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TRADE AND SDG 13 – ACTION ON CLIMATE CHANGE

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Abstract

This paper assesses the interaction of international trade with climate policies, and the influence of trade on the implementation of SDG 13 (climate change). Although international trade contributes directly to GHG emissions, increased trade can help to achieve development goals in a GHG-efficient manner, provided that GHG emissions are correctly priced everywhere. Given that emissions are not universally priced, the paper examines where policies related to trade may be misaligned with or otherwise hindering climate change objectives. While concluding that the multilateral agreements of the World Trade Organization do not generally prevent governments from pursuing strong domestic climate policy, the chapter does identify potential misalignments. These include import tariffs on environmental goods, barriers to trade in services and domestic policies designed to support local low-carbon industry but which are restrictive of international trade and therefore potentially counter-productive. The paper concludes by stressing the importance of building up resilience in the global trade system in the face of increasingly frequent and severe weather-related shocks.

Keywords: climate change, trade, sustainable development

JEL Classification: F18, Q54

Contents

1. INTRODUCTION

SDG 13 addresses climate change mitigation and adaptation but explicitly "acknowledg[es] that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change".

It is however less detailed than many of the other SDGs, and is noticeably brief on issues around reduction of GHG emissions for climate change mitigation. This is understandable, given that the SDGs were developed at the same time as countries were negotiating a new international agreement on climate change. Now that the Paris Agreement on climate change has been finalised, SDG13 can be seen as rather subservient to the strong commitments made in that agreement on both mitigation and adaptation, as well as the subsequent transparency and review processes of the Paris Agreement.

Nevertheless, it is valuable to consider how trade and trade liberalisation policies may help or hinder action on climate change, including achievement of SDG13. The substance of this chapter is based on two chapters of a major 2015 study on *Aligning Policies for a Low-carbon Economy* (OECD-IEA-NEA-ITF, 2015). That study recognises that climate change policies do not operate in isolation and that other policy areas can strongly influence whether climate objectives are achieved, and at what overall cost. The report provides a broad diagnosis of how various policy measures and regulations may be misaligned and negatively interacting with climate change policies. The misalignment approach is also reflected in SDG 13 through the second of the three targets: "Integrate climate change measures into national policies, strategies and planning". Alignment and interaction of policies is therefore a useful lens through which to address the role of trade in achieving SDG13.

2. TRADE AND GHG EMISSIONS

International trade influences patterns of global GHG emissions in a number of ways. The environmental impacts of trade have often been framed in terms of their scale, composition and technique effects (Grossman and Krueger, 1993; Copeland and Taylor, 2003). When applied to GHG emissions, the scale effect refers to changes in emissions due to the increased economic activity from trade – including increased transport – which usually leads to increased emissions. The composition effect refers to changes in a country's emissions profile as relative prices and resource allocation between sectors adjust in response to international trade. As trade increases, some sectors will expand and others will contract in line with a country's comparative advantage, which could lead to either an increase or decrease in its overall emissions intensity, all else constant. The technique effect refers to improvements in emissions intensity due to innovation in the way goods and services are produced, such as through the international diffusion of lower carbon goods and services via trade. Policy settings can influence how trade, through these three effects, influences GHG emissions.

International trade also acts to move "virtual emissions" around the world, "embedded" in traded products. Usually, GHG emissions are attributed to countries on a territorial production basis, so that all emissions physically released within a country's borders count towards that country's emissions inventory. However, emissions generated in the production of exported goods (or intermediate products) will essentially be "consumed"

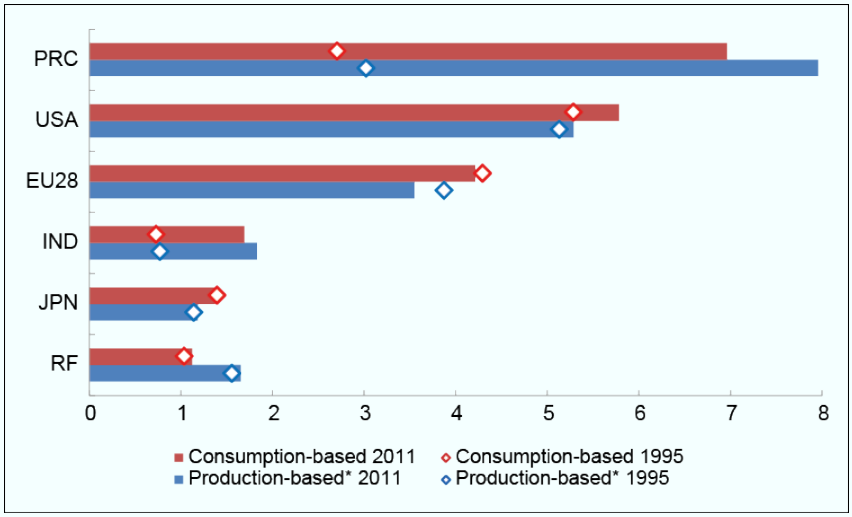
in another country where the final good is purchased. This presents a challenge for emissions accounting. If instead national emissions were to be calculated on a consumption basis – i.e. including estimates of emissions released during the production of imported goods consumed within the territory – this would paint a different picture, though it is technically challenging (Box 1).

Box 1: Traded Emissions: Calculating Emissions Based on Production and Consumption

A comparison of countries' production and consumption emissions can be visualised using data from the OECD's input-output tables combined with IEA data on CO2 emissions. Intellectually it might appear more appropriate to consider consumption-based emissions when assessing countries' efforts to reduce GHG emissions. If perfect information were available, it would be interesting to determine how a global carbon budget could be carved up based on the real emissions influenced by the consumption in each country. This would in theory remove any concerns about "carbon leakage" (see below) and would allow each country to take responsibility for the emissions its economic activity really generates. In practice, at least two issues need to be considered.

First, even though it can be claimed that a country is responsible for the emissions along global production chains generated by its economic activity, that country's possibilities to influence the emissions intensity abroad are limited. This is where an international agreement on territorial emissions continues to play an important role. Second, all GHG data are far from perfect, and agreeing on methods for measuring and comparing consumption-based emissions remains challenging (Lenzen et al., 2013; Nakano et al., 2009; Peters et al., 2011). Nevertheless, estimates such as those presented in the figure below provide a useful illustration of the importance of international trade for GHG emissions allocation. The data are similar to those presented for net export and import by region in the Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report (Agrawala et al., 2014).

Figure 1: Top 6 Countries and Regions in Total Consumption-Based and Production-Based Emissions, 2011
(gigatons of CO2)



* Production-based estimates after reallocation of emissions from non-resident final expenditures on fuel.

PRC = People's Republic of China, RF = Russian Federation, USA = United States of America.

Source: Author, based on OECD input-output tables and IEA CO2 emissions data www.oecd.org/sti/inputoutput/co2 (accessed 12 April 2017).

Another means by which trade influences GHG emissions is by acting as a vector for "carbon leakage". The interconnectedness of the global economy through trade means that countries' core climate policies do not operate in isolation. Short-term costs imposed by climate policies could lead to "carbon leakage" in cases where imports of carbon-intensive goods increase in response to more stringent mitigation efforts. Energy-intensive firms in many countries remain concerned that if domestic climate-related regulation is misaligned with the stringency of regulation in other countries, this will harm competitiveness at the firm and sector level and could lead to industrial flight to countries with less stringent climate regulation, with corresponding economic and employment impacts in the original country. This could be either through altered balance of trade flows or through relocation of capacity. Emissions reduction efforts would also be undermined, as part of the avoided emissions would now occur somewhere else. This potential "carbon leakage" to "pollution havens" has been much discussed in the literature (see examples in Condon and Ignaciuk, 2013; and Arlinghaus, 2015).

So far, there is not much evidence that climate policies have led to much carbon leakage. A recent review of empirical studies found very little evidence of sector-level competitiveness effects arising from carbon pricing systems implemented to date (Arlinghaus, 2015). While the literature is in broad agreement that the EU ETS has stimulated some emissions abatement, no causal link could be established between carbon pricing – including the EU ETS and a range of carbon taxes – and carbon leakage. For carbon taxes, while abatement through decreases in energy intensity was found, only very small impacts on competitiveness were identified (ibid.). Further, no causal effects of the system on employment, output or international trade have been found; observed employment decreases are more likely due to the financial crisis and the decades-long gradual shift away from manufacturing in OECD countries (Warwick, 2013; Pilat et al., 2006).

Further, the industrial competitiveness landscape will also be influenced by the evolution of domestic energy prices (IEA, 2013; Flues and Lutz, 2015). The cost of climate policy is one of many factors in this picture; energy costs, labour costs, exchange rates, transport costs, product specialisation, and local demand markets and regulations are important determinants of industrial competitiveness (IEA, 2013; ECF, 2014).

The absence of evidence of competitiveness effects to date can however be challenged on the grounds that future emissions reduction levels will need to be much higher than implemented so far, with higher costs and possible trade distortions as a result. This, of course, hinges on the relative ambition of climate policies in different countries, including how the Nationally Determined Contributions (NDCs) are implemented and how they evolve in future. NDCs are national mitigation plans for the post 2020 period, submitted to Paris Agreement. While not explicit on trade, the Agreement contains a transparency and ambition mechanism designed to increase trust between countries on the relative ambition of their actions (Box 2).

Despite these various influences on patterns of emissions, trade itself is not the climate villain. International trade does of course have direct emissions implications due to GHG emissions from transport (as well as other direct environmental impacts such as invasive alien species in containers and ballast water). But when the life-cycle emissions of goods are taken into account, a different picture may emerge. Comparing life-cycle emissions means looking at the GHG emissions produced at all stages of a product's life, such as production, transport, end-use and disposal. If the production process in another country is much less emissions-intensive than in the country where the good is to be consumed, then overseas production may still have lower emissions

despite the emissions from international transport. How a product is produced is often more important than where it is produced. This can be an important factor where policies are designed to favour local production over imported products on environmental grounds.

Further, the principle of free trade and comparative advantage suggests that over the long term, free and fair trade should lead to a more efficient (and resource-efficient) outcome for the same level of economic output, assuming that climate-related externalities are correctly priced everywhere. In 2050, feeding 9 billion people all striving for wealthier lifestyles will be less resource-intensive with free trade than it would be without it, again assuming that GHG externalities are correctly priced.

The problem is that not all GHG emissions are yet correctly priced. This means that it is important to assess how international trade is likely to affect global GHG emissions, and where policy misalignments could lead to higher GHG emissions.

Box 2: Trade and the Paris Agreement

The conclusion of the Paris agreement in 2015 is a landmark in international cooperation on climate change. The "hybrid" nature of the agreement – a universal commitment to limit warming accompanied by country-determined action plans – allows for countries to steadily increase their ambition while subject to an international transparency and review process to measure progress. Interestingly, the word "trade" is not mentioned in either the Paris Agreement or the accompanying technical decision by the Conference of the Parties. The underlying text in the original Framework Convention on Climate Change (agreed in 1992) can be assumed still to hold: "Measures taken to combat climate change, including unilateral ones, should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade". This mirrors the principles in international trade law discussed below, although the WTO agreements do not include any specific mention of climate change. The bottom-up nature of country commitments made under the Paris Agreement makes it ever more important that international trade law does not act to prohibit governments in pursuing legislation aimed at achieving ambitious climate goals.

The rest of this chapter examines how trade policies may be misaligned with countries' objectives on climate change. First, it looks for misalignments within international trade agreements and trade rules themselves. It then focuses on where domestic policies – including those intended to foster green growth – may be hindering the diffusion of low-carbon goods through international trade. Finally, the role of policy in improving the resilience of the trading system in the face of physical climate impacts is briefly considered.

3. POTENTIAL MISALIGNMENTS WITH INTERNATIONAL TRADE RULES

The international trade regime includes rules agreed multilaterally under the WTO, rules agreed bilaterally or plurilaterally through regional trade agreements (RTAs), and jurisprudence from prior disputes relating to trade rules. Taken as a whole, does the trade regime act to restrict governments' ability to pursue ambitious climate policies? The following sections suggest that, in general, the trade regime is not in itself misaligned with climate objectives.

3.1 Multilateral Agreements under the World Trade Organization

The WTO's primary agreement governing goods trade, the General Agreement on Tariffs and Trade 1994 (GATT), does not in itself prevent countries from pursuing climate policies. The GATT lays out the core principles for free trade. Key among these are the principles of non-discrimination between "like products" from different trading partners (most-favoured nation treatment) and between "like products" of foreign and domestic origin (national treatment). The question of whether products that differ only in the way they are produced – such as differences in GHG emissions during production – should be considered "like products" has been extensively debated by commentators and in ongoing WTO case law.

However, the GATT also allows for countries to justify policies on environmental (and other) grounds through Article XX, even if the measures partly violate one or more of the core principles.[1] Although the exemptions do not specifically mention climate change (the text dates from 1947), there is no clear evidence that the GATT in itself has acted to discourage countries from pursuing policies relating to climate change. In the few instances that WTO case law has tested whether climate change is an appropriate reason for justification under Article XX, opinions have generally been favourable (Tran, 2010).

Several of the more specific WTO agreements are also relevant to policies and measures targeting climate change objectives. One particular example is the Agreement on Subsidies and Countervailing Measures (SCM). Subsidies for the deployment of low-emitting technology have been one of the few policy tools readily available for governments seeking to take fast action on the low-carbon transition, given the barriers often faced when seeking to implement carbon pricing systems.

In general, the WTO Dispute Settlement Mechanism has allowed for jurisprudence to build up on an as-needed basis, with the application of trade rules to particular cases being clarified through emerging case law, including for measures related to climate change. In the case of subsidies, the dispute settlement process can lead to authorised unilateral trade remedies adopted by WTO members. Remedies such as anti-dumping and countervailing duties are legitimate, WTO-sanctioned responses to injuriously dumped or subsidised imports.[2] Recently, unilateral remedies have been applied in two directions within the same low-carbon industry. For example, the United States first imposed anti-dumping and countervailing duties on finished solar panels from the People's Republic of China (PRC). In response, the PRC imposed similar measures on polysilicon precursors from the United States. The result of this escalation is reduced overall trade and increased costs in the supply chain (see review of studies in OECD,

[1] If a policy measure related to climate change mitigation seeks exemption from goods trade rules as a necessary measure for the low-carbon transition, the measure must satisfy the content of one of the paragraphs of Article XX. In most environmental cases this means the measure must be "relating to the conservation of exhaustible natural resources" or be "necessary to protect human, animal or plant life or health". The measure seeking exemption must also satisfy the chapeau of the article – that is, not to constitute an "arbitrary or unjustifiable discrimination between countries where the same conditions prevail" or a "disguised restriction on international trade".

[2] For countervailing duties, the implementing party must demonstrate that "specific" subsidies were provided that caused "injury" to the domestic complaining industry before countervailing duties can be imposed. Export subsidies and local content subsidies – which are generally prohibited – are deemed specific. For all other subsidies, the subsidy must be shown to be limited to a specific company or industry, or group of companies or industries. Subsidies that are not prohibited, are not specific or do not cause injury are permissible under WTO rules.

2015). Although policy options for de-escalating trade remedies exist,[3] the costs incurred all across value chains and the uncertainty created for investors reinforce the importance of ensuring that domestic subsidies are designed in accordance with WTO principles, including the SCM.

3.2 Regional Trade Agreements

Outside of the WTO, governments have for many years pursued bilateral or plurilateral trade and investment agreements, often with the aim of creating closer ties with trade partners or moving towards deeper regional economic integration. Increasingly, these RTAs include specific environmental provisions (or environmental side agreements) which can be used to encourage more stringent environmental action (OECD, 2007; George, 2014). For example, provisions can include agreements to not weaken environmental laws in order to seek increased incoming international investment, and agreements to ensure that judicial enforcement capacity is available (e.g. the Peru-US and CAFTA-DR-US agreements; see US GAO, 2014 for a review). The effectiveness of these provisions depends on their degree of ambition, the extent to which they are binding on the parties, the stringency of their enforcement, and the nature and extent of co-operation between or among the parties to implement the provisions.

More recent RTAs aim to tackle behind-the-border barriers to trade in a more profound way than the WTO's Agreement on Technical Barriers to Trade (TBT). As well as chapters related to environment or sustainable development, these RTAs tend to include provisions on regulatory co-operation aiming to streamline regulations to reduce the cost of doing business internationally. Although this co-operation may cover environmental regulations, including those relevant to climate change mitigation, co-operation does not impede each party's sovereign right to regulate. Concerns have also been raised that investor-protection clauses, if included in RTAs where all parties have robust domestic investor protection laws, could be detrimental to the development of climate change policy measures. However, investor protection clauses have been used for many years and no conclusive evidence of this effect has been documented (Australian Productivity Commission, 2010; Tietje et al., 2014; BIAC, 2015).

3.3 Environmental Goods Trade Liberalisation

Increased trade in environmental goods can help to mitigate environmental problems while also supporting economic growth. Most OECD countries have, over time, reduced their import tariffs for environmental goods, including those relevant to climate change mitigation. However, formal tariff-based trade barriers still exist for environmental goods, in particular outside the OECD area, with the result that the diffusion of some technologies important for addressing GHG emissions is hindered and costs in those countries are higher than they should be.

[3] These include reductions in the level of the duty imposed (not seeking to counter the full value of the dumping), reducing the scope (e.g. to specific product or import value) or targeting only companies with a dominant anti-competitive market position (Wu and Salzman, 2014; Swedish National Board of Trade, 2013).

The prospect of a multilateral agreement at the WTO with commitments on environmental goods tariffs has been discussed many times since 2001, so far with little progress in formal negotiations (Steenblik, 2005; Sauvage, 2014). Progress has been made outside of the WTO on a plurilateral basis. The Asia-Pacific Economic Cooperation (APEC) countries took a leading role in environmental goods trade by agreeing on the APEC List of Environmental Goods and committing to reduce applied tariff rates of the listed products to 5% or less by the end of 2015. In 2014, a group of WTO members, including OECD and non-OECD countries (among them the PRC), commenced new plurilateral negotiations towards an Environmental Goods Agreement that is likely to include goods that are important for climate change mitigation (or are components thereof). If concluded successfully, such an agreement could potentially be formalised under the WTO in due course. Technical challenges remain, including reaching agreement on which goods should be considered for tariff liberalisation, given that many goods also have clearly non-environmental uses and are not separately identified in the Harmonized System (HS), the international classification and coding system used to track international trade (Steenblik, 2005; Sauvage, 2014).

Non-tariff barriers (NTBs) also hinder environmental goods dissemination sometimes to a larger extent than tariff barriers. These include, for example, burdensome customs procedures, testing and certification requirements, and local-content requirements such as those described under the domestic measures section below. Although the current negotiations on trade in environmental goods cover only tariffs and not NTBs, successful conclusion of an agreement on reducing tariffs for environmental goods would potentially pave the way for future agreement extending to non-tariff barriers.

4. MISALIGNMENTS ARISING THROUGH DOMESTIC POLICIES RELATED TO TRADE

Within the framework of the international trade regime, the trade effects of some domestic policies can have an important bearing on their effectiveness to support the low-carbon transition. These policies are examined in this section.

4.1 “Local-content Requirements” for Renewable Energy

As part of their recovery from the financial crisis, many countries have implemented various forms of industrial policy, albeit often under different names (Evenett et al., 2009; Warwick, 2013). Where such policies directly support emissions-intensive investment, such as new subsidy arrangements favouring fossil fuels, misalignments with the low-carbon transition may exist that also distort international markets. These are covered in other chapters of this report.

A number of these newly introduced policies aim to promote green growth through the stimulation or creation of domestic industries manufacturing low-carbon power generation equipment. This trend has been referred to as the rise of “green industrial policy” (e.g. Wu and Salzman, 2014; Rodrik, 2013). Such measures may initially appear to be beneficial for the low-carbon transition. But various analyses have highlighted that if the measures are designed to be overly restrictive of international trade, they are likely to lead to higher prices for both domestic and international suppliers, with the overall effect of hindering uptake of low-carbon electricity-generating technologies.

Box 3: Local-Content Requirements in Renewable Energy Markets

Local-content requirements (LCRs) have increasingly been used to support the development of renewable energy. OECD research shows that LCRs linked to wind and solar PV have been planned or implemented in at least 21 countries, including 16 OECD countries, mostly since 2009. LCRs are typically imposed as a precondition for access to financial support schemes such as feed-in tariff (FiT) programmes or as part of eligibility requirements in renewable energy public tenders. Some countries have also designed LCRs as eligibility criteria for direct financial transfers such as subsidised loans and loan guarantees from government agencies and national development banks, such as in Brazil. In some cases, different LCR ratios are used depending on the technology used in downstream installations, such as India (OECD, 2015; OECD et al., 2013; Bahar et al., 2013).

To highlight the effects of LCRs on international investment, OECD empirical analysis indicates that while FiT policies play an important role in attracting international investment in solar PV and wind energy, LCRs have a detrimental effect on global international investment flows in these sectors and hinder the effectiveness of FiT policies when attached to them. The estimated detrimental effect of LCRs is slightly stronger when both domestic and international investments are considered. This indicates that LCRs do not have positive impacts on domestic investment flows (OECD, 2015). At the same time, recent OECD Computable General Equilibrium (CGE) modelling has shown an array of expected negative impacts of LCRs on trade across different sectors (Stone et al., 2015).

The rise of LCRs for renewable energy has led to at least five WTO disputes since 2010, highlighting the importance that governments place on new renewable energy industries. The most recent high-profile example concerned the National Solar Mission in India.

The Jawaharlal Nehru National Solar Mission, launched in 2009, uses a competitive bidding process for new solar power tenders. The mission is planned over three phases from 2012–22, with the original aim of 20GW of on-grid capacity and 2GW of off-grid solar installations. In 2015 this target was increased to 100GW

Under phase I (2010-13) of the National Solar Mission, developers had to abide by a 60% LCR for projects using PV crystalline silicon (c-Si) cells and a 30% LCR for solar thermal and concentrated solar power, to qualify for the 25-year power purchase agreement (PPA) with a fixed FiT. PV modules using thin-film technology were exempted from the 60% LCR, unlike projects using PV panels with c-Si technology. Since October 2012, only locally manufactured PV modules can qualify for the "Off-grid and Decentralized Solar Applications" support scheme (which provides a capital subsidy of 90% of the benchmark cost for solar-PV power projects below 100 kW).

During Phase II (2013–17), the auction for 750 megawatts (MW) of PV capacity included a mandatory LCR, to be eligible to receive Viability Gap Funding.1 Under international pressure, the LCR was reduced in scope to cover only a part of the total capacity auctioned. Nevertheless by 2017 more than 1GW will have been awarded with the LCR. Against this backdrop, the United States filed a complaint against India at the WTO. In February 2016 the WTO Dispute Settlement Body ruled that the LCR was not compliant with the WTO TRIMs agreement, and in September 2016 the Appellate Body upheld the ruling.

This ruling added further precedent to a previous example of a successful WTO challenge against an LCR introduced by the Canadian province of Ontario in connection with its FiT subsidy scheme. In that case, the LCR was found to be in breach of GATT (General Agreement on Tariffs and Trade) and TRIMS (Agreement on Trade-Related Investment Measures) commitments, though the FiT scheme itself was not found to be in breach of the SCM (Agreement on Subsidies and Countervailing Measures). For more information on these WTO disputes, see https://www.wto.org/english/tratop_e/dispu_e/cases_e/ds456_e.htm and www.wto.org/english/tratop_e/dispu_e/cases_e/ds412_e.htm (accessed 28 April 2017).

Box 3 considers the specific and highly visible example of local-content requirements (LCRs) for renewable energy equipment. These can be considered a policy misalignment for the low-carbon transition because they can raise the overall costs of downstream activities (e.g. installation). New OECD work indicates that LCRs have hindered both competitiveness and international investment in solar photovoltaics (PV) and wind energy. The increasingly globalised nature of value chains for wind and solar technology means that intermediate products cross borders many times. LCRs are usually intended to support mid-stream manufacturers, and the resulting market distortions can increase costs for actors further down the value chain. If these actors are in the same country, the policy may have a net negative effect for the domestic sector it is trying to support. Overall, such policies are likely to raise costs all across the production chain (Bahar et al., 2013; OECD, 2015).

The risk of higher overall costs also exists in relation to other trade-impacting "behind the border" measures in the same sectors. These include measures with more direct trade implications (such as local-equity requirements and export quotas) and those that deter international investment and therefore lead to overall less efficient supply chains (e.g. national standards that favour domestic producers or more informal measures that favour local enterprises over foreign ones). The prevalence of these measures – and the WTO disputes associated with them – highlights the need for policy makers to better align and take a more holistic approach to trade and investment policies in order to provide effective policy support to achieve the low-carbon transition.

5. BARRIERS TO TRADE IN SERVICES

Over time, the global importance of trade in services has risen significantly. Global value chains and highly streamlined international logistics networks have made international deployment of services a key part of modern trade. The value created by services as intermediate inputs now represents over 30% of the total value added in manufactured goods. The international trade regime addresses services trade through the General Agreement on Trade in Services (GATS), agreed in 1994. However, negotiations on specific liberalisation commitments under the agreement have faltered over time and many barriers to trade in services remain in the form of domestic regulations.[4] Some of these are important for the low-carbon transition.

Trade in services is important for climate change mitigation in a number of ways. In general, more efficient services sectors contribute to improving productivity and enhancing competitiveness across the whole economy – in manufacturing as well as in services sectors themselves (OECD, 2014). Greater productivity will often lead to lower energy use and emissions intensity. Also, as economies become ever more interconnected through value chains, a trend towards "servicification" can be identified, with companies increasingly turning to provision of services attached to the delivery of goods. For example, a jet engine manufacturer is more likely to lease its engines to airlines, and an industrial turbine manufacturer is more likely to lease its turbine. This usually leads to better maintenance and performance of the equipment, resulting in lower fuel use and lower emissions. It is also likely to lead to better overall utilisation rates of physical capital, thereby contributing to a more energy efficient economy. But to be effective, this "servicification" of the economy requires smooth international trade in services (Swedish National Board of Trade, 2014).

[4] Progress is being made on a plurilateral basis, In 2013, a group of 23 WTO members started plurilateral negotiations on a specific Trade in Services Agreement (TISA) that follows GATS principles and aims to establish commitments between signatories in areas such as licensing, financial services, telecoms, e-commerce, maritime transport, and professionals moving abroad temporarily to provide services.

Modern global value chains (GVCs) have become increasingly international, connected and reliant on domestic policies that are open to international trade and fair to international investors. Intermediate goods may cross borders many times in their journey from primary material to finished goods. Expedient movement of goods, machinery and people is essential to ensure that the global production machine has a sufficient supply of services and materials to keep it running smoothly.

Recent OECD work on global value chains (OECD, 2013) points out that increasingly the "just-in-time" nature of value chains makes them quite vulnerable to external shocks. The OECD defines global shocks as "rapid-onset events with severely disruptive consequences covering at least two continents" (OECD, 2011). Two recent examples are highlighted in OECD (2013), where major physical events in one part of the world caused measurable knock-on effects for global industries. One example, not climate-related, is the earthquake and tsunami in Japan in 2011, which had considerable knock-on effects on the global electronics and automotive industries. Another example is flooding in Thailand in 2012, which at its peak covered areas accounting for 45% of the world's manufacturing capacity of computer hard disk drives and led to global disruptions not only in the computer industry but also the automotive industry (OECD, 2013).

Box 4: Services Trade Restrictiveness Index (STRI)

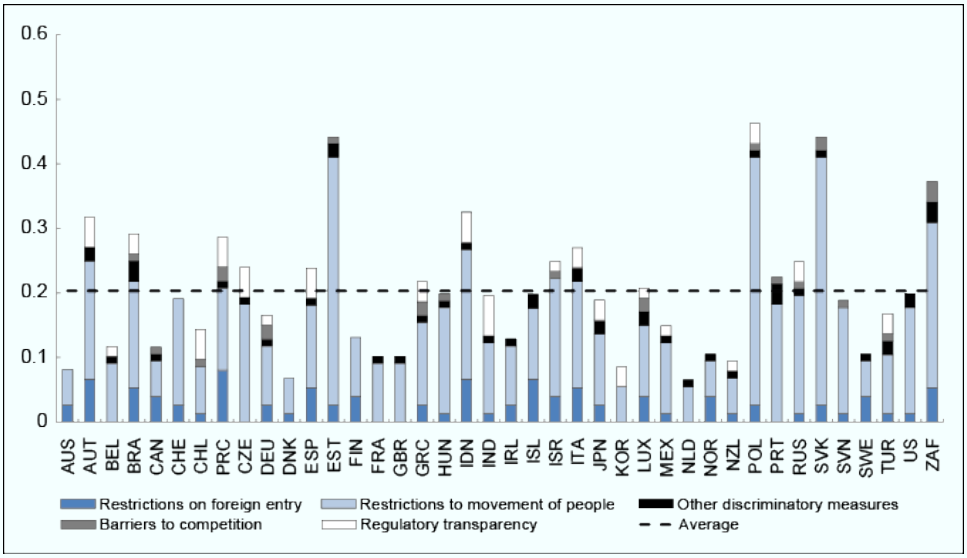
Since 2014, the OECD has been tracking barriers to services trade across countries and sectors through the Services Trade Restrictiveness Index (STRI). The STRI contains a regulatory database of laws and regulations in existence today, and composite indices that quantify identified restrictions across five standard categories, with values between zero and one. A score of zero corresponds to complete openness to trade and investment, while being completely closed to foreign services providers yields a score of one.

The STRI provides a unique diagnostic tool, generating a picture of services restrictiveness at the national level and by sector, covering 18 sectors in 40 countries. It allows benchmarking for individual countries and relative to global best practice, and enables countries to quickly see where the outlier restrictions are and where potential bottlenecks exist.

For the first time, comprehensive and comparable information is available for policy makers to scope out reform options and assess their likely effects; for trade negotiators to clarify those restrictions that most impede trade; and for businesses to understand entry requirements for foreign markets. The knock-on consequences for downstream users of these services are demonstrable. The STRI in combination with the OECD-WTO TiVA-GVC database are powerful tools for further analysis of regulatory spillovers in global value chains and the interdependence between sectors in an interconnected and increasingly digital world.

Figure 2 shows an example of STRI data for engineering services, a key service area relevant to climate change technology. Engineering services are labour-intensive, particularly at the high-skill level. Therefore, measures categorised under "Restrictions to movement of people" have the strongest impact in the restrictiveness levels for these services. The other policy category that affects the degree of restrictiveness in engineering services relates to "Restrictions on foreign entry". Some countries maintain ownership restrictions on the basis of qualifications and licensing, at times coupled with residency and licensing requirements for board members and managers of engineering firms. More open services markets improve competitiveness and productivity both in the services sectors in question and downstream industries using services as inputs. Engineering services underpin the infrastructural development of the economy and the smooth functioning of essential public services. Hence, promoting the cost-effectiveness and quality of these services can represent a source of economic growth and create significant spill-over effects.

Figure 2: Services Trade Restrictiveness Index* by Policy Area: Engineering



Note: *The STRI indices take values between zero and one, one being the most restrictive.

Source: OECD (2014), "Services Trade Restrictiveness Index: Policy brief," OECD, Paris, available at: www.oecd.org/tad/services-trade/STRI%20Policy%20Brief_ENG.pdf (accessed 12 April 2017).

6. RESILIENCE OF THE MODERN TRADE SYSTEM TO CLIMATE CHANGE

Climate-related events such as flooding and severe storms are likely to intensify due to climate change, thus increasing the systemic risk inherent in GVCs. Companies are already responding by complementing "just-in-time" with "just-in-case" contingency plans and seeking trade-offs between cost minimisation and security of supply. Companies are seeking to diversify risks geographically and between different suppliers, and there is some evidence of a trend towards "back-shoring" or "near-shoring" with GVCs being splintered into shorter chains. The OECD has helped countries understand their vulnerability to shocks via the TIVA database (OECD et al., 2013), and is helping governments to better understand GVC risks through the G20-OECD Framework for Disaster Risk Management and the *OECD Principles for Country Risk Management* (OECD, 2013).

When considering alignment issues in national strategies for climate change adaptation and resilience, it will be increasingly important to consider how each country's position and role in GVCs – and the national policies shaping the participation of firms in those value chains – could be developed to ensure resilience in the face of increasingly frequent and severe weather-related shocks.

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