2014)	39	32.6	22.6	4.2	3.4	4.4 (39.8)	33.4
Africa							
South Africa (2012)	84	7	0.2	5	4	1.9 (13.8)	47.9
Egypt (2012)	74	10	0	9	8	11 (19.3)	48.5
Morocco (2012)	76	12.7	0.01		0.08	11.4 (21.8)	71.4
East Africa (2012)	11	30	50	6	3	15.3 (14.3)	22.9
Southern Africa (2011)	52	16	25	3.5	3.5	15.3 (14.3)	22.9
Comparison							
EU (2013)*	78.7 (11)	9	-7	8	3	1.6 (13.6)	72.4
US (2013)*	84.2 (12.5)	8	-10	5	2	0.9 (11.4)	59.5

Notes: Compiled from USAID, climate links, greenhouse gas emission factsheets (https://www.climatelinks.org/resources). Negative values in the category land use change and forestry indicate a mitigation to greenhouse gases attributed, for example, to afforestation and more extensive agriculture; 'Energy' includes: fuel combustion, electricity, heat, transport and energy consumption industry; * computed from OECD, environment statistics; ** data from World Bank Development Indicators.

Figure 9 / CO2 emissions embedded in trade, 2016



Source: Ritchie and Roser (2020).

3.4. EU IMPORTS FROM DCS AND RELATED ENVIRONMENTAL PROBLEMS IN SPECIFIC SECTORS

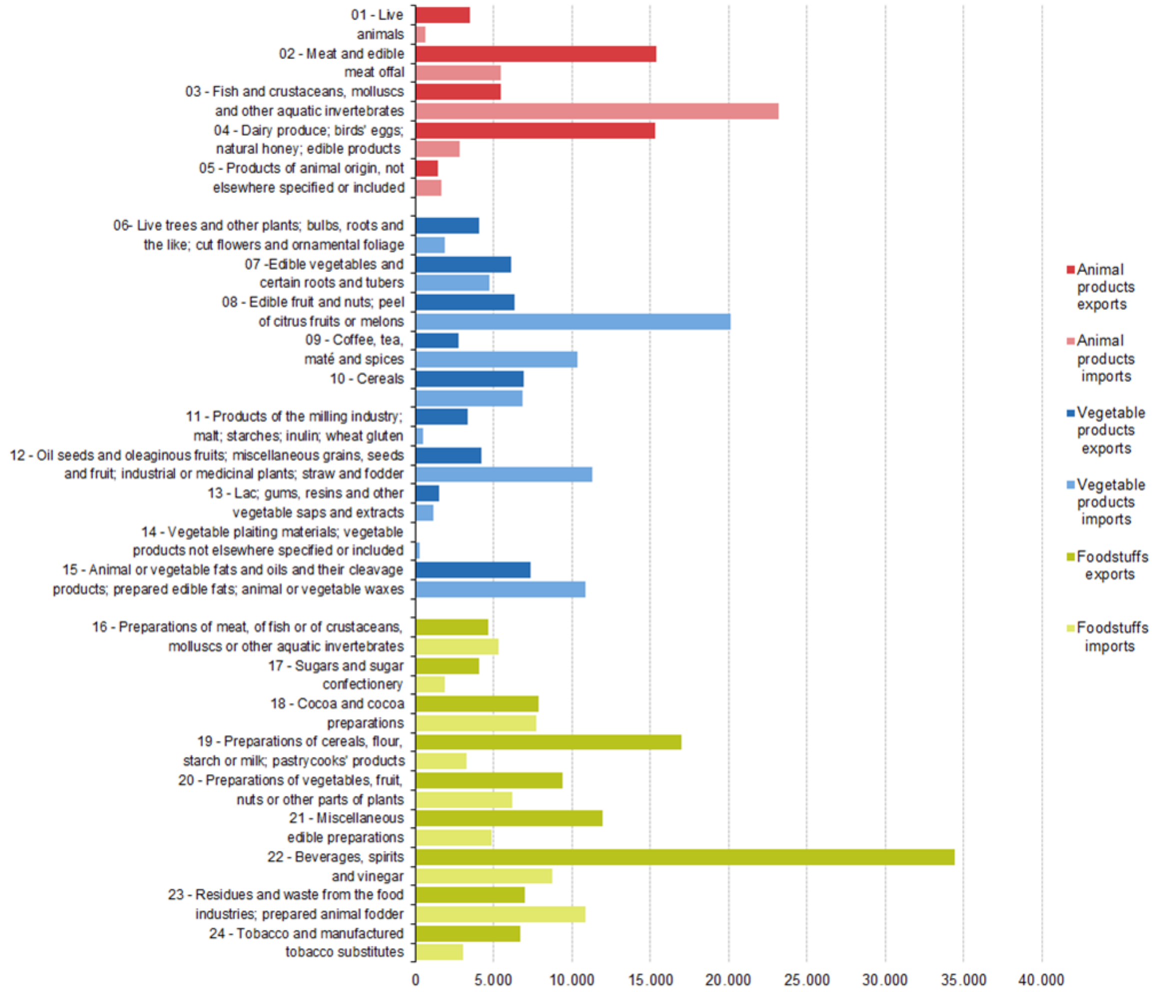
3.4.1. Environmental problems linked to agriculture and fisheries production and exports

EU patterns of trade with DCs in agriculture and fishery products

The EU's trade policy can leverage environmental sustainability in the tradeable sectors of those countries that it trades with. The EU imports significant agriculture product volumes from third countries, notably DCs. Since agricultural production in DCs is often linked to disproportionate greenhouse gas emissions (as the previous section showed), section 3.4.1 will analyse more closely the issues linked to their environmental costs.

Eurostat (2020) statistics indicate that the largest product group of agricultural imports covers 'fish and crustacean, molluscs and other aquatic invertebrates', with an import value of EUR 21 billion, followed by 'fruits and nuts, peel of citrus fruits or melons', worth EUR 20 billion (Figure 10). Sizeable import volumes are also registered in the group 'coffee, tea and spices', 'oil seeds and oleaginous fruits', 'animal or vegetable fats' and 'residues and waste from food industry'. The EU's major trading partners in agricultural products are the US, Brazil, Norway, China, Argentina and Ukraine.

Figure 10 / EU27 agricultural trade, by product groups, 2019, in EUR billion



Source: Eurostat.

The role of DCs in the everyday supplies of EU consumers will become clearer if we go into more detail about imported agricultural items. Fish and seafood are mainly imported from DCs, and they consist of exotic fishes, like tuna, reef fishes, squid, cuttlefish and shrimp. The largest suppliers are China (fish fillets, molluscs), Ecuador (shrimp, tuna), Vietnam (fish fillets, shrimps), Morocco (molluscs) and India (shrimp). Also, a handful of least-developed countries – Mauritania, Bangladesh, Senegal, Madagascar and Tanzania – are among the EU's suppliers (CBI, 2019a).

Europe imports considerable amounts of fresh fruit to satisfy a stable demand over the year. Imports are mainly from DCs. The most prominent products are bananas, citrus fruits, grapes, avocados, pineapples and mangos. Bananas originate from Ecuador, Colombia and Costa Rica; pineapples from Costa Rica; grapes from Chile, South Africa, India and Egypt; mangos from Peru, Brazil and West Africa; avocados from Peru, South Africa and Mexico; berries from Peru, Morocco and South Africa; and citrus fruits from South Africa, Egypt, etc. (CBI, 2019b).

Oil seed imports comprise soybean, which is primarily imported from the US, Brazil and Argentina. Rapeseed and rapeseed oil are imported from Australia, Canada and Ukraine; sunflower meal and oil from Ukraine and Russia; and palm oil from Indonesia, Malaysia and Colombia (USDA, 2018). With these items as well, supplies from DCs predominate.

This brief survey of the origins of agricultural products suggests that the EU's agricultural trade patterns have been promoted by FTAs, EPAs, GSP and EBA.

Monoculture production in export agribusiness in DCs

Agricultural exports from DCs are often associated with agro-industrial monocrop production. As pointed out in a Food and Agriculture Organization (FAO) publication (Clapp, 2015), global markets have driven this large-scale monoculture production; the enormous environmental costs of it – including greenhouse gases, soil erosion, depletion of water resources and loss of biodiversity – are widely recognised. A report by the Social Watch NGO claims that governments and multilateral development banks support these trends (Social Watch, 2011).

Examples of export crops produced in large-scale monoculture are soybeans and oil seeds in Argentina; soybeans and sugar cane in Brazil; and biofuels in Colombia. They are mainly produced in DCs for the world market. The average size of holdings in the big agricultural exporting countries is considerably greater than in the EU. According to census reports for the year 2000, the average size of agricultural holdings was 582 hectares in Argentina, 72 hectares in Brazil, 83 hectares in Chile and 84 hectares in Colombia, compared to 40 hectares in Germany and 34 in Austria (Lowder et al., 2014).

Production is often operated or dominated by multinationals, or is in the hands of national elites. Both of these have close relations to national government:[50] on the one hand, this can be problematic for environmental matters if profit-seeking is the dominant theme; but on the other hand, it can be an advantage, if environmentally friendly production techniques are promoted by the large companies. Monocultures demand the increased use of fertilisers, pesticides and genetically modified seeds (FAO, 2002b).[51] A well-known example is the widespread use of glyphosate in Argentina, with its associated health risks. Those inputs into agriculture are provided by powerful multinationals.[52]

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[50] For example, in coffee production large coffee traders (like the German Neumann group) and coffee roasters (like the Swiss Nestlé with Nespresso and Starbucks, the German JAB and the Italian Lavazza) controlled 35% of the coffee market in 2018, partly down to the production stage (Panhuysen and Pierrot, 2018). With soybean, in Brazil there were six global and Brazilian soybean export traders who dominated Brazilian soybean production in 2016, among them Archer Daniels Midland, Bunge, Cargill, Louis Dreyfus; COFCO and Amaggi. Trase (2018) discusses the concentration of ownership in soybean growing in Argentina, where large-scale ownership by established families (such as the Anchorena family) and transnationals (like Benetton, Cargill and others) dominate; they yield great political influence, which led the Kirchner coalition to withdraw the introduction of export taxes on soybean in 2008 (Sly, 2017). In the largest palm oil-producing country, Indonesia, 51% of palm oil plantation holdings are owned by big private companies, the most important being Wilmar of Singapore. In the second largest palm oil producer, Malaysia, the share of plantations owned by large private companies is as high as 60% (Jaafar et al., 2015). As Pye (2019) points out, the Malaysian government maintains close relations with those big players and ensures that state regulations are in line with their interests.

[51] In countries dominated by large-scale monocultures, the use of pesticides is significant, according to FAO statistics. In 2017, 4.9 kg of pesticides were used per hectare in Argentina; in Brazil it was 6.0 kg; and in Chile also 6.0 kg, in contrast to 3.3 kg in Austria (FAOSTAT, Environment indicator).

[52] A good example is Argentina, where the Monsanto group controls the glyphosate market and owns the intellectual property rights of genetically modified soy (Sly, 2017).

Monocultures not only lead to a loss of biodiversity, but can also encourage deforestation. This is most evident in the case of soybean and cattle raising in Brazil, and in the case of palm oil production in Indonesia (Pye, 2019). National governments are subject to pressure from interest groups to permit deforestation. For example, in Brazil, in the 2006 Soy Moratorium major soy traders committed not to purchase from land cleared in the Amazon after 2008, but the moratorium could not be extended to cover the endangered Cerrado region which consequently faced increasing deforestation as soy production shifted there. Furthermore, the winner of the 2018 government elections abolished the rainforest conservation programmes (Trase, 2018; Harstad, 2020). In Guatemala, sugar cane production resulted in deforestation, as did coffee production in Nicaragua.

Furthermore, monocultures have a high demand for irrigation. Large-scale livestock production, moreover, causes methane and ammonia emissions.[53] Agro-industrial monocultures also go hand in hand with the use of genetically modified crops. Besides detrimental environmental consequences, particularly in several Latin American countries, monoculture production also endangers small-scale subsistence farming, which is carried out at far lower environmental cost. An example is coffee, which is cultivated either as shade-grown coffee by small-scale subsistence farmers (as in most Latin American countries), or as large-scale sun-grown coffee, which predominates in Brazil (Bacon and Rice, 2015). To take another example, in Indonesia and Malaysia large-scale monoculture is threatening small-scale palm oil growing, which has much better environmental performance (Jaafar et al., 2015; Pye, 2019).

Box 3 presents a short case study on Peru, illustrating how improved export prospects – driven by an FTA with the EU, among other factors – contributed to the establishment of special agricultural export products, and also promoted the concentration of land ownership and monoculture. Box 4 provides further illustration, by looking at the promising market prospects but problematic environmental consequences of avocados – a recently created top export product in Peru.

It is problematic to address the negative effects of large-scale agriculture in DCs (i.e. disproportionate use of pesticides, fertilisers, irrigation, deforestation, soil erosion), since in Western developed countries it is precisely that type of agricultural exploitation that predominates, with all the negative environmental impacts mentioned. Although developed countries have adopted regulations that limit the use of fertilisers and pesticides, in practice the rules are often breached. It is hard to demand environmentally friendly agriculture from DCs, when the EU's own agriculture harms the environment. However, one can require DCs to implement similar legislation (e.g. glyphosate stop).

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[53] The emission intensity in beef cattle production was 29 kg CO_2 equivalent per kg product in Argentina and 34 kg in Brazil, compared to 11 kg in Austria and 13 kg in Germany in 2017 (FAOSTAT, environment indicators).

BOX 3 / CASE STUDY: RECENT TURN TO LARGE-SCALE AGRICULTURE IN PERU

The EU is Peru's number one export destination, ahead of the US and China: 37% of the country's exports go to the EU. It has witnessed strong agricultural export growth – due not least to the EU Andean Community FTA. Peru's exports to the EU include copper, zinc, avocados and asparagus (in which it is the world's largest supplier), decaffeinated unroasted coffee, bananas, mangos and berries.

Peru has many rivers on the coastal side of the country, but it also has deserts. Major public irrigation projects have been undertaken to increase the surface area under agricultural cultivation.

The growth in the agricultural export industries is now leading to a concentration of ownership of agricultural holdings. Peru had previously attempted to reduce the concentration of landownership on *haciendas*. In 1961, 70% of land was held by 0.3% of agricultural units. The most radical agrarian reform in all of South America abolished the *haciendas*, redistributed land to *campesinos* (with a limit of 250 hectares) and set up cooperatives. In 1993, under the Fujimori government, private large-scale ownership of land was reintroduced on uncultivated land, which was to become arable under irrigation projects; land was transferred not only to private Peruvian nationals, but also to foreigners. Large-scale producers were considered to have the potential to invest in methods to improve efficiency and produce for export. Large companies emerged, like Camposol, which, with 22,000 hectares, is the world's largest asparagus grower. There was also a concentration of land for the production of biofuels and palm oil. The owners are partly US, European and Malaysian companies (palm oil) (Oxford Business Group, 2016).

BOX 4 / CASE STUDY: ENVIRONMENTAL COSTS OF AVOCADOS

The main demand for avocados comes from the US (1.1 million tonnes per year) and Europe (650,000 tonnes in 2018) (Searle, 2019). Avocados require a semi-arid climate and are grown in an increasing number of places, such as Mexico, Peru, Colombia, the Dominican Republic and the US (California). They are grown as a single crop, and hence deplete soils, and require fertilisers and pesticides. The critical point in avocado growing is the crop's water requirement: avocados require three times as much water as grapes, and twice as much as oranges. Also, there is the danger of deforestation. Avocado growing has become a highly profitable business. This, for example, attracts criminal gangs in Mexico to share profits, while the wages of workers remain poor (Gonçalves, 2018). Europe's supply comes from South Africa, Peru, Morocco, Kenya and Spain. An increase in plantations in Greece and Southern Italy can be observed. Efficient irrigation systems are very important in avocado growing.

The EU is aware that the agricultural specialisation of DCs in certain export products encourages monocultures, with their environmental burdens. For example, the mid-term review of GSP acknowledges that Pakistan's increased cotton production, which comes in the wake of improved access to EU markets for cotton products, has led to an intensive use of pesticides, with resulting soil pollution (EC, 2018e).

What could the EU do to act against the environmental problems associated with large-scale monocultures in DCs? A few measures come immediately into mind: The EU could establish an intensive dialogue with its DC trade partners on the environmental damage caused by monocultures (fertilisers, pesticides, intensive water requirements, soil degradation) and it could discuss ways of combating this within its deep and comprehensive agreements and EPAs. The dialogue would have to focus on the major export products of the trade partner. Furthermore, to provide an additional reward for small and medium-scale agricultural producers, which often have lower environmental costs, EU trade policy could introduce a higher tariff concession for those producers. In addition, the EU could provide technical assistance to DC trade partners to convert to organic farming, under the Trade and Sustainable Development (TSD) chapters of its trade agreements. The legal and political possibilities and efficiency of such measures need to be analysed in further research.

Deforestation driven by agricultural export industries

Recent studies provide empirical evidence that deforestation is correlated with agricultural exports (Persson et al., 2014; Karstensen et al., 2013).

Tropical deforestation is a global problem. The Amazon rainforest, for example, is crucial as a weapon against global warning: if it is reduced below a critical point, its rain-generation system no longer works and it will become savannah.

Large-scale undertakings like beef and soybean production in Brazil endanger the Amazon and Cerrado region through deforestation, and this is associated with enormous CO_2 emissions (Butler, 2014; WWF, 2014). In 2011/2012, 79% of Brazil's and 94% of Argentina's soybean production went into export; and 25% of Brazil's and 27% of Argentina's soybeans went to Europe (WWF, 2014). About 8% of Brazil's beef production has gone to Europe in recent decades, though there has been some decline since 2006 (Karstensen et al., 2013). WWF (2014) made a clear statement: 'Demand for soy in the EU uses an area of almost 15 million hectares, 13 million in South America.' The verified correlation between deforestation (and the associated CO_2 emissions) and exports has increased over the years (Karstensen et al., 2013).

Persson et al. (2014) investigated the linkage between deforestation and trade in four forest-risk commodities: beef, soybean, palm oil and wood. The producer countries examined were Argentina, Bolivia, Brazil, Paraguay, Democratic Republic of the Congo, Indonesia, Malaysia and Papua New Guinea. These countries represent 83% of beef and 99% of soybean exports from Latin America; 97% of global palm oil exports; and roughly half of the trade in tropical hardwood products. The countries under consideration were responsible for one third of the deforestation in 2009. Like Karstensen et al. (2013), the authors found that a third of the products were consumed in a country other than that in which they were produced. While China was the number one importer of products related to deforestation, Europe came second, being a major importer of beef and soybean from Brazil and of palm oil from Indonesia.

The EU is aware that trade preferences and associated export growth in DCs carries the risk of promoting deforestation. For example, the GSP mid-term review 2018 argues that the growth of floriculture export production is linked to deforestation (EC, 2018e). The EU has been addressing this issue. For example, within the TSD chapter of the FTA with the Andean Community, a working group has been discussing measures to monitor deforestation in Colombia and Ecuador (EC, 2018b).

What can the EU do to fight deforestation in its DC trade partners? The EU could demand a system of certification of origin to be established by the partner country for the principal products causing deforestation. Such a system is necessary to track the source. Brazil, in principle, has such a system. The accuracy of the information is verifiable from satellite images. Furthermore, the EU could request the commitment of partner governments to enforce rainforest conservation programmes (a halt to deforestation; reforestation). Deforestation and reforestation can be monitored by satellite. Harstad (2019) argued that the Mercosur deal should be linked to a declaration by the Brazilian government that conservation programmes are reintroduced. (As mentioned above, the Amazon Soybean Moratorium of Brazil, which forbade the purchase of soybean from deforested land was put on halt in 2018). He also stressed that it is not enough just to require the certification of origin and clean supply chains, as non-certified goods would simply be sold domestically (Harstad, 2019). In addition, the EU could co-finance rainforest/Amazon conservation and reforestation programmes. It could fund programmes such as the initiative '1 billion trees'. The idea of advanced countries financing rainforest conservation programmes in Brazil was also proposed by Harstad and Mideksa (2017) who suggested that such attempts should above all address the lower regional levels in Brazil, rather than the federal state, and that they should provide sufficient finance for conservation so that the alternative – deforestation – becomes unprofitable.

The role of certification, the Fairtrade label and organic production in limiting the environmental and social cost of agricultural exports in DCs

Voluntary sustainability standards in agriculture, also known as certifications, have mushroomed in the past two decades. They are established by producer organizations, NGOs and intergovernmental organizations and request the holder of a certification to meet certain criteria in production to prevent environmental harm. According to International Trade Centre (2020), for agricultural products, more than 100 different certifications exist which aim at assuring biodiversity, prevent degradation of land and preserve freshwater systems. Without attempting to provide an overview over these many certifications or discussing their efficiency, which is beyond the scope of this study, examples of well-known certifications are briefly presented in this section to highlight the goals, requirements and achievements of such certifications.

The Fairtrade production standards are operated in several important crops in DCs, such as coffee, tea, bananas, cocoa, flowers and cotton, mainly in Latin America and Africa. The Fairtrade standard covers essential areas of environmental protection: reduction of energy and greenhouse gas emission, water quality, prohibition of harmful chemicals in fertilisers and pesticides, prohibition of genetically modified organisms and conversion to organic farming. Fairtrade evaluates the environmental benefits of fair-trade production regularly (Fairtrade, 2020a; 2020b; 2020c).

Bacon and Rice (2015) and Klier and Possinger (2012) evaluate the environmental effects of Fairtrade coffee in Latin America, where the largest share of Fairtrade coffee growers are located. They find that fairtrade promotes the conversion to organic farming, reduces the use of agro-chemicals and preserves biodiversity through the promotion of shade-grown coffee. For banana growing in Colombia, Fairtrade found that external costs are 45% lower than in conventional production (Fairtrade, 2019). Furthermore, Fairtrade determined that fair-trade cotton growing in India produced 30% fewer environmental effects than conventional production, due to less use of water, less water and soil pollution and fewer greenhouse gas emissions (Fairtrade, 2017).

Given the urgent necessity to limit deforestation linked to soybean production, the multi-stakeholder certification scheme Round Table for Responsible Soy was created in 2011, with the aim of blocking any conversion of rainforest or habitats to soy cropland; it has undertaken a mapping project for responsible soybean expansion. Nevertheless, this certification has been criticised for certifying genetically modified soy production (WWF, 2014). Some even speak of 'greenwashing', while environmental damage will continue due to the economic impunity of the soy business, and thus poor enforcement (Aseed Europe, 2008).

As rich countries' consumers become more and more sensitive to the social and environmental harm associated with agricultural products, so the creation of certification standards has multiplied. It is difficult to judge their aims and control mechanisms: for example, there are seven leading palm oil certification standards. A study by the Forest Peoples Programme (McInnes, 2017) found that of these seven, only the Round Table on Sustainable Palm Oil has robust requirements; the Malaysian standard was acceptable, but the Indonesian was not.

EU trade policy could make better use of certification standards as a means to achieve sustainability goals, although their benefit would depend on a systematic, periodical evaluation. In principle, one might suggest that the EU could offer better tariff concessions to certified products and organic products within its FTAs and GSP. However, so far, tariffs are generally raised in the WTO based on a simple product classification which does not distinguish whether the product is conventionally produced or certified. The EU could prove the legal possibilities of the proposed tariff concessions and initiate a debate within the WTO to change the present system. The EU could also promote certifications through technical and financial assistance under the TSD chapters in its FTAs. This measure seems to be easy to put into practice. However, it would not offer a cost incentive to producers as a reduced tariff does. The incentive for producers would be rather prospective higher sales in view of the consumer trend in favour of certified products.

Environmental effects of large-scale aquaculture industries in DCs

This subsection looks at the environmental effects of aquaculture in DCs. This covers an important share of the EU's fish consumption. Fish-farmed salmon, shrimp and tilapia imported from DCs have become daily items in the diet of EU citizens. A large share of those imports benefit from EU FTA arrangements.

Aquaculture – fish-raising in a man-made controlled environment for commercial production – has become an essential way of meeting consumer demand for fish. According to the OECD, the share of aquaculture in human fish consumption is projected to reach almost 60% by 2028 (OECD/FAO, 2019). Asian countries (China, Indonesia, India, Vietnam, Philippines) account for the largest share of world aquaculture production, 92%. Their aquaculture is operated in combination with rice growing, and produces zooplankton-consuming carp and crawfish. It is considered relatively environmentally friendly. By contrast, aquaculture in the Americas (3% of world production) concentrates on carnivorous species (shrimps and salmon), which require fish meal and fish oil feeding. African production mainly consists of Nile tilapia farmed in Egypt, Uganda and Nigeria (AFD/EC/GIZ, 2017). The EU and the US are the number one consumers of aquaculture fish. Besides importing, the EU also hosts its own aquaculture production, for which specific health, environmental and sanitary rules have been established.

Aquaculture exports typically originate from large-scale production, and this is dominant in Europe and the Americas; small-scale aquaculture – which produced mainly for the local market – was traditionally the rule in Asia and Africa, before the establishment of export industries. Industrial fish farming concentrates on high-yield species, like salmon, shrimp and tilapia; these have a special diet and require a capital-intensive fish-processing infrastructure.

Export-oriented aquaculture is promoted as an instrument for economic development for DCs by international institutions such as the FAO and the International Monetary Fund (through its structural adjustment programmes) because of the employment prospects for poor local people and the export earnings of foreign reserves (Rivera-Ferre, 2009).

As a report by the EU Commission on aquaculture opportunities for DCs (AFD/EU/GIZ, 2017) points out, aquaculture can entail a number of different aspects of environmental damage, like risk to the natural habitat through the excessive use of certain fish species for feeding; the introduction of exotic species and genetic pollution to endemic species; and climate risks due to changes in water levels and water quality. The introduction of bio-toxins to manage disease, bacteria and viruses can endanger water quality and lead to health risks being posed by the aquaculture product. Environmental low-risk aquaculture requires careful planning and management, based on profound scientific knowledge. Decisions on whether to use wild or hatchery juveniles, to have high- or low-density stocking, to use local or imported seed – all these have important consequences for the environment. The report stresses the importance of implementing aquaculture projects in DCs with experienced partner agencies and research institutes – like the FAO, the EU Directorate-General for Maritime Affairs and Fisheries (EU DG MARE) or World Fish – and of closely evaluating the practices (AFD/EU/GIZ, 2017).

Several studies investigate the environmental impact of aquaculture. Rivera-Ferre (2009) looks at shrimp production in India. Shrimp production has become an intensive, large-scale monoculture aquaculture, and since the late 1980s has been oriented towards exports. It requires massive feed inputs, fertilisers and chemicals. About 70% of global shrimp production in 2004 came from shrimp farming. Shrimp are mainly produced by Asian (China, Thailand, Vietnam, Indonesia, India, etc.) and Latin American (Brazil, Mexico, Ecuador, Colombia, Venezuela) countries and are imported by the EU, US and Japan. The establishment of shrimp production in DCs was financed by the World Bank and other development banks, and has attracted international investors. There has been a concentration in the production chains through vertical and horizontal integration, and retailers have become powerful agents. Shrimp farming has generated mainly low-paid jobs. However, shrimp production has non-negligible environmental effects: it is responsible for 20-50% of mangrove deforestation (particularly in Latin America), which entails the salinisation of waters and a decrease in fish species; the further diffusion of nutrients and chemicals pollutes coastal waters; and fish meal feeding leads to the extinction of local small fish species and a decline in biodiversity. Particularly problematic is the use of antibiotics to prevent disease: antibiotics that have found their way into food are believed to contribute to human resistance to antibiotics (Rivera-Ferre, 2009).

The studies on the environmental costs of shrimp farming discussed in Rivera-Ferre (2009) conclude that intensive shrimp farming would prove unprofitable if it had to take proper account of its external costs. The destruction of mangrove forests and water pollution destroy ecosystems and income opportunities for the local population, while the profit from shrimp farming accrues to just a few people. Rivera-Ferre (2009) shows that the guidelines published by the Consortium Programme in 2006 – a network of the World Bank, World Wildlife Fund (WWF), the FAO and aquaculture centres in the Asia-Pacific region – on 'International Principles for Responsible Shrimp Farming' aim to reduce the problems of shrimp farming through technological expertise and safety measures, as well as eco-labelling. Nevertheless, she points out that this will not solve the social problems linked to shrimp farming.

In salmon production, residual antibiotics have been completely eradicated in Norwegian salmon production (The Fish Site, 2018) thanks to early life-cycle vaccination. By contrast, the amount of antibiotics used in salmon farming in Chile – the second largest world producer, after Norway – is significant (Miranda et al., 2018). Those authors indicate that the amount of antibiotics used in salmon farming is 1 gram per tonne in Norway, compared to 580 grams per tonne in Chile.

Tilapia is another aquaculture product of increasing importance. Originally raised in Africa, it is now produced also in the US, Latin America and Asia, where it is an alien species[54]. With the low environmental standards common in many locations, there is a risk that tilapia could become an invasive species (Grover, 2011). Tilapia raising has become big business, with large import consumer markets in the US and Europe (Mapfumo, 2018). Major exporters in 2018 were the US (10% of world exports), Argentina (5.6%), Chile (5.6%) and China (5.2%) (Tridge, 2020). The main environmental risk of tilapia farming is that the fish could escape into the wild: tilapia is a very invasive species, which squeezes out native species through aggressive breeding.

While the EU introduced regulations on organic aquaculture back in 2007, certification standards only appeared globally once the FAO issued its guidelines in 2011. Among the most important certification schemes are Friends of the Sea, GlobalG.A.P., Aquaculture Stewardship Council (ASC) and Best Aquaculture Practices (Potts et al. 2016; International Trade Centre 2020).

To give just one example of the handful of certifications in the fisheries sector, the ASC certification initiated by the WWF in 2004 provides global standards for salmon, shrimp, tilapia, pangasius, trout, abalone, bivalves (oysters, mussels, clams and scallops) and seriola and cobia.

The ASC standards address:

› Preservation of the natural environment and biodiversity

› Preservation of water resources and water quality

› Preservation of diversity of species and wild populations (e.g. preventing escapes, which could pose a threat to wild fish)

› Responsible sourcing and use of animal feed and other resources

› Good animal health and husbandry (no unnecessary use of antibiotics and chemicals (www.asc-aqua.org).

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54 In 2017, China was the largest producer, followed by Indonesia, Egypt and Brazil. Important producers are found in Africa (Egypt, Uganda, Kenya, Ghana, Nigeria), Asia (Indonesia, Philippines, Thailand, Vietnam, Bangladesh) and Latin America (Brazil, Mexico, Ecuador, Honduras, Costa Rica).

Most ASC certificates are held by salmon, shrimp and mussel farms (ACS certification update Dec. 2019), including large-scale salmon farming in Norway, Denmark, Chile and Canada.

Despite such initiatives, however, in 2015, only 14% of global fish production, capture and aquaculture was from certified fish (Potts et al., 2016 in FAO, 2018).

As concerns organic aquaculture, it has to comply with even stricter environmental standards; but unfortunately, these are set by a multitude of national certification schemes (see FAO, 2002b). In 2009, the largest proportion of organic aquaculture was found in Europe (25,000 tonnes of production in 2009), closely followed by Asia (20,000 tonnes); some way back were the Americas (7,000 tonnes) and Africa (2,000 tonnes). However, organic aquaculture represented only 0.1% of total world aquaculture production (Johnson, 2011). In 2013, only 0.1% of worldwide aquaculture was organic fish farming (Potts et al. 2016). More recent data is hard to find, and the FAO does not produce any regular statistics. Consequently, it would appear that the certification of aquaculture and organic fish farming is lagging behind in most parts of the world, and that there is ample scope for further development in this sector.

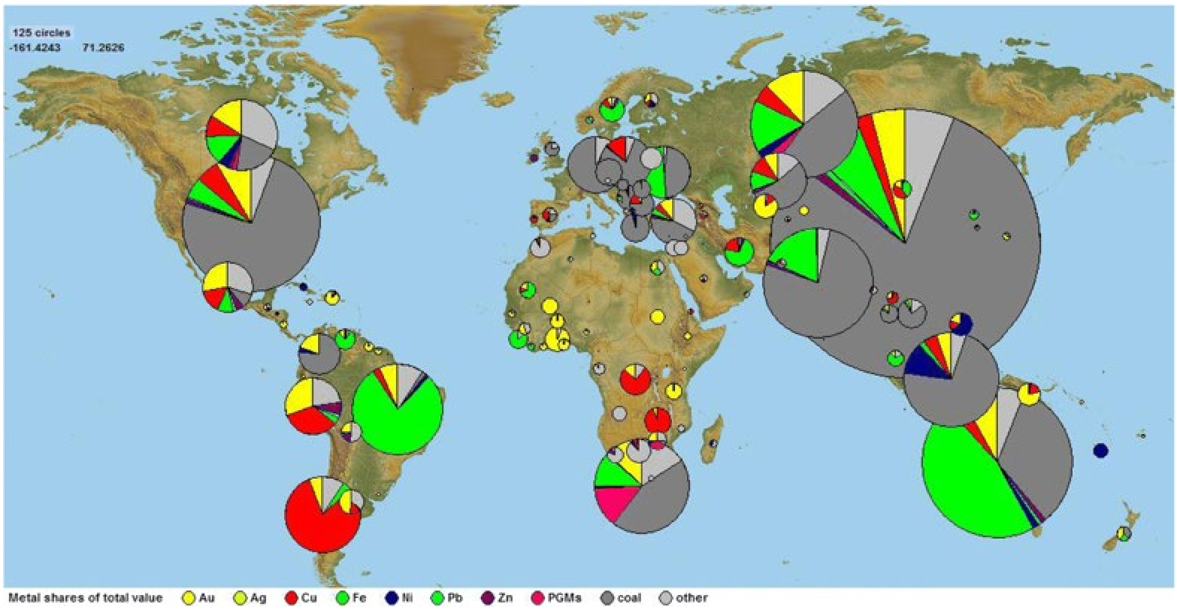
What can the EU do to improve sustainability in aquaculture of its DC trade partners? Two measures seem to appear straightforward: First, as industrial-scale aquaculture requires intensive technological and scientific knowledge to run production with minimal environmental consequences, and as it is difficult for DCs to provide such resources, the EU could provide assistance programmes for DCs to implement measures for more environmentally friendly practices in aquaculture. As another measure, the EU could grant preferred market access to aquaculture firms with certification. A good example where the EU has already taken the initiative in this direction is the EPA with the Pacific states, which contains a provision to promote sustainable fisheries and good fisheries practices. It envisages a comprehensive reporting requirement for these states, and consultations between the two parties are held to control its application and effects. Thus the EU grants fisheries products of these countries access to its markets subject to compliance with sustainable fisheries management (EC, 2018b). More research is required to assess the efficiency of different certification schemes and the legal possibilities to link preferential treatment to certifications.

3.4.2. Environmental costs of mining industry exports in DCs

This section looks at the environmental effects of mining in developing countries. This is important because the EU imports the bulk of its mineral resource requirements, and to a great extent from DCs. The mining sector produces many and varied environmental costs in DCs, where environmental regulations are much less strict than in Europe.

Trade in resource materials is important, as resource-poor countries depend on resource-rich ones. The main traded mineral products are coal, iron ore, copper, gold, platinum, rare earth and bauxite. Among mineral producers are some advanced countries, like the US, Australia and Canada, but also a large share of emerging market economies and developing countries, such as China, Russia, India, Indonesia, South Africa, Brazil, Chile, Peru, Mexico and Colombia (see Figure 11 below). China, the engine of worldwide mineral demand, is also the most important mining country (Ericsson and Löf, 2019).

Figure 11 / World mineral producer countries, in 2010



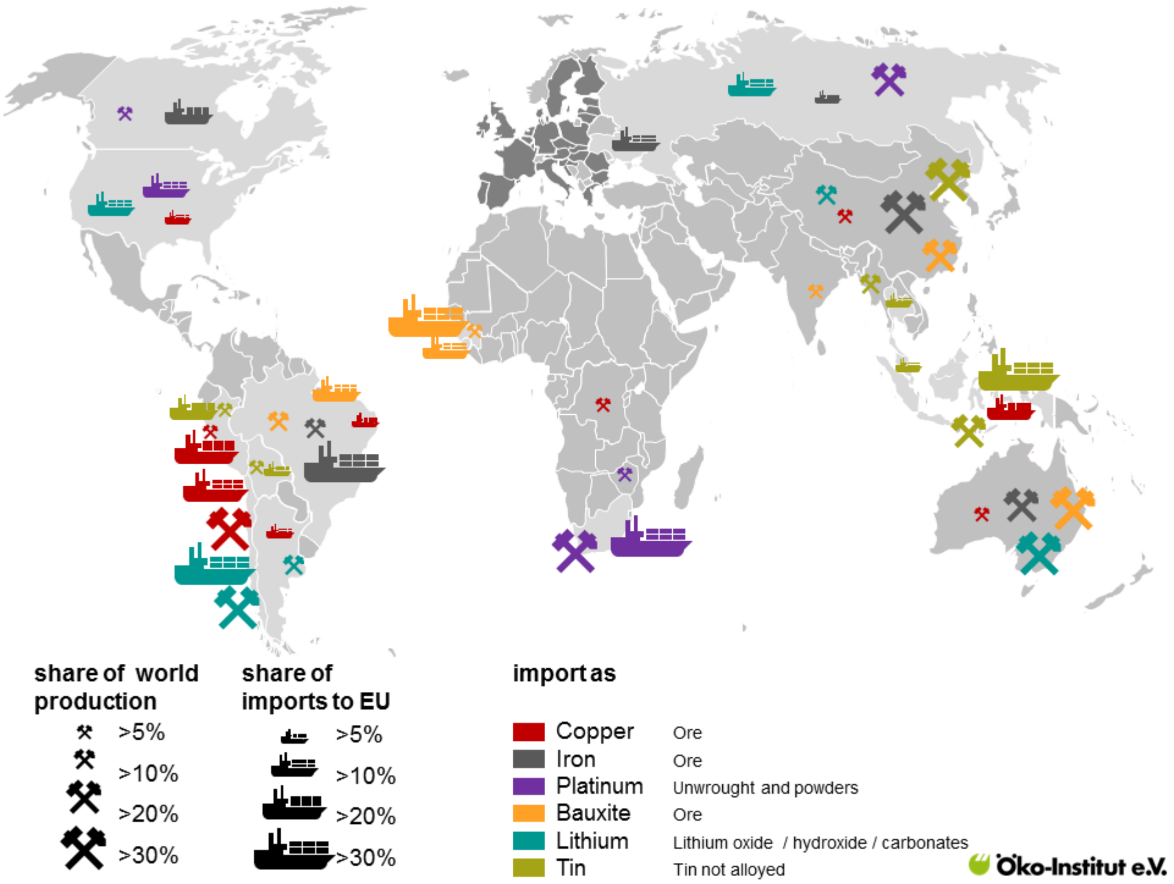
Source: Eriksson and Löf (2019).

There are some 20 DCs in the world where mining plays a major role in the economy. According to the mining contribution index (which accounts for the share of mining in production, in exports, in exploration investment and in rental income) (Ericsson and Löf, 2019) mining ranks high as a dominant economic activity in a number of African countries, like the Democratic Republic of the Congo, Namibia, Botswana, Tanzania, Zambia, Mali, Mauretania, Liberia, Burkina Faso and Ghana; in a few Latin American countries, like Chile, Peru and Guyana; a few Asian countries, like Mongolia and the Kyrgyz Republic; and in Australia. Mining exports are a major income source for many developing countries.

As already stated, the EU imports most of its demand for mineral products. Although recycling in minerals is an important source of supply, in 2014 the EU imported about 50% of its iron ore requirements, about 40% of copper and aluminium, more than 80% of tin and platinum, and almost all of its lithium requirements (Schüler et al., 2017).

At present, the EU imports practically all its copper needs from Chile and Peru, with both of them it maintains FTAs. The EU's lithium imports mainly originate from Chile, with much less coming from Russia and the US (Figure 12). Iron ore mainly comes from Brazil, Canada and Turkey; platinum mainly from South Africa; and bauxite from Guinea, Brazil and Liberia. Gold is mainly sourced from Canada, the US and South Africa. The EU's mineral sourcing mirrors preferential trade agreements and it has a preference for politically stable sources (which rules out many African countries). The view has been expressed that an FTA with Australia or China could lead to a diversification of sourcing (Farooki et al., 2018), although this could be questioned, given that shipping costs (and thus distance) are an important factor in the trade in minerals.

Figure 12 / Minerals import sources for the EU



Source: Schüler et al. (2017).

Mining has a serious environmental impact, because it destroys the natural landscape and biodiversity through deforestation and the erosion of soil layers.

The UNDP guide on best practices in mining (UNDP, 2018) enumerates as environmental burdens of mining:

› deforestation (e.g. in the Amazon)

› destruction of biodiversity

› dust from the mining process

› erosion and contamination of soil

› production of waste mining rock (waste containing radioactive material)

› water contamination

› acid mine drainage.

These environmental effects endanger the living conditions and earnings of the indigenous population and the health of workers, and thus violate human rights (UNDP, 2018). The Rio Declaration on Environment and Development 1992, expressed these concerns and established the ‘polluter pays’ principle; these goals have subsequently been enshrined as constitutional protection of the right to a healthy environment in most countries worldwide, including DCs (UNEP, 2019).

One sector with particularly problematic environmental effects is gold mining. For every gold ring manufactured, 20 tonnes of sludge waste are produced, containing cyanide and toxic heavy metals. The toxic waste is often directly dumped into natural water. Dams are often built to contain mining waste (Brilliant Earth, 2020), but catastrophic toxic waste spills have been reported in Russia, South Africa, China, Ghana, Peru and Romania.

Besides large-scale mining, about a quarter of world production is from artisanal gold mining, which uses mercury. This activity is considered to be the major source worldwide of mercury pollution. Some 10-19 million workers, including women and children, work in mercury-based gold mining in Africa, Asia and Latin America. Artisanal gold mining is particularly intensive in China, Indonesia, Bolivia and Colombia. It is considered to be the fifth most important toxic pollution problem in low- and middle-income countries (Green Cross Switzerland/Pure Earth, 2016). While cyanide produced in large-scale gold mining has a short lifetime, mercury used in artisanal gold mining accumulates in the soil and water and has far-reaching health problems, (Esdaile and Chalker, 2018).

The Harvard Law School International Human Rights Clinic (2016) investigated the environmental damage from a century of gold mining in South Africa's Rand region. It pointed out the dangers to the local population's health from toxic spills in the soil and water and from the dust caused by mining, and it highlighted the failure of the South African government to demand restitution from mining firms in any consistent way.

Eco-friendly ways of gold mining that do not use toxic chemicals are available. Certification systems with standards such as Fairtrade Gold, Fairmined Gold, Fairtrade Ecological Gold and Fairmined Ecological Gold have appeared (Amalena, 2020), which stress the managed disposal of mining waste in artisanal production, and raise the issues of fair working conditions (equal pay for women, no child labour) and the avoidance of toxic chemicals. In the US, the No Dirty Gold campaign was initiated by major jewellery chains in 2004 to promote responsible sourcing (Bland, 2014).

Advanced countries have introduced legislation to limit the environmental harm from mining. In the EU, all forms of mining need a permit which is granted upon verification that the mining process complies with the 'Best Available Techniques Reference' document of the Commission of 2009, required by the Directive on the management of waste from extractive industries (2006/21/EC). This stipulates that there must be a waste management plan to minimise water and soil pollution and an accident prevention policy. In the US, state governments can require mining companies to repair old mining sites, such as gold mines.

While the EU has taken care that mining in its territory produces least possible negative environmental effects, practically no measures exist that address the environmental consequences of the EU's mineral imports in the producer countries. For example, there is no legislation in the EU that requires importers of gold to verify the responsible mining practices of their suppliers. However, following the OECD "Due Diligence Guidance for Responsible Mineral Supply Chains" of 2011,[55] the EU does have a regulation

[55] See https://www.oecd.org/daf/inv/mne/mining.htm

designed to prevent the import of so-called 'conflict minerals': by 2021, importers of gold, tin, tantalum and tungsten must be able to prove that the imports do not originate from illegal activities that finance wars or from forced labour (EC, 2018f). One reason for the regulation was the export of minerals from the Democratic Republic of the Congo (gold, tungsten, tantalum, tin). The US addressed this problem by imposing a regulation back in 2010, requiring companies that use imports from the Democratic Republic of the Congo to report the fact (EP, 2015: 33). However, the extractive industries sector is regarded as notoriously non-transparent (EP, 2015).

The guidelines of UNDP on best practices in mining, on environmentally and socially sustainable practices (UNDP, 2018) acknowledge the contribution that mining can make to generating jobs and economic growth, but stress that the environmental and social consequences must also be considered if sustainable development is to be ensured. The guidelines prompt governments in resource-extracting countries to implement regulations that ensure care for the environment and the social aspects of mining. It argues that governments need to assume responsibility for the local environmental and health consequences of mining, as well as for the climate-change effects, and that they should be held accountable to the public. Their responsibility should cover the whole extraction process, from design of extraction to disclosure of the mining site.

There are several other international intergovernmental organisations (and organisations affiliated to international institutions) that deal with guidelines for mining and that give advice to governments on formulating legislation:

› the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development supported by UNCTAD, among others

› the World Bank Mining Investments and Governance Review

› the African Mining Vision of the African Union

› the ASEAN Minerals Cooperation Action Plan

› the UNDP ACP-EU Development Minerals Programme

› Multilateral development banks also maintain environmental standards for mining sector credit applicants.

Other standards serve as guidelines for large-scale mining companies: the Australian Centre for Sustainable Mining Practices, Canada's Towards Sustainable Mining, the International Council of Mining and Metals (which covers 27 major mining companies), the Initiative for Responsible Mining Assurance which certifies mine sites (UNDP, 2018).

Among other things, the Responsible Mining Index 2020[56] measures how companies assess and manage their environmental impacts. It covers 30 large-scale companies and 850 production sites in the Americas, Asia, Australia and some Sub-Saharan African countries. The index shows that companies tackle mainly air quality and energy consumption: the management of tailings-related risk[57] is sparser.

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56 See: https://2020.responsibleminingindex.org/en

57 Tailings are waste products of the mining process comprising pulverised rock, water and chemicals disposed at the mining site. Not properly managed, they contaminate ground water.

The EU has shown awareness of the problematic use of mercury in gold mining: this was addressed at a working-group meeting of the EU-Andean Community FTA. The issue of responsible supply chains in mining has been raised with Colombia (EC, 2018: 49).

What can the EU do to promote more sustainable mining with its DC trade partners? On the macro level, the EU could permit only mineral sourcing from countries with well-implemented environmental standards for extraction and waste management. This would certainly promote sourcing from advanced countries (US, Canada, Australia) and discredit sourcing from Africa and China. Potential trading partners could be offered the prospect of free trade only once they achieve certain standards. On the micro level, in order to prevent mineral imports from extraction with harmful environmental effects and bad waste management, products could be required to state their exact supply chains. At each step in the supply (extraction, first processing, trade), a vendor would be required by law to check compliance of the source with environmental regulations. This would require transparency, and extracting firms would need to make information available to the public. Such a requirement would certainly favour large firms, with better knowledge of environmental legislation and the financial capacity to ensure environmentally friendly measures. Special attention would have to be payed to small artisanal production since they could face an unmanageable burden by strong environmental requirements. Moreover, it might create an incentive for small-scale artisans to whitewash environmentally problematic production by selling it illegally to large-scale producers at a discount.

3.4.3. EU waste shipments and recycling industry in DCs

E-waste shipments and recycling in DCs

Following the Waste Electrical and Electronic Equipment (WEEE) Directive of 2012 (Directive 2012/19/EU), the EU has a high collection rate of electronic waste. This waste typically contains hazardous substances and is difficult and costly to recycle. This has resulted in the practice to export e-waste to developing countries. Although exporting of hazardous e-waste is restricted by the European Waste Shipment Regulation (Regulation 2006/1013/EU) which implemented the Basel Convention, Eurostat reports that the share of hazardous waste being shipped outside the EU has increased from 0.8% in 2009 to 3.4 % in 2016 (Eurostat, 2019). Moreover, there is considerable scope for illegal activities: since second-hand, used electronic equipment is not subject to the EU Waste Shipment Regulation, there is large potential for illegal exports as waste is often simply declared as second-hand products (Illés and Geeraerts, 2016). The Basel Action Network (BAN) argues that such exports frequently originate from waste recycling plants in the EU, and are sent to DCs such as Nigeria, Ghana, Tanzania, Pakistan, Thailand and the Ukraine (Laville, 2019).

Significant environmental effects arise as the dismantling and recycling of e-waste is mostly done in the informal sector. This results in the release of heavy metals – like cadmium, chromium, lead, copper, mercury, antimony, nickel – and other toxic compounds, like dioxins, into the local environment, threatening soil, air and groundwater and entering the food chain. In the end, those substances have led to a significant increase in chronic disease in the local population. China and other countries (such as Thailand in 2018) have reacted with a ban on e-waste imports from the EU (Laville, 2019).

A special case of e-waste is lead-acid battery recycling and lead smelting in DCs; these activities generate some of the worst toxic pollution, according to Green Cross Switzerland/Pure Earth (2016). Battery recycling is mostly done in a small-scale, artisanal way: the workers are not protected from exposure to the lead, and both lead and lead acid are dumped straight into the local soil and water. Particularly in Africa, this is a widespread business: used batteries come either from inside Africa or from illegal imports, and the melted lead is exported. In consequence, the lead concentration in local people has been measured at six times the critical value indicated by the World Health Organization (Öko-Institut, 2020). Nigeria is described as an example of these practices in Sorge (2019). Öko-Institut e.V. demands a two-fold approach: the relevant national governments should implement regulations to stop such practices, while firms that use lead in battery production in Europe, notably in the automobile industry, should examine their sourcing more carefully. Lead is mainly in demand from China, Europe and the US. A large proportion originates from recycled lead (Europe 74%; US 100%) (ILA, 2015).

The EU has to decide whether it wishes to take full responsibility of the disposal/recycling of its e-waste or whether it wishes to continue to burden DCs with its waste. If it chooses the first option, it would have to strictly prohibit the exportation of e-waste and used electronic products. To fight illegal exports, it would have to improve freight inspection at major shipping ports. Present regulations are not strict enough and in practice there are too many loopholes to export such waste. If the EU chooses this strategy, to become self-sufficient in handling its e-waste, it would also have to promote the creation of e-waste recycling companies in the EU where collected e-waste is processed. It would have to improve the implementation of its existing treatment standards for these recycling companies.[58] In order to discourage low cost, environmentally unfriendly lead recycling in DCs, the EU could oblige actors in sectors such as the automobile industry and electronics industry which source lead to exercise due diligence of their material sources, meaning that companies have to gather and present to officials detailed information from their suppliers to make sure that the supply does not come from illegal sources. This practice is already required with companies in the timber sector, where illegal imports also occur (EP, 2015: 32).

Plastic waste shipment and recycling in DCs

Plastic waste constitutes another item where the EU has been exporting – albeit officially – large amounts to DCs, on account of increased plastic waste and inadequate recycling capacities. There is, however, big potential for increasing recycling activity in the EU: by the end of the 2010s, only 17% of the EU's total plastic waste were collected for recycling, the rest was landfilled or incinerated. Roughly 40% of plastic packages were recycled in the EU (EEA, 2019). The European Environment Agency (EEA, 2019) reports that extra-EU plastic waste exports amounted to more than 200,000 tonnes in 2015, but thereafter declined to 150,000 tonnes. Up to 2017, exports generally went to Asian countries, with China and India being the principal destinations by far.

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58 It should be remembered that the EU has created the European Standards for Waste Electrical and Electronic Equipment (Cenelec, 2017). Those require treatment plants to report on downstream operators, be it in the country or outside. Their implementation with minimum standards specification was still ongoing in 2019 (Digital Europe, 2019). An international certification standard for e-waste recycling is the Responsible Recycling R2 standard managed by Sustainable Electronics Recycling International and the e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment which request strict conformity with legal requirements. The e-Steward Standard requests also strict non-exportation of electronics with hazardous substances. Certified companies are mainly found in North America, one also in the UK, but not in EU countries. (http://e-stewards.org/)

After China's 2017 ban on plastic waste imports, the world had to search for new destinations for such exports (China used to take 51% of all plastic waste exports for recycling). Flooded by plastic waste imports, other countries, such as Thailand, Malaysia and Vietnam, have followed the restrictive policy of China (Gaia, 2019).

One tonne of plastic waste results in 2.7 tonnes of CO_2 emissions (EEA, 2019). It is common practice for developed countries to recycle high-quality plastics and then export the remainder. Much of that waste imported by DCs cannot be recycled and has to be incinerated and disposed of in landfills. The incineration of plastics emits carbon monoxide, dioxins, nitrous oxide and other toxic substances, which lead to respiratory diseases and nervous disorders (Heinrich Böll Stiftung, 2019). A further burden is that the plastic waste is often contaminated.

In May 2019, countries agreed to add plastics waste to the provisions of the Basel Convention, due to come into force in 2021. Exporters will then be required to obtain the prior consent of receiving countries (Kliuyeva, 2020).

The EU will have to make up its mind which strategy with plastics waste it wishes to pursue in future. One possibility is that it could take a first-mover position and ban plastic waste exports completely. This would constitute a radical step in trade policy which would require important complementary policies. First, the EU would need to install sufficient recycling capacity to handle its plastic waste in autarchy. The European Commission proposes that the capacity would need to increase fourfold between 2015 and 2030 (EC, 2015). Second, plastic packaging would have to be substituted by biodegradable materials, and third, the collection rate of PET plastic bottles, intended to reach 90% in 2029, would have to be more ambitiously pursued, probably by introducing returnable bottles. So far, only Germany, the Scandinavian and Baltic countries are operating a system of deposit bottles (Boksch 2020).

3.4.4. Environmental effects of textiles and the clothing industry in DCs

Textiles are a top consumer product, and a large proportion is imported from DCs. In turn, the textile industry is often the starting point for those countries to establish a manufacturing industry and to start their economic development. Nevertheless, the textile industry does have environmental costs for those places.

The textile industry comprises the production of yarns and fabrics from natural (cotton, silk, wool, etc.) and synthetic (polyamide, polyester) fibres, high-tech yarns and the apparel industry.

Production in the EU is focused on high value-added products, comprising technical/industrial textiles and non-woven products for the automotive and medical sectors, etc., as well as high-quality garments with a high design content. The textiles and clothing sector in the EU was worth EUR 166 billion in 2013, accounting for 3% of value added and 6% of employment in manufacturing. Some 20% of EU production is sold to third countries, and the EU is a major exporter on world markets, with exports of clothing representing 30% of the world market (worth EUR 129 billion in 2017). Its exports comprise high-tech textiles produced in Northern countries and fashion products dominating in Italy, Spain and France.

On the other hand, the EU ranks as the number one importer of apparel on the world markets. The top 10 countries of origin of EU apparel imports are China (EUR 27 billion in 2018), Bangladesh (EUR 16 billion), Turkey (EUR 10 billion), India (EUR 5 billion), Cambodia (EUR 4 billion), Vietnam and Pakistan (EUR 3 billion apiece), Morocco and Tunisia (EUR 3 billion apiece). Among those exporters are EBA and GSP+ countries, for which the textiles are a vital industry. Imports from DCs are low-cost, fast-fashion products (EC, 2020b, 2020c; Statista, 2020; CBI, 2020).

As a result of the low price of imports and the desire of consumers for new fashion products, the amount of clothes that consumers buy has risen steeply in the past few decades. The World Bank reports that in 2019 consumers bought 60% more garments than in 2000; the price of clothing declined by 36% between 1996 and 2012, while the proportion of consumer spending on clothing (4% in 2017) has fallen only marginally (Sajn, 2019; World Bank, 2019). Since most of these products are imported from the third world, the environmental impact is felt in DCs. The production of raw materials (cotton, silk), the spinning of fibres, the weaving of fabrics and dyeing require large quantities of pesticides, water and chemicals (Sajn, 2019).

Sajn (2019) points out that the growing of cotton (43% of fibres on the EU market) has important environmental consequences, as it requires large land areas, takes huge amounts of fertilisers and pesticides, and consumes large quantities of water. All natural fibres have a high environmental impact: silk is considered to be particularly environmentally unfriendly, with a strong effect on global warming and wool contributes to CO_2 emissions. Organic cotton, whose share is growing, has a much lower ecological impact than conventional cotton (Fairtrade America, 2017).

The production of fabrics mostly occurs in DCs. Of the chemicals used in the clothing industry, 165 are classified as hazardous. Meanwhile, dyeing involves high water consumption: 200 litres of water are needed to produce one kilogram of textiles; 3,800 litres of water are needed to produce a pair of jeans. The unfiltered discharge of wastewater from these processes also constitutes a serious danger to the environment in DCs. And the cutting, sewing and gluing in clothes production all consume energy. Now, however, new dyeing technologies – with lower consumption of water and the replacement of chemicals with enzymes – have been proposed by European industries. The textiles industry is a major water pollutant in textile-exporting countries like China (20% of total water pollution), Indonesia (29%) and Turkey (32%). The fashion industry is also responsible for 10% of CO_2 emissions – more than is set free by all air and maritime transport together, and similar to the automotive industry (Sajn, 2019; Paraschiv et al., 2015; World Bank, 2019).

In summary, the relocation of the textiles and clothing industry to DCs has outsourced considerable environmental effects from the EU to DCs.

There are some interesting in-depth case studies on the environmental effects of the textile industry in DCs. Sakamoto et al. (2019) report on the environmental effects of the textile industry in Bangladesh. The garment industry has been the engine of Bangladesh's growth in recent years and contributes 80% of its exports. However, the amount of untreated wastewater discharged into rivers near production sites amounted to over 200 million cubic metres in 2016 and is projected to reach 350 million cubic metres in 2021. The discharged effluent brings heavy metals – vanadium, chromium, molybdenum, zinc, nickel, mercury, copper, cadmium and arsenic – into river water, which in turn is used for agricultural crops. The polluted water causes gastrointestinal illness in the short term, and serious health problems (like respiratory disease) in the long term. Sakamoto et al. (2019) found that, despite legislation in Bangladesh requiring textile companies to install effluent treatment plants, these are not effective as there is a lack of knowledge, skills and resources. The Dhaka Watershed Report of the World Bank 2011 (cited in Water Integrity Network, 2017) found that a shortage of manpower means that the government authorities too seldom inspect the treatment of effluent, and corruption and low fines mean that companies can easily continue to discharge untreated waste effluent. Sakamoto et al. (2019) point to similar problems faced in India in the 1990s; they comment that the problems were partly solved by the government's introduction of central effluent treatment plants.

Two Greenpeace reports from 2011 – *Dirty Laundry* and *Hung Out to Dry* (Greenpeace 2011a; 2011b) – showed that many international fashion brands source from suppliers in China, who discharge untreated wastewater into the Yangtze and Pearl rivers. Moreover, they found that Chinese textile companies use chemical substances banned in the European textile industry, in particular nonylphenol ethoxylates, which disintegrate into substances that have a serious impact on the human immune and hormone system, as well as serious consequences for the aquatic system. Such substances have been found in the products of well-known fashion brands, and so they could also harm consumers in the importing countries and leak into the water system when washed (Paraschiv et al., 2015).

The EU is aware of the environmental problems related to its textile and clothing imports from the poorest DCs. It requires the exporters of textiles to comply with its Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) regulation, which forbids the use of certain chemical substances in textile products, such as mercury phosphate. However, this requirement is more of a product standard, and does not go to make the production process any more sustainable (EC, 2018e). Under the standard GSP and EBA preferences, the EU cannot demand that textile exporters employ more environmentally friendly production processes. This is, however, possible under GSP+.

The European Parliament has asked the Commission to promote the use of raw materials produced in an ecologically friendly way and to implement regulation on the due diligence obligation of companies in the garment supply chain (EP, 2020). The World Bank believes that consumers have to change their consumption of fashion and increase recycling, while fashion companies need to push for higher environmental standards in their supply chain. Such points were also made by the World Economic Forum at the sustainable development and impact summit in September 2019.[59]

There are several ways how the EU could help its DC trade partners to make textiles production more sustainable. The EU could provide incentives that ecologically more sustainable fibres are used in imported textiles. For example, pesticides and fertilizers are reduced under the Better Cotton Initiative, a non-profit organization joined by farmer organisations and international brands, and completely banned with organic cotton. However, its share in fabrics is still low. Furthermore, there are more sustainable fibres such as flax, hemp and jute and manmade cellulosic fibres. In this context, the EU could examine the legal possibilities to provide better tariff concessions for textiles made of these fibres. As another possibility, the EU could require large-scale importers of textiles and garments to ensure that their suppliers comply with the EU environmental standards for the textile industry. As consumers get more aware of the environmental harms caused in textiles production, initiatives such as the international Zero Discharge of Hazardous Chemicals Initiative, to which already some large fashion brands like H & M

59 See: https://ec.europa.eu/commission/presscorner/detail/en/IP_19_821

adhere, have started. In the EU, the EU ecolabel for textiles was initiated. It is granted to companies that proof environmental sustainability across the entire supply chain. The ecolabel was awarded to Lenzing who maintains production sites across the globe. (EU, n.d.) These are voluntary standards for which companies opt to meet pressure from the consumer side. The EU could even consider that compliance with such standards become obligatory for sellers on the EU market. Yet another possibility how the EU could assist to improve the sustainability of textiles production in DCs is to provide technical support and to finance the implementation of more environmentally friendly production techniques and wastewater treatment with free trade partner countries and under the GSP. EU member states have started such initiatives. For example, the German government initiated the Partnership for Sustainable Textiles which aims to bundle the responsibility of German firms along with global producers along the supply chain in the textile industry. It involves known German brands like Aldi and kik and attempts to monitor wastewater management in China, Bangladesh, Pakistan, Vietnam and Turkey. (Partnership for Sustainable Textiles, n.d.) Another example is the Sweden Textile Water Initiative which aims at improving efficiency in water, energy and chemical use in the textiles industry at factory level in India, China, Bangladesh, Ethiopia and Turkey. It cooperates with 72 supplying factory sites worldwide to 20 Swedish brands. (SIWI Stockholm, n.d.) Such initiatives might have an even stronger impact if EU members join and coordinate their efforts.

3.4.5. Environmental problems of the steel industry in DCs

The issue of cheap steel imports from (mainly) Asian countries competing with the European steel industry has long been discussed in the EU. In particular, certain technologically less specialised kinds of steel imports from DCs are pushing into the European market. However, whereas the energy-intensive steel-making sector in the EU has considerably improved its energy efficiency in recent decades, DCs operate with much less efficient plants and produce higher CO_2 emissions and air pollution.

Looking at the market for steel, the world's largest producer region is Asia, with 72% of world production (of which China accounts for half). Europe follows, with 16% of world production, while the US has 6%. Steel is mainly used in construction, the automotive industry, mechanical engineering and metal products. Around 90% of the steel consumed by the EU comes from its own production. The EU imported 25.3 million tonnes of steel in 2019, including from Turkey (5.8 million tonnes), Russia (3 million tonnes), South Korea (2.9 million tonnes), China (2.4 million tonnes), India (2.2 million tonnes) and Ukraine (1.8 million tonnes), among others (Eurofer, 2020).

The European steel industry has to deal with overcapacity and competition from imports. Since 2018, the EU has used a safeguard clause for steel imports pursuant to Article XIX of GATT claiming that rapid growth of steel imports would put serious injury to the European steel industry. It is planned to last for three years and will protect against excessive imports due to trade diversion by Asian steel producers after the US introduced steel tariffs. Imports that exceed the usual levels are charged a 25% tariff (EC, 2018g).

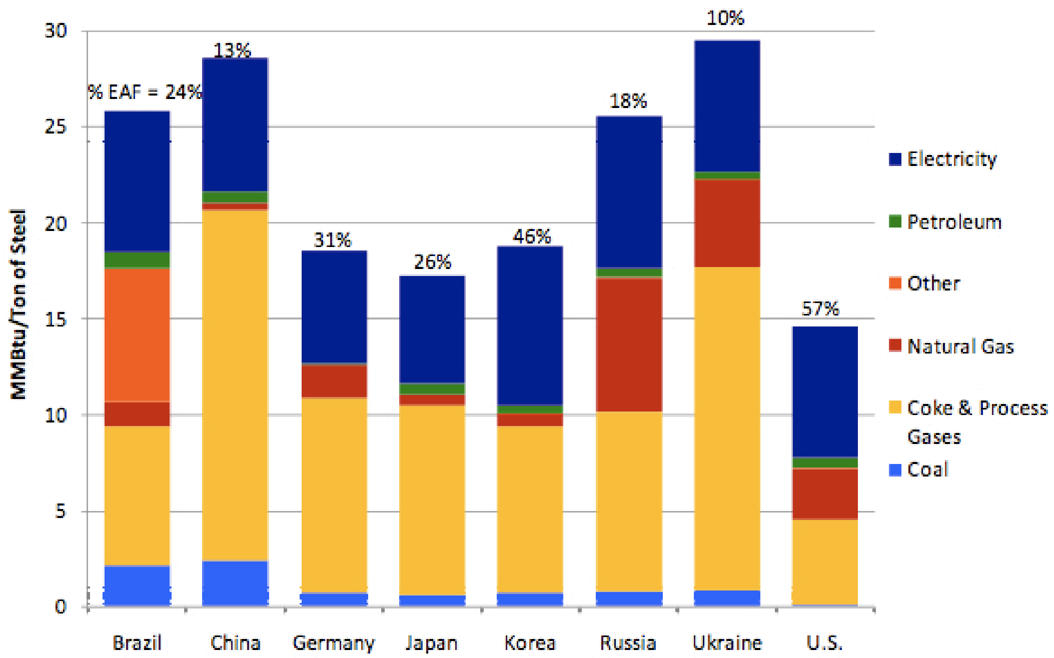
Steel production is energy intensive: it causes 4-7% of human-produced CO_2 emissions globally (EC, 2020d). Steel can either be produced from iron ore or from steel scrap (which requires 20% less energy). The use of steel scrap has helped to reduce the iron and steel sector's energy consumption in Europe by 50% over the past 40 years (EC, 2020d).

The traditional production of steel from iron ore uses coke ovens, sinter plants, blast furnaces and basic oxygen furnace converters. The energy consumption per tonne of steel is between 17 and 23 gigajoules, and in 2005-2008 CO_2 emissions were 2.3 tonnes per tonne of steel. The steel industry is one of the biggest sources of CO_2 emissions in industry, accounting for 24% of total industry CO_2 emissions. Research is continuing at the industry level into the use of process gases from steel making for generating electricity and heating, in order to reduce CO_2 emissions by 20-25%. Industry consortia are aiming to develop a process technology to reduce today's CO_2 emissions by 50%. New lightweight steels would also reduce energy requirements (EC, 2020d; Pooler, 2019).

The World Steel Association (2020) points out that a reduction in CO_2 emissions and an improvement in energy use in the steel industry would require combined efforts by government and industry and would necessitate improvements in recycling, innovation in new steels and process innovations. The OECD (2015) reports a dramatic rise in the number of carbon mitigation patents in the steel industry since the 1990s.

Figure 13 / Energy intensity comparisons of steel producers

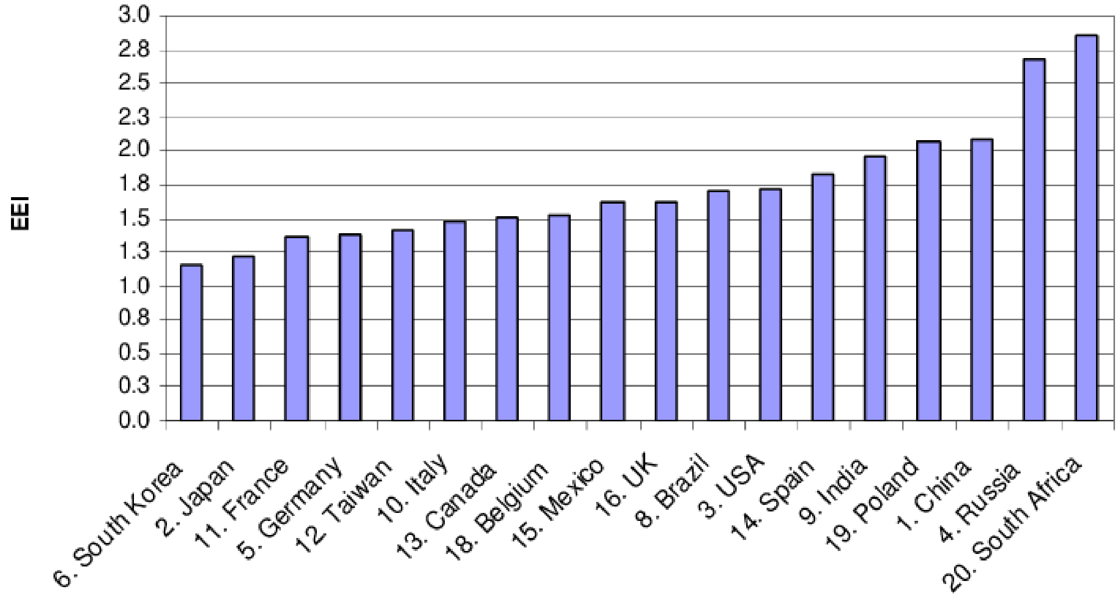
Million British thermal units (MMBtu) per ton of steel and source of energy employed, 2006, and percentage (above columns) of electric arc furnace production



Source: Berezowsky (2011).

Neither the World Steel Association nor the International Energy Agency reports country comparisons on energy efficiency in the steel industry. However, one source – admittedly none too recent – is Berezowsky (2011). According to this report, figures from the US association MetalMiner show considerable differences in steel production energy efficiency (see Figure 13 and Figure 14). Whereas the steel production of one of the EU's suppliers, South Korea, is equivalent to the German level, production in Ukraine, Russia and China consumes significantly more energy per ton of steel. Hasanbeigi et al. (2016) report that in 2010, CO_2 emissions in the steel industry were 1,708 kilograms per tonne in Germany and 1,736 kilograms/tonne in the US, but 2,148 kg/tonne in China. As for the EU's principal foreign supplier, Turkey, Ates (2015) estimates that the energy intensity of steel production – the most energy-consuming sector in Turkey – could be reduced by over 50% and greenhouse gas emissions could be cut by up to 39% by 2030.

Figure 14 / Energy efficiency of top steel-producing countries for the year 2000



Notes: Countries sorted by energy efficiency index (EEI); numbering of countries according to their ranking as top 20 steel producers in 2000 (data missing for Ukraine, rank 7, and Belgium, rank 17).
Source: Elzen et al. (2008).

The EU has a few options to improve energy efficiency among its suppliers and to combat CO2 emissions; however, some of these are not strictly speaking in the domain of trade policy. As a measure which would in the long term press supplier countries to upgrade their environmental standards, the EU could impose a CO2 border tax on steel products. However, a number of critical points of such a measure would have to be considered. A carbon border tax on steel products may seriously question the competitive advantage of present steel source countries like China or the Ukraine, which use mainly blast furnace and basic oxygen furnace. Thus, a carbon border tax on steel would most probably be considered as another drop in the bucket in the present trade war in the world steel market. Furthermore, the resulting increase in steel prices, like for example of flat rolled steel, would lead to a cost increase of EU manufacturers which would either reduce their profits or result in higher consumer prices. As another option, the EU could provide technical assistance to firms in DCs to introduce more efficient production processes. Such measures have been initiated by the EU. For example, the EU supports the Ukraine to adopt legislation to promote energy efficiency in the Ukraine industry within the European Neighbourhood and Partnership Instrument (EU, 2011). Finally, the EU could support the participation of firms from DCs in research consortia on steel process development more strongly. There are examples for innovation cooperation in the steel sector between EU partners and Chinese companies, for example between the Chinese Baowu Steel Group and Siemens aiming to advance smart manufacturing and supported at government level (Unido, 2020). Another example is Siderwin, a consortium led by the international steel group Arcelor Mittal (owned 40% by the Indian Mittal family) joined by 11 European companies and research institutions with the aim to research on CO2-free steel production. Siderwin received funding from the EU´s Horizon programme.

3.5. ENVIRONMENTAL GOODS AND SERVICES TO MITIGATE ENVIRONMENTAL DAMAGE IN DCS

Given the problematic environmental effects in many industries of DCs (as discussed in the previous sections), trade pessimists will be inclined to discredit trade. However, in economic terms, there is agreement that exports are a major income source for DCs and that technology spill-overs through trade are important for economic development. Furthermore, one should consider that environmental goods and services[60] could make an important contribution to mitigating environmental problems in DCs. It is often suggested that developed countries which possess such technologies should export them to DCs. This would be another way in which DCs could benefit from trade with developed countries (Onder, 2012). In this vein, in 2001 the WTO Doha Round mandated the elimination of trade barriers to environmental goods.

The market for environmental goods and services is huge in rich countries; but market projections suggest that the biggest growth will be in DCs. In 2011, growth in environmental goods was 10% in Africa, 9% in Asia (excluding Japan) and 5% in Latin America, compared to 2% in Western Europe (Bucher et al., 2014). OECD statistics show that the leading exporters of environmental goods are Western countries – but surprisingly also China, which occupies second place among exporters (after Germany) and has a similar volume as the US. A number of countries in the EU export environmental goods. Establishing improved access to DCs through FTAs would have a double benefit: it would ensure that EU producers establish in the foreign market, and at the same time would contribute to resolving environmental problems in DCs. Although this sounds very promising, one has to consider that developing countries are unlikely to have the financial means to make a major investment in green technologies. Investment in environmental technologies will thus have to be channelled through development policy or foreign direct investment.

Among policy measures to promote EU´s green exports to DCs, two possibilities are straightforward: First, The EU could use its trade policy to enable free market access, without a transition period, for environmental goods exports to DCs. Second, the EU could include technical support to governments and financing through the European Investment Bank as instruments under the TSD chapter of FTAs with DCs (e.g. in EPAs). In this way, the EU could play a more active role in DCs, as for example in Africa, a role which it has left in the recent past more and more to other world players.

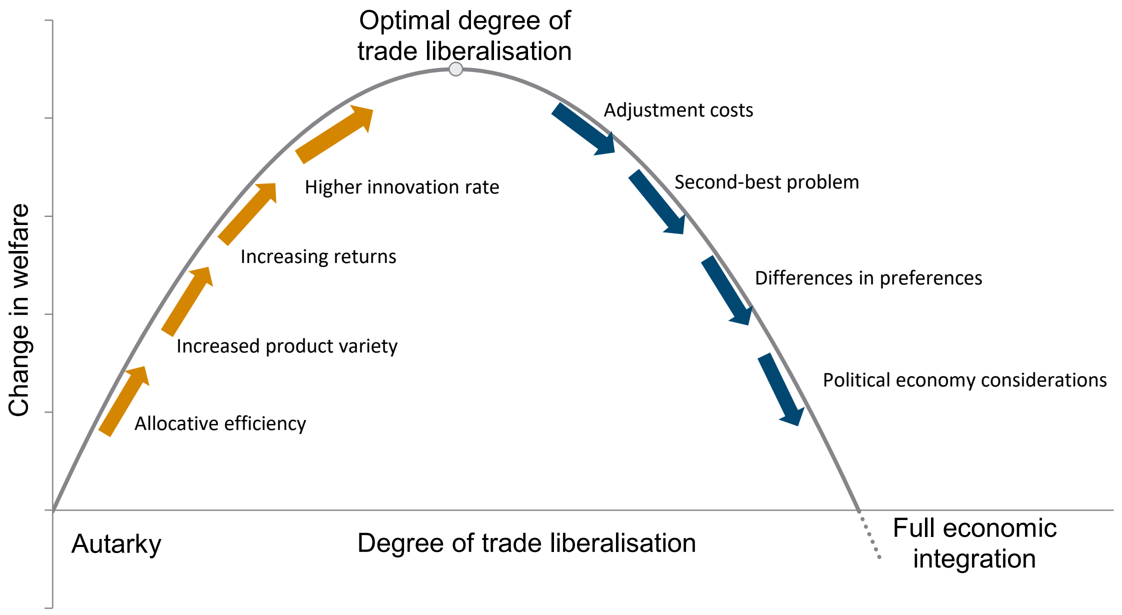
[60] The OECD lists 164 products as environmental goods and services (Bucher et al., 2014); see also: 'Sky-high carbon tax needed to avoid climate catastrophe, say experts', *Guardian*, 29 May 2017. Available at https://www.theguardian.com/environment/2017/may/29/sky-high-carbon-tax-needed-to-avoid-catastrophic-global-warming-say-experts

4. Accounting for external effects in the EU-Mercosur FTA

The interest in trade liberalisation in general and in free trade agreements stems from their potential to induce significant welfare gains. The assumed positive effects include efficiency gains from improved resource allocation, resulting in lower prices for consumers, an increased product variety and gains from exploiting increasing returns to scale. From a dynamic perspective, one important aspect to be added to this list is the positive impact on the innovation rate, as larger markets lead to higher expected profits, which in turn make innovation efforts more profitable.

In Grübler and Stöllinger (2018) we argued that a proper assessment of the impacts of any FTA needs to balance these gains from trade against potential negative implications from trade integration – that is, the '*pains from trade*' (Figure 15).

Figure 15 / Concept of the optimal degree of trade integration (schematic representation)



Source: Adapted from Grübler and Stöllinger (2018).

The assumption that some of the pains from trade – especially relating to differences in preferences – would set in and intensify as economies become more integrated implies that there is an optimal degree of trade integration that yields the maximum benefits.[61] This schematic representation does not exclude

[61] Moreover, the extent of both the gains and the pains from trade may differ across trade with different trading partners. For example, adjustment costs may be higher in trade with developing countries than in trade with developed countries, as in the latter case intra-industry trade dominates.

the possibility that certain factors that contribute to the gains from trade could continue to be active at higher levels of trade integration, or could even intensify (e.g. increasing returns to scale). Likewise, pains from trade may already be relevant at low levels of trade integration (e.g. market imperfections and the related second-best issue).

The second-best problem means that a policy which is optimal under conditions of perfect competition may no longer be optimal if a market imperfection is present. Indeed, such a market imperfection may warrant an alternative policy as the appropriate response. Applied to the issue of trade integration, this means that more trade liberalisation via FTAs may not be the optimal policy in case market imperfections exist – e.g. non- or under-pricing of environmental degradation related to production and trading activities. Renowned economists such as Nicholas Stern argue that climate change is the result of the greatest market failure in history.[62] Hence, it seems appropriate to assume considerable environmental negative external effects. These negative external effects also need to be taken into account in the context of FTAs.

Against this background, we undertake a partial analysis, in which we focus, on the one hand, on the gains from trade that arise from lower prices for consumers, thanks to imported goods, and on the other hand, on the additional CO_2 emissions resulting from increased trade between the partners in an FTA. More precisely, we estimate the trade expansion effects from the deep and comprehensive FTA between the EU and Mercosur concluded in June 2019 (though not yet in force). Based on these trade expansion effects, we calculate implied welfare changes using the approach suggested by Arkolakis et al. (2012) focusing on Austria, the EU as a bloc and – due to data constraints – Brazil on the side of Mercosur. In parallel, we calculate the CO_2 emissions embodied in trade, following Wiebe and Yamano (2016). The additional CO_2 emissions are translated into monetary costs, using estimates for the appropriate pricing of CO_2 emissions and existing carbon taxes (or cap and trade pricing systems), respectively. Both methodologies are of a comparative-static nature – that is, the situation is compared before and after implementation of the FTA.

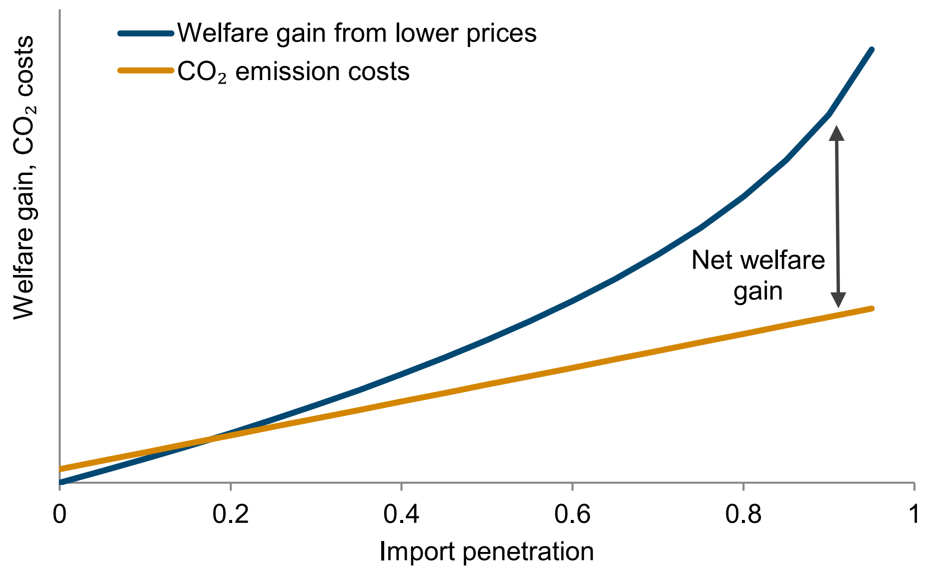
For these particular opposing effects – the price-induced welfare gains and the CO_2 emissions embodied in the additional exports – it is reasonable to assume that they arise in parallel, growing with the level of (estimated) trade expansion induced by implementation of the EU-Mercosur FTA. Hence, in principle there could be a point where the allocative efficiency gains from trade are fully compensated by the CO_2 emission costs (Figure 16). Given that the formula used by Arkolakis et al. (2012) assumes that efficiency gains increase disproportionately as economies become more open, it is very unlikely that the CO_2 emission costs fully counteract the gains from trade.[63] Ultimately, this depends on the price assigned to one tonne of CO_2 emissions.[64]

[62] See for example: https://www.theguardian.com/environment/2007/nov/29/climatechange.carbonemissions

[63] The position of the emission cost curve is not predetermined and is influenced by reallocation effects from and to more or less emission-intensive industries.

[64] This affects the slope of the emission cost curve.

Figure 16 / Example of gains and pains from trade: Lower prices versus CO2 emissions



Note: Import penetration is defined as the share of imports in a country's gross production.
Source: Authors' own representation.

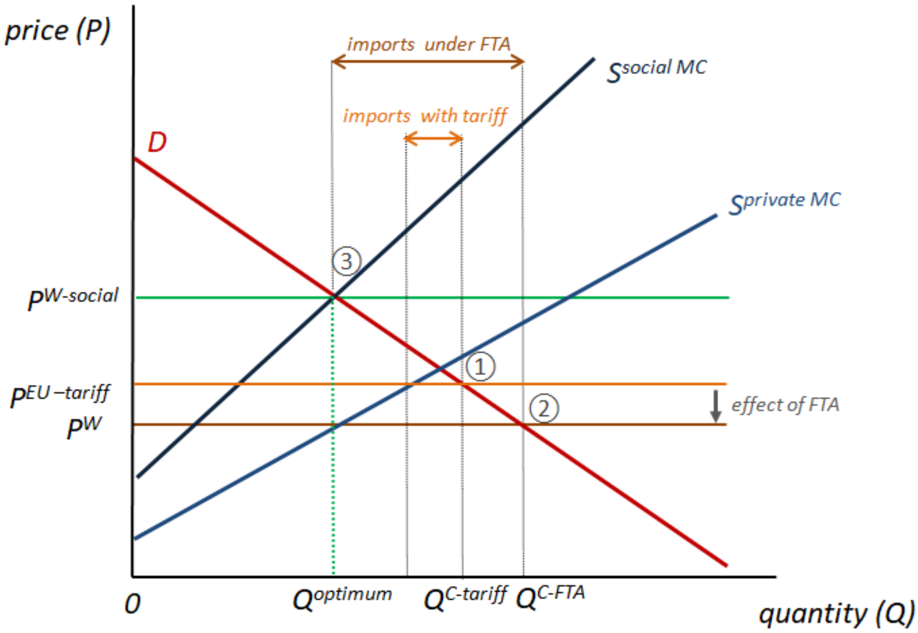
4.1. ECONOMIC EFFECTS OF TARIFF REDUCTIONS IN THE PRESENCE OF NEGATIVE EXTERNAL EFFECTS

A key insight from standard theories of international trade is that the removal of trade barriers such as tariffs leads to welfare increases and to a more efficient allocation of resources. This result does not necessarily hold when negative external effects are present (illustrated in Figure 17). Let us assume that this negative external effect consists of CO_2 emissions in the absence of a carbon pricing mechanism (a carbon tax or an emission trading system).

A negative external effect in production implies that the social marginal cost curve ($S^{social\ MC}$) lies above the private marginal cost curve ($S^{private\ MC}$), because the production process imposes costs on society that private firms do not have to pay for (e.g. climate and health risks associated with an increase in CO_2 emissions).

In an open economy, the market equilibrium is found when the world market price equals domestic demand (downward-sloping curve, D). Assume that initially the EU is a small, open economy imposing import tariffs on Mercosur. This leads to a price in the EU economy ($P^{EU\text{-}tariff}$) that is above the world market price under free trade (P^W). In this situation, the market equilibrium is found at the intersection of the price in the EU economy and the demand curve (the point labelled ①), where the resulting level of consumption is found at point $Q^{C\text{-}tariff}$. Since private marginal costs at this level of output are above the price level in the EU, a small part of the demand is covered by imports.

Figure 17 / Trade and welfare effects of an FTA with a negative external effect



Source: Authors' own representation.

What happens if the EU-Mercosur FTA enters into force and the EU tariff is eliminated? In this case, the price level in the EU drops to the world market price (P^W), EU consumption and imports increase, and free trade equilibrium is established (the point labelled ②). Due to the negative external effect, this free trade equilibrium, however, does not coincide with the social optimum (the point labelled ③), which is found at the output level $Q^{optimum}$. Relevant for this socially optimal equilibrium are (i) the demand curve, (ii) the social marginal cost curve in the EU and (iii) the international price level which – for the social optimum to materialise – needs to take account of the negative externality ($P^{W\text{-}social}$). At this point, EU imports drop to zero. Obviously, this is an extreme case, but this simple example illustrates two important points. First, tariff reductions need not be the optimal policy in the presence of a negative externality. In fact, an FTA and the associated tariff reduction would aggravate the existing distortion of the resource allocation, as imports would increase, even though the social optimum would suggest lower import levels – or, in the illustrated extreme case, a total suspension of imports. Second, the cost of the negative external effect needs to be taken into account in a welfare analysis. In the context of CO_2 emissions, this means putting a price tag on this '*public bad*'.

To be clear, our empirical analysis does not allow the social optimum for the EU-Mercosur FTA to be pinned down. Rather, we estimate the additional CO_2 emissions associated with the trade expansion that is expected to result from the FTA. These are compared to the estimated gains from trade, to which we turn next.

4.2. THE GAINS FROM REDUCING BARRIERS TO TRADE

The empirical analysis of the gains from trade makes use of the workhorse model in international trade theory – the gravity model. More precisely, we employ a structural gravity approach (see for example, Yotov et al., 2016), which is estimated at the bilateral industry level. The analysis benefits from the detailed industry structure of the World Input-Output Database (WIOD) (Timmer et al., 2016), featuring 56 industries and covering trade in both goods and services.[65] Moreover, WIOD has the advantage that it includes 'internal' trade, i.e. domestic sales, as recommended by the modern gravity literature. Ideally, we would investigate the trade relations between the EU and Mercosur. However, as Argentina, Paraguay and Uruguay are not included in the WIOD, we focus on the expected effects for EU-Brazil and Austria-Brazil trade relations.

4.2.1. Baseline tariffs and tariff reductions in the EU-Mercosur FTA scenario

To the extent possible, the scenario mirrors the published tariff reductions summarised by the European Commission (2019f).[66] Despite the rich industry structure, our data does not allow us to fully capture the very detailed and complex tariff schedules of the EU-Mercosur Agreement. Therefore, our assumptions follow the more aggregate results. More precisely, in our EU-Mercosur FTA scenario, the tariffs are adjusted to fit the 92% reduction in tariffs on the EU side and the 91% on the Brazilian (Mercosur) side. Additional information, such as the full elimination of EU tariffs on industrial goods, is equally reflected in the scenario.

The industry-level tariffs (simple averages across tariff lines) used for the baseline scenario are those prevailing in 2014, the last year covered in the WIOD. These are summarised in Table 5, along with the tariffs assumed in our EU-Mercosur FTA scenario. In the latter, the tariffs in many industries are eliminated entirely. Overall, the tariff reductions are larger on the Brazilian side, which is due to the fact that the baseline tariffs in 2014 were higher in most industries. An exception is the agricultural sector, where tariff levels in 2014 were similar in the EU and in Brazil. Agriculture is also the main sector in which the EU does not remove tariffs entirely.

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65 More precisely, we use the WIOD 2016 Release, available at: http://www.wiod.org/release16

66 The tariff schedules (Appendix I to the agreement) are not yet publicly available. See texts of the agreement: https://trade.ec.europa.eu/doclib/press/index.cfm?id=2048.

Table 5 / Tariff schedules before (2014) and after the EU-Mercosur Agreement

Industry description	Industry	Baseline (import tariff as of 2014)		Import tariffs under EU-Mercosur FTA	
		Brazilian tariffs faced by the EU	EU tariffs faced by Brazil	Brazilian tariffs faced by EU	EU tariffs faced by Brazil
Agriculture	**A**				
Crop and animal production	A01	7.2%	7.4%	0.5%	1.3%
Forestry and logging	A02	3.5%	1.1%	0.2%	0.2%
Fishing and aquaculture	A03	9.1%	8.1%	0.6%	1.5%
Mining and quarrying	**B**	4.0%	0.0%	0.0%	0.0%
Manufacturing	**C**				
Food, beverages, tobacco	C10-C12	15.0%	11.8%	1.5%	0.0%
Textiles, apparel, leather	C13-C15	26.5%	8.0%	2.6%	0.0%
Wood, cork, straw products	C16	9.6%	3.1%	1.0%	0.0%
Paper products	C17	12.4%	0.2%	1.2%	0.0%
Printing & recorded media	C18	14.0%	1.7%	1.4%	0.0%
Coke, refined petroleum	C19	0.5%	1.5%	0.1%	0.0%
Chemicals	C20	8.1%	5.0%	0.8%	0.0%
Pharmaceuticals	C21	5.7%	1.6%	0.6%	0.0%
Rubber and plastic products	C22	15.4%	4.7%	1.5%	0.0%
Non-metallic mineral products	C23	10.7%	3.3%	1.1%	0.0%
Basic metals	C24	10.0%	1.6%	1.0%	0.0%
Fabricated metal products	C25	16.4%	2.8%	1.6%	0.0%
Electronic and optical products	C26	13.2%	2.7%	1.3%	0.0%
Electrical equipment	C27	15.4%	2.4%	1.5%	0.0%
Machinery and equipment n.e.c.	C28	12.6%	1.8%	1.3%	0.0%
Motor vehicles	C29	24.3%	5.6%	2.4%	0.0%
Other transport equipment	C30	12.2%	2.4%	1.2%	0.0%
Furniture; other manufacturing	C31_C32	17.7%	2.0%	1.8%	0.0%
Repair & installation of equipment	C33	12.6%	1.8%	1.3%	0.0%

Note: Tariffs are unweighted tariffs. For the EU-Mercosur FTA scenario the tariffs were adjusted to fit the 92% reduction in tariffs on the EU side and the 91% cut on the Brazilian (Mercosur) side. Additional information, such as the full elimination of EU tariffs on industrial goods, has been taken into account.
Source: UN Trade Analysis Information System (TRAINS) database, EC (2019f), authors' assessment.

4.2.2. Results from the gravity model and predicted trade expansions

The trade expansion effects are estimated using a structural gravity model that includes multilateral resistance terms.[67] The main specification of this model takes the form:

(1) $$x_{i,j,k,t} = \beta_1 \cdot \tau_{i,j,k,t} + \beta_2 \cdot FTA_{i,j,t} + B_{i,j,k} + P_{i,k,t} + \Pi_{j,k,t} + \epsilon_{i,j,k,t}$$

where $x_{i,j,k,t}$ denotes exports from country *i* to country *j* in industry *k* at time *t*. Likewise, $\tau_{i,j,k,t}$ are the tariffs faced by country *i* when exporting to country *j* in industry *k* at time *t* and FTA is an indicator

[67] Multilateral resistance terms account for the potential trade diversion effects that arise for third parties when country pairs lower their bilateral tariffs, as is the case with FTAs. Technically, they are captured by exporter-time and importer-time fixed effects and in our specification by exporter-industry-time and importer-industry-time fixed effects because our model has an industry dimension.

variable that takes the value 1 if the exporter-importer pair *ij* has an FTA in place at time *t*; and zero otherwise. Tariffs and the FTA dummy are the key variables for estimating the trade effects under the EU-Mercosur FTA scenario. Important for the proper estimation are the various fixed effects, including the exporter-importer-industry fixed effects, $B_{i,j,k}$, and the aforementioned multilateral resistance terms, $P_{i,k,t}$ and $\Pi_{j,k,t}$, which control for the average trade barriers imposed by the exporter and importer, respectively (in industry *k* at time *t*). $\epsilon_{i,j,k,t}$ denotes the error term.

The estimation results from the gravity model in equation (1) are reported in Table 6 (specification 1). The model includes the aforementioned 'internal trade' flows. The estimated coefficients for tariffs and the FTA indicator variable reported in specification 1 are used to derive the trade expansion effects for the EU-Mercosur FTA. In addition, two types of non-tariff measures (NTMs) – sanitary and phytosanitary (SPS) measures and technical barriers to trade (TBT) – are included in the model as control variables. All estimated effects show the expected signs. In particular, decreases in the tariff rates are expected to lead to higher (bilateral) trade flows between trading partners, as indicated by the negative sign of the coefficient for the tariff variable. Equally in line with expectations is the positive coefficient of the FTA variable, which suggests that implementation of an FTA increases trade flows even when the associated tariff reductions are accounted for.

Table 6 also reports the results from a modified gravity model which excludes the exporter-importer-industry fixed effects (specification 2). This variant of the gravity model has the advantage that it allows the inclusion of the usual gravity variables, such as the distance between trading partners (in logs), an indicator variable for countries sharing a common border or a common language. For all these variables, the estimated coefficients have the expected sign, which provides additional reassurance that the empirical model is delivering plausible results. Moreover, separate specifications for goods trade and services trade indicate that tariff reductions lead to statistically significant increases in trade only in the case of the former (goods trade). This was also expected, since there are hardly any tariffs applicable for trade in services (there may be exceptions for some business services, e.g. software programming).

The procedure for translating the estimated gravity results into trade expansion effects is as follows. For all trade flows between EU member states and Brazil, the estimated baseline exports are increased by a trade expansion factor that is equal to the marginal effects of the tariffs (i.e. the estimated coefficient), times the tariff reduction in the EU-Mercosur FTA. In addition, the trade-creating effect from implementation of an FTA is added. For all these calculations, the coefficients from specification 1 in Table 6 are used.

Table 6 / Results from gravity estimations

Dependent variable: exports	Total trade		Goods only	Services only
	(1)	(2)	(1a)	(1b)
Tariffs	-2.5405***	-1.0485***	-2.6684***	0.0074
	(0.3147)	(0.3000)	(0.3265)	(0.3123)
SPS measures (accumulated)	-0.0001	0.0021	-0.0002	0.0095***
	(0.0004)	(0.0015)	(0.0005)	(0.0027)
TBT measures (accumulated)	0.0073***	0.0551***	0.0075***	-0.0231*
	(0.0025)	(0.0037)	(0.0025)	(0.0120)
FTA	0.0552*	0.4535***	0.0439	0.1148***
	(0.0309)	(0.0608)	(0.0353)	(0.0400)
Internal trade		4.1558***		
		(0.1362)		
ln distance		-0.9470***		
		(0.0496)		
Common language		0.2463***		
		(0.0683)		
Colonial relationship		0.1979***		
		(0.0706)		
Common border		0.2838***		
		(0.0585)		
Constant	11.7808***	14.1457***	11.0522***	12.1615***
	(0.0018)	(0.4558)	(0.0050)	(0.0007)
Exporter-industry-time FE	yes	yes	yes	yes
Importer-industry-time FE	yes	yes	yes	yes
Exporter-importer-industry FE	yes	no	yes	yes
Observations	556,696	574,724	237,539	319,157
Pseudo-R-sq.	0.999	0.980	0.998	0.999

Note: Estimation with STATA using ppmlhdfe command. FE = fixed effects. FTA dummy coded as ‘0’ (= no FTA in place) for ‘internal trade’. Ln = logarithm of. Years included: 2000, 2003, 2006, 2009, 2012, 2014. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.
Sources: WIOD, UN TRAINS database; CEPII GeoDist database (Mayer and Zignago, 2011); DESTA database (Dür et al., 2014); wiiw NTM database (based on notifications to the WTO); authors’ own estimations.

This procedure allows us to calculate the percentage increase in trade between our baseline predictions from the gravity model and the EU-Mercosur FTA scenario. Since the baseline estimations of our gravity model also do not yield a perfect fit to the trade flows actually observed, we apply the percentage increases in trade flows to the actual exports in the baseline model (that is the actual flows in 2014). The results for trade flows between the EU and Brazil and between Austria and Brazil are presented in Table 7 and Table 8, respectively.

Table 7 / Implied increases in trade between the EU and Brazil, in million USD

Year: 2014 (all figures in million USD)		EU exports to Brazil			Brazilian exports to the EU		
Industry description	Industry	(1) Actual	(2) FTA	(3) Difference	(1) Actual	(2) FTA	(3) Difference
Agriculture	**A**	**403.9**	**479.7**	**75.8**	**7,989.5**	**10,253.4**	**2,264.0**
Mining and quarrying	**B**	**488.9**	**518.2**	**29.2**	**2,848.6**	**3018.7**	**170.1**
Manufacturing	**C**	**46,001.6**	**67,396.0**	**21,394.4**	**24,183.6**	**33,562.8**	**9,379.2**
Food, beverages, tobacco	C10-C12	2,712.7	4,180.7	1,468.1	9,066.2	16,518.2	7,452.0
Textiles, apparel, leather	C13-C15	482.9	988.7	505.8	1,105.0	1,362.9	257.9
Wood, cork, straw products	C16	72.2	94.7	22.5	619.3	714.4	95.1
Paper products	C17	794.3	1,034.2	239.9	1,736.5	1,840.3	103.7
Printing & recorded media	C18	67.4	97.4	30.0	19.4	21.0	1.6
Coke, refined petroleum	C19	1,221.2	1,335.4	114.2	980.7	1,047.6	66.9
Chemicals	C20	7,394.7	9,451.5	2,056.9	1,883.2	2,274.9	391.6
Pharmaceuticals	C21	3,443.4	4,102.1	658.7	371.8	396.9	25.1
Rubber and plastic products	C22	1,587.1	2,447.2	860.1	232.9	275.6	42.6
Non-metallic mineral products	C23	786.0	1,047.1	261.1	171.1	202.6	31.5
Basic metals	C24	1,878.8	2,524.4	645.6	2,806.0	3,048.3	242.3
Fabricated metal products	C25	2,060.7	3,217.8	1,157.2	184.3	208.0	23.6
Electronic and optical products	C26	2,468.8	3,711.5	1,242.6	282.1	330.7	48.6
Electrical equipment	C27	2,566.8	3,978.9	1,412.1	517.4	567.0	49.6
Machinery and equipment n.e.c.	C28	8,384.8	11,972.8	3,588.0	1,317.7	1,455.9	138.2
Motor vehicles	C29	4,882.8	9,855.1	4,972.3	480.6	627.9	147.3
Other transport equipment	C30	2,530.9	3,495.9	965.0	930.6	1,039.0	108.4
Furniture; other manufacturing	C31-C32	1,092.4	1,639.4	547.0	1,478.6	1,631.7	153.0
Repair & installation of equipment	C33	1,573.9	2,221.3	647.4	0.0	0.0	0.0
Utilities	**D-E**	**555.3**	**597.7**	**42.4**	**7.6**	**11.7**	**4.2**
Construction	**F**	**396.2**	**416.9**	**20.7**	**375.1**	**388.6**	**13.5**
Services	**G-U**	**14,325.9**	**15,150.6**	**824.7**	**7,359.4**	**7,717.5**	**358.1**
Total trade	TOTAL	62,171.8	84,559.1	22,387.3	42,763.8	54,952.8	12,189.0
		change in exports (in %)		*36.0%*	*change in exports (in %)*		*28.5%*

Note: Based on the gravity results in the baseline model (specification 1 in Table 6). Results for the services sector are aggregated. Estimations were performed at the detailed services industry level.
Source: Authors' own estimations.

Table 8 / Implied increases in trade between Austria and Brazil, in million USD

Year: 2014 (all figures in million USD)		Austrian exports to Brazil			Brazilian exports to Austria		
Industry description	Industry	(1) Actual	(2) FTA	(3) Difference	(1) Actual	(2) FTA	(3) Difference
Agriculture	**A**	**5.3**	**6.1**	**0.8**	**7.6**	**12.0**	**4.4**
Mining and quarrying	**B**	**2.8**	**3.1**	**0.3**	**21.2**	**26.6**	**5.4**
Manufacturing	**C**	**1,159.8**	**1,740.4**	**580.6**	**176.6**	**208.4**	**31.8**
Food, beverages, tobacco	C10-C12	150.0	209.4	59.4	35.3	50.6	15.3
Textiles, apparel, leather	C13-C15	11.5	28.3	16.8	6.3	7.5	1.2
Wood, cork, straw products	C16	4.4	5.9	1.6	1.3	1.5	0.1
Paper products	C17	31.7	48.1	16.4	9.8	10.3	0.5
Printing & recorded media	C18	0.3	2.8	2.5	0.1	0.1	0.0
Coke, refined petroleum	C19	6.0	7.3	1.2	0.0	0.0	0.0
Chemicals	C20	101.2	153.5	52.3	8.0	10.5	2.5
Pharmaceuticals	C21	65.2	83.0	17.8	0.2	0.4	0.2
Rubber and plastic products	C22	32.5	47.4	15.0	1.9	2.3	0.4
Non-metallic mineral products	C23	46.5	60.5	13.9	5.0	5.6	0.5
Basic metals	C24	113.6	157.9	44.4	23.7	25.1	1.4
Fabricated metal products	C25	62.3	99.2	37.0	1.6	1.8	0.2
Electronic and optical products	C26	39.5	59.7	20.2	5.4	6.0	0.5
Electrical equipment	C27	75.1	122.6	47.5	9.0	9.8	0.9
Machinery and equipment n.e.c.	C28	251.4	365.2	113.8	33.2	35.5	2.3
Motor vehicles	C29	55.3	126.7	71.4	6.1	7.0	0.9
Other transport equipment	C30	38.8	53.9	15.1	8.8	10.9	2.1
Furniture; other manufacturing	C31_C32	30.9	43.3	12.4	20.9	23.7	2.8
Repair & installation of equipment	C33	43.7	65.4	21.7	0.0	0.0	0.0
Utilities	**D-E**	**18.3**	**18.8**	**0.5**	**0.1**	**0.1**	**0.1**
Construction	**F**	**14.7**	**15.3**	**0.6**	**44.0**	**46.3**	**2.3**
Services	**G-U**	**172.9**	**183.0**	**10.2**	**91.4**	**95.7**	**4.3**
Total trade	TOTAL	1,355.5	1,948.0	592.5	340.8	389.0	48.2
		change in exports (in %)		*43.7%*	*change in exports (in %)*		*14.1%*

Note: Based on the gravity results in the baseline model (specification 1 in Table 6). Results for the services sector are aggregated. Estimations were performed at the detailed services industry level.
Source: Authors' own estimations.

At the aggregate level, according to our methodology EU exports to Brazil increase by 36% and imports from Brazil by 29%. Austrian exports to Brazil are estimated to expand by 44%, while Brazilian exports to Austria are estimated to grow more moderately, by 14%. One reason for this is that the share of the construction and services industries in Brazilian exports to Austria is comparatively high, and in those industries the trade expansion effects of the FTA are relatively small. The EU industries that benefit most from the FTA, in both absolute and relative terms, include machinery and motor vehicles. This is also true for Austrian exports to Brazil. In this context, it is worth mentioning that the differences in the increases in export flows across industries in relative terms are entirely due to the differences in the tariff changes, since in the gravity model a single elasticity (marginal effect) was estimated for the effect of the import tariff.

4.2.3. Welfare gains from the EU-Mercosur Agreement

The changes in the estimated trade expansion from the gravity model are transformed into changes in welfare (which is proxied by GDP), using the formula suggested by Arkolakis et al. (2012). According to this formula, the gains from trade can be identified with the help of only two summary statistics: (i) the import penetration rate, measured as gross exports over gross output; and (ii) the elasticity of imports with respect to variable trade costs, or 'trade elasticity' for short.

The more open an economy is (i.e. the higher the import penetration), the larger are the gains from trade. Likewise, the smaller the trade elasticity (denoted by ε), the larger the gains from trade.[68] According to this logic, the gains from trade are defined relative to an autarky situation where, by definition, the import penetration rate is zero. Defining λ as 1 minus the import penetration rate (i.e. the share of domestic sales in domestic absorption) the gains from trade can be calculated as:

(2) $$\frac{\Delta W}{W} = 1 - \lambda^{\frac{-1}{\varepsilon}}$$

where $\frac{\Delta W}{W}$ denotes the change in welfare which, again following Arkolakis et al. (2012), we interpret as the percentage change in GDP.

Importantly, this formula gives the predicted welfare gain from trade, in comparison to an autarky situation. To retrieve the gains from trade associated with trade expansion resulting from the EU-Mercosur FTA, we calculate these gains from trade twice. The first time, we perform the calculation using the import penetration rate from the benchmark scenario (i.e. actual trade in 2014); the second time, we apply the corresponding import penetration rate with an EU-Mercosur FTA in place. The difference between the two can be assigned to the implementation of the FTA between the two trading blocs. Note that, for these calculations, we cannot apply the overall import penetration rates, but need to use the bilateral ones. In the case of the trade relationship between Austria and Brazil, the bilateral import penetration rate is the ratio of Austrian imports from Brazil over Austrian gross output.

For the calculation of the trade elasticity, we again follow the suggestion in Arkolakis et al. (2012) and use the coefficient of the tariff variable derived from a trimmed-down structural gravity model that contains only tariffs, in addition to the necessary set of fixed effects. We estimate the trade elasticity twice: once at the bilateral aggregate level (macroeconomic trade elasticity) and once at the usual bilateral industry level (average industry-level trade elasticity), yet, imposing a common coefficient over all industries. This approach yields trade elasticities of -5.29 and -2.93, respectively.

The calculated welfare (GDP) gains according to equation 2 are summarised in Table 9 for both trade elasticities. In the discussion, we focus mainly on the results based on the average industry-level trade elasticity (panel a), which is in line with the set-up of the gravity model. It is also estimated at the (bilateral) country-industry level but yields one coefficient for the average trade elasticity. Applying the average industry-level trade elasticity yields a welfare gain from trade of 0.013% for the EU. While this is a relatively small increase in GDP, the gains for Austria are even more modest, estimated at 0.002%.

[68] To be more precise, the smaller the absolute value of trade elasticity, the larger the gains from trade (since the trade elasticity is negative).

This can be explained by two factors. First, the existing trade patterns imply an only moderate increase in Brazilian exports to Austria (see Table 8 above), which are, of course, identical to Austrian imports from Brazil. Hence, the change in the Austrian import penetration rate is also low, resulting in small gains from trade. Second, Brazil is not a major trading partner for Austria and is relatively less important compared to the EU as a whole, where Spain and Portugal, among others, maintain more intensive trade relations with Brazil.

Our results for the GDP gains for Brazil are in line with the predicted GDP gains reported in the Sustainability Impact Assessment of the EU-Mercosur FTA, recently published by the London School of Economics. In their 'conservative scenario' (LSE, 2020: Table 4), the authors predict a 0.1% GDP gain for the EU and a 0.2% GDP gain for Brazil from the EU-Mercosur FTA. Hence, their numbers for Brazil are very close to our findings (0.19%). By contrast, our results for the EU (0.013%) are much lower than those reported in LSE (2020), and are also lower than those from earlier studies such as Burrell et al. (2011) or Kirkpatrick and George (2009). We assume that the main reason for these differences stems from differences in the methodologies applied, as the studies cited are all based on computable general equilibrium models.

The next step in our analysis is to compare the above gains from trade with the direct environmental pains from trade.

Table 9 / Predicted welfare gains from the EU-Mercosur FTA

(a) Average industry-level trade elasticity (ε = -2.93)

	Actual trade in 2014			**Trade under EU-Mercosur FTA**			**Gains from trade assigned to EU-Mercosur FTA**			
	Gains from trade (vs autarky)			Gains from trade (vs autarky)			In % of GDP		In million USD	
Country	aggregate	with Brazil		aggregate	with Brazil		with Brazil		with Brazil	
Austria	8.97%	0.016%		8.97%	0.018%		0.002%		9	
EU	6.87%	0.045%		6.89%	0.058%		0.013%		2,249	
Country	aggregate	with Austria	with the EU	aggregate	with Austria	with the EU	with Austria	with the EU	with Austria	with the EU
Brazil	2.71%	0.012%	0.531%	2.91%	0.017%	0.724%	0.005%	0.193%	115	4,362

(b) Macroeconomic trade elasticity (ε = -5.29)

	Actual trade in 2014			**Trade under EU-Mercosur FTA**			**Gains from trade assigned to EU-Mercosur FTA**			
	Gains from trade (vs autarky)			Gains from trade (vs autarky)			In % of GDP		In million USD	
Country	aggregate	with Brazil		aggregate	with Brazil		with Brazil		with Brazil	
Austria	5.07%	0.009%		5.07%	0.010%		0.001%		5	
EU	3.86%	0.026%		3.87%	0.033%		0.007%		1,264	
Country	aggregate	with Austria	with the EU	aggregate	with Austria	with the EU	with Austria	with the EU	with Austria	with the EU
Brazil	1.51%	0.007%	0.296%	1.62%	0.009%	0.403%	0.003%	0.107%	64	2,433

Source: Authors' own calculations.

4.3. ENVIRONMENTAL PAINS FROM TRADE

As was discussed in detail in section 3, there are numerous potential environmental implications resulting from FTAs, including the agreement between the EU and Mercosur, many of which are industry specific. The analysis in this section focuses on the negative environmental effects that are directly linked to the additional trade flows induced by the FTA. Restricted by data availability, we limit these direct environmental effects to the CO_2 emissions embodied in additional exports.

4.3.1. CO_2 emissions embodied in trade

The starting point for this analysis constitutes the previously described predicted trade expansion attributable to the EU-Mercosur FTA. The International Input-Output Table from the WIOD for the year 2014 is used to calculate the CO_2 emissions related to the additional export flows.

Following Wiebe and Yamano (2016), the calculation of CO_2 emissions embodied in international trade flows requires three components. These are (i) the CO_2 emissions per unit of gross output which are summarised in the global CO_2 emissions coefficients matrix, CO_2; (ii) the global Leontief inverse, *L*; and (iii) the export demand vector, *EX*, which is built from (diagonalised) bilateral export demand vectors.

For any country *r*, the CO_2 emission coefficients are defined as $CO_{2,r} = CO_2\ emissions_r \,/\, gross\ output_r$, This ratio is formed at the industry level *i*. The value-added coefficients of country *r* and all other countries are arranged in a diagonal matrix of dimension $C.I \times C.I$ (where *C* is the total number of countries and *I* is the total number of industries). This matrix is labelled CO_2. The data for CO_2 emissions at the country-industry level are provided in the WIOD Environmental Accounts for 2019,[69] which are explained in Corsatea et al. (2019). The number of countries included in the WIOD Environmental Accounts and the industry classification are fully aligned with the WIOD Release 2016.

The second element is the global Leontief inverse, $L = (I\text{-}A)^{-1}$, where *A* denotes the input-output coefficient matrix. The coefficient matrix (and hence the Leontief matrix) is of dimension $C.I \times C.I$ and contains the technological input coefficients of country *r* in the diagonal elements and the technological input coefficients of country *r's* imports (from a column perspective) and exports (from a row perspective) in the off-diagonal elements. The coefficients in the Leontief matrix represent the total direct and indirect input requirements of any country-industry from all other industries in order to produce one dollar's worth of output for final demand.

The final building block is the global export demand matrix. This matrix, denoted by *EX*, is composed of the diagonalised bilateral export demand vectors for each country *r* and for each of its partners. The 'domestic' exports are set to zero. The *EX* matrix is also of dimension $C.I \times C.I$.

The global CO_2 emissions embodied in trade, CO_2iT, can therefore be calculated as

(3) $$\mathrm{CO_2 iT} = \mathrm{CO_2} \cdot \mathrm{L} \cdot \mathrm{EX}$$

[69] The data is freely available at: https://ec.europa.eu/jrc/en/research-topic/economic-environmental-and-social-effects-of-globalisation

Since we are interested in the *additional* CO_2 emissions embodied in exports, we calculate CO_2iT in equation 3 twice: once with the baseline export demand matrix containing the actual export flows observed in 2014, and once with the export demand matrix containing the predicted exports from our EU-Mercosur FTA scenario. The difference between the two is equal to the additional tonnes of CO_2 emissions attributable to the EU-Mercosur FTA.

The results are presented in Table 10. At this stage, it is important to note that these results are presented from the perspective of the producer (as opposed to the user). For example, CO_2 emissions in Austrian exports are assigned to Austria, although the goods and services exported are ultimately consumed in Brazil. The reason for choosing the producer perspective is that the CO_2 emissions related to Austrian exports are emitted in Austria, so that the associated environmental (and health) damage takes effect primarily in Austria. Since we are interested in comparing the gains from trade of a country with the environmental costs arising from the induced trade flows for that same country, the producer perspective seems appropriate.

The additional CO_2 emissions are driven essentially by two factors. These are the magnitude of the trade expansion, on the one hand; and on the other, the industry structure, coupled with the industry's CO_2 emission intensity (which are both country specific). The combination of these factors explains the somewhat surprisingly low additional tonnes of CO_2 emissions in Brazilian exports to Austria: in addition to low export expansion, Brazilian exports contain a comparatively high share of services, which are characterised by a low CO_2 emission intensity, compared to manufacturing goods-producing industries.

The last element needed to quantify the environmental costs related to additional trade-related CO_2 emissions, which partially offset the GDP gains from trade (as illustrated earlier in Figure 16), are carbon prices.

Table 10 / CO2 emissions in trade between the EU, Austria and Brazil

	Actual CO_2 emissions in trade (2014) *in '000 tonnes*		**CO_2 emissions in trade under EU-Mercosur FTA** *in '000 tonnes*		**Additional CO_2 emissions due to EU-Mercosur FTA** *in '000 tonnes*	
Country	with Brazil		with Brazil		with Brazil	
Austria	693.5		738.9		45.5	
EU	17,132.4		21,567.0		4,434.6	
Country	with Austria	with the EU	with Austria	with the EU	with Austria	with the EU
Brazil	132.6	26,947.0	136.4	30,246.0	3.8	3,299.1

Source: Authors' own calculations.

4.3.2. The price of CO2 emissions

Given that CO_2 emissions constitute an external effect, putting a price tag on the emission of one tonne of CO_2 (or any other quantity) is a challenging task. Fortunately, many countries have started to 'internalise' this externality, either by imposing a carbon tax or in the form of a cap and trade system. An important example of the latter is the European Emission Trading Schemes (ETS). Under these schemes, a pre-defined number[70] of emission certificates – so-called 'allowances' – is issued. An EU

70 The number of emission certificates issued in the ETS system is gradually reduced over time (from one phase to the next).

Allowance Unit (EUA) entitles the owner to emit one tonne of CO_2. The total number of allowance units determines the maximum amount of CO_2 that European producers are allowed to emit (within the sectors and activities covered by the EU ETS). This is the 'cap' in the system. The trading part of the EU ETS stems from the fact that the allowances can be bought and sold at various energy exchanges, such as the European Energy Exchange (EEX).[71] The advantage of such a trading system is that there is no need for regulators to set a price for an EUA. Rather, the price is determined by demand and supply through a market mechanism. In principle, this should lead to efficient outcomes, because firms that can reduce emissions at comparatively low cost are able to sell their emission allowances, while those firms for which it would be expensive to install emission mitigating measures can buy the allowances. In this way, emission trading ensures that emissions are cut where it is least costly to do so.[72]

Despite the indications from market-determined prices of CO_2 observable in emission trading systems (which are also in place in Canada, for example, and are expected to be implemented in China by the end of 2020)[73], determining the 'appropriate' price of one tonne of CO_2 emissions is a difficult task. Therefore, a wide array of estimates for the price of CO_2 emissions, and hence the appropriate size of the tax, have been suggested. We use different estimates to calculate these costs. In a 2017 report by the High-Level Commission on Carbon Prices, Nobel laureate Joseph Stiglitz and former World Bank chief economist Nicholas Stern advocate a price of between USD 40 and USD 80 per tonne by 2020, and a price of up to USD 100 per tonne by 2030 (High-Level Commission on Carbon Prices, 2017).[74] Parry (2019) proposes different prices for DCs (approximately USD 35 per tonne of CO_2) and for advanced economies (approximately USD 70 per tonne of CO_2). A recent report by the International Monetary Fund (IMF, 2019) suggests a CO_2 price of USD 75. According to this report '*Limiting global warming to 2°C or less requires policy measures on an ambitious scale, such as an immediate global carbon tax that will rise rapidly to $75 a ton of CO_2 in 2030*' (p. viii).

Table 11 / Range of carbon prices (per tonne of CO2)

	EU ETS	Parry (2019) for EM	Parry (2019) for DevC	IMF (2019)	Stiglitz-Stern proposal	Swedish carbon tax
in USD	28	35	70	75	100	123
in EUR	25	31	63	67	89	110

Note: EM = Emerging markets; DevC = Developed countries. EUR/USD conversion at the average 2019 exchange rate. Swedish carbon tax is originally quoted in Swedish krona.
Sources: See indications in the text.

A range of carbon prices is summarised in Table 11: at the low end of the scale, the price of an EUA in the EU ETS hovers at around EUR 25[75] (USD 28[76]), while at the high end the national carbon tax

[71] In the earlier phases of the EU ETS, companies also receive some free allowances ('grandfathering').

[72] See also the EU's website on the ETS: https://ec.europa.eu/clima/policies/ets_en

[73] See: https://www.reuters.com/article/us-china-carbon/china-to-make-national-carbon-trading-breakthrough-by-year-end-official-idUSKBN1ZD05N.

[74] See also: „Sky-high carbon tax needed to avoid climate catastrophe, say experts", The Guardian, 29 May 2017. Available at https://www.theguardian.com/environment/2017/may/29/sky-high-carbon-tax-needed-to-avoid-catastrophic-global-warming-say-experts.

[75] This number refers to the price range before the Corona crisis which led to a severe drop in the EUA price starting end of February 2020. See: https://www.eex.com/en/market-data/environmental-markets/auction-market/european-emission-allowances-auction.

[76] At average EUR-USD exchange rate for the year 2019.

introduced by Sweden amounts to about USD 123 (1,190 Swedish krona).[77] These prices can be directly used to assess the environmental pains from trade attributable to additional CO_2 emissions that are linked to the EU-Mercosur FTA (as reported in Table 10) in monetary terms (Table 12).

Table 12 / Environmental costs in monetary terms linked to the EU-Mercosur FTA

			Implied additional CO_2 emission costs (in million USD) arising from the EU-Mercosur FTA						
	Additional CO_2 emissions		EU ETS	Perry (2019)			IMF (2019)	Stiglitz-Stern	Swedish carbon tax
Exports (from to)	*in '000 tonnes*	*price (USD/tCO₂)*	*28*	*35*	*/*	*70*	*75*	*100*	*123*
Austria → Brazil	45.5		1.3			3.2	3.4	4.5	5.6
EU → Brazil	4,434.6		124.1			310.4	332.6	443.5	546.1
Brazil → Austria	3.8		0.1	0.1			0.3	0.4	0.5
Brazil → EU	3,299.1		92.3	115.5			247.4	329.9	406.3

Source: Authors' own calculations.

4.4. GAINS FROM TRADE PREVAIL, BUT VARY BY THE PRICE OF THE 'PUBLIC BAD'

For the baseline results of the attempted comparison of the gains from trade with the environmental pains from trade, we choose the recent estimate of the IMF of USD 75 as our benchmark (Table 13).

Table 13 / Environmental costs reducing gains from the EU-Mercosur FTA

Exports (from to)	GDP gain from trade (million USD)	CO_2 costs @USD 75	'environmental pain' as % of GDP gain
Austria → Brazil	9	3.4	37.9%
EU → Brazil	2,249	332.6	14.8%
Brazil → Austria	115	0.3	0.2%
Brazil → EU	4,362	247.4	5.7%

Source: Authors' own calculations.

The analysis suggests that the additional CO_2 emissions arising from the EU-Mercosur FTA shave a negligible 0.2% off the GDP gains from trade in the case of Brazilian exports to Austria, whereas in the reverse direction GDP gains are reduced by 38%. In the case of EU-Brazil trade relations, the CO_2 emission costs cut GDP gains by 15% (EU-Brazil) and 6% (Brazil-EU), respectively.

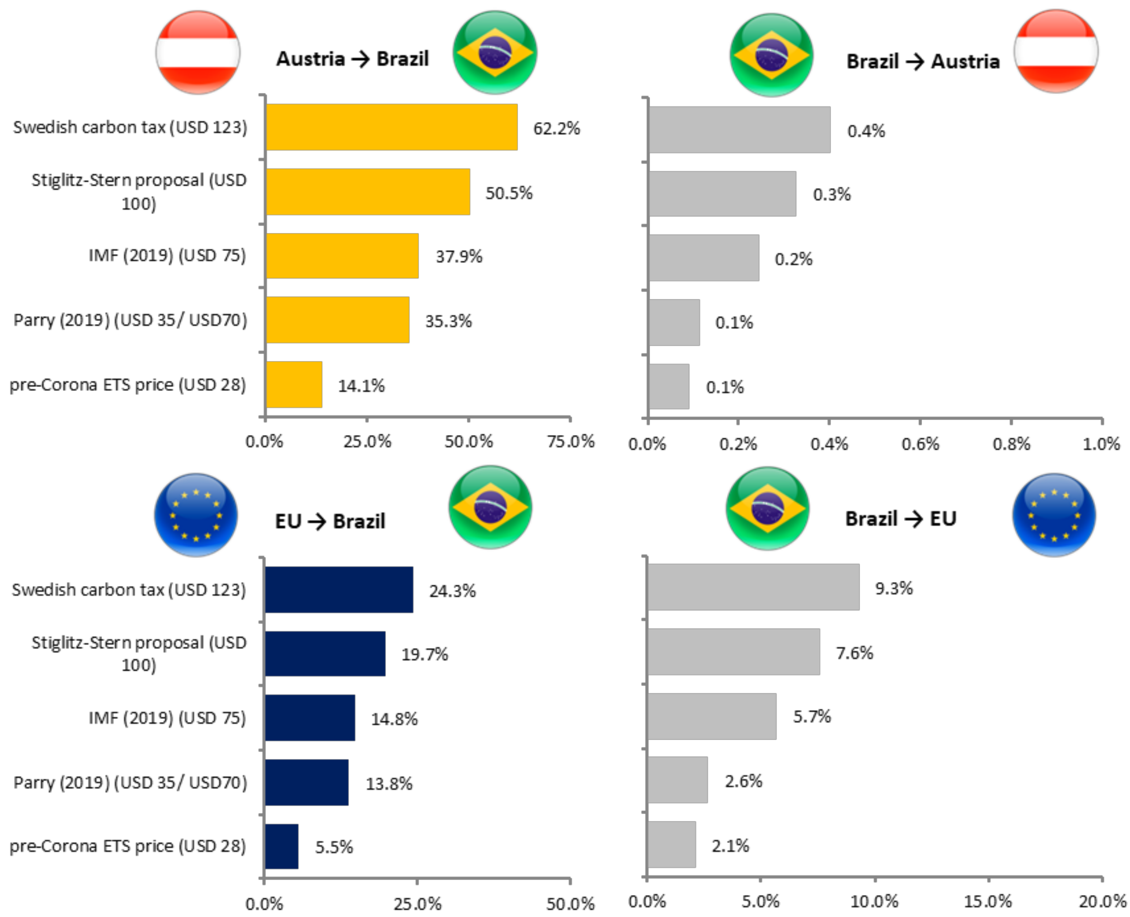
One reason for the large variation in the ratio between gains and environmental pains from trade is again the industry structure, in combination with the industry's CO_2 emission intensity, as was the case in the variation in CO_2 tonnes. What needs to be taken into account as well is the fact that the methodology used by Arkolakis et al. (2012) to calculate the gains from trade is based on the import penetration of a country, rather than on its exports. This explains, for example, why the Austrian GDP gains from trade are very small (USD 9 million) – much smaller than the corresponding Brazilian gains (USD 115 million) – whereas the opposite is true for the CO_2 costs for the two countries. This is

[77] See website of the Swedish government: https://www.government.se/government-policy/taxes-and-tariffs/swedens-carbon-tax/

consistent with the prediction from the gravity model that the expansion of Brazilian exports to Austria will be very modest. This moderate export expansion is associated with comparatively low additional CO_2 emission costs and low GDP gains for *Austria*, because Brazilian exports to Austria are equal to Austrian imports from Brazil. The latter are relevant for the calculation of Austria's gains from trade.

The costs associated with CO_2 – and therefore the share that is trimmed from the welfare gains – certainly depends on the assumed price of CO_2 emissions. This is true across all four trade constellations portrayed in Table 13. The share of the price-induced GDP gain that is offset by the cost of CO_2 emissions is summarised in Figure 18 for the different prices set out in Table 11. The chart clearly shows the implied additional CO_2 emission costs, presented in Table 12. It quickly reveals that even if we assume a very high carbon price, such as the Swedish CO_2 tax, the additional cost of emissions does not totally wipe out the estimated gains from trade, either in trade relations between Austria and Brazil or in relations between the EU and Brazil. Still, Figure 18 illustrates that at elevated carbon prices, the negative environmental externality does expunge a considerable proportion of the welfare gains to be reaped from trade. This can be seen as a reminder that such negative externalities are ideally captured by appropriate policy measures.

Figure 18 / Overview of environmental cost in per cent of GDP gain at different CO2 prices



Note: Mind the different scales on the x-axis.
Source: Results from Table 12 and Table 13 based on the indicated literature.

5. Conclusion

The EU maintains a vast network of free trade agreements with industrialised economies, as well as with developing countries. More recently, these have featured provisions on environmental sustainability. The EU-Japan trade agreement, which entered into force in February 2019, was the first to explicitly stipulate the trading partners' commitment to the Paris Agreement, aimed at mitigating global warming. However, commitments within so-called Trade and Sustainable Development Chapters are not enforceable through the dispute-settlement mechanism. If they were, the EU could temporarily implement punitive measures in case of non-compliance. However, the EU's recommendation for the future relationship with the United Kingdom gives a flavour of a potentially new pathway taken by the EU: It defines the fight against climate change, and in particular the commitment to the Paris Agreement, as an essential element of the partnership resulting in the suspension of provisions of the agreement in the event of infringement.

Today, this is generally not the case, as the EU follows a soft-power approach, which is in contrast to the US, which has (in the past) ensured enforceability through the applicability of its state-to-state dispute-settlement mechanism. Comparing the US to the EU, Bastiaens and Postnikov (2017) suggest that fines and sanctions embedded within the FTAs of the US incentivise trading partners to reform even during the negotiating process, whereas change takes place more slowly during the implementation phase of EU agreements, following a dialogue approach.

The lack of enforceability is, to a large extent, attributable to existing multilateral WTO regulations. In particular, the classification of products (concept of 'likeness') does not allow for the differentiation of tariff and market access concessions along production criteria. What counts in WTO case law instead are the physical properties of goods, besides the capability of products to serve the same use and the perception of consumers regarding products' substitutability.[78]

Labelling (including eco-labelling and fair-trade labelling) that allows consumers to make more environmentally sustainable decisions about their purchases is allowed, but disputed at the WTO. Referring to the 'PPM Problem', the WTO Secretariat is confronted by member countries arguing that discriminatory measures, including labels, based on processes and production methods (PPMs) that leave no trace in the final products should be considered inconsistent with WTO agreements (WTO, 2020). Alongside the soft measure of labelling, the opportunity to apply zero tariffs to, for example, organic farming or fair-trade products could provide significant leverage towards the transition to more sustainable businesses.

Negotiations at the level of the WTO on an Environmental Goods Agreement failed in 2016; given the current stance of the USA with respect to international environmental agreements and concerns raised by China regarding free-riding possibilities for other emerging markets, there is no prospect of a revival in sight. Hence, the EU would have to assume a leading role, taking the risk of trade diversion.

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78 See e.g. Krenek (2020), applied to border carbon adjustments in the Context of the European Green Deal.

For DCs, the EU grants preferential market access under its Generalised Scheme of Preferences, which comprises mainly African and South Asian countries. The EU has assumed the task of promoting environmental legislation through administrative assistance and monitoring in DCs. The GSP+ scheme asks countries to implement 27 international conventions in the areas of human rights, labour standards, good governance and environmental protection. In turn, tariffs are dropped for 66% of all tariff lines. If countries do not fulfil their obligations, the EU can withdraw its unilaterally granted preferences. The major limitation of this instrument is that it currently only applies to eight countries (Armenia, Bolivia, Cape Verde, Kyrgyzstan, Mongolia, Pakistan, Philippines and Sri Lanka), reducing to seven when Armenia is dropping out of the scheme as of 1 January 2022.

The EU is a major trading partner for many DCs and should thus pay attention to the environmental problems caused by the production and trade in goods across different sectors.

It imports a wide range of agricultural products from DCs, particularly tropical fruits, soybean, palm oil and sunflower oil. Import flows clearly mirror the intensive network of FTAs and preferential schemes of the EU with DCs. Export-oriented agricultural production in DCs typically takes the form of large-scale monoculture production, which involves a number of problematic environmental consequences (intensive use of fertilisers, pesticides, intensive use of scarce water resources, loss of biodiversity) and is in many cases linked to deforestation, not only of rainforest.

The EU is a major importer on world markets of aquaculture fish (shrimp, tilapia, salmon), which mainly originates from DCs in Asia, Africa and Latin America. Fish farming can have serious environmental effects when foreign species are introduced into a habitat, due to feeding practices and the need to fight disease with antibiotics. There are big differences in aquaculture practices. Most fish-farming products come from non-certified business and would not comply with the aquaculture regulations of the EU.

Another important sector in the trade relations of DCs with the EU is mining. Despite advances in the concept of the circular economy and its own extraction industry, the EU imports a considerable amount of iron ore, copper, bauxite, lithium, gold and platinum, partly from North America, but to a significant extent from FTA partners in South America and Africa. While mining regulations ensure best practice standards in advanced countries, those standards are poor in DCs. Mining there has serious ecological consequences, with derelict sites, waste dumping, soil contamination, and with pollutants entering the food chain through agriculture and hence causing serious health problems in the local population. A very sad example is artisanal gold mining in DCs, which employs mercury.

The EU is also one of the major importers of textiles and clothing from DCs. For those countries, the textile sector is vital and they benefit from GSP preferences and EU FTAs. However, the textile sector has one of the highest rates of CO_2 emissions, pollutes groundwater in DCs with highly toxic substances without strict wastewater treatment, and uses chemical substances that are often forbidden in the EU.

Despite the strong position of European steel producers in the world market, the EU imports certain types of steel from European neighbours and a few Asian countries. Given that the steel industry is a big source of CO_2 emissions, and also given the low energy efficiency in those countries, the imports have high environmental externalities.

Last but not least, the EU has been shipping e-waste, including lead-acid batteries, and plastic waste to DCs for recycling. Due to missing regulations in those places, the social, health and environmental effects of waste recycling in DCs are enormous. Several Asian countries have recently banned waste imports. Aware of the ecologically problematic treatment of waste in DCs, the European Commission should push its recent initiative to forbid waste exports and provide resources to track illegal export practices.

Trade-related CO_2 emissions are relevant not only in the steel industry, but in essentially all tradeable sectors – though to different extents, depending on the sector's emission intensity. In the absence of appropriate carbon pricing, the CO_2 emissions embodied in trade flows constitute a negative external effect, and as such must be considered to represent 'pains from trade', which can be contrasted with the 'gains from trade' that result from the conclusion of free trade agreements.

The calculation of the additional CO_2 emissions related to the EU-Mercosur FTA shows that these pains from trade are non-negligible. They lop off 15% of the gains from trade (resulting from lower consumer prices) accruing to the EU and 6% of the gains reaped by Brazil. Hence, while the environmental costs from additional CO_2 emissions induced by the EU-Mercosur FTA do not completely wipe out the gains (in terms of gross domestic product) resulting from this agreement, they are still relevant. Moreover, the conclusion that overall the gains from trade are greater than the pains depends heavily on the measurement and pricing of environmental hazards available for analysis.

Despite these clear results, the EU's current FTA strategy – enshrined in the Trade for All strategy of 2015 (EC, 2015b), but in essence already laid down in the Global Europe strategy of 2006 (EC, 2006) – appears inconsistent with the European Green Deal. The latter contains a sort of 'environmental proofing' clause, which stipulates that all EU policies must be aligned with the objectives of the Green Deal. In particular, the Green Deal mentions the option of carbon border taxes for trade relations with countries that do not have a domestic carbon emission tax or an emission trading system comparable to the EU ETS (such as the Mercosur economies).

The Trade for All strategy refers to the EU's commitment to sustainability (in all its dimensions) in its trade policies and to the sustainable development goals under the 2030 Agenda for Sustainable Development, in an attempt to boost the importance of socio-economic and environmental aspects in FTAs. That is why the Commission carries out sustainability impact assessments, involving an in-depth analysis of the potential impacts – including the environmental effects – of FTAs.

However, even a comprehensive impact assessment cannot solve the much deeper conflict between potential carbon border adjustment measures, especially a carbon border tax, as envisaged by the Green Deal, and the striving for an across-the-board tariff elimination in the context of deep and comprehensive FTAs. It seems difficult, if not impossible, to resolve the conflict, given the diametrically opposed policy objectives: dealing effectively with environmental externalities, on the one hand, and removing trade barriers as far as possible, on the other. This trade-off requires tough policy decisions. If the Green Deal is to be taken seriously, priority ought to be given to climate action and to the protection of the environment more generally.

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7. Appendix

A.1. APPENDIX

ACP	African, Caribbean and Pacific states
ASC	Aquaculture Stewardship Council
ASEAN	Association of Southeast Asian Nations
BAN	Basel Action Network
CETA	Comprehensive Economic and Trade Agreement between the EU and Canada
DC	Developing countries
DCFTA	Deep and comprehensive free trade area
DESTA	Design of Trade Agreements Database
EAC	East African Community
EBA	'Everything But Arms' arrangement of the EU
EEX	European Energy Exchange
EFTA	European Free Trade Association
EGA	Environmental Goods Agreement envisaged by a group of WTO members
EGSS	Environmental goods and services sector
EPA	Economic partnership agreement
ETS	Emission Trading Scheme
EU DG MARE	EU Directorate-General for Maritime Affairs and Fisheries
EUA	EU Allowance Unit of the ETS
FAO	Food and Agriculture Organization
FTA	Free trade agreement
GATT	General Agreement on Tariffs and Trade
GHG	Greenhouse gas emissions
GIZ	German Corporation for International Cooperation
GSP	Generalised Scheme/System of Preferences
GVA	Gross value added
IPCC	Intergovernmental Panel on Climate Change
LDC	Least-developed country
MMBtu	Million British thermal units
NDC	Nationally determined contribution
NGO	Non-governmental organisation
NTM	Non-tariff measure
OECD	Organisation for Economic Co-operation and Development
PI	Preferential imports (in figures)
PPMs	Processes and production methods
SADC	South African Development Community
SDG	Sustainable Development Goal
SPS	Sanitary and phytosanitary measure
TAHD	Trade Agreement Heterogeneity Database
TBT	Technical barrier to trade
TREND	Trade and Environment Database
TSD	Trade and Sustainable Development chapters in trade agreements
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
WIOD	World Input Output Database
WTO	World Trade Organization
WWF	World Wildlife Fund

A.2. BENEFICIARIES OF THE EU GSP SCHEME AS OF 1 JANUARY 2019

General GSP

CK	Cook Islands
FM	Micronesia
NR	Nauru
NU	Niue
SY	Syrian Arab Republic
UZ	Uzbekistan
CG	Congo, Rep.
IN	India
ID	Indonesia
KE	Kenya
NG	Nigeria
WS	Samoa
TJ	Tajikistan
TO	Tonga
VN	Vietnam

GSP+

AM	Armenia
BO	Bolivia
CV	Cabo Verde
KG	Kyrgyz Republic
MN	Mongolia
PK	Pakistan
PH	Philippines
LK	Sri Lanka

EBA

BT	Bhutan	GW	Guinea-Bissau
KM	Comoros	HT	Haiti
GQ	Equatorial Guinea	LA	Lao PDR
ER	Eritrea	LS	Lesotho
ET	Ethiopia	LR	Liberia
KI	Kiribati	MG	Madagascar
ST	Sao Tome and Principe	MW	Malawi
SO	Somalia	ML	Mali
SS	South Sudan	MR	Mauritania
SD	Sudan	MZ	Mozambique
TL	Timor Leste	MM	Myanmar
TV	Tuvalu	NP	Nepal
AF	Afghanistan	NE	Niger
AO	Angola	RW	Rwanda
BD	Bangladesh	SN	Senegal
BJ	Benin	SL	Sierra Leone
BF	Burkina Faso	SB	Solomon Islands
BI	Burundi	TZ	Tanzania
KH	Cambodia	TG	Togo
CF	Central African Republic	UG	Uganda
TD	Chad	VU	Vanuatu
CD	Congo, Dem. Rep.	YE	Yemen
DJ	Djibouti	ZM	Zambia
GM	Gambia, The		
GN	Guinea		

Source: EC(2020a).

A.3. CLASSIFICATION OF THE ENVIRONMENTAL GOODS AND SERVICES SECTOR

Eurostat uses the classification of environmental protection activities (CEPA) and of resource management activities (CReMA). Overall, sixteen categories and some sub-categories are differentiated in their data:

CEPA 1	Protection of ambient air and climate, of which:
CEPA 1.1.2	and 1.2.2 Protection of climate and ozone layer
CEPA 2	Wastewater management
CEPA 3	Waste management
CEPA 4	Protection and remediation of soil, groundwater and surface water
CEPA 5	Noise and vibration abatement
CEPA 6	Protection of biodiversity and landscapes
CEPA 7	Protection against radiation
CEPA 8	Environmental research and development, of which:
CEPA 8.1.2	Environmental research and development for the protection of climate and ozone layer
CEPA 9	Other environmental protection activities

CReMA 10	Management of water
CReMA 11	Management of forest resources, of which:
CReMA 11.A	Management of forest areas
CReMA 11.B	Minimisation of the intake of forest resources
CReMA 12	Management of wild flora and fauna
CReMA 13	Management of energy resources, of which:
CReMA 13A	Production of energy from renewable resources
CReMA 13B	Heat/energy saving and management
CReMA 13C	Minimisation of the use of fossil energy as raw materials
CReMA 14	Management of minerals
CReMA 15	Research and development activities for resource management
CReMA 16	Other resource management activities

A.4. LIST OF TRADE AGREEMENTS WITH ENVIRONMENTAL PROVISIONS, 1948-2011

Entry into force	EU	Treaty [Covered/Enforceable]	C/E
1958	●	European Community (EC)	E
1973	●	EC-Egypt	C
1976	●	EC-Algeria	C
1971	●	EC-Overseas Countries and Territories	E
1973	●	EC-Norway	E
1976		Australia-Papua New Guinea (PATCRA)	E
1988		Andean Community (Cartanega)	C
1992	●	EC-Hungary	C
1992	●	EC-Poland	C
1993	●	EC-Bulgaria	C
1993		Economic Community of West African States (ECOWAS)	C
1998	●	EC-Tunisia	C
1992	●	EC-Czech Republic	E
1992	●	EC-Slovak Republic	E
1992		EFTA-Turkey	E
1993	●	EC-Romania	E
1993		EFTA-Bulgaria	E
1993		EFTA-Romania	E
1994		Common Market for Eastern and Southern Africa (COMESA)	E
1994		Costa Rica-Mexico	E
1994	●	European Economic Area (EEA)	E
1994		North American Free Trade Agreement (NAFTA)	E
1994		Turkmenistan-Ukraine	E
1996		Canada-Chile	E
1996		Czech Republic-Estonia	E
1996		Czech Republic-Lithuania	E
1996		EFTA-Estonia	E
1996		EFTA-Latvia	E
1996		Estonia-Slovak Republic	E
1996		Lithuania-Poland	E
1996		Lithuania-Slovenia	E
1996		Macedonia-Slovenia	E
1997	●	EC-Palestinian Authority	E
1997	●	EC-Slovenia	E
1998		Chile-Mexico	E
1998		Latvia-Poland	E
1998		Slovenia-Turkey	E
1999		Bulgaria-Macedonia	E
1999		EFTA-Morocco	E

Data source: Kohl et al. (2016).

Table cont. (2/2)

Entry into force	EU	Treaty	[Covered/Enforceable] C/E
2000	●	EC-Israel	C
2000	●	EC-Morocco	C
2000	●	EC-South Africa	C
2001	●	EC-Macedonia	C
2002	●	EC-Jordan	C
2002	●	EC-San Marino	C
2003	●	EC-Chile	C
2005		Chile-China	C
2006	●	EC-Albania	C
2008		China-New Zealand	C
2008		EFTA-SACU	C
2009		Australia-Chile	C
2009	●	EC-Cameroon	C
2009	●	EC-Cote d'Ivoire	C
2010		Peru-China	C
2000		East African Community (EAC)	E
2000		Jordan-US	E
2001		Bulgaria-Israel	E
2001		Bulgaria-Lithuania	E
2001		Canada-Costa Rica	E
2001		Mexico-Northern Triangle	E
2002		Bosnia & Herzegovina-Turkey	E
2002		Bulgaria-Latvia	E
2002		Croatia-Turkey	E
2002		EFTA-Jordan	E
2003		Australia-Singapore	E
2003		Chile-South Korea	E
2003		Chile-US	E
2003	●	EC-Lebanon	E
2003		Singapore-US	E
2004		Australia-US	E
2004		Japan-Mexico	E
2004		Morocco-US	E
2004		Panama-Taiwan	E
2005		Bahrain-US	E
2005		Singapore-South Korea	E
2006		Central America-Dominican Republic-US	E
2007		Chile-Japan	E
2007		Japan-Thailand	E
2008		Brunei-Japan	E
2008	●	EC-CARIFORUM States EPA	E
2008		El Salvador-Honduras-Taiwan	E
2008		Indonesia-Japan	E
2008		Japan-Philippines	E
2009		Canada-Peru	E
2009		Japan-Switzerland	E
2009		Oman-US	E
2009		Peru-US	E
2010		India-South Korea	E
2011		Canada-Colombia	E

Data source: Kohl et al. (2016).

A.5. ENFORCEABILITY – FORMULATIONS

Example for enforceability of environmental regulations in trade agreements

Not enforceable	Member Countries shall undertake joint policies that enable a better use of their renewable and non-renewable natural resources and the preservation and improvement of the environment
Enforceable	A Party shall not fail to effectively enforce its environmental laws, through a sustained or recurring course of action or inaction, in a manner affecting trade between the Parties, after the date of entry into force of this Agreement. Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between the Parties where the same conditions prevail, or a disguised restriction on international trade, nothing in this Chapter shall be construed to prevent the adoption or enforcement by a Party of measures: (a) necessary to protect public morals; (b) necessary to protect human, animal or plant life or health. Each Party recognises that it is inappropriate to encourage investments by investors of the other Party by relaxing its environmental measures. To this effect each Party should not waive or otherwise derogate from such environmental measures as an encouragement for establishment, acquisition or expansion of investments in its Area

Data source: Kohl et al. (2016), pp. 126-127.

IMPRESSUM

Herausgeber, Verleger, Eigentümer und Hersteller:
Verein „Wiener Institut für Internationale Wirtschaftsvergleiche“ (wiiw),
Wien 6, Rahlgasse 3

ZVR-Zahl: 329995655

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Offenlegung nach § 25 Mediengesetz: Medieninhaber (Verleger): Verein "Wiener Institut für Internationale Wirtschaftsvergleiche", A 1060 Wien, Rahlgasse 3. Vereinszweck: Analyse der wirtschaftlichen Entwicklung der zentral- und osteuropäischen Länder sowie anderer Transformationswirtschaften sowohl mittels empirischer als auch theoretischer Studien und ihre Veröffentlichung; Erbringung von Beratungsleistungen für Regierungs- und Verwaltungsstellen, Firmen und Institutionen.

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