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Trading in Green

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Policy Notes on Climate Change and Trade in Indonesia

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FAST-FORWARD CLIMATE ACTION

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Executive Summary

This document is a compilation of three policy notes that were prepared as background to the Indonesia Climate Change and Development Report (CCDR).

Policy Note 1: To position itself to benefit from the global transition to a low-carbon economy, Indonesia needs to adapt to new sources of international demand, adjust its existing productive capabilities, and cultivate new green industries. While the carbon intensity of Indonesia's international trade has declined, absolute CO_2 emissions embedded in trade have increased. Indone-

sia has untapped potential in exports of green goods and technologies. Green goods imports represent an important source of access and transmission of new green technologies, underscored also by the fact that Indonesia's green goods imports are more technology-intensive than exports. The extent to which Indonesia can competitively export green, technologically sophisticated products is still low relative to other countries, however, its potential to diversify into these products is relatively high.

Policy Note 2: Firms, not nations, compete in international markets. The analysis of firm-level trade in green goods in this note highlights firm-level dynamics in exports and imports of green goods and services, and the opportunities and challenges faced by firms trading such products. The results show that the degree of involvement of Indonesian firms in international trade matters in trade of green goods, especially for exports. Two-way traders–firms that both export and import–export more green products, trade in higher-technology green goods, and have higher survival rates in export markets. Although firms' entry rates in green goods exports is lower compared to other products, the number of firms engaged has been increasing, signaling potential to boost Indonesia's competitiveness and trade in green goods. Trade policies such as import and export approvals, harmonization of standards, tariff and non-tariff measures, and access to critical foreign skills, are important to lowering barriers for Indonesian firms to enter, stay, and be competitive in green goods and services markets.

Policy Note 3: An enabling trade policy framework will not only play a critical role in boosting Indonesia's green competitiveness and enabling access to climate-friendly products and technologies critical for both mitigation of, and adaptation to, climate change. Targeted measures such as liberalizing remaining tariffs on imports of green goods, streamlining and eliminating unnecessary non-tariff measures including harmonizing national standards on green goods with international ones, reducing the stringency of local content requirements, including enforceable environmental provisions in trade agreements, and participating in plurilateral and multilateral trade policy initiatives on green goods are needed to create this enabling trade policy framework in Indonesia.

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INDONESIA'S GREEN INTERNATIONAL COMPETITIVENESS AND GREEN TRADE

Introduction

Although Indonesia's economy has diversified over the past decades, natural resource extraction remains a key sector for both the domestic economy as well as international trade. Overall, exports of primary products and resource-based manufactures make up over 60 percent of Indonesia's total exports. Indonesia is a large exporter of fossil fuels and the world's largest palm oil exporter, with a 55 percent share in total global exports (International Monetary Fund, 2021). Coal made up 11 percent of exports, followed by palm oil (8 percent), and petroleum gas (4 percent) in 2019. Over 60 percent of the total coal production was exported in 2019, making Indonesia the world's largest coal exporter (International Energy Agency 2021). The government receives royalties from oil, gas, and coal mining, equivalent to 7.5 percent of total government revenue.[1]

Indonesia's ability to diversify away from primary products, reduce carbon emissions, adapt to climate change, and transition to a low-carbon economy is strongly interlinked with trade and trade policy. Despite the declining importance of trade for Indonesia's economy over the two decades to 2020 (trade openness more than halved, falling from 72 percent in 2000 to 33 percent in 2020), it is expected that trade and trade policies will play a crucial role in climate adaptation and mitigation efforts. On one hand, increased global demand for goods and technologies to reduce carbon emissions and enable the climate transition present Indonesia with opportunities to diversify production and exports into green products and technologies. On the other hand, access to lower cost environmentally friendly goods and technologies through imports will also enable Indonesia's own climate transition. More generally, however, trade is linked to climate change through different mechanisms, including by affecting the location and scale of production; influencing consumption decisions; affecting the international movement of goods and services; and through the transfer of technologies that may lead to lower emissions in production.

1 Oil, gas, and coal mining royalties were 4.3 percent, 1.9 percent, and 1.3 percent of total revenue, respectively, in 2019 (IMF 2021).

To position itself to benefit from the global transition to a low-carbon economy, Indonesia needs to adapt to new sources of international demand, adjust its existing productive capabilities, and cultivate new green industries. Indonesia has an untapped potential for exports of green goods. With exports of green goods of US$5.8 billion (3.6 percent of total goods exports) in 2020, Indonesia is far below the global and East Asia and Pacific (EAP) average at 12 percent and 9 percent, respectively. The analysis in this note shows that exports of Environmentally Preferable Products; Waste Management, Recycling and Remediation; and Cleaner or More Resource Efficient Technologies/Products are the green product categories that exhibit the highest Revealed Comparative Advantage (RCA) for Indonesia, while at the same time being the closest to current production facilities (proximity). This makes them ideal for potential export growth areas.

Trade in green goods and technologies offer Indonesia not only previously untapped export opportunities but also access to environmental technologies to combat climate change. There are a range of goods, services, and technologies that will be crucial for countries' climate mitigation and adaptation strategies–for example, wind and hydropower turbines, solar water heaters, photovoltaic cells, tanks for the production of biogas, and landfill liners for methane collection. Trade in such green goods and technologies enables and facilitates Indonesia's access to global markets for green goods and access to cheaper and higher-quality green technologies. Accessing high-quality and affordable environmental goods in global markets would increase their use within Indonesia and stimulate innovation and technology transfer. In turn, increasing trade in clean technologies can also promote development, job creation, and innovation while promoting climate change mitigation and adaptation.

Apart from meeting its ambitious Nationally Determined Contribution (NDC), trade and trade policy will also play a significant role in Indonesia's Green Growth Program. The program focuses on three priority sectors: (i) sustainable energy; (ii) sustainable landscapes; and (iii) sustainable infrastructure in Special Economic Zones (SEZs). The objective of the program is to scale up green growth and to increase inclusive green investment in priority sectors, leading to reduced emissions and healthier, more productive ecosystems that will

need to be enabled by the right policies, among which trade and investment policies will play a major role.

In addition to the climate transition, structural forces in the wake of the COVID-19 pandemic are expected to reshape the international trading landscape and present major opportunities and challenges for Indonesia. The economic shock induced by the COVID-19 pandemic combined with the ensuing rise in shipping costs and supply chain disruptions are likely to significantly alter the international trading landscape and reconfigure global value chains. A shift away from just-in-time supply chain management for businesses, combined with a renewed focus on "near-shoring", will alter international trade and transportation flows and likely have a positive impact on reducing carbon emissions.

The rest of this note focuses on crucial aspects related to Indonesia's green competitiveness and diversification potential. The first note analyzes the carbon content of Indonesia's trade flows, the second note explores the landscape of Indonesia's trade of green goods, the third note focuses on identifying specific areas of Indonesia's green international competitiveness potential, and the last note offers policy recommendations.

How Green is Indonesia's Trade: Carbon Content

The carbon intensity of Indonesia's trade flows has seen a significant decline over the years, more than halving since 2005. While imports and exports in goods and services each more than doubled–from under US$100 billion in 2005 to over US$200 billion in 2019, CO_2 emissions embedded in Indonesia's trade flows have only increased by 9 percent (Figure 1). This overall decline in CO_2 intensity can be attributed to an increase in the carbon intensity of imports while, conversely, the carbon intensity of exports fell slightly over the same period. Overall, CO_2 emissions embedded in Indonesia's trade flows add up to 564 and 672 metric tons of CO_2 for every US$1 million of exports and imports, respectively

(Figure 2). This is slightly lower than the carbon intensity of exports of Malaysia and Thailand, but higher than that of the Philippines.

CO_2 emissions embedded in Indonesia's exports are mainly sourced domestically rather than imported (Figure 3), while imported CO_2 emissions are mainly consumed, rather than re-exported (Figure 4). An estimated 84 percent of exported CO_2 emissions originate from domestic sources, suggesting that international green competitiveness will require making changes in domestic production. This signals that there is room for greening inputs through imports and domestic reform for firms to change processes. On the other hand, and consistent with this observation, imported CO_2 is mainly consumed (86 percent) and only a small share is re-exported. In terms of global ranking, this puts Indonesia's carbon content of trade at the 19th and 20st rank, for exports and imports respectively.[2] Among peer countries in the EAP region, however, Indonesia remains at the top–with the highest CO_2 emissions embedded in trade.

Around 60 percent of CO_2 emissions embedded in exports mainly stem from agriculture (including mining and quarrying), manufacturing, and coal and petroleum products (refined and plastic). During the 2005-18 period, nearly one-half of the emissions embedded in exports were accounted for by other manufacturing (food, textiles, wood, and paper products at 25 percent) and agriculture, mining and quarrying (21 percent, Figure 5). An additional 14 percent was embedded in exports of coal and petroleum while transport and storage made up 12 percent). There has been a notable increase in export CO_2 emissions stemming from transport and storage as well as basic metals, while the emissions from exports of coal and petroleum products have been declining.

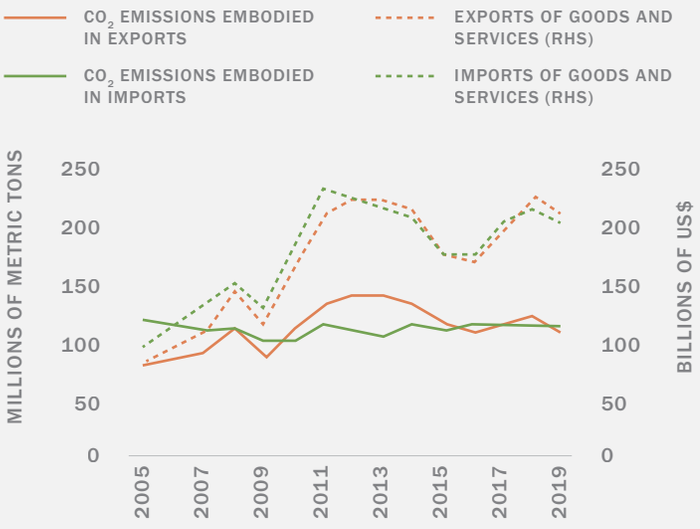
Nearly one-half of CO_2 emissions embedded in imports are from transport (including storage), basic metals, and coal and petroleum products that account for the largest sectoral shares. On the imports side, in the 2005-18 period, emissions embedded in imports of transport and storage (17 percent), basic metals (15 percent), and coal and petroleum products (refined and plastic) (13 percent) accounted for nearly one-half of all emissions in imports. Other manufacturing (at 12 percent) is also significant (Figure 6). Unlike exports, CO_2 emissions in transport and storage imports have declined over time, while emissions in basic metals and computer and other elec-

2 IMF Climate Change Dashboard based on 2019 prorated data.

3 CCDR Trade Note 3 "The Role of Trade Policies in Indonesia's Green Transition" discusses in more detail the role of trade policy in greening trade in Indonesia.

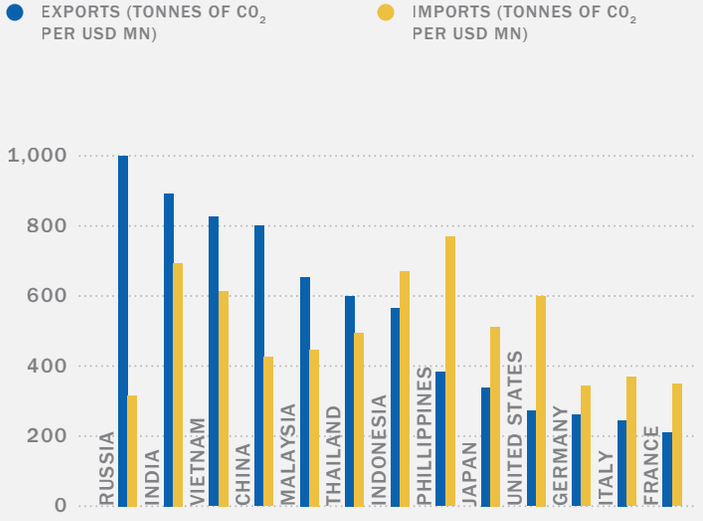
trical equipment has increased. There is, therefore, room to ensure trade policy allows for greener imports, which would also play a role in greening domestic production and exports, in addition to greener local raw materials.[3]

FIG 1 CO_2 EMISSIONS EMBODIED IN INDONESIA'S EXPORTS AND IMPORTS



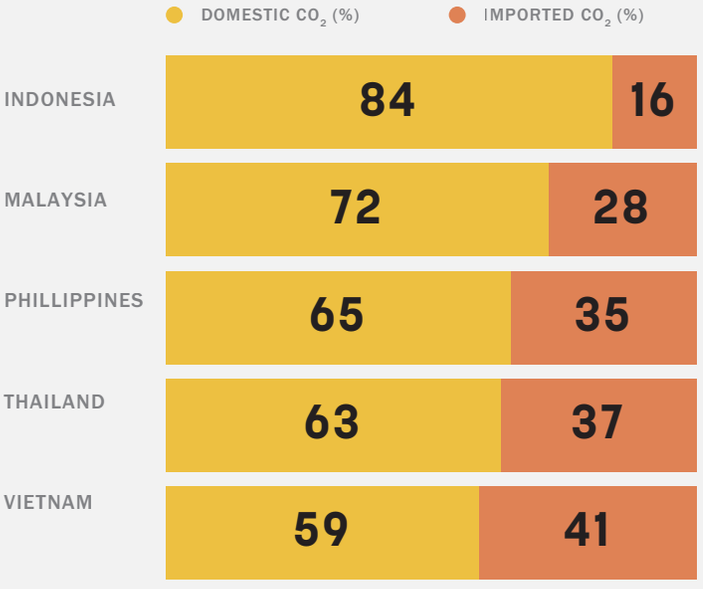
Source: World Bank staff calculations based on IMF.

FIG 2 CO_2 EMISSIONS IN TRADE: CROSS-COUNTRY COMPARISON (METRIC TONS OF CO_2/US$1 MILLION)



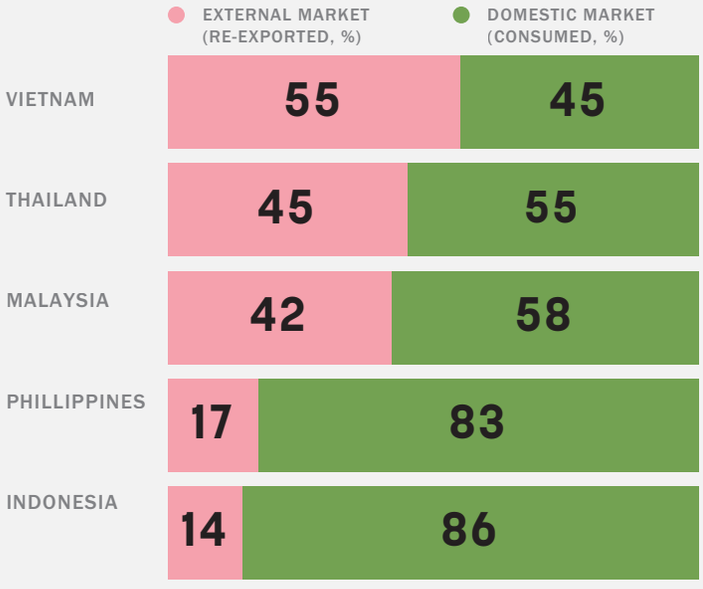
Source: World Bank staff calculations from OECD data 2018.

FIG 3 SOURCES OF EXPORTED CO_2 (%)



Source: World Bank staff calculations from OECD data 2018

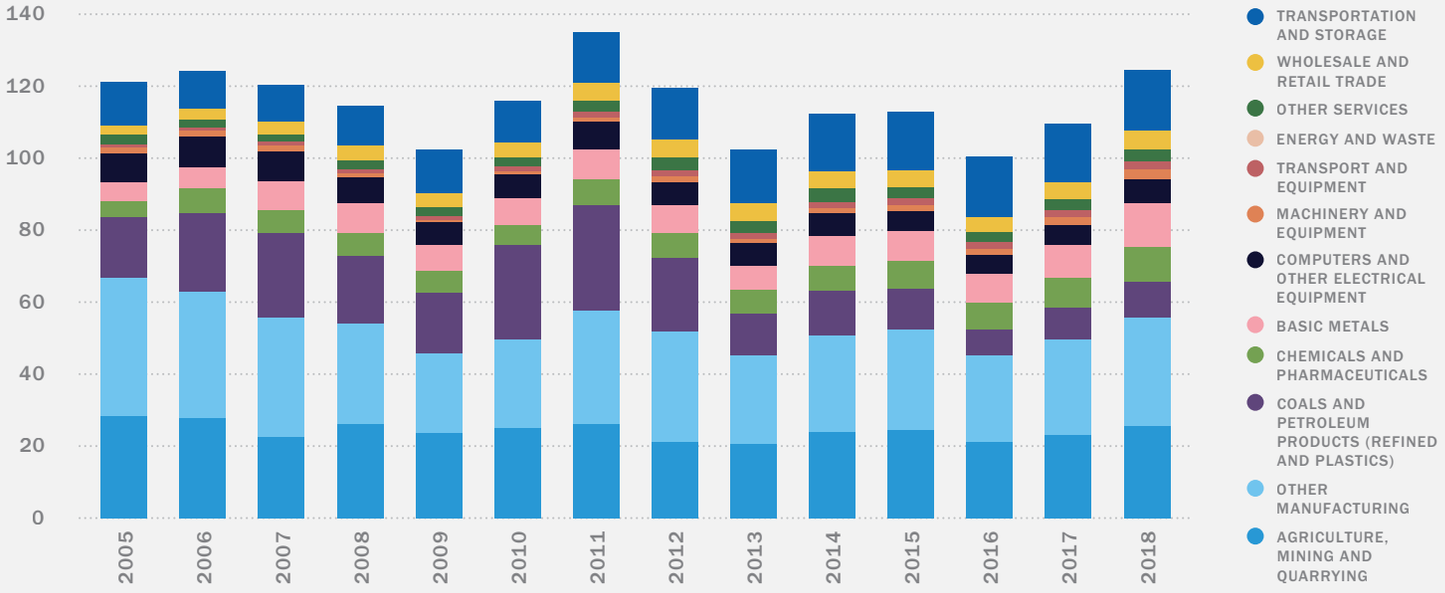
FIG 4 USE OF CO_2 CONTAINED IN IMPORTS (%)



Source: World Bank staff calculations from OECD data 2018.

FIG 5

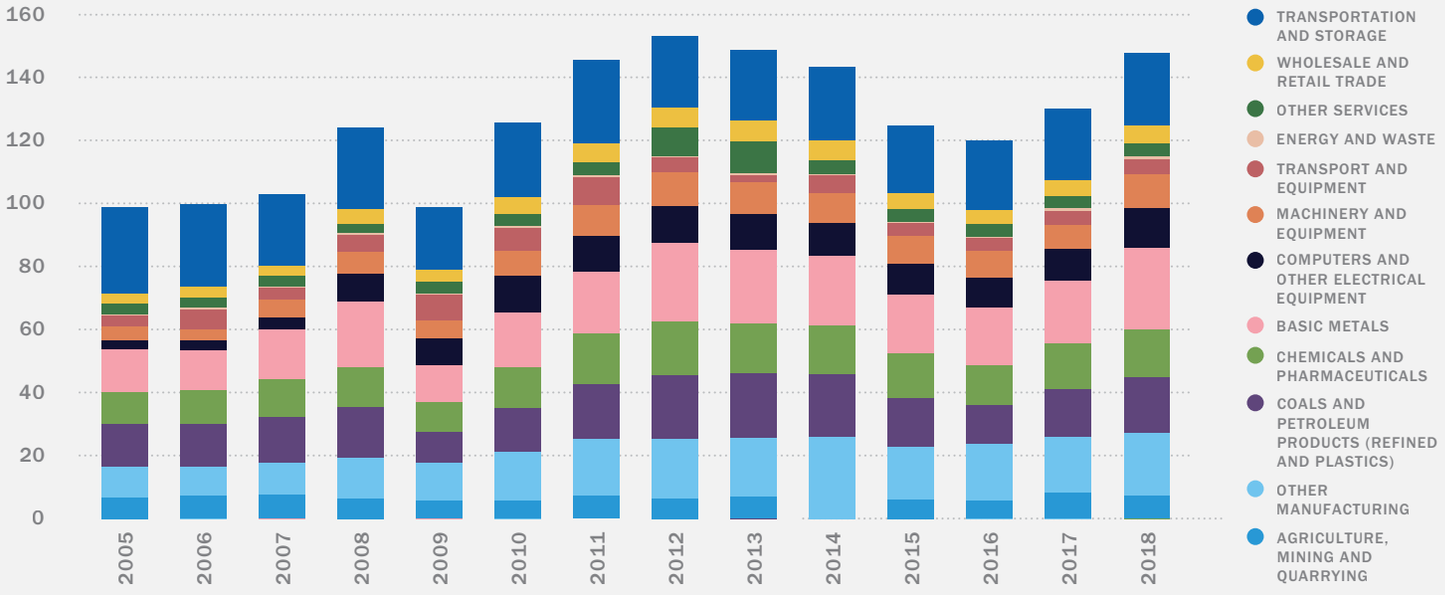
CO_2 EMISSIONS EMBODIED IN EXPORTS BY SECTOR (MILLIONS OF METRIC TONS)



Source: World Bank staff calculations from OECD data.

FIG 6

CO_2 EMISSIONS EMBODIED IN IMPORTS BY SECTOR (MILLIONS OF METRIC TONS)



Source: World Bank staff calculations from OECD data.

Indonesia's Trade in Green Goods and Technologies

Defining Environmental Goods

There have been several attempts to develop lists of products with environmental benefits. The Organisation for Economic Co-operation and Development (OECD) has put together indicative lists of products ranging across a number of environmental categories such as air pollution control; wastewater management; renewable energy; and environmental monitoring, analysis, and assessment (OECD 1999). The World Trade Organization (WTO) and Asia-Pacific Economic Co-operation (APEC) were created specifically for trade negotiation purposes. The WTO lists were created through a process of product submission from member countries, following the Doha Declaration mandate (WTO 2001). The APEC list is a set of environmental goods that the 21 APEC member states agreed to reduce applied tariff rates to 5 percent or less by the end of 2015 (APEC 2012). This is a non-binding commitment, but it has advanced, as there are now 19 APEC member economies who are fully compliant (APEC 2021).

The green goods referred to in this note are based on the list of green products defined by the Green Transition Navigator (GTN)–a compilation of the APEC, OECD, and WTO green goods classifications. The GTN of green products–or products with environmental benefits–lists and collates these into a single dataset totaling 543 products classified at the six-digit level of the 1992 version of the Harmonized Standard (HS). The list is also inclusive of green technologies in the World Bank's (2007) "International Trade and Climate Change: Economic, Legal, and Institutional Perspectives" report. Compilation and agreement of an equivalent list on environmental services, and data on trade in such services is still challenging. WTO commitments remain even more modest compared to commitments of greens/environmental goods. The discussion in this note, therefore, focuses on environmental goods trade. Appendix 1 provides detailed examples of each category of environmental goods/green goods used in this analysis.

Indonesia's trade in Environmental Goods

Indonesia has significant untapped potential in exports of green goods and technologies,[4] while imports are at par with global and regional averages. Green goods amounted to US$5.8 billion or 3.6 percent of total goods exports in 2020, far below the global and EAP average of 12 percent and 9 percent, respectively (Figure 7). Conversely, with imports of green goods at about 12 percent of total goods imports (Figure 8) or US$17 billion (Figure 9), Indonesia's imports of green goods are relatively higher compared to regional peers in East Asia Pacific–at an average of 11 percent. The number of products imported (extensive margin) had a historically higher share of imports than the values (intensive margin), at an average of 12 percent of all products imported during 2010-20, compared to about 9.3 percent of value of imports for the same period.

Major destination markets for Indonesia's exports of green goods are Singapore, the United States, and Japan, while the main import markets are China and Japan (Figure 10). As such, main destination and source markets are well aligned with that of aggregate goods exports and imports, with the biggest trading partners being China, Japan, and Singapore. In terms of exports, more than one-half of Indonesia's exports of green goods are destined to markets in the

4 Green goods are defined based on the environmental benefits they provide rather than their carbon content. The term green goods and environmental goods (EGs) are used interchangeably.

EAP region–to Singapore (16 percent), Japan (9 percent), Thailand (7 percent), China (7 percent), Malaysia (5 percent), Philippines (4 percent), Republic of Korea (4 percent), and Vietnam (4 percent). In turn, imports of green goods are much more concentrated from a few source markets: China accounts for 43 percent of Indonesia's imports of green goods, followed by Japan with 10 percent. Outside of the EAP region, the United States and Germany are also important trading partners. The United States accounts for 15 percent of Indonesia's exports of green goods and about 5 percent of imports of green goods, while Germany accounts for 4 percent of imports (Figure 10).

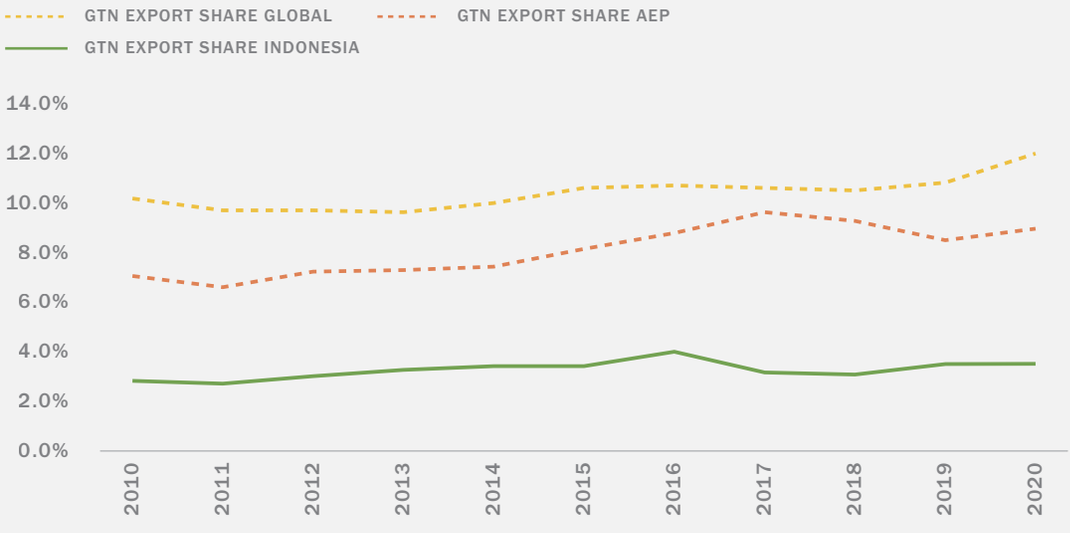
Exports of Wastewater Management and Potable Water Treatment Products, Renewable Energy Plants, and Cleaner or More Resource Efficient Technologies represent significant export potential for Indonesia. These categories of green goods accounted for more than two-thirds of Indonesia's exports of green goods and were also the fastest growing export segments (Figure 11). Wastewater management and potable water treatment products and renewable energy plants made up the largest share of exports with 28 percent and 23 percent of total green goods exports in 2020. In turn, the fastest growing green goods export categories were environmental monitoring, analysis, and assessment equipment and products for the clean-up or remediation of soil and water, growing by 42 percent and 38 percent during the 2017-20 period, respectively. In terms of products, exports of motorcycles (Cleaner or More Resource Efficient Technologies and Products), anhydrous ammonia (Wastewater Management and Potable Water Treatment), primary lithium cells and batteries (Cleaner or More Resource Efficient Technologies and Products), and other electronic integrated circuits (Management of Solid and Hazardous Waste and Recycling Systems) were among the top green products exported with potential to be further expanded, given also existing comparative advantages (see list in Appendix 1).

On the imports side, in addition to Wastewater Management and Potable Water Treatment products, Renewable Energy Plants, Management of Solid and Hazardous Waste and Recycling Systems and Air Pollution Control also make up notable shares (15 and 13 percent respectively). The fastest growing imported green goods categories were Environmentally Preferable Products based

on end use or disposal characteristics, Air Pollution Control, and Wastewater Management and Potable Water Treatment products growing by 94 percent, 45 percent, and 45 percent between 2017-20, respectively (Figure 12). Top imported products were diagnostic/laboratory reagents (Wastewater Management and Potable Water Treatment, steam turbines and other vapor turbines (Renewable Energy Plant), and processors and controllers of electronics integrated circuits (Management of Solid and Hazardous Waste and Recycling Systems).

Green goods imports represent an important source of access and transmission of new green technologies for Indonesia, underscored also by the fact that green goods imports are more intensive in medium and high-tech products than exports. Exports of green goods include 64 percent of medium and high-tech products, compared to imports with 73 percent. Green goods exports' intensity in medium and high-tech product has increased significantly–from 56 percent in 2008 to 64 percent in 2020. In addition, Indonesia's green goods trade has higher technology-intensity than Indonesia's overall trade in goods. Access to these technologies through imports will help Indonesia to not only improve productivity and a more efficient allocation of resources but also to lower production costs and improve international competitiveness. Furthermore, access to new technologies might also generate new tasks and jobs in Indonesia–new job categories that emerge when more sophisticated technology is introduced might lead to a higher demand for highly skilled labor.

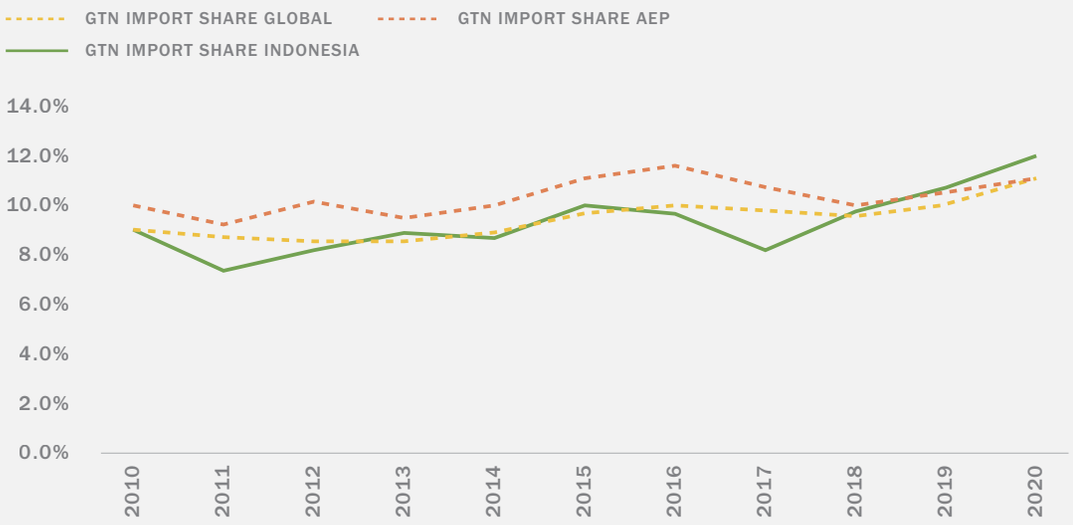
FIG 7 GLOBAL SHARE OF GREEN GOODS EXPORTS



Source: World Bank staff calculations from BPS[5] data

5 Statistics Indonesia (*Badan Pusat Statistik*: BPS) is a non-departmental government institute of Indonesia that is responsible for conducting statistical surveys. Its main customer is the government, but statistical data is also available to the public.

FIG 8 GLOBAL SHARE OF GREEN GOODS IMPORTS

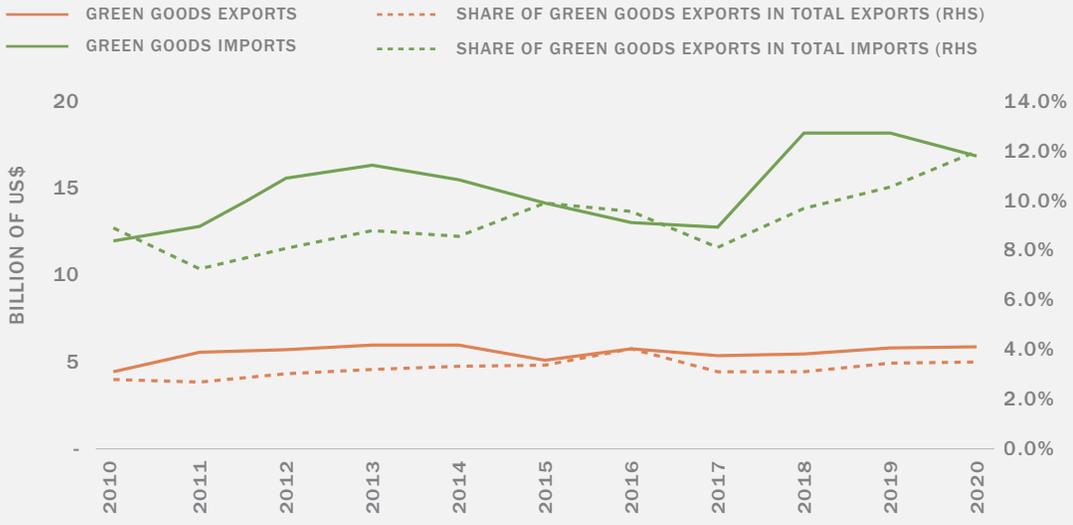


Source: World Bank staff calculations from BPS[6] data

6 Statistics Indonesia (*Badan Pusat Statistik*: BPS) is a non-departmental government institute of Indonesia that is responsible for conducting statistical surveys. Its main customer is the government, but statistical data is also available to the public.

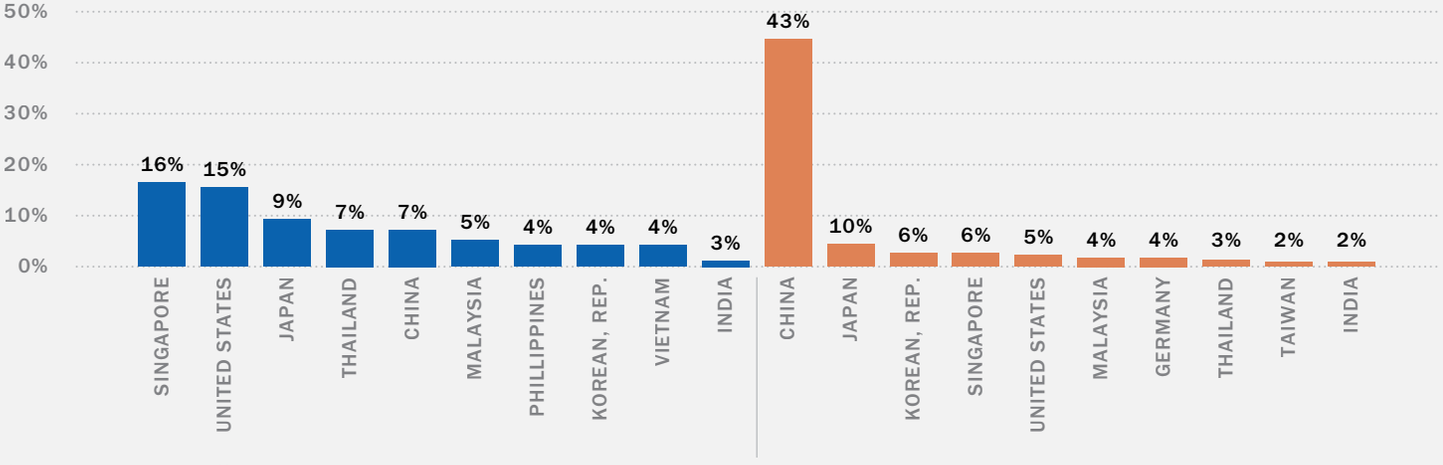
"Indonesia has significant untapped potential in exports of green goods and technologies."

FIG 9 GREEN GOODS TRADE IN INDONESIA



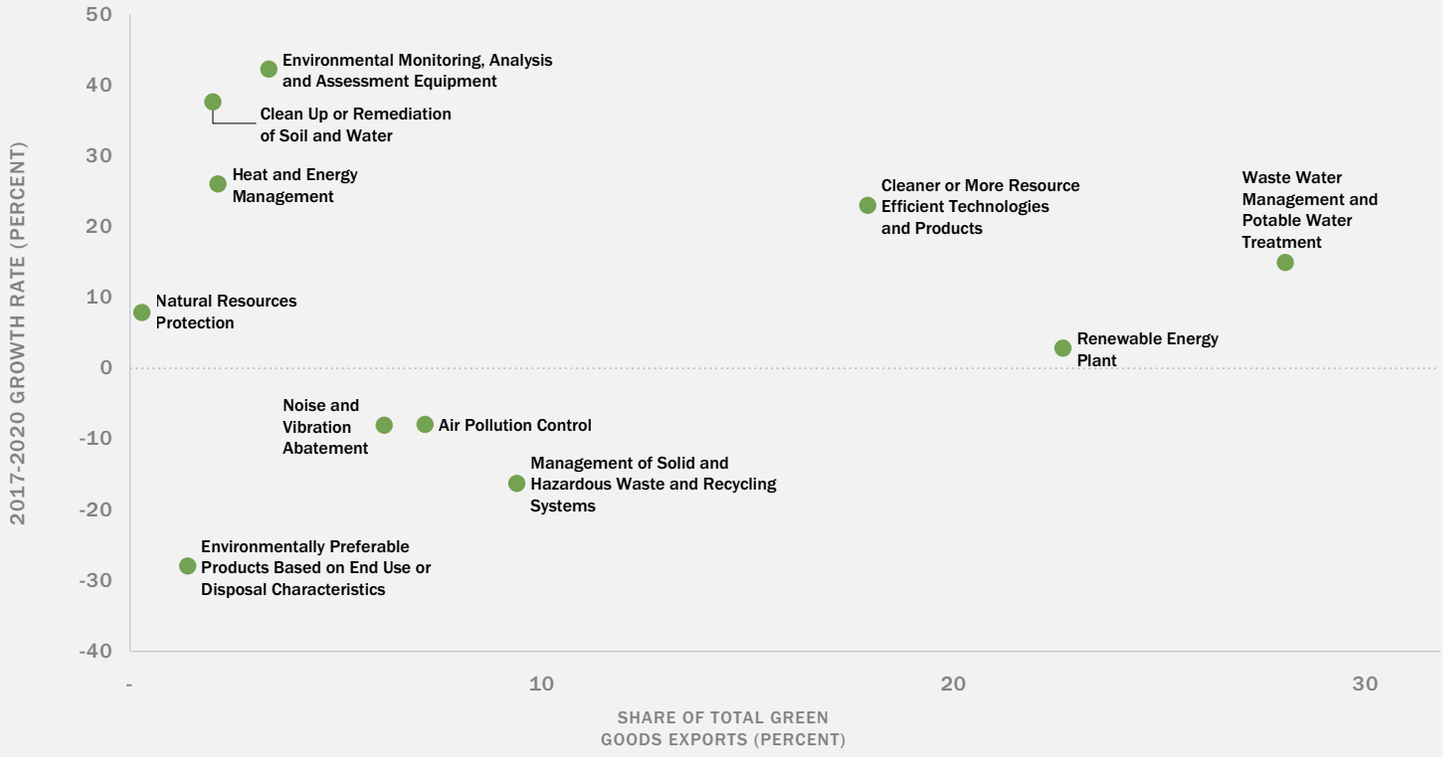
Source: World Bank staff calculations from BPS data.

FIG 10 MAJOR TRADING PARTNERS FOR GREEN GOODS



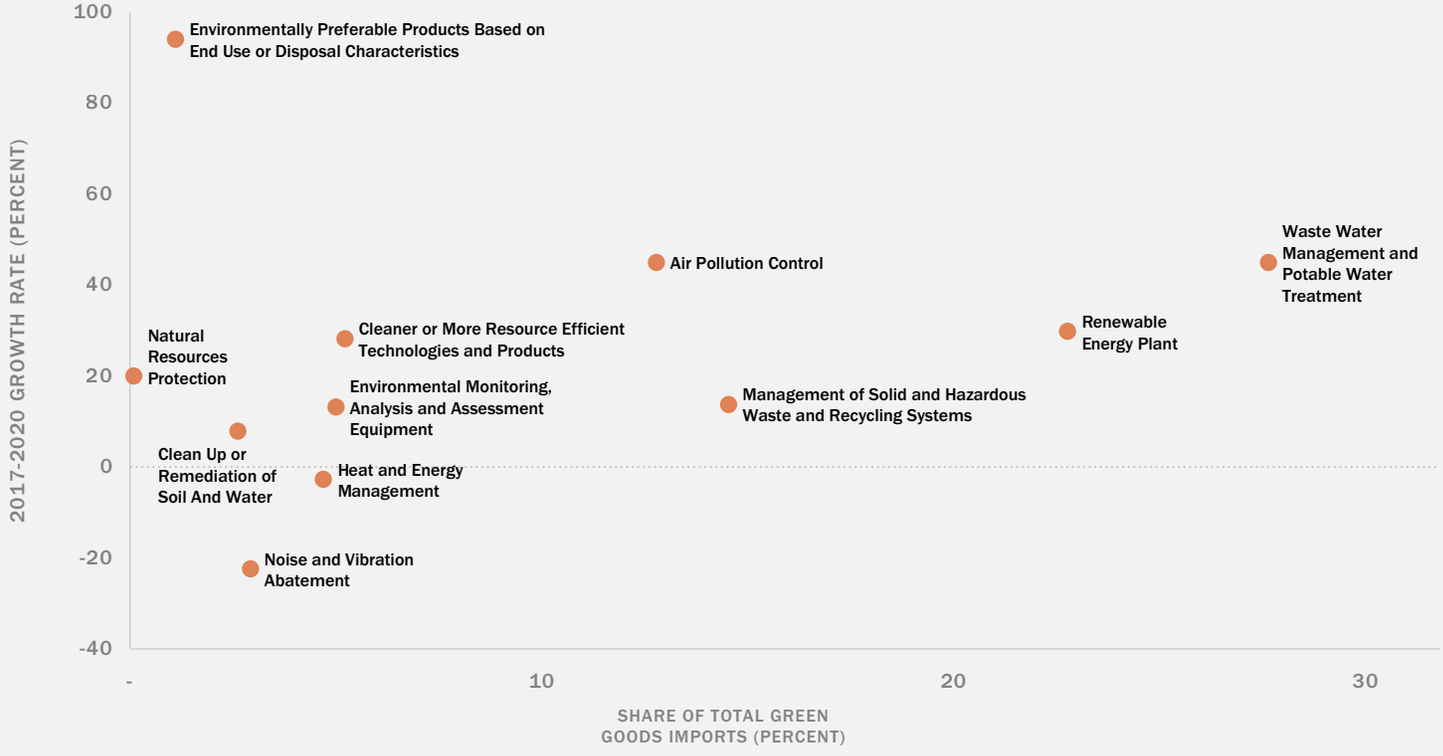
Source: World Bank staff calculations.

FIG 11 GREEN GOODS EXPORTS BY CATEGORY, 2020



Source: World Bank staff calculations based on GTN data

FIG 12 GREEN GOODS IMPORTS BY CATEGORY, 2020



Source: World Bank staff calculations based on GTN data

Green Competitiveness Potential

International competitiveness encompasses several that can help explain international trade trends and determine countries' ability to successfully transition to the green economy. International competitiveness mainly encompasses factors such as capacity for technological innovation, degree of product specialization, and the quality of the products traded. Such structural factors may influence a country's trade performance favorably. These are enabled by country-specific factors that affect firm performance and, therefore, determine a country's competitiveness. The country-level aspects include resource endowments, cost of labor and production inputs, financial and technological infrastructure, access to markets, and institutional and regulatory frameworks.

The extent to which Indonesia can competitively export green, technologically sophisticated products (green complexity index), is still low relative to other countries, and has sharply declined since 2014 (Figures 13 and 14).[7] The Green Complexity Index

7 For details on these metrics, see Andres and Mealy (2021). Retrieved from www.green-transition-navigator.org

(GCI) sums up the Product Complexity Index (PCI) of green products a country is competitive in. The PCI ranks products according to the similarity of the countries that export them competitively. The PCI is often used as a proxy for the technological sophistication of a product. Indonesia currently ranks 69 on the GCI,[8] much lower than peer countries in the region–Malaysia and Thailand at number 36 and 34, respectively. Indonesia's performance on the green competitiveness index and green competitiveness potential, is strongly interlinked with its economic complexity. On this Indonesia performs relatively poorly, ranked at number 127, much lower than Thailand and Malaysia at number 38 and 25, respectively (Figure 14).

Indonesia's potential to diversify into green, technologically sophisticated products (green complexity potential: GCP) ranks relatively higher than other countries and has been steadily improving since 2005 (Figures 13 and 14). With respect to GCP, Indonesia ranks number 37, higher than Malaysia and Vietnam but lower than Thailand (at number 25). The GCP measures how much potential a country has to diversify into green, complex products in the future based on the proximity and complexity of products it is not yet competitive in. On this measure, Indonesia's performance on the complexity potential is promising.

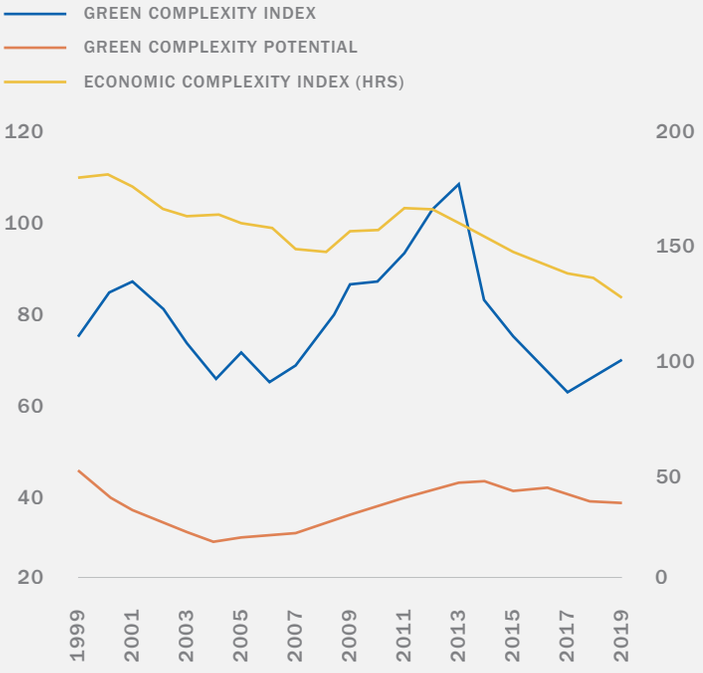
Indonesia has a higher probability of developing future competitiveness in green products with lower product complexity, as green products closest to current capabilities are those with lower product complexity and technologies. Proximity measures the product's alignment with the country's productive capabilities and identifies green diversification opportunities that were closely related to their existing production capabilities, as this would allow them to take advantage of skills, infrastructure, and know-how that they already possess. Green products with the closest proximity to Indonesia's current production capabilities are Environmentally Preferable Products; Waste Management, Recycling and Remediation; and Cleaner or More Resource Efficient Technologies/Products (Figure 15). Among these, bicycle hubs and free-wheel sprocket wheels, primary cells and batteries, and machinery for liquifying air and other gases are shown to be at the intersection of products with high potential and high RCA. This may be because Indonesia's productive know-how is more closely focused on extracting fossil fuel resources.

8 The GCI aims to capture the extent to which countries are able to competitively export green, technologically sophisticated products.

Conversely, green products with the lowest proximity to Indonesia's current production possibilities are Gas Flaring Emission Reduction products, Clean Up or Remediation of Soil and Water, Resources and Pollution Management, and Environmental Monitoring and Analysis Equipment.

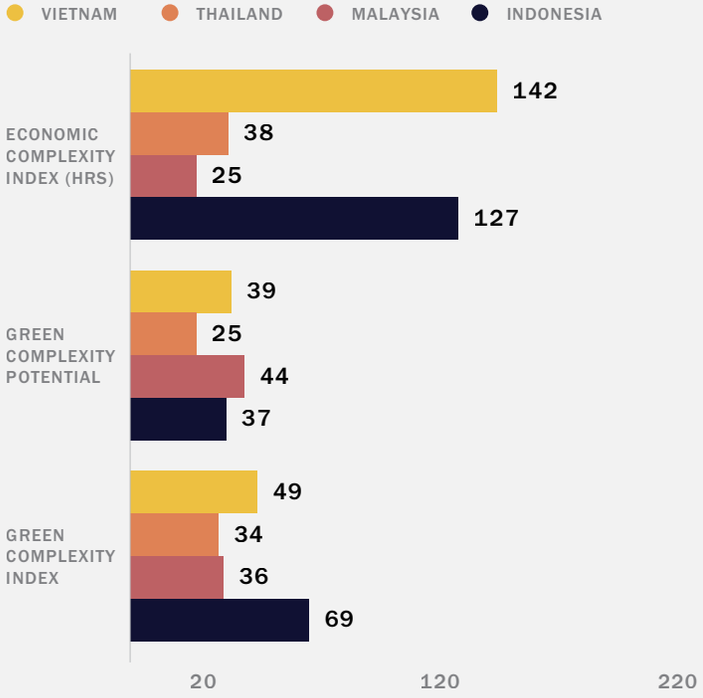
Environmentally Preferable Products, Waste Management, Recycling and Remediation, and Cleaner or More Resource Efficient Technologies and Products are also the green products that exhibit the highest RCA and, therefore, making them ideal potential export growth areas (Figure 15). Nevertheless, Indonesia's potential to diversify into products the country is not yet competitive in is promising. Countries with higher green competitiveness potential scores are significantly more likely to have greater future increases in their green competitiveness index, green export ratio, and the number of green products they can export competitively. Indonesia's potential increased until 2005 but has since worsened slightly and stagnated in recent years. Access to green technologies through trade could play a key role in realizing this potential.

FIG 13 INDONESIA'S GREEN COMPETITIVENESS RANKING



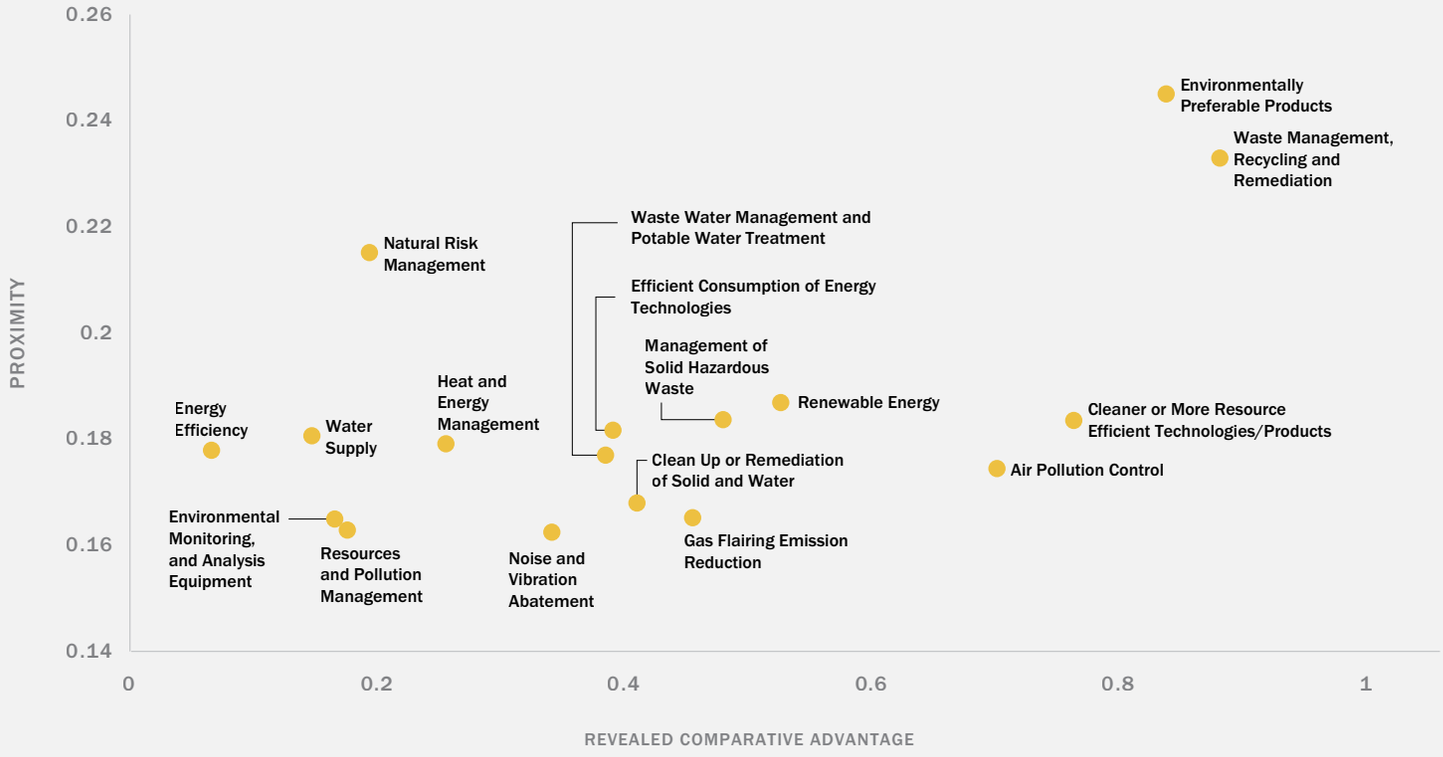
Source: World Bank staff calculations from GTN data.

FIG 14 GREEN COMPETITIVENESS: REGIONAL COMPARISON OF RANKINGS



Source: World Bank staff calculations from GTN data.

FIG 15 INDONESIA'S GREEN COMPETITIVENESS POTENTIAL BY GREEN PRODUCT CATEGORIES



Source: World Bank staff calculations from GTN data.

Conclusions and Recommendations

The global and Indonesia's own transition to a greener and more sustainable growth are likely to accelerate the need to reduce the carbon content of Indonesia's trade flows. As Indonesia transitions away from natural resource-based growth, the role of carbon-intensive sectors is expected to decline– directly reducing the emissions embedded in Indonesia's trade flows. This will be due to both a decarbonizing global and domestic economy, as well as Indonesia's ongoing efforts to diversify the economy to be less vulnerable to commodity prices. At the global level, decarbonization efforts and the increased focus on the use of green goods will likely also alter the carbon content of Indonesia's trade. In addition, the carbon content of Indonesia's trade will be affected by climate policies of major trading partners such as the United States and the European Union (EU). Trade with the EU–Indonesia's third-largest

trading partner after China and Japan–and policies such as the EU Green Deal or the EU Carbon Border Adjustment Mechanism (CBAM) will impact on Indonesia's exports. It is likely that selected carbon-intensive sectors with a high share of exports to the EU will see a decline in output.

With the right policies in place,[9] Indonesia stands to benefit from green technology spillovers, especially given that green products most similar to current capabilities are those with lower product complexity and technologies. Technology diffusion, including international diffusion of ideas in the form of knowledge spillovers are the hallmark of international trade. Trade is a channel of diffusion for innovation–including through imports and trade in technology. Trade policies such as liberalization of both tariff and non-tariff barriers contributes to ensuring the link between trade and innovation. Trade is, therefore, a key channel for improving green production capabilities, technology spillovers for green goods, and realizing the potential of green trade.

Identifying green products and technologies that are key to Indonesia's decarbonization and climate adaptation and mitigation will be key to reducing the carbon content of trade and becoming more competitive. Although still low relative to other countries, Indonesia's green competitiveness has been steadily improving after 2014, while its green competitiveness potential has been stable. Environmentally Preferable Products; Waste Management, Recycling, and Remediation; and Cleaner or More Resource Efficient Technologies/Products are also the green products that exhibit the highest RCA–thereby making them ideal for potential export growth areas.

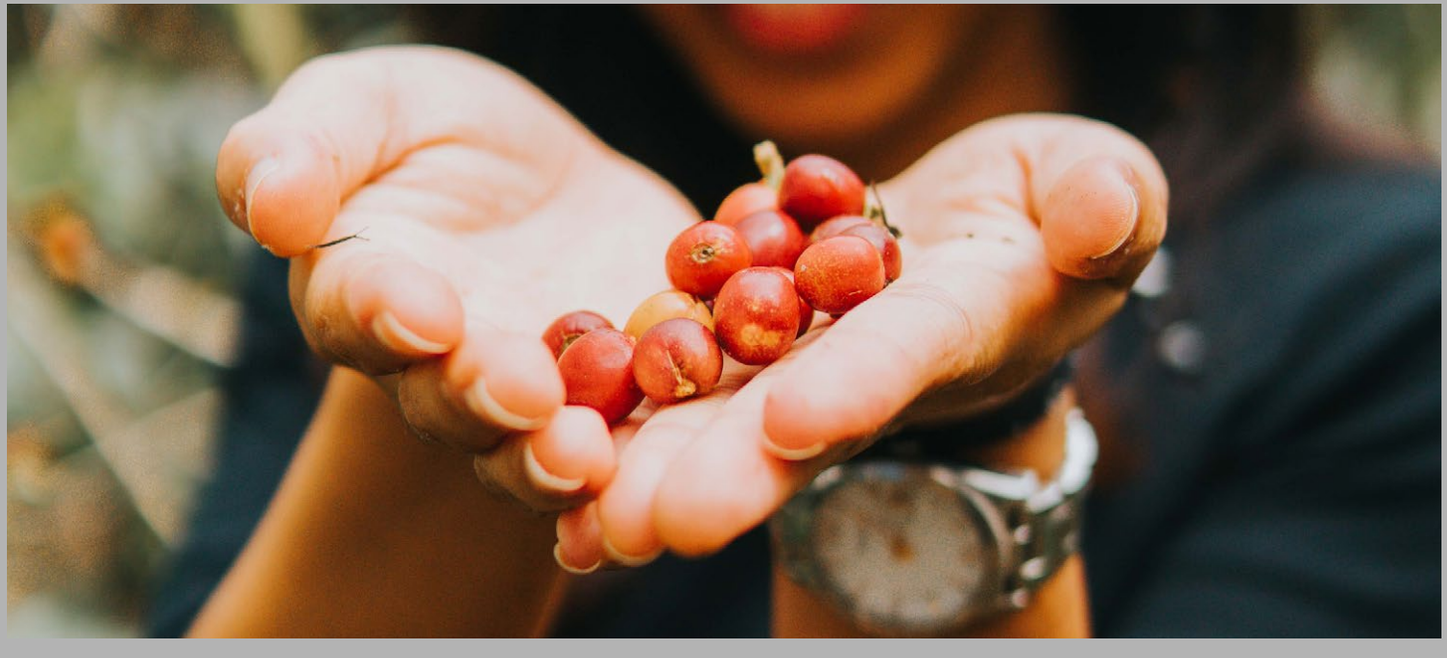
Indonesia could boost its export potential in environmentally preferable products and allow access to green goods for final use and production of other green goods. Imports of green goods could be used for decarbonizing processes such as monitoring emissions and energy as well as renewable energy products–both at the consumer and producer level. At the production level, access to these products would facilitate cleaner production processes readiness for extreme weather events. In doing so, trade would also potentially contribute to lower emissions in consumption and production.

9 See Policy Note 3: "The Role of Trade Policies in Indonesia's Green Transition".

02

P.25–48

FIRM-LEVEL OPPORTUNITIES AND CHALLENGES OF GREEN GOODS, TECHNOLOGIES, AND SERVICES TRADE IN INDONESIA



Introduction

Indonesia's green international competitiveness will be determined by a combination of both country-specific and firm-level factors. On the one hand, country-specific factors such as resource endowments, the production and other input costs, financial and technological infrastructure, access to markets, and institutional and regulatory frameworks shape a country's overall competitiveness (Hawawini et al. 2004). In turn, international competitiveness is a function of a firm's capability to achieve higher performance than its competitors in foreign markets. As a result, firm-level determinants also play a major role in shaping green competitiveness.

As such, a firm-level examination of the international trade in green goods and services in this note highlights opportunities and challenges faced by trading firms, and policies needed to boost their competitiveness going forward. This note zooms in on firm-level aspects of Indonesia's green trade and competitiveness and outlines recent trends in the trade of green goods and technologies by types of firms, the importance of green goods trade in firms' total trade, their entry and exit in the import and export market of green goods, as well as the challenges they face in importing and exporting green goods.

Results highlight that due to key challenges to both importing and exporting, trade in green goods and services remains limited but, with the right policy mix, Indonesia can take advantage of existing and increasing opportunities. There are several key findings. First, firms trading in green goods are more likely to be large and a higher share are foreign owned. Second, the share of firms entering green goods export markets is lower than the share of firms entering non-green goods export markets, suggesting that expected returns remain relatively low. The number of two-way traders entering export markets for green goods has, however, increased over time. Third, Indonesian firms that are more internationally exposed (two-way traders that both import and export) are better performers, export more green products, trade in higher-technology green goods, and have

higher survival rates in export markets. Fourth, further measures to streamline import and export approvals, harmonize standards, and reduce tariff and non-tariff measures (NTMs) where possible, will help to lower barriers for Indonesian firms to enter, stay, and be competitive in producing and exporting green goods

Open markets can improve access to new technologies and make local production processes more efficient and environmentally sound for firms in Indonesia, especially as over 90 percent of green goods are intermediate and capital goods that are used for production. With the right policies in place, there are a set of new green export opportunities that firms in Indonesia can tap into. On the one hand, this is because global value chains are reconfiguring both in response to a decarbonizing world and due to the effects of the ongoing COVID-19 pandemic shocks and responses. On the other hand, both climate change and COVID-19 have brought forward a renewed emphasis on the role of sustainable supply chains and new green industries in international trade. Firms that simultaneously export and import (that is, two-way traders or Global Value Chain or GVC firms)[10] are more involved in international activities than those engaged in only one of those modes of internationalization. This involvement creates opportunities to increase competitiveness by sharing technological knowledge, skills, and resources.

10 GVC firms are loosely defined as firms that both import and export, as these are the firms that are more internationally involved and GVC firms typically import to export.

Firm-Level Trade in Green Goods, Technologies, and Services

Firm Characteristics in Green Trade

The number of firms involved in green goods[11] trade has increased in Indonesia, with a larger share of firms importing green goods than exporting. The number of firms trading green goods reached 19,911 importers and 6,362 exporters in 2018, up from 15,231 importers and 6,080 exporters in 2014.[12] Between 2014-18, an average of 38 percent of all exporters were traders of green goods–of which two-thirds were firms that are two-way traders–while the corresponding figure for importers was an average of 70 percent–of which 40 percent are two-way traders. The share of firms trading green goods remained broadly stable between 2014-18 (Figure 16) as has the share of green goods per firm (Figure 17).

Survey responses show that most EG firms trading internationally are large and have relatively higher foreign ownership relative to domestic EG traders and non-EG traders. A 2022 World Bank survey of a total of 621 firms were asked about their green manufacturing practices and whether they traded in green goods in the last fiscal year. Among these, about 22 percent were international traders of green goods, of which, about 30 percent reported to be importers only, 31 percent were exporter-only firms and 39 percent were both importers and exporters.[13] Of the interviewed firms, 21 percent of the 621 were domestic traders of EGs. Some 67 percent of EG international traders are large firms, 33 percent are medium-sized firms, while there are no small firms (Figure 18). Nearly 30 percent are foreign owned (Figure 19) while, interestingly, 40 percent are located in Central Java. Domestic EG traders' characteristics are similar to non-EG traders, with the majority being medium-sized and only 5 percent being foreign-owned. Interestingly, 8 percent of international

11 Green goods or environmental goods (EGs) as referred to in this note are aligned with the list of green products defined by the Green Transition Navigator (GTN). This list is based on a compilation of the Asia-Pacific Economic Co-operation (APEC), Organisation for Economic Co-operation and Development (OECD), and the World Trade Organization (WTO) green goods classifications and add up to a list totaling 543 products classified at the six-digit level in HS1992. Throughout this note, the terms green goods and EGs will be used interchangeably.

12 Exporter or importer is defined as a firm that imported pr exported at least one green good in the time period. This is obtained from customs data sourced from the Indonesian Directorate General of Customs and Excise (DGCE).

13 Since the survey only asks about trade in the last year while the customs data considers trade in a period of five years, the lower shares are to be expected. Moreover, the customs data covers the universe of traders in Indonesia, while the survey is from a limited sample but provides us with more updated information. Values are weighted averages of the responses.

EG traders reported to be government owned–a higher share than for both non-EG traders and domestic EG traders (Figure 19).

EG exporters are also more likely to trade in environmental services (ES) compared to importers, but information on ES trade remains limited. Environmental services are often challenging to distinguish. They may involve construction of a geothermal power plant to the installation, repair, or maintenance of a facility critical to mitigation and adaptation to climate change. Generally, they are services crucial to the delivery and proper functioning of environmental equipment (OECD 2017). Among the surveyed firms, only 3.6 percent of importer-only firms participated in ES trade. In contrast, 14.6 percent and 17.0 percent of exporter-only firms and two-way EG traders respectively reported participating in ES trade. The average among all EG traders that were also involved in ES trade was only 6.3 percent (around 20 firms).

Firms that both export and import account for a larger share of green goods trade. Firms that both export and import are more likely to export than import green goods and make up a large share of the firms that export green goods in Indonesia (64 percent) but a smaller share (around one-third) among importers (Figure 20 and 21). Similarly, among the surveyed firms, there are a slightly higher number of two-way traders among firms in international green goods trade (41 percent of all EG traders) compared to importer-only or exporter-only firms (both making up 7 percent). This is consistent with broader characteristics of trading firms in Indonesia where 73 percent of exporters and 40 percent of importers are two-way traders and with the stylized fact that over two-thirds of export value in Indonesia is generated by two-way traders (Cali et al. 2022).

Firms trading in green goods are not specialized in such trade, as green goods make up a small share of the export and import baskets of firms, although this has increased slightly between 2014 and 2018. In both value terms and the number of products traded, imports of green goods have a larger share in the firms' basket of traded goods compared to exports, although both are very low overall. On average, green goods made up about 12 percent of the number of products exported and 9 percent of value in 2018 (Figure 17). Firms trading green goods are, therefore, rarely specialized in such trade, and mostly trade in non-green goods. Conversely, imports of

green goods accounted for about 21 and 20 percent of the number and value of imports, respectively in 2018. Apart from a slight recent increase, these shares have been broadly stable between 2014-18.

Indonesia's exports and imports of green goods are quite geographically concentrated among trade partners. Green goods exporters have only one-half the number of trading partner countries as exporters of non-green goods. The average number of partner countries per firm is three for green goods exporters, compared to six for non-green goods exporters. In terms of source countries, the difference is smaller: non-green goods are imported from an average of four countries per firm, compared to three for importers of green goods. These numbers have not changed much in recent years.

Green goods trade is highly concentrated among firms and, of the biggest Indonesian firms, the top 5 percent account for more than two-thirds of green goods trade. Conversely, the bottom 75 percent made up only 6 percent of exports and 8 percent of imports of green goods in 2018. Of all trading firms, the concentration of green goods traders is slightly higher than the concentration of all trading firms. For non-green goods, the top 5 percent of firms make up about 5 percentage points lower share than green goods imports and 10 percentage points for exports generated by the top 5 percent. Import concentration is higher than for exports of green goods. Nearly 70 percent of imports and about 65 percent of export value is generated by the top 5 percent of firms, while the top 1 percent generate an average of 44 percent of imports and 30 percent of exports in green goods.

"The number of firms involved in green goods trade has increased in Indonesia, with a larger share of firms importing green goods than exporting."

FIG 16

GREEN GOODS EXPORTERS AND IMPORTERS: NUMBER (LHS) AND PERCENT (RHS) OF TOTAL

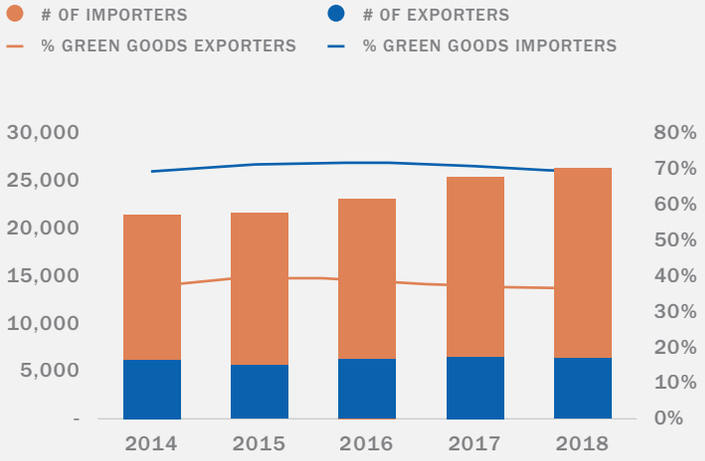


FIG 17

GREEN GOODS TRADE IN TRADERS' BASKETS (PERCENT)

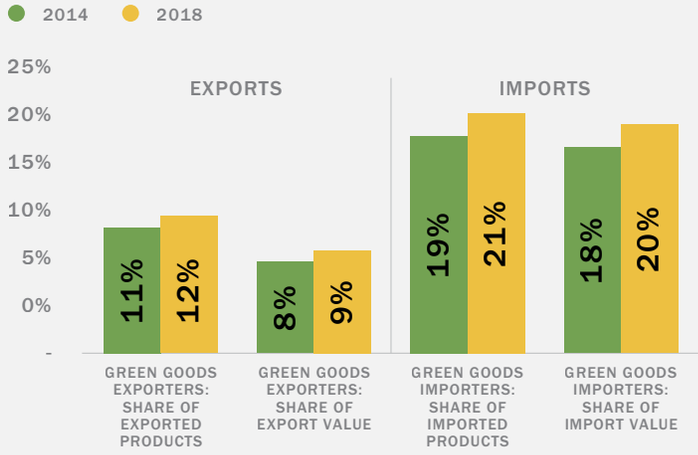


FIG 18

FIRM SIZE OF EG TRADERS (SURVEY RESULTS)

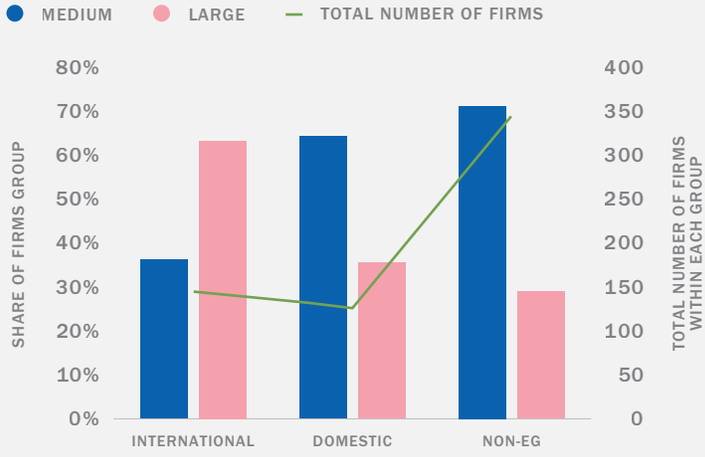


FIG 19

OWNERSHIP OF EG TRADERS (SURVEY RESULTS)

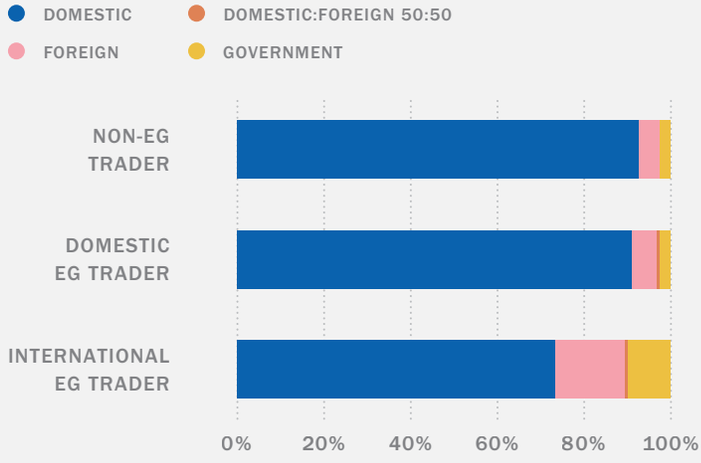


FIG 20

TWO-WAY TRADERS ARE MORE LIKELY TO EXPORT GREEN GOODS (PERCENT)

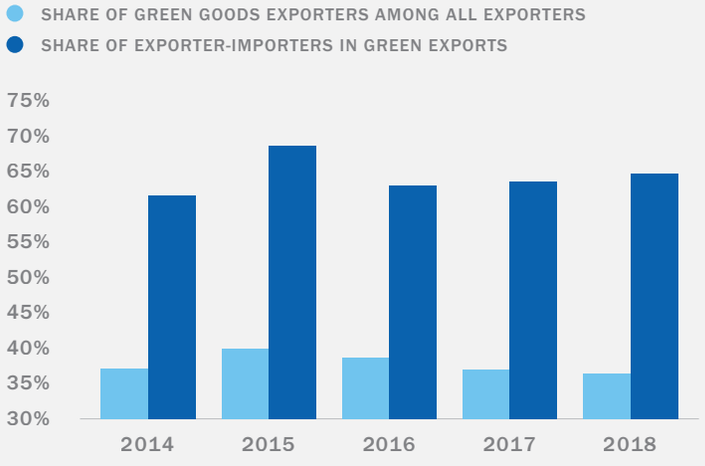
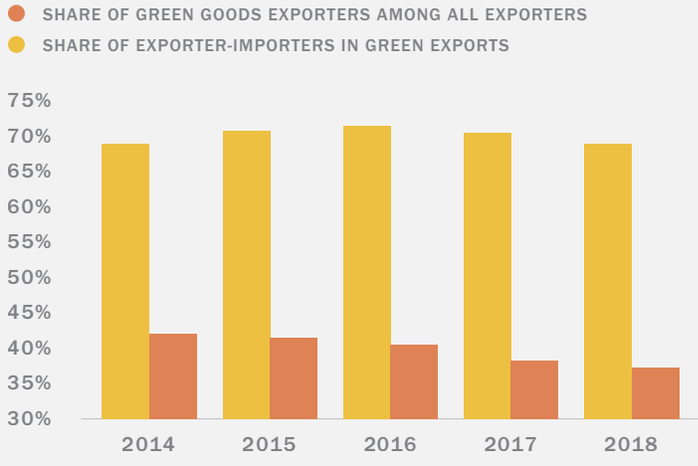


FIG 21

..BUT LESS LIKELY TO IMPORT (PERCENT)



Source: Figures 16, 17, 20, and 21: World Bank staff calculations using DGCE data and green goods list from GTN.
Figures 18 and 19: World Bank 2022 CCDR Survey.

Products Traded by Firms in Green Trade

Green goods[14] mainly consist of intermediate products (53 percent) and capital goods (38 percent) and only a small share of consumption products (8 percent) (Figure 22). Within each category of EGs, Waste Management, Recycling and Remediation products have the largest share of consumption goods (38 percent), followed by natural resource management (25 percent). These categories contain some goods that are purposed for end use. Nevertheless, the bulk of EGs are used for production of other goods. Appendix 2 provides the top traded environmental goods and their environmental categories.

The main category of green goods exported by two-way traders are Efficient Consumption of Energy Technologies and Carbon Capture and Storage (ECETCCS) which mainly consist of capital and intermediate products. Among ECETCCS HS-10 products, 53 percent are intermediate products and 47 percent are capital products (Figure 22). This indicates that these imports are used as inputs for production and exports. This is followed by Natural Resource Protection Products, of which 75 percent are intermediate products, and Cleaner or More Resource Efficient Technologies and Products (Figure 22-24). Conversely, export only firms are engaged in the exports of Environmentally Preferable Products (EPPs) followed by ECETCCS goods. Two-way traders have higher shares in the exports of all types of green goods relative to export-only firms. Each firm exports an average of one to three green goods with ECETCCSs having the largest number of distinct exported products per firm.

Overall, there has been an increase in the average value of exported green goods per firm, driven mostly by two-way traders. With the exception of Waste Management, Recycling, and Remediation, and Energy Efficiency Products, there has been an increase in the average firm-level value shares of EGs. For instance, the value of exports of Gas Flaring Emission Reduction and Cleaner or More Resource Efficient Technologies Products each increased by 6 percentage points between 2014-18. On the other hand, there have been slight declines or stagnations, with minimal growth in the green goods exports of exporter-only firms.

14 Green goods are defined by the environmental benefits they provide rather than their carbon content. The term green goods and environmental goods (EGs) are used interchangeably.

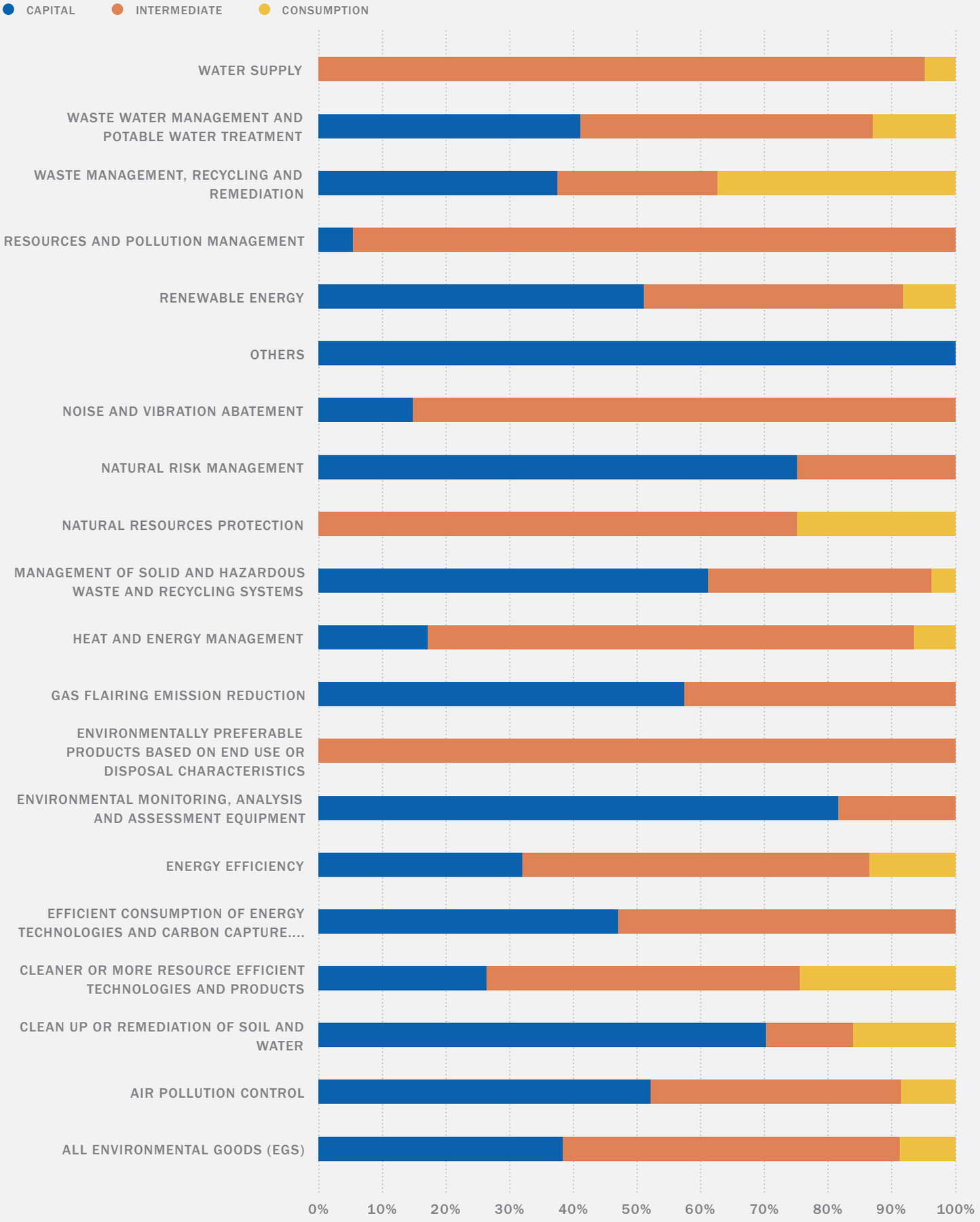
ECETCCS products are also the most imported green goods by all firms, followed by Cleaner or More Resource Efficient Technologies which have seen the highest increase in the firm-level import shares. This is closely followed by Renewable Energy and EPPs, both averaging 16 percent of import value for two-way traders (Figure 23).[15] For importer-only firms, Natural Risk Management products made up a larger share than EPPs based on end use, followed by Cleaner or More Resource Efficient Technologies products. Among importer-only firms, Natural Resource Protection, Cleaner or More Resource Efficient Technologies, and Natural Risk Management products had an increase in average firm-level shares between 2014-18. Conversely, Water Supply products declined in the shares of both firm types and EPPs dropped in the firm-level share of two-way traders.

There is more variation in the distinct number of imported green goods compared to exports. The number of imported products varies between one and six products on average per firm. Once again, ECETCCS make up the highest number of products imported per firm (an average of five products between 2014-18 for both two-way traders and importer-only firms). There are also heterogeneities in the concentration of firms across different types of green goods. For instance, the export concentration of firms in the Renewable Energy and Cleaner or More Resource Efficient Technologies products is higher than the average, with 79 percent and 82 percent of value accounted for by the top 5 percent of firms. Within the subset of energy efficiency products, the share of the top 5 percent of firms is only 42 percent of exports and 50 percent of imports.

15 The discussion focuses on EGs most closely linked to climate change. Statistically, the second most imported product was Wastewater Management and Potable Water Treatment with 18 percent average value share per firm.

FIG 22

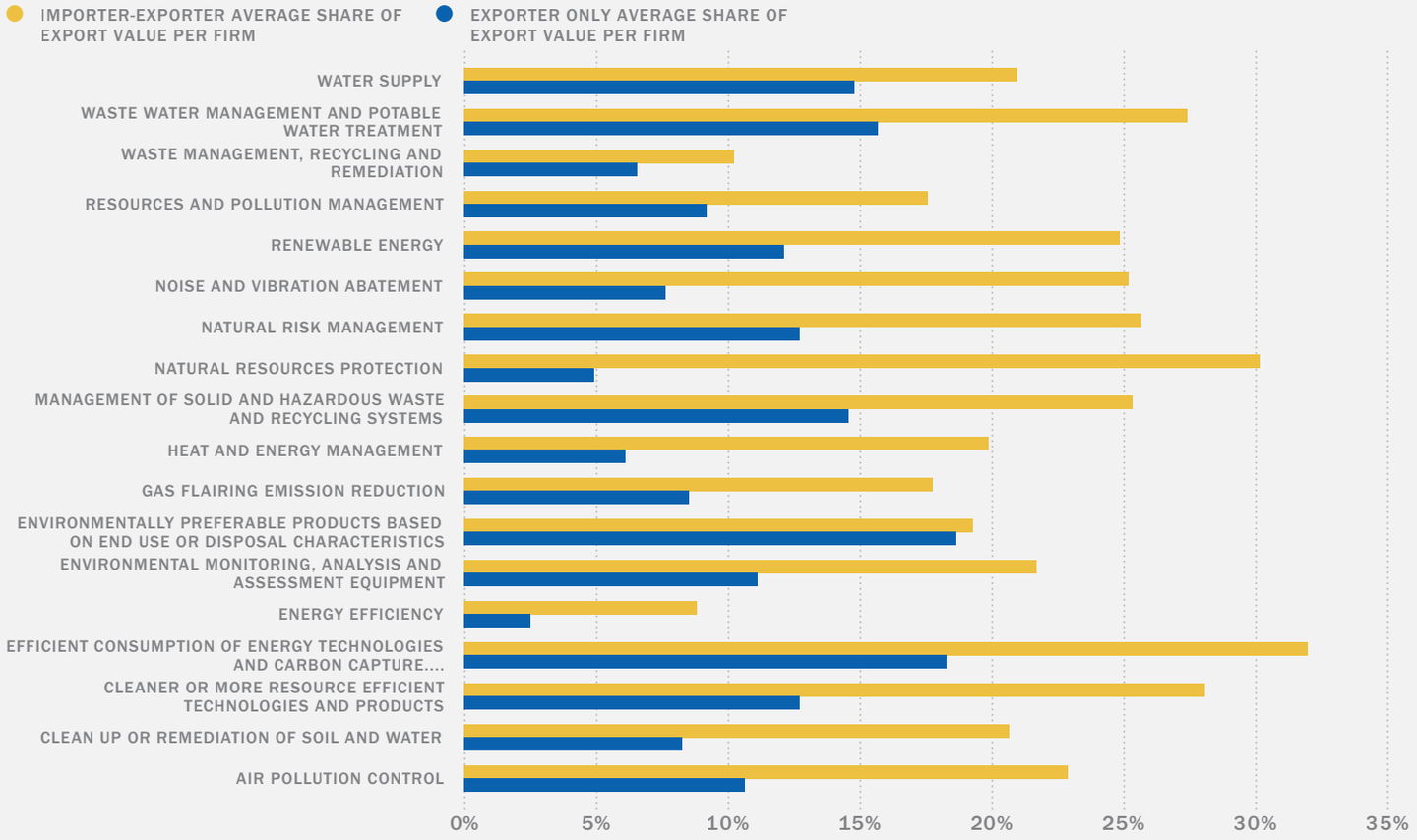
GREEN GOODS BASED ON END-USE CLASSIFICATION AND FUNCTION (% SHARE, WITHIN EACH CATEGORY)



Source: World Bank staff calculations from GTN list. Capital, intermediate and consumption goods are categorized using UNSTAT concordance of System of National Accounts (SNA)

FIG 23

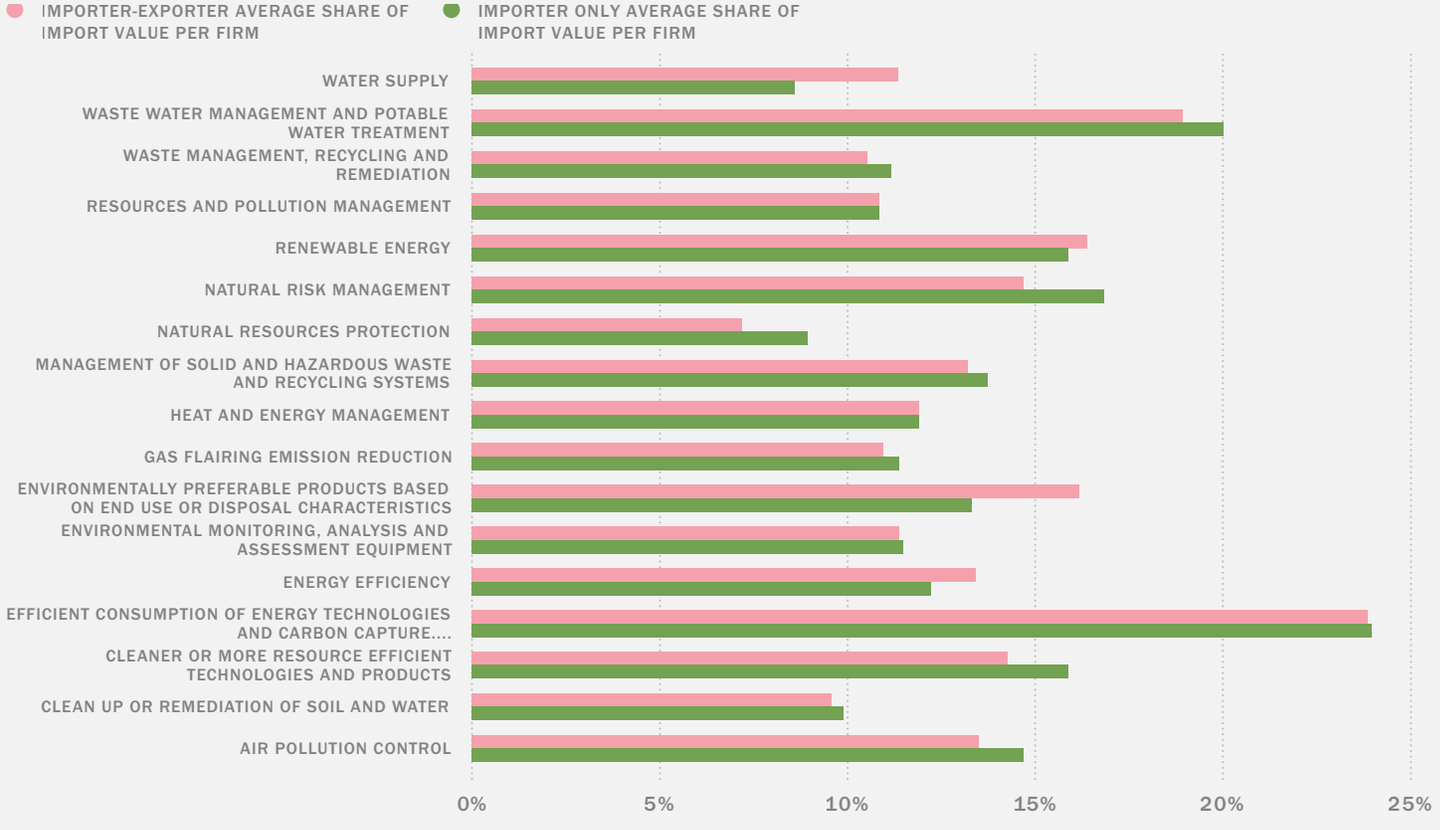
AVERAGE SHARE OF IMPORTS BY GREEN GOOD CATEGORY AND FIRM TYPE (2014-18)



Source: World Bank staff calculations from DGCE data.

FIG 24

AVERAGE SHARE OF EXPORTS BY GREEN GOOD CATEGORY AND FIRM TYPE (2014-18)



Source: World Bank staff calculations from DGCE data.

Technology Intensity of Firm-Level Trade in Green Goods

A country's ability to compete in high-technology markets is important to its overall competitiveness in the global market, and this is even more critical in a decarbonizing global economy and the role of trade in technology spillovers. Imported technology has the potential to further restructure the Indonesian economy, not only from resource-based but also to a greener trading economy. Furthermore, imports are one of the channels for technological spillover from trade.

The green goods imported by two-way traders have a higher technology-intensity than average trade.[16] Importer-exporters imported, on average, 9 percent of high-technology goods in 2018 but 26 percent of high-technology green goods (Figure 25).[17] The share of high-technology green goods imports is also slightly higher than the high-technology green goods imports of importer-only firms (19 percent). Notably, the share of high-technology green goods imports has increased over time for both two-way traders (by 8 percentage points between 2014 and 2018) and importer-only firms (by 5 percentage points).

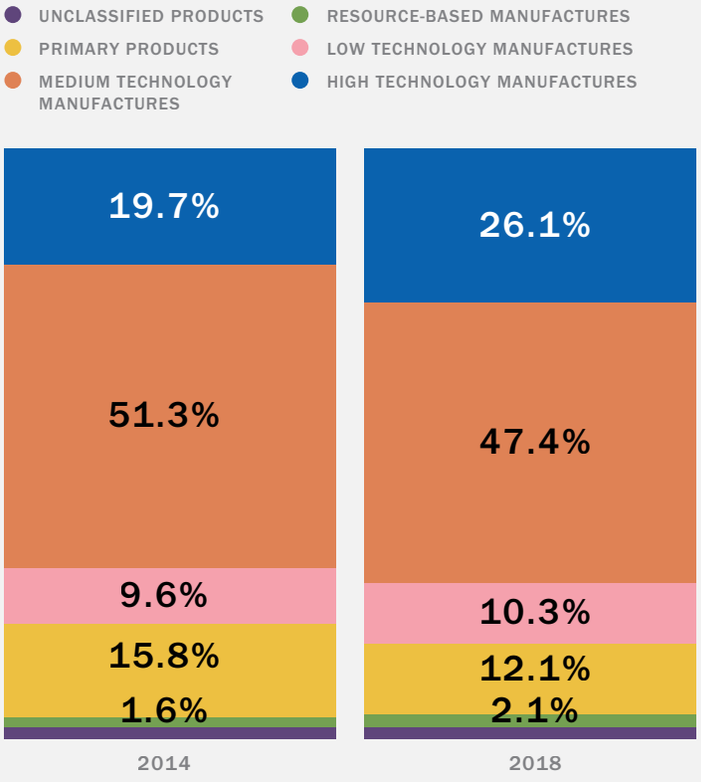
Similarly, exports of green goods by two-way traders have relatively high technology embodied in them. The green goods exports of two-way traders include, on average, 20 percent of high-technology goods (Figure 26). This is lower than the high-technology imports share but slightly higher than the high-technology exports of exporter-only firms (18 percent) and much higher than the share in non-green goods exports of these firms (3 percent). Reflecting the nature of the Indonesian economy and relative comparative advantages, the share of resource-based manufactures is higher in the exports of green goods by two-way traders (13 percent), compared to their imports (2 percent). Similarly, the share of low-technology exports is much higher (13 percent) than their imports (10 percent).

There are a few products where exporter-only firms trade in higher technology goods. Heat and Energy Management, Wastewater Management and Potable Water Treatment, and Clean up or Remediation of Soil and Water are the three products that have higher technology intensity in the exports of exporter-only firms compared to two-way firms.

16 Technology intensity is categorized using the Lall classification.

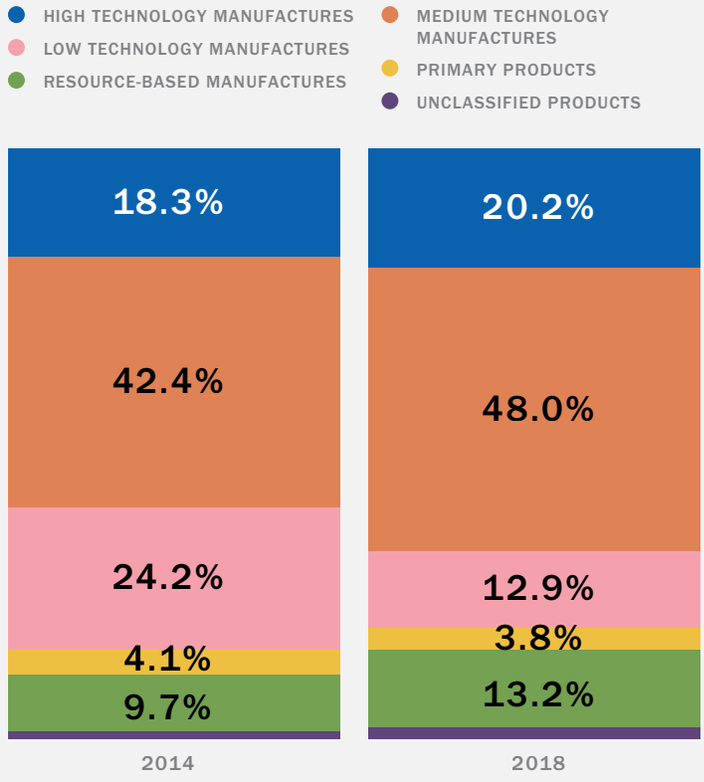
17 All averages are for the 2014-18 period. Most EGs are usually machinery and other equipment so this result is unsurprising.

FIG 25 TECHNOLOGY INTENSITY OF GREEN GOODS IMPORTS FOR IMPORTER-EXPORTERS



Source: World Bank staff calculations.

FIG 26 TECHNOLOGY INTENSITY OF GREEN GOODS EXPORTS BY IMPORTER-EXPORTERS



Source: World Bank staff calculations.

"A country's ability to compete in high-technology markets is important to its overall competitiveness in the global market, and this is even more critical in a decarbonizing global economy and the role of trade in technology spillovers."

How Competitive is Green Goods Trade for Firms in Indonesia?

Understanding trends in the entry/exit and the survival of firms trading green goods is essential to understanding the competitiveness of trade in green goods and for the design of a policy environment that enables firms not only to export but also to stay active in trading. Firm entry to, exit from, and survival in foreign markets, can be a signal of the external environment (favorable or unfavorable) such as government regulations or macroeconomic uncertainty. Entry into export markets involves substantial sunk costs and a firm's decision to enter depends on the expected demand and future returns from exporting. Free market entry and conditions that enable firms to operate are essential for the development of new ideas. Firms tend to persist in exporting once they begin to export to recoup sunk costs but may exit if they were initially overly optimistic about the market's demand or risks faced in the foreign market (Dixit 1988). Firm exit can also be a key to transferring resources to more productive uses and, thereby, achieving, over time, structural shifts in the economy.

In Indonesia, the share of firms entering green goods export markets is lower than the share of firms entering non-green goods export markets, suggesting that expected returns remain relatively low. Entry rates into non-green goods exports are twice as high as for green goods–averaging around 10 percent higher and 1,272 firms a year between 2015 and 2018.[18] Although entry rates of importer-exporter firms into green goods exports has been relatively stable (Figure 27), overall entry in has slightly decreased over time, mostly driven by exporter-only firms (Figure 28). Conversely, entry into the importing of green goods is higher than exports by 8 percentage points. Firm differences are not as pronounced for imports of green goods, where entry rates are only 4 percentage points lower than non-green

18 Entry is defined as if a firm was not trading green goods, but starts trading green goods in the following year, such a firm is defined as entering in the following year into trade in that particular good.

goods imports, and there is little difference between the entry rates of importer-only firms and two-way traders.

The number of two-way trader firms entering export markets for green goods has increased over time, and these traders also have higher entry rates relative to exporter-only firms. The entry rate into green exports is slightly higher for two-way traders, at around 11 percent or an average of over 776 firms a year–over 1.5 times that of exporter-only firms. Exporter-only firms have also been declining in their entry rates and in the numbers. On the other hand, exporter-only firms have slightly higher entry rates into non-EG trade (22 percent) compared to two-way traders. This suggests that being more internationally exposed, these GVC firms or two-way traders can leverage existing relationships and learn more from their trading activities to enable them to take advantage of market access opportunities.

Exit rates from both import and export markets are also lower in green goods than in non-green goods–suggesting more firms continue EG trade than non-EG trade–but the proportion of EG traders has not changed over the 2015-18 period. Using firm-level trade data, firms' decisions to stop trading in green goods is examined.[19] The results show that exit rates from importing and exporting green goods are lower than non-green goods for all firm types (Figure 29 and 30). For two-way traders, the average exit rates were 12 percent for green goods imports and 15 percent for other imports. For exports, the gap is larger at 10 percent for green goods and 15 percent for other products. However, exits for two-way traders remain slightly lower than the average for non-green goods (20 percent). The percentage point differences in green goods and other goods exit rates are similar for importer-only or exporter-only firms. As average entry and exit rates are broadly the same, this explains the broadly unchanged share of traders in green goods in the time period (see Figure 16).

ECETCCS and renewable energy have the highest entry rates, suggesting that expected demand and future returns from these products are high. Entry rates for both import and export markets are highest for these two groups of products, while Natural Resource Protection has the lowest entry and exit rates. About 600 firms start exporting ECETCCS products each year, and around 3,000 start importing.[20] For renewable energy, these numbers are 561 and 2,673

19 Exit is defined as if a firm was trading green goods but stops trading green goods in the following year. Such a firm is defined as exited in the following year from trade in that particular good.

20 For examples of products within each category, see Policy Note 1.

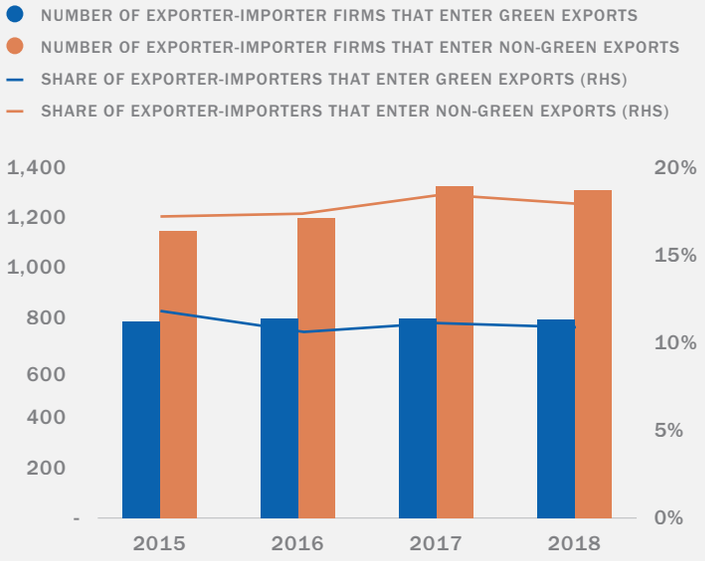
respectively. Around 57 percent of new exporters in renewable energy are two-way traders. Natural Risk Management has had the lowest number of new traders per year (28 for exports and 47 for imports) while Natural Resource Protection the lowest share (less than 1 percent for both imports and exports).

These products also have the highest exit rates, therefore, turnovers are much higher in these products. For imports and exports, the largest share of firms stopped trading the products of ECETCCS and renewable energy. The exit rates for imports of these products averaged 9 and 8 percent per year, respectively, representing an average of over 2,000 and 1,800 firms per year. For exports, the averages are 5 percent per year, or 571 and 591 firms per year, respectively. These shares are slightly higher for two-way traders for both imports and exports–except for renewable energy exports where two-way traders have lower exit rates. The lowest exit from imports and exports is in Natural Risk Management which averaged less than 1 percent.

Overall, firm survival in green goods trade is lower than in other products, but the difference in survival rates reduces over time. As firms trading in green goods have lower entry and exit rates, the question arises about how long firms survive in the market. The firm survival rates for both imports and exports are lower for trade in green goods than other products for all firm types. This difference lessens over time, however, for both import and export survival, as survival rates improve the longer a firm stays in the market.

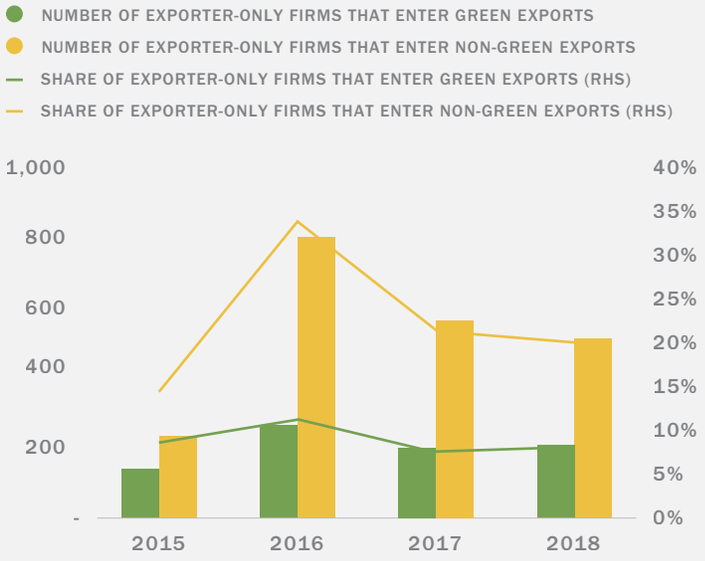
Two-way traders have higher survival rates in green goods markets and being a two-way trader matters more for survival in green goods export markets than imports. Overall, survival rates are higher for two-way traders in export markets. This difference is evident across most green goods with a few exceptions, however, this difference is not pronounced for imports, where survival rates of importer firms and two-way traders are at par. Only the most productive firms engage in exporting activities and two-way traders are more likely to survive and continue exporting.

FIG 27 TWO-WAY TRADERS' ENTRY RATES



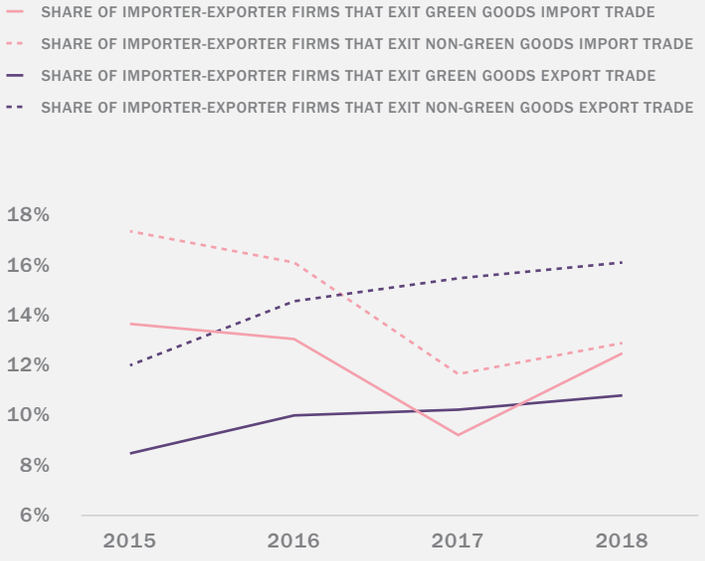
Source: World Bank staff calculations.

FIG 28 EXPORTER-ONLY FIRMS' ENTRY RATES



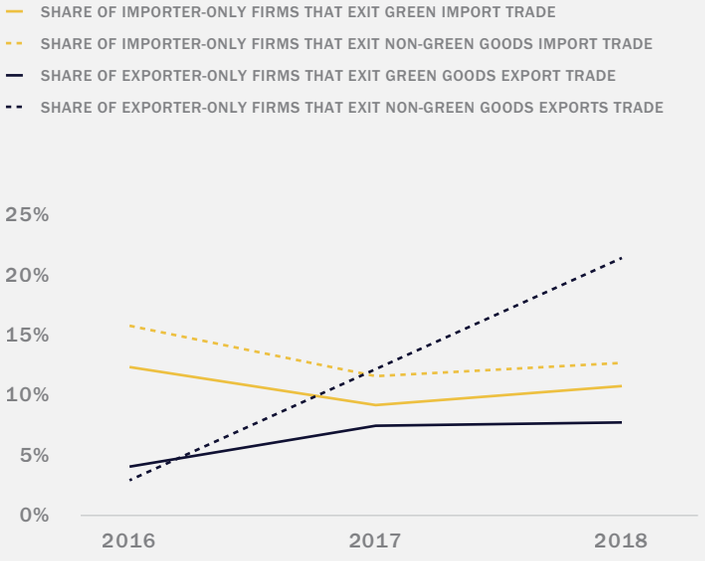
Source: World Bank staff calculations.

FIG 29 TWO-WAY TRADERS EXIT RATES



Source: World Bank staff calculations.

FIG 30 IMPORTER-ONLY/EXPORTER-ONLY FIRMS EXIT RATES



Source: World Bank staff calculations.

Trade-Related Challenges Faced by Firms Trading in Green Goods and Services

Finally, we examine some of the underlying challenges firms face in trading green goods which may provide insights into competitiveness constraints and firm entry and exit rates. Using the CCDR survey described earlier, we examine challenges reported by firms trading in green goods in Indonesia. A total of 145 of the surveyed firms trade in green goods internationally while 128 trade domestically–for a total of 273 of the 621 firms that were interviewed. A total of 101 firms responded to questions on import challenges and 104 on export challenges related to trading in green goods.

Overall, 72 percent of firms reported facing import challenges, while 70 percent reported facing export challenges, with each firm facing multiple trade-related challenges. The challenges identified included trade regulations including tariff and NTMs. Among these, NTMs such as customs procedures and compliance with Indonesian national standards were cited, as well as destination markets' local content requirement (LCR) rules among others. LCRs are prevalent for products such as solar panels and electric motors and vehicles.

Despite tariffs on green goods being relatively low, import tariffs were reported by the majority to be an obstacle or the main obstacle for importing of green goods. Among import challenges listed, 23 percent identified import tariffs, the highest share of any single obstacle (Figure 31). There may be several reasons why firms reported this. First, tariffs are straightforward and easier to estimate in terms of costs. Second, firms trading in green goods are importing not only green goods (Figure 17), and this response may refer to other products outside of the green goods list.[21] Notably, products outside of the green goods list may be used as inputs in the production of green goods and tariffs on those may still be high. Finally, further analysis shows that tariffs on a limited number of green goods remain high.[22]

21 The survey did not have information on which specific products firms were referring to when they reported the challenges. Rather the question was: "What are the main challenges this company faces when importing EGs" with a list of options.

22 See Policy Note 3: "The Role of Trade Policies in Indonesia's Green Transition" on the tariff schedule on the full list of green goods.

Among non-tariff related obstacles, customs procedures (18 percent),[23] and compliance with Indonesian national standards *Standar Nasional Indonesia* (SNI) (13 percent), are key hindrances to importing green goods. Customs and administrative procedures are necessary for the smooth application of trade and other policies, however, they can restrict trade and increase costs if the procedures are more stringent than necessary, or they are inefficiently applied. Import customs procedures include both documentary and border compliance requirements, contributing to the increase in the number of hours and days at the border. Some examples include recommendation documents, import licenses, SNI compliance, pre-shipment verification certificate (Surveyor Report), and bill of lading insurance policy. Indeed, SNI compliance was further singled out as an important obstacle. SNI compliance is mandatory in Indonesia for thousands of intermediate and capital goods (which most green goods are, including domestically produced ones). As certification requires a visit to the factory premises by an Indonesian certifying agency, the cost is considerably higher for imported goods. The monetary cost is compounded by the uncertain duration of the process and World Bank research has found this procedure to negatively impact firms in Indonesia.[24]

23 The survey did not elaborate which specific customs procedures

24 SNI certification is also a recurrent cost as the certification must be renewed every year against a fee and the certification process must be carried out again every three or four years depending on the product (see Cali and Montfaucon 2021).

Other challenges to importing include the lack of information for importing (10 percent), port-of-entry restrictions (7 percent), government procurement (5 percent), and LCRs (5 percent). The survey revealed that firms face multiple trade-related challenges in importing green goods and, while this is a limited sample, the results are in line with previous findings about some of the most problematic NTMs that traders face in Indonesia. This additional information reveals that these same measures potentially affect the greening of Indonesia's production and exports.

The main challenge identified in exporting green goods are standards in export markets (25 percent) and the lack of harmonization between Indonesia's standards and international ones, followed by export approvals (15 percent) (Figure 32). Firms exporting green goods face challenges in meeting product standards in destination markets. This may be because most of these products are highly technologically sophisticated (Figure 25 and 26). Crucially, this is consistent with Indonesia's low harmonization with international standards and an increased trend toward the adoption of national standards, among the reasons why firms may find it more challenging to compete internationally. Indeed, over 80 percent of firms surveyed reported that the recognition of Indonesian standards in foreign markets and harmonization with that of trading partners is a key obstacle (Figure 33). This also relates to reported challenges with obtaining export approvals from Indonesian authorities which can be cumbersome when some of the documents and restrictions apply.

Among other challenges identified were the lack of information on market access (13 percent), the high costs of imported inputs (11 percent), and customs procedures both in Indonesia and destination markets (11 percent) (Figure 32). Production cost due to the high cost of imported inputs is unsurprising given the prevalence of NTMs affecting intermediate goods imports. Customs procedures in both Indonesia and destination markets can also be challenging and these are usually compounded due to the documentary requirements of export approvals domestically, and standard certifications. This relates to the lack of information on foreign markets. This lack of information on market access further resonates with the finding that more internationally exposed firms (two-way traders) dominate green goods trade, especially exports (see Figure 20).

Despite these challenges, 41 percent of importers and 32 percent of exporters reported benefiting from duty-free or special permits or subsidies when trading green goods (Figure 34). This suggests that there may be efforts to stimulate such trade, or these traders are taking advantage of policies that affect these goods, even if the policies may not necessarily be of environmental benefit.[25] Unfortunately, more in-depth information on these was unavailable at the time of writing this note.

As for environmental services trade, and despite recent reforms, the main identified challenges have to do with businesses being unable to access critical foreign skills (Figure 35). The main challenges faced by firms have to do with getting working visas and permits for foreign workers (13 percent), restrictions on the number of foreign workers (11 percent), and requirements for workers to be local or native (9 percent). These contribute to shortages of needed skills for firms.[26] Although the Omnibus Law has also adopted complementary reforms to address skills shortages that could reduce the benefits from investment liberalization, it appears that the impact has not yet been realized and these reforms may not have covered services critical to trade and production of green goods and technologies.

25 The survey does not provide more details of the type of benefits and subsidies that are most prevalent, and this is an area of follow-up research.

26 Until recently, Indonesia operated a highly restrictive work permit system that involved a limited set of occupations eligible for work permits and a cumbersome approval process. This included the approval of the Expatriate Manpower Employment Plan and the issuance of the Expatriate Manpower Employment License by the Ministry of Manpower. Any work permit needed for a position outside the eligible ones required the approval of the line ministries related to the specific sector and occupation. The restrictiveness of the work permit system effectively prevented businesses from accessing foreign talent–unlike the case in most other countries in the region.

FIG 31 IMPORT CHALLENGES

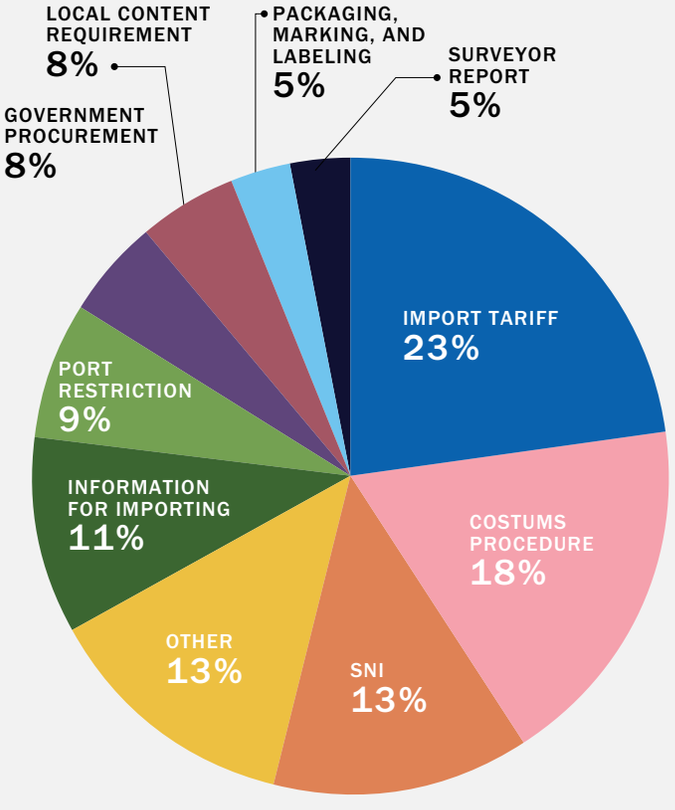


FIG 32 EXPORT CHALLENGES

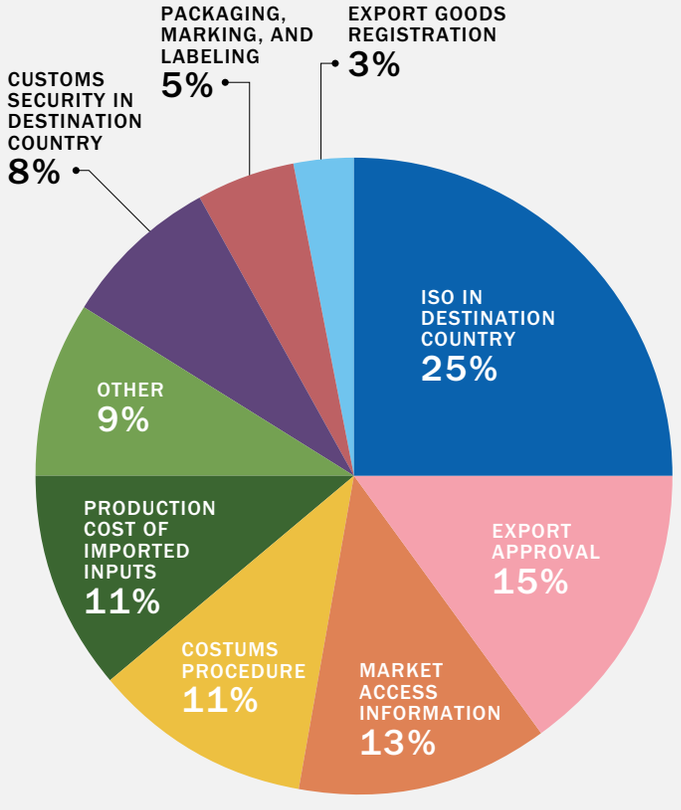


FIG 33 CHALLENGES WITH PRODUCT STANDARDS

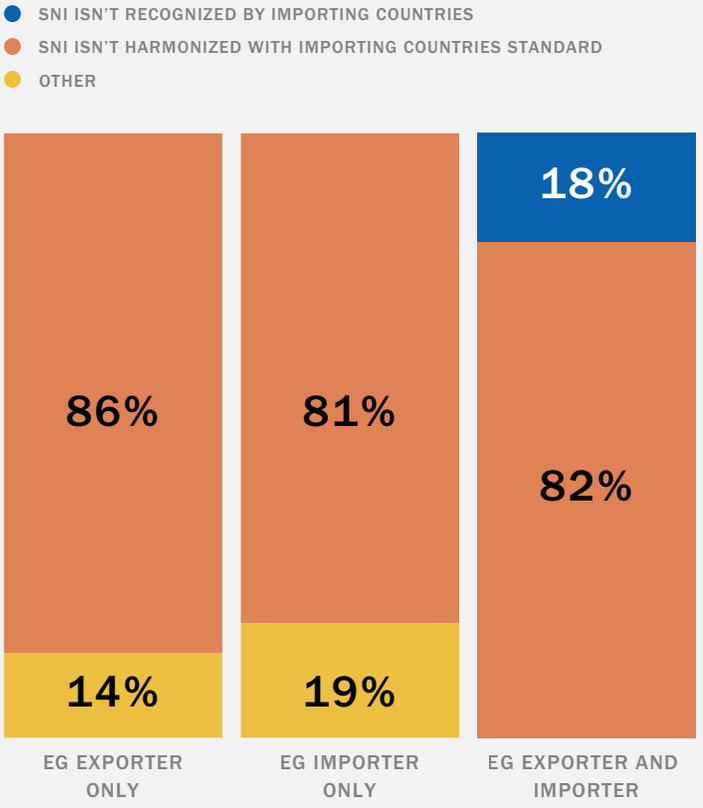


FIG 34 DUTY-FREE OR SPECIAL PERMITS OR SUBSIDIES FOR TRADING EG

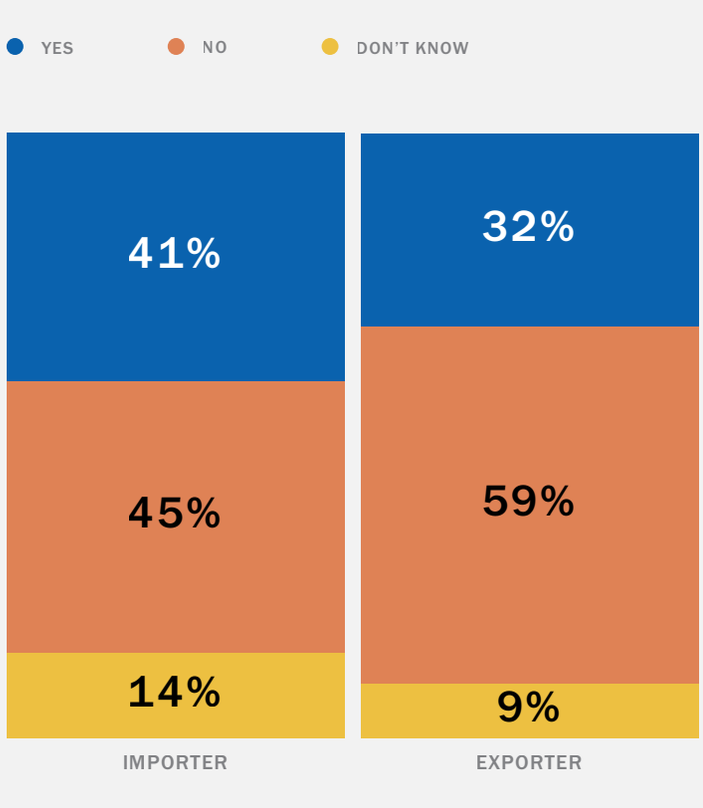
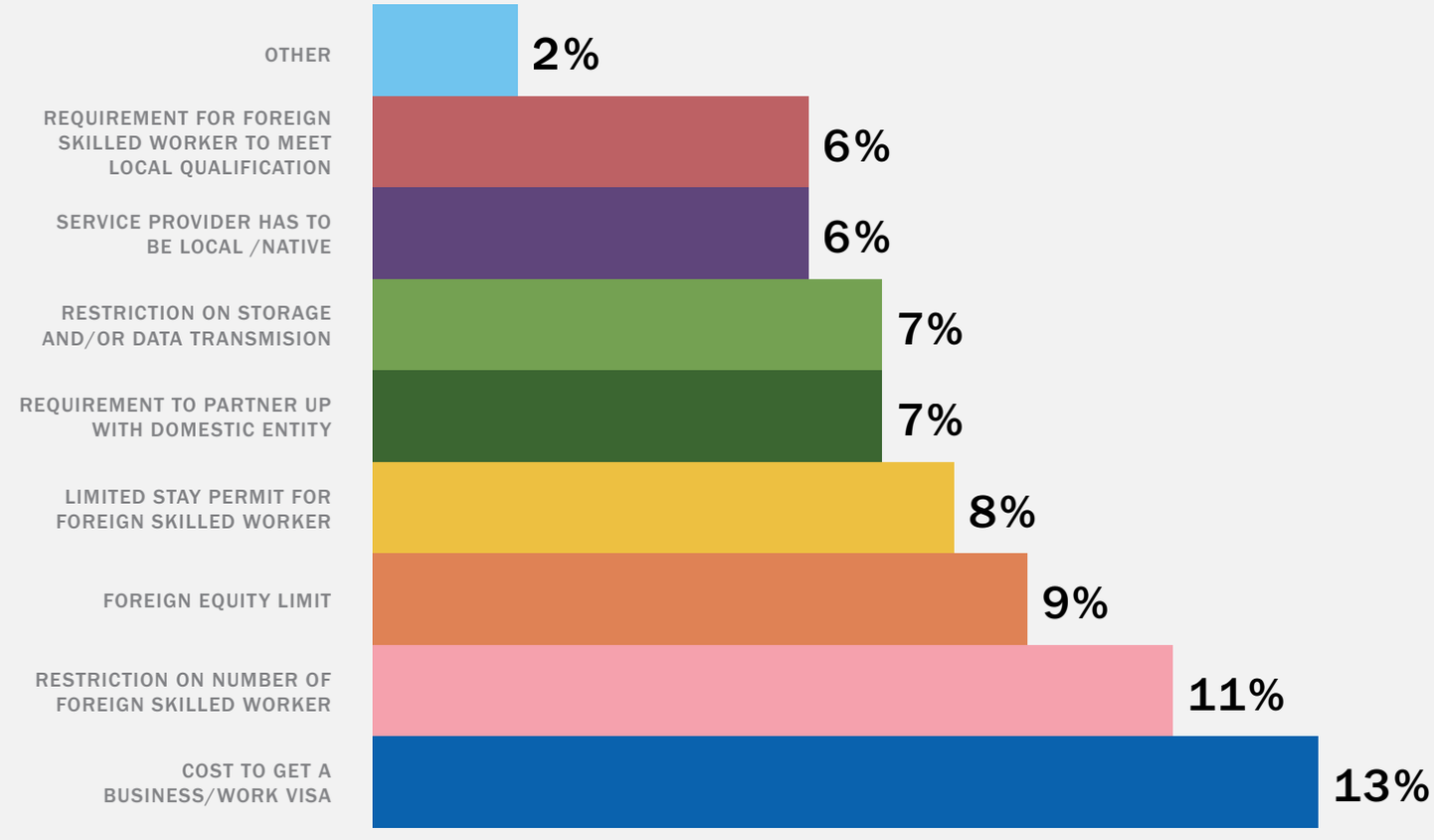


FIG 35 CHALLENGES RELATED TO INTERNATIONAL TRADE OF ENVIRONMENTAL SERVICES



Source: Figures 5.1-5.5 : Authors calculations based on the World Bank 2022 CCDR Firm Survey.

Conclusions and Key Takeaways

Although Indonesian firms' entry rates in green goods trade is lower compared to other products, an increasing number of firms are engaged in green goods trade in Indonesia, signaling increased opportunities. As demand for green products increases globally, more opportunities are opening up and firms have the opportunity to scale up trade in green goods. Indonesian firms that both export and import are better performers, export more green products, trade in higher-technology green goods, and have higher survival rates in export markets. This is because these two-way traders are generally more exposed to international competition compared to importer-only and exporter-only firms, making them more competitive, more informed, and adaptable to shocks. Furthermore, in the presence of today's GVCs, firms need to import to export, and two-way traders are more likely to have access to a larger variety of high-quality inputs.

Trade policies such as import and export approvals, harmonization of standards, and tariff and non-tariff measures are important to lowering barriers for Indonesian firms to enter, stay, and be competitive in producing and exporting green goods. To stimulate non-exporters to engage in exports, reducing foreign market entry costs will be more effective. This includes addressing challenges such as tariffs for products that still have high tariffs, harmonization of standards, export approval processes, access to imported inputs through addressing non-tariff measures such as pre-shipment inspection (surveyor report), and customs procedures. To stimulate existing exporters to export more to their established trade partners, lowering bilateral trade tariffs and non-tariff barriers would be more appropriate–especially mutual recognition of standards and international harmonization of some standards in Indonesia. In addition to these behind the border steps, trade agreements may have a large impact by reducing information costs and unlocking export markets.[27]

27 Policy Note 3 explores in more detail the role of trade agreements in the climate change agenda.

Keeping the costs of environmental goods and services low, including access to critical skills and technologies, is not only a way of ensuring competitiveness, but also of making cleaner practices more accessible and widespread, including for domestic firms. An enabling environment for firms to import and export green goods and environmental services could benefit both domestic importers and exporters and non-traders. Ensuring access to green goods imports would also enable greater competitiveness in green goods exports for Indonesian firms. GVC firms tend to have lower export market exit rates because of their embeddedness in specific segments of the international production chain and close collaboration with GVC firms in other countries. Two-way traders can also use the contacts that their trade partners already have to obtain information and access to foreign markets. Such firms tend to have increased efficiency derived from purchasing intermediate inputs abroad which improves export performance (Bertrand 2011). As such, ensuring that firms can easily import would also ensure that firms are exporting green goods efficiently.

03

P.49–74

THE ROLE OF TRADE POLICIES IN INDONESIA'S GREEN TRANSITION

Introduction

Aligning trade policies with green development will be of crucial importance for Indonesia's green transition and climate adaptation and mitigation plans. An enabling trade policy framework is needed to ensure that Indonesian companies and consumers have access to green and environmentally friendly goods, services, and cutting-edge technologies at competitive prices. In turn, this will help incentivize the private sector to scale up green activities and the adoption of green technologies, boost investment and innovation in clean sectors and create green jobs. It will also encourage consumers to adopt more environmentally friendly consumption habits. With lower barriers on green and climate-friendly products and services, international trade can be a powerful tool for Indonesia's climate change mitigation and adaptation efforts.

Despite low average tariffs on imports of green goods and technologies, burdensome and costly non-tariff measures (NTMs) pose a significant cost to green goods in Indonesia, and their competitiveness. At an average of 1.1 percent, Indonesia's tariffs on green goods are generally low and also lower than aggregate average tariffs. Estimates, however, suggest that NTMs on green goods impose significant costs, equivalent to an average 20 percent tariff and higher than "non-green" goods. Among NTMs, import approvals, compliance with Indonesian national standards (*Standar Nasional Indonesia*: SNI), and pre-shipment inspections have a major impact on products critical to climate change adaptation and a worse impact than other countries in the region. Targeted NTM reforms are needed to ensure that discriminatory and costly NTMs are streamlined or eliminated.

In addition, local content requirements (LCR), aimed at creating local manufacturing capacity, are particularly burdensome, especially in the case of renewable energy and green technologies. For example, LCR regulations set the level of domestic components for solar modules at a minimum of 40 percent, contributing not only to distortions and efficiency losses but also, to date, the underdevelopment of the local solar industry. This is because, domestically

produced solar panels are more expensive, their efficiency is lower, and they are not suitable substitutes for solar panels that could be imported from foreign markets (Institute for Essential Services Reform: IESR 2021). Similarly, stringent LCRs for electric vehicles (EVs) are unlikely to achieve their intended objective of developing Indonesia's EV industry and will instead delay its growth. Finally, LCRs act as barriers to international public procurement and as such reduce the attractiveness of major renewable energy sector public procurement projects.

Of Indonesia's 11 trade agreements, four contain environmental provisions and only two of these are (weakly) legally enforceable. Conversely, at the global level, close to 90 percent of trade agreements currently in force include some form of commitments concerning the environment. Of Indonesia's trade agreements in force, only the ASEAN-Republic of Korea, ASEAN-Japan, Indonesia-Chile, and Indonesia-Japan agreements include environmental provisions. Of these, the Indonesia-Chile and ASEAN-Japan agreements include environmental provisions that could be (weakly) legally enforced. The inclusion of such provisions in trade agreements has been shown to mitigate their potential adverse environmental effects–including deforestation. Indonesia also ratified a trade agreement with countries of the European Free Trade Association (EFTA)[28] in May 2021 which strengthens its certification and monitoring, reporting and verification (MRV) systems for the trade of sustainable palm oil. Although EFTA countries are a very small market for Indonesia (less than 0.5 percent of Indonesia's imports and exports), the use of MRV in trade agreements could be scaled up.

Indonesia is not one of the 46 members of the World Trade Organization (WTO) engaged in plurilateral negotiations seeking to eliminate tariffs on green goods under the Environmental Goods Agreement (EGA). Indonesia also does not participate in the three recently launched multilateral initiatives aimed at tackling issues at the nexus between trade policy and climate change, namely the Trade and Environmental Sustainability Structured Discussions (TESSD), the Informal Dialogue on Plastics Pollution and Sustainable Plastics Trade (IDP), and the Fossil Fuel Subsidy Reform (FFSR). Despite recent momentum on trade-related environmental issues during the preparation for the 12th WTO Ministerial Conference in December 2021, so

28 Iceland, Liechtenstein, Norway, and Switzerland.

far there has not been much progress on this agenda globally. In the early stages, however, Indonesia was one of the signatories of the Asia-Pacific Economic Cooperation (APEC) agreement in 2012 committing to limit tariffs on 54 environmental goods (EGs) to a maximum of 5 percent. Other multilateral and plurilateral initiatives have so far been limited in terms of country participation, and negotiations were limited to reducing tariffs, not tackling significant NTMs and barriers affecting environmental services (de Melo and Solleder 2020).

Results of simulations using a partial equilibrium trade model at the product level suggest that unilateral, regional, and multilateral liberalization of tariffs on green goods trade would have previously untapped benefits for Indonesia. First, unilateral liberalization of tariffs would boost the private sector's access to cheaper and cutting-edge green goods and technologies, increase imports of green goods (especially of Cleaner or More Resources Efficient technologies and Natural Risk Management), and strengthen trade ties with important trading partners such as the United States; Taiwan, China; Hong Kong SAR, China; and India. Second, regional liberalization of tariffs on green goods trade among APEC countries would create important "trade creation" effects with other participating countries and would benefit Indonesian exporters of green goods such as Energy Efficiency; Resource and Pollution Management; and Water Supply. Third, results also show that the opportunity costs of not participating in the WTO EGA could be significant for Indonesia–not only in terms of lost export and import opportunities but also for being able to shape the content and course of negotiations in these different multilateral forums. Conversely, liberalizing tariffs on green goods under the umbrella of the WTO EGA is estimated to boost Indonesia's green goods exports by 1.1 percent (US$99 million) and imports by 1.2 percent (US$214 million).

The rest of the note focuses on trade policy constraints to developing Indonesia's green competitiveness and diversification potential. The first note takes stock of tariffs applied by Indonesia on imports and tariffs faced by exports of green goods; the second note looks at the landscape of NTMs affecting green goods imports and reports estimates of their ad valorem equivalents; the third note zooms in on environmental provisions in Indonesia's existing free trade agreements; the fourth note quantifies the benefits of liberalizing trade in green goods; and the last note offers policy recommendations.

Tariffs on Green Goods and Technologies

At an average of 1.1 percent,[29] Indonesia's tariffs on green goods are generally low and lower than aggregate average tariffs (at 2 percent). These lower-than-average tariffs on green goods are mostly a result of green goods liberalization under the APEC agreement, under which Indonesia and other APEC countries[30] committed to limiting tariffs on 54 EGs to a maximum of 5 percent. As such, Indonesia's tariffs on green goods are consistent with global trends, with average tariffs on green goods being lower than average aggregate tariffs. Low average tariffs, however, hide some tariff peaks that still remain for several products and product categories. For example, while on the one hand imports of green products for Waste Management, Recycling and Remediation and Gas Flaring Emission Reduction benefit from close to zero average import tariffs (Figure 36), higher than average tariffs are applied on green goods categories such as Cleaner or More Resource Efficient Products (2.9 percent), Natural Risk Management (2.6 percent) and Environmentally Preferable Products (1.7 percent). There are also more than 20 product lines with applied tariffs of more than 5 percent, among which the highest apply to imports of motor vehicles, undenatured ethyl alcohol and tanks, casks, and drums with tariffs above 20 percent.

Indonesia's Most Favored Nation (MFN) tariffs[31] on green goods imports remain high (6.1 percent), and there are several product lines with tariff peaks of above 25 percent. MFN tariffs are the highest on green goods categories such as Cleaner or More Resource Efficient Products (10 percent), Water Supply (9.5 percent), and Heat and Energy Management (8.2 percent) (Figure 38). There are several tariffs peaks that apply to imports of products such as motor vehicles, and bicycles (including tricycles) with tariffs of 35-40 percent and over 25 percent, respectively. Participation in the WTO EGA would allow Indonesia to reduce these MFN tariffs and benefit from increased market access for exports to other participating countries.[32]

29 All tariffs reported in this note were calculated using trade weighted averages.

30 APEC countries are Australia; Brunei Darussalam; Canada; Chile; China; Hong Kong SAR, China; Indonesia; Japan; Republic of Korea; Malaysia; Mexico; New Zealand; Papua New Guinea; Peru; the Philippines; the Russian Federation; Singapore; Taiwan, China; Thailand; the United States of America; and Vietnam.

31 MFN tariffs are tariffs imposed on imports from other members of the WTO, unless the country is part of a preferential trade agreement.

32 For a list of adaptation and mitigation categorization of the green goods, see Table 4 in Appendix Three.

In terms of market access, Indonesia also faces relatively low average tariffs (1.8 percent) on its exports of green goods in destination markets. Among green goods categories, tariffs on Indonesia's exports of products for Natural Risk Management (6 percent), Cleaner or More Resource Efficient Products (3.2 percent), Energy Efficiency (2.9 percent), and Noise and Vibration Abatement (2.9 percent) are among the highest (Figure 37). There are also high tariffs of above 10 percent applied to Indonesia's exports of products such as undenatured ethyl alcohol, motor vehicles for the transport of more than 10 persons, vapor-generating boilers (including hybrid boilers), and bicycles (including tricycles). Overall, however, tariffs on Indonesia's exports to major destination markets (EU, China, Japan, United States) are generally low but high tariffs reduce Indonesia's exports to Pakistan, Argentina, and Brazil (Figure 39).[33]

33 In December 2021, Indonesia and MERCOSUR countries (Argentina, Brazil, Uruguay, and Paraguay) launched negotiations for a Comprehensive Economic Partnership Agreement which could potentially cover the liberalization of green goods.

FIG 36 INDONESIA'S AVERAGE TARIFFS ON GREEN GOODS IMPORTS 2019

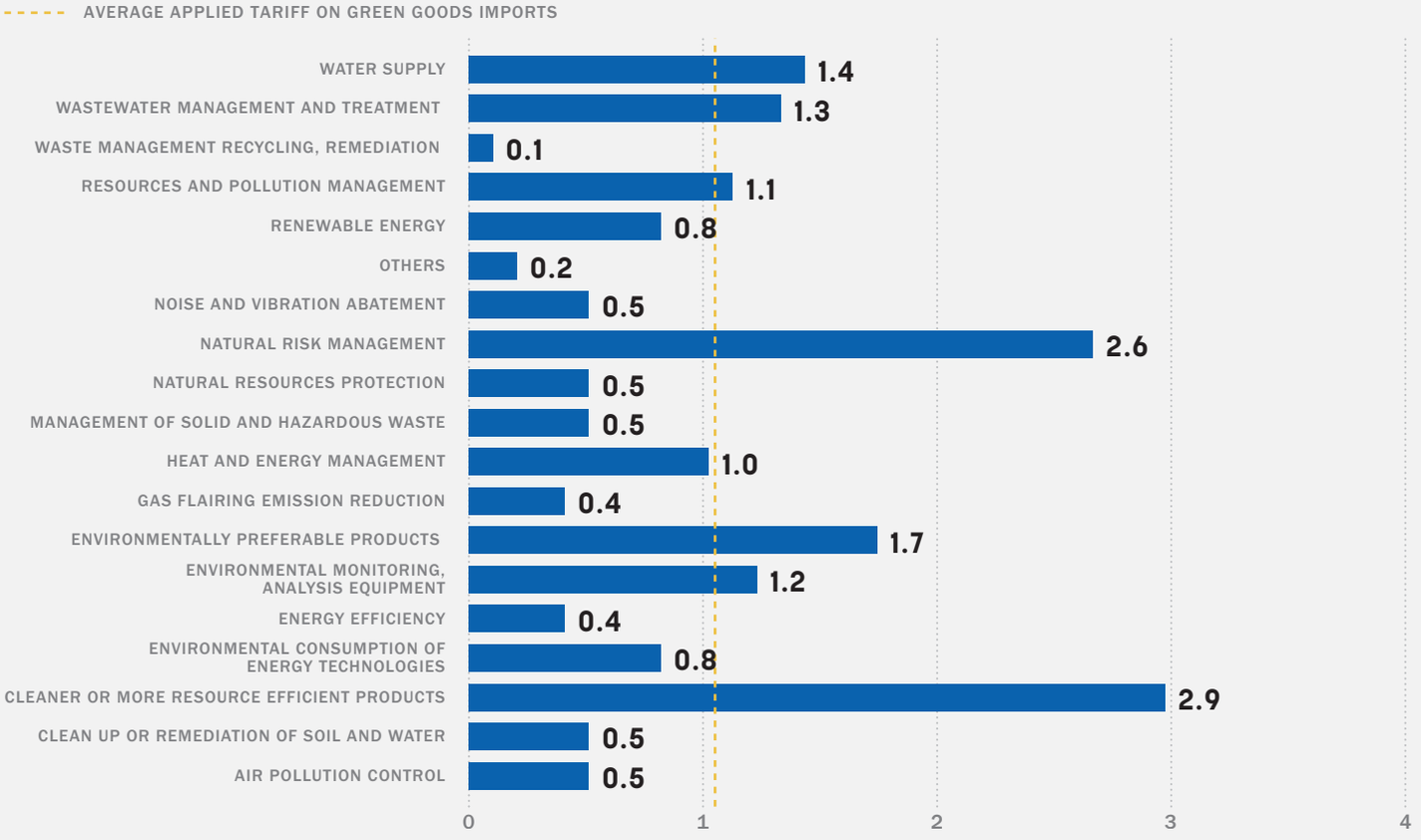


FIG 37 TARIFFS FACED BY INDONESIAN GREEN GOODS EXPORTS 2019

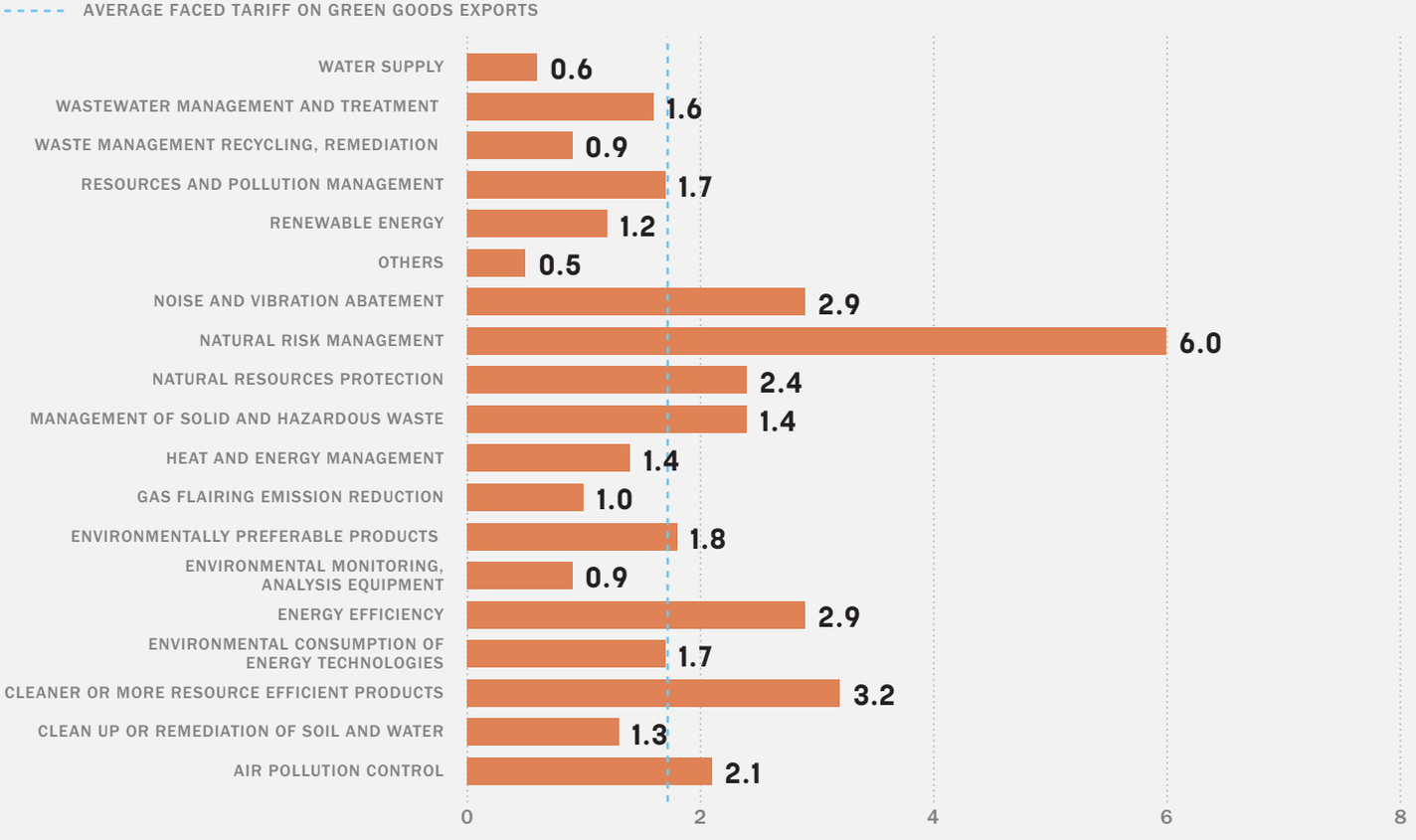


FIG 38 INDONESIA'S MFN TARIFFS ON GREEN GOODS IMPORTS 2019

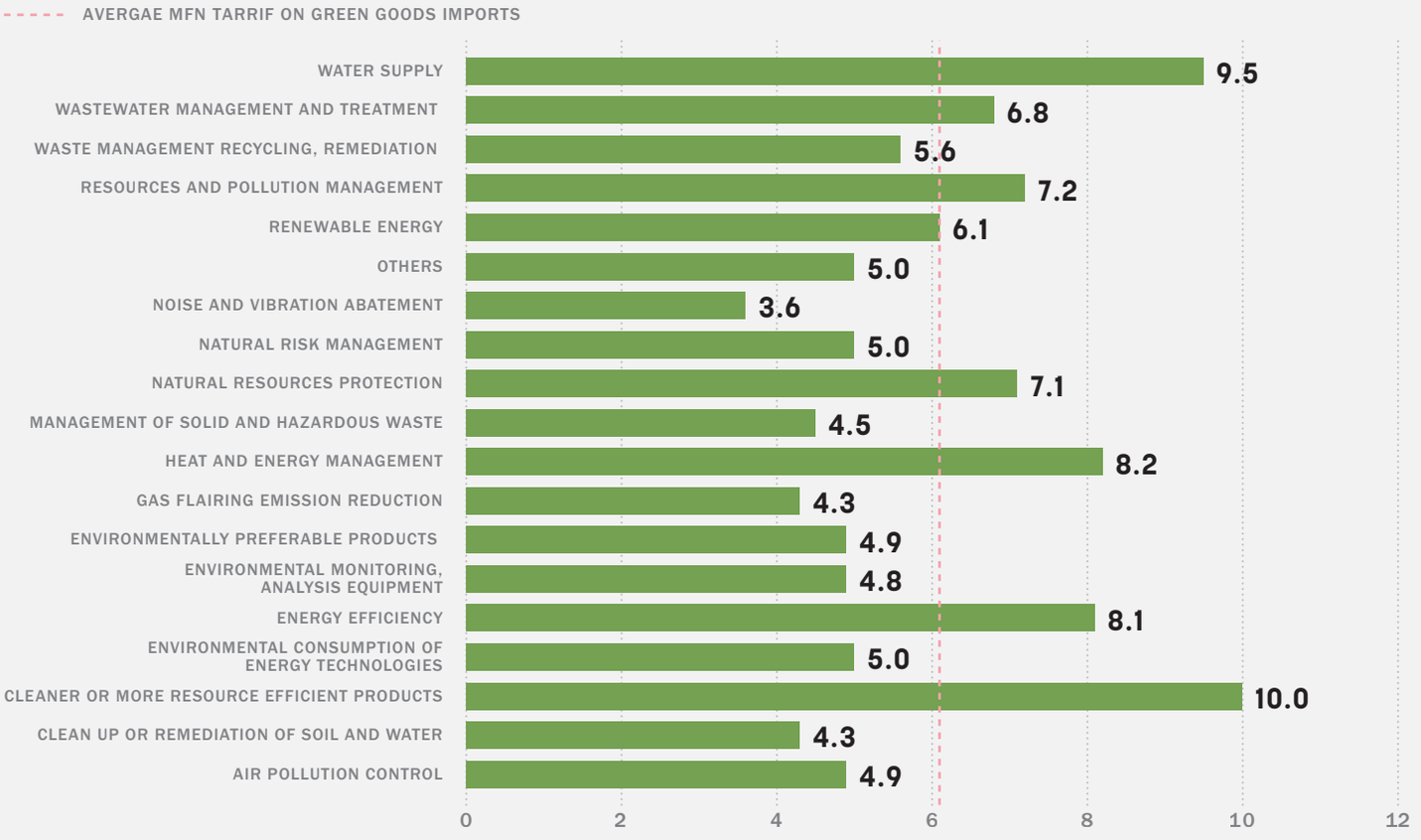
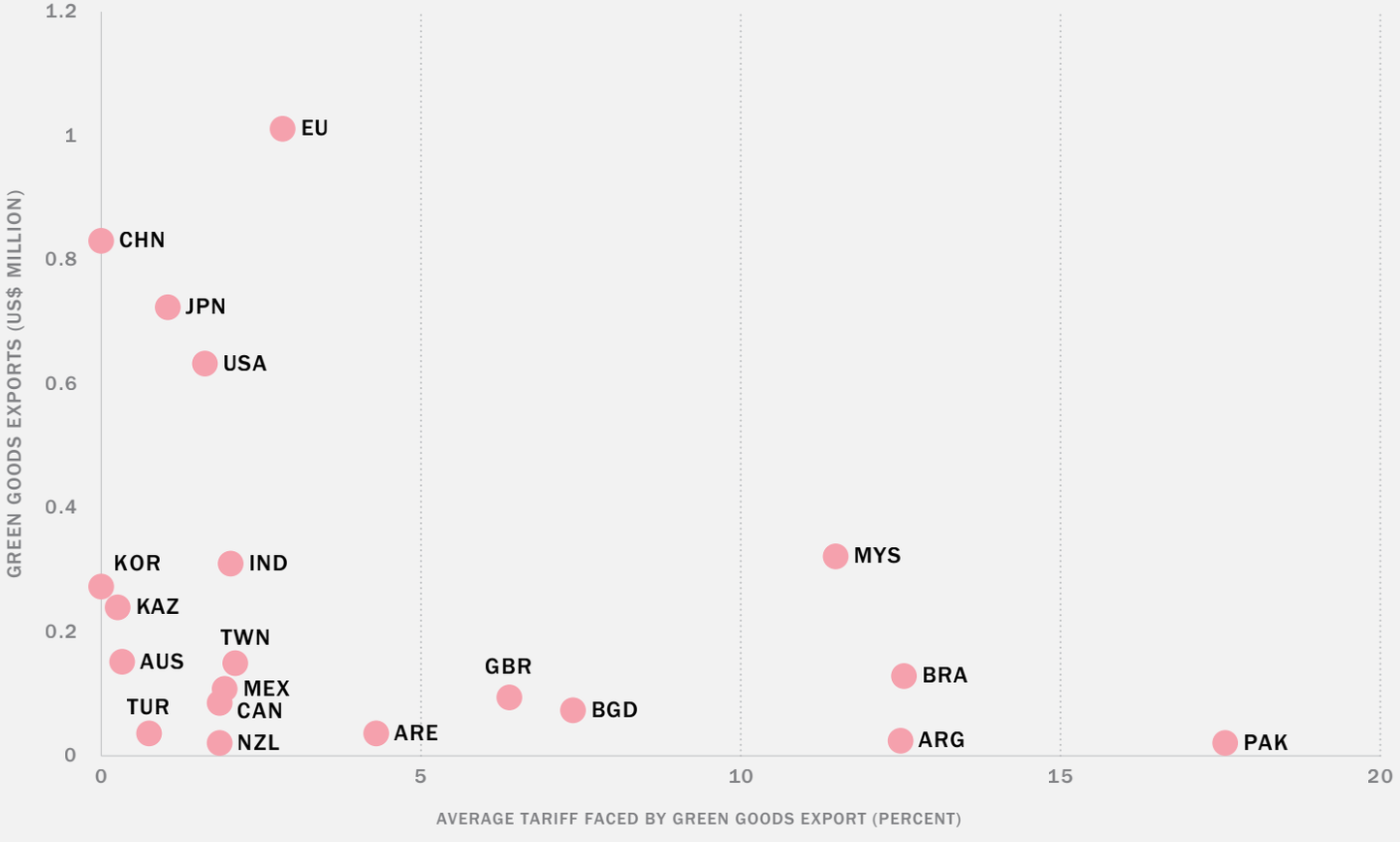


FIG 39 AVERAGE TARIFFS FACED BY INDONESIAN GREEN GOODS IN MAJOR EXPORT MARKETS 2019



Source: Figures 36-39 World Bank staff calculations based on the World Bank WITS database.

Non-Tariff Measures (NTMS) Affecting Green Goods and Technologies

Despite low tariffs, a high incidence of NTMs on imports of green goods and technologies prevails in Indonesia. In 2020, there were over 40 NTMs applied to imports of green goods out of over 60 NTMs applied to all imports into Indonesia.[34] The bulk of these are technical barriers to trade (TBT) (18 percent in 2020),[35] followed by sanitary or phytosanitary (SPS) measures (12 percent) (Figure 40).[36] With the exception of quantity controls (QC) and inspection measures, NTMs applied to imports of green goods have increased over the years. The more pronounced increase in SPS measures may be associated with an increasing preference for quality products as a country's income rises (Munadi 2019). More generally, however, the increase in NTMs applied on green goods is consistent with Indonesia's increasing incidence of NTMs applied to all imports (Cali and Montfaucon 2021). The measure which affects the highest share of green goods imports is traceability of information requirements (a TBT measure), affecting 27 percent of imports in 2020, closely followed by pre-shipment inspections and import approvals (Figure 41).

Between 2009-18, Indonesia submitted 46 environment-related NTM notifications to the WTO. The majority of these were related to sustainable agriculture management, the implementation of multilateral environmental agreements (MEAs) and the management of chemical, toxic, and hazardous substances. Among types of measures, these NTMs fall mostly under technical regulations, import licenses, and conformity assessments and pertain to agriculture, manufacturing, and chemicals.

To estimate the costs and distortedness of NTMs on green goods trade, a two-step estimation method is used. The rationale for the two-step estimation is that trade policy affects both the trade volume and price of green goods. The first step is to estimate how trade

34 For NTMs, we use the most recently updated database on NTM measures from the World Bank Jakarta (see Cali and Montfaucon 2021 for details). This database contains information on NTMs at the three-digits level of the MAST NTM classification for all existing regulations for Indonesia at HS10 level. The database is novel and time varying at a monthly level, and spans from 2008 to 2020.

35 These are measures referring to technical regulations, and procedures for assessment of conformity with technical regulations and standards.

36 These are measures that are applied to protect human/animal life from risks arising from additives, contaminants, toxins, or disease-causing organisms in their food; to protect human life from plant- or animal-carried diseases; to protect animal or plant life from pests, diseases, or disease-causing organisms; to prevent or limit other damage to a country from the entry, establishment or spread of pests; and to protect biodiversity. These include measures taken to protect the health of fish and wild fauna, as well as of forests and wild flora. Note that measures for environmental protection (other than as defined above), to protect consumer interests, or for the welfare of animals are not covered by SPS.

volumes adjust in the presence of a wide variety of NTMs and implicitly the price effects on imports and import demand. In a second step, the change in the domestic price of a product in response to a change in NTMs (that is, the ad valorem equivalent (AVE) of NTMs) is calculated. Finally, a unique AVE for each NTM affecting green goods is derived by taking the weighted average of product-specific AVE for each NTM. The import share of each product relative to all products exposed to that NTM is used as weight.

Estimates show that in addition to their high incidence, NTMs on green goods are burdensome and distortive, with tariff equivalents that are much higher than for other products (non-green goods). Estimations of the tariff equivalent of NTMs on green goods reveals that most NTMs impose significant costs, equivalent on average to a 20 percent tariff, compared to only 12 percent on other products. Among NTMs, SPS measures are shown to have the highest tariff equivalent of 147 percent, while TBTs are estimated to impose a burden equivalent to a tariff of 26 percent, compared to only 9 percent for other products. Among TBT measures, tolerance limits and packaging requirements pose the highest cost on imports and among SPS, special authorization requirements are the most burdensome. While the majority of SPS measures are applied to protect human, animal or plant life or health, these regulations can be implemented more effectively, reducing their costs. For TBT measures, requirements such as labelling, packaging, and product identification, as well as the prohibition of the use of certain substances and of repaired or used products also pose very high costs.

Among the most affected by NTMs are green products and technologies critical for climate change mitigation efforts, especially in terms of the energy transition. In most cases, various NTMs are applied to the same products at the same time, compounding the compliance cost of NTMs. This is evident for products used for resources and pollution management,[37] where 10 different sets of regulations are applied, each adding up to very high ad valorem tariff equivalents for these products (Figure 42). Similarly, products used for Air Pollution Control, Gas Flaring Emission Reduction, and Efficient Consumption of Energy Technologies and Carbon Capture and Storage (ECETCCS), are affected by multiple NTMs at a time and, therefore, have particularly high costs compounding to over 200 per-

37 Agriculture and land use transition/natural resource management that are important for mitigation efforts.

cent ad valorem tariffs. This shows the most affected products in both number and tariff-equivalent costs but there are more than 13 NTMs and trade in all green products is adversely affected by NTMs.

Not all NTMs are problematic and require reform, rather the key is identifying measures which impose an unnecessary burden, and negatively impact green trade. The focus is on measures that fulfill the three conditions underlying the breach of a key principle of WTO rules: (i) they discriminate against imports; (ii) they are not necessary to achieve a non-trade objective; and (iii) they are likely to impose significant costs on imports. Based on these conditions, previous World Bank research identified four trade reforms that Indonesia needs for competitiveness, export growth, and resilience of firms to shocks. These are: (i) pre-shipment inspection; (ii) restrictions on port of entry of imports; (iii) mandatory certification with SNI; and (iv) import approval requirements.

The results show that these NTMs that need reform are also detrimental to green goods trade critical to the climate agenda–resulting in their increased imported cost and hindering their access to the Indonesian economy. Results show that pre-shipment inspections, compliance with SNI, and import approvals are indeed costly to the access of green goods and technologies through imports (Figure 43). For instance, the cost of SNI compliance is above 100 percent–that is, US$1.00 for every US$1.00 of imported products used for Resource and Pollution Management–and US$0.23 per US$1.00 for import approval compliance for these products. Reforming these NTMs would have a positive impact on firms' access to green inputs.

The impact of these NTMs is also worse in Indonesia compared to other countries in the region, suggesting lower implementation efficiency and higher compliance costs, thereby hampering Indonesia's green transition and comparative competitiveness. Even when the same measures are applied to the same goods in different countries, the cost of the measures will differ, depending on how the measures are implemented–which translates to the compliance cost to traders. This compliance cost is captured through the tariff ad valorem equivalent of NTMs. Further analysis reveals that when the same non-tariff measure is applied in other countries, the cost of these measures in Indonesia is significantly higher for green goods. For example, the cost of pre-shipment inspections of green goods are

18.6 percent higher in Indonesia and port of entry restrictions up to 17.5 percent (Figure 44).[38]

LCRs or "localization rules" are also often cited as distortive, especially in the case of renewable energy and green technologies, and these policies have not achieved the desired result in other countries (World Economic Forum 2021). LCRs require firms to use a certain percentage of domestically produced goods or services and are among the fastest growing NTM measures applied worldwide.[39] To comply with LCRs, firms are often required or incentivized to substitute imported inputs for what may be more expensive and lower quality domestically produced ones, leading to increases in costs, loss of efficiency and competitiveness. LCRs are imposed by governments with the objective of helping the development of local industries but stringent and high minimum LCRs often act as a deterrent to their growth. Indeed, LCRs applied in other countries for the purposes of developing domestic productive capability of renewables have mostly led to increased costs.[40]

LCRs pose a major obstacle to the development of the renewable wind and solar industry in Indonesia. Despite significant potential to expand the use of wind and solar energy, their growth has been lagging, partially due to stringent LCRs. For example, LCR regulations[41] set the level of domestic components for solar modules at 40 percent, contributing to the underdevelopment of the local industry as domestically produced solar panels are more expensive than imported ones and local production of solar panels is highly reliant on imported parts and components. The price of imported solar modules from China ranges from US$0.25-0.37/Wp[42] while the average price of local solar modules is US$0.47/Wp (IESR 2019), implying that the efficiency of local solar modules is also lower.

Stringent LCRs also apply to the EV industry in Indonesia, compensated by generous incentives to attract investors. For two- and three-wheeled EVs, a minimum local content of 40 percent and for four-wheeled EVs a minimum 35 percent local content is currently required. LCRs will be further raised to a minimum of 60 percent for two- or three-wheeled EVs produced between 2024 and 2025, and 80 percent for those manufactured after 2026. For four-wheeled or more EVs the LCR will be raised to 40 percent if manufactured during 2022-23, 60 percent during 2024-29, and 80 percent from 2030 onwards.

38 Data for other countries for import approval NTM was unavailable.

39 Link

40 For example in Brazil, India, and South Africa as discussed in Bazilian et al. (2020).

41 MoEMR Regulation No. 49/2018 on the Utilization of Roof Top Solar PV by PT. Perusahaan Listrik Negara (PLN) and MoI Regulation No. 5/M-IND/PER/2/2017.

42 The capacity of solar installation is measured in watt peak (Wp) which is the maximum electrical capacity a solar cell can yield under ideal circumstances.

Developing and maximizing domestic linkages needs to be balanced with achieving international competitiveness, including through the use of competitively priced imported intermediates. The Indonesian Government is very keen to develop the domestic EV industry and, in addition to LCRs, it also introduced incentives to attract investors and stimulate growth of the local industry.[43] For example, imports of parts and components are allowed if local suppliers do not have the capacity to produce these components. In addition, EV manufacturers who develop production facilities in Indonesia can import completely built-up EVs and are exempted from luxury goods tax.[44] These initiatives are expected to jump-start sales of EVs in Indonesia.

43 PR No. 55/2019.

44 Government Regulation No. 74/2021 and Ministry of Finance Regulation No. 141/PMK.010/2021.

" Despite low tariffs, a high incidence of NTMs on imports of green goods and technologies prevails in Indonesia."

FIG 40 NUMBER OF INDONESIA'S NTMS ON GREEN GOODS

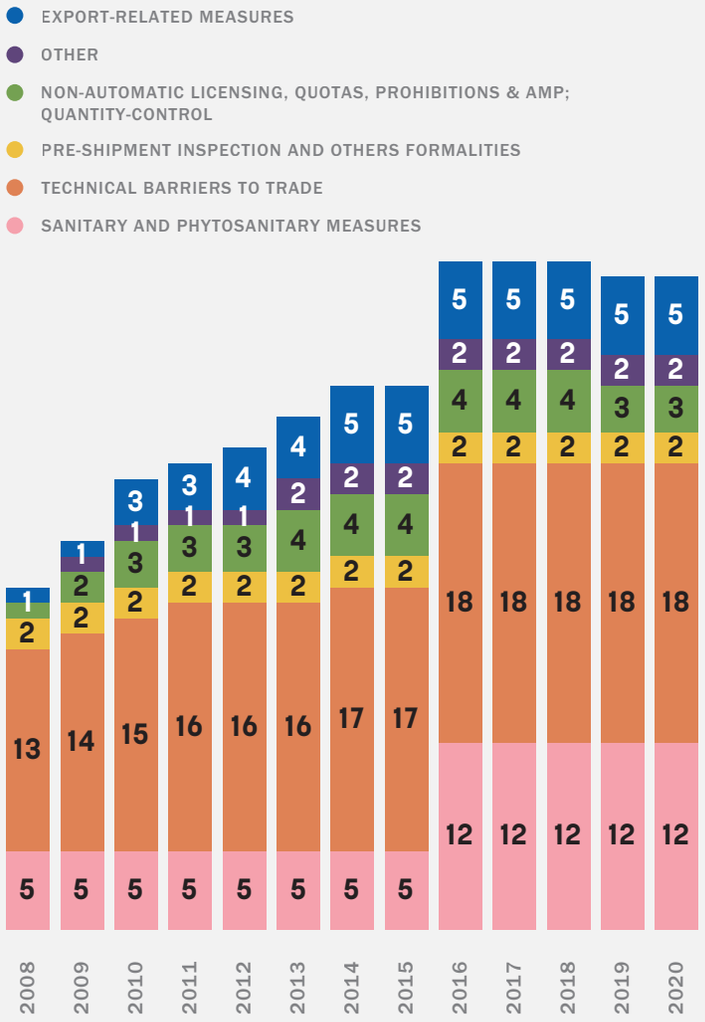


FIG 41 SHARE OF GREEN GOODS IMPORTS AND EXPORTS AFFECTED BY SPECIFIC NTMS 2020

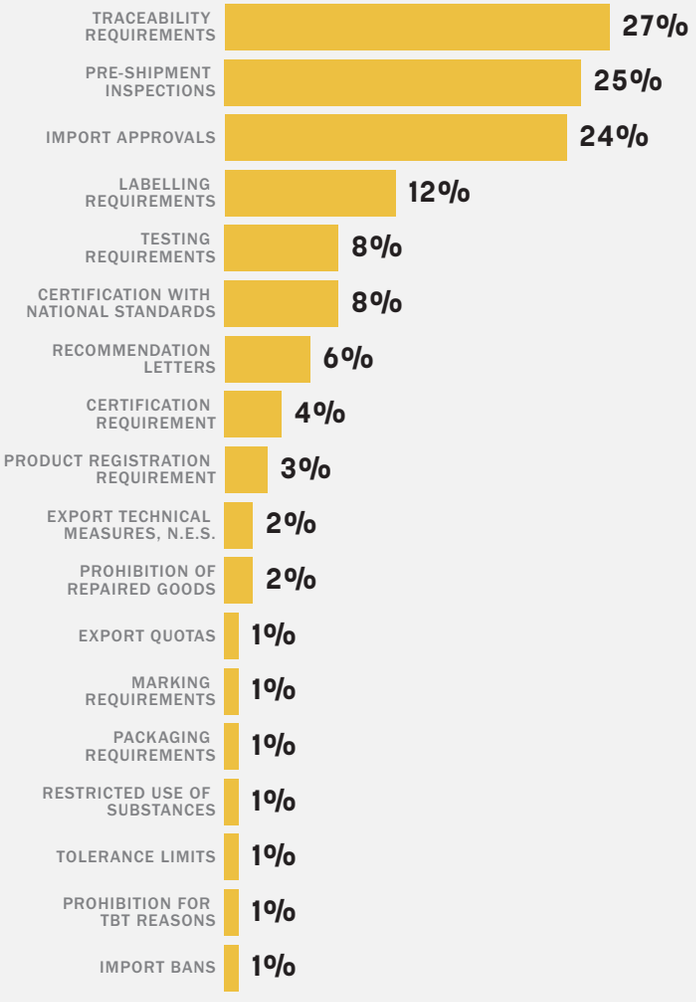


FIG 42 TARIFF EQUIVALENT OF SPECIFIC NTMS ON MOST AFFECTED EGS

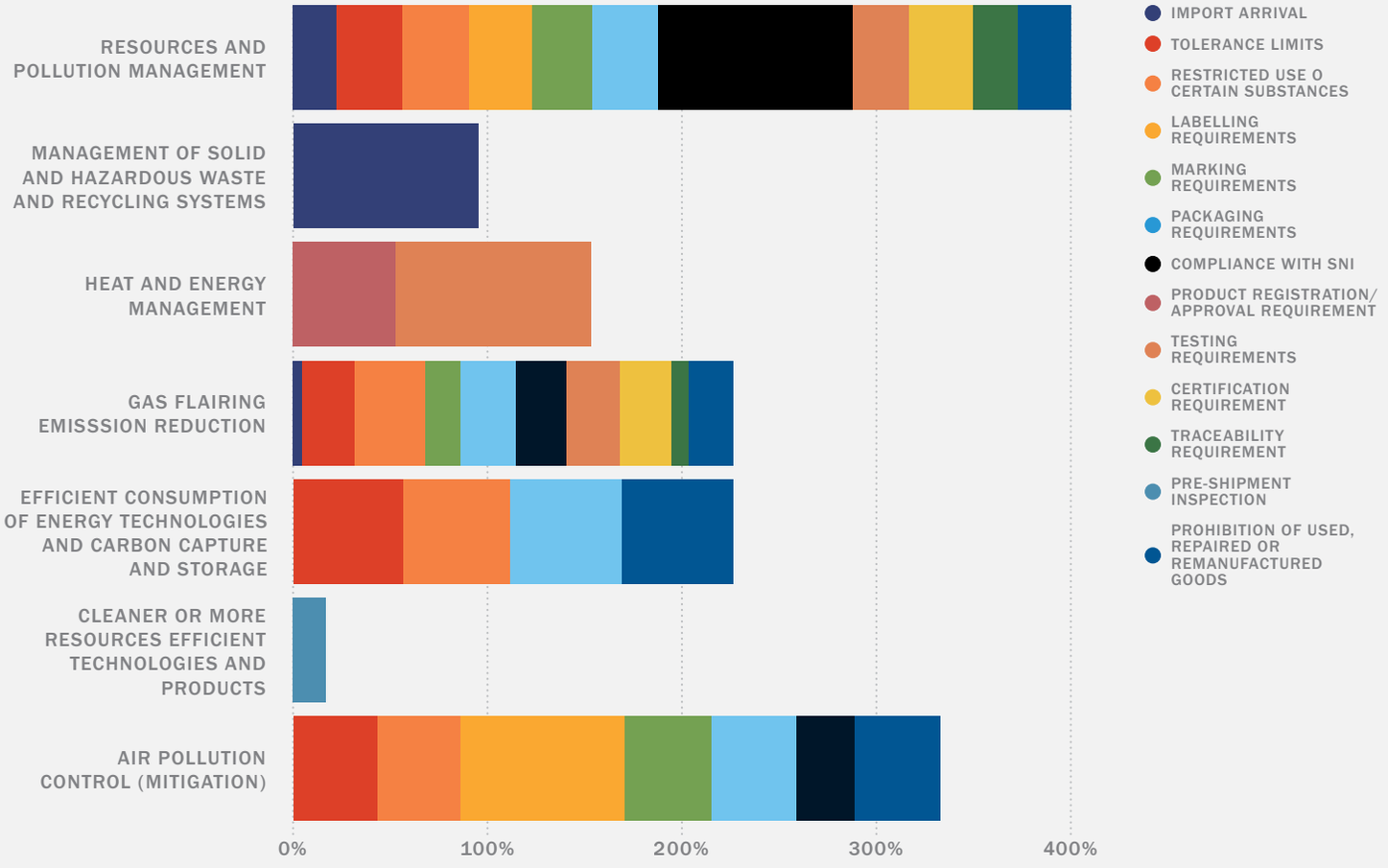
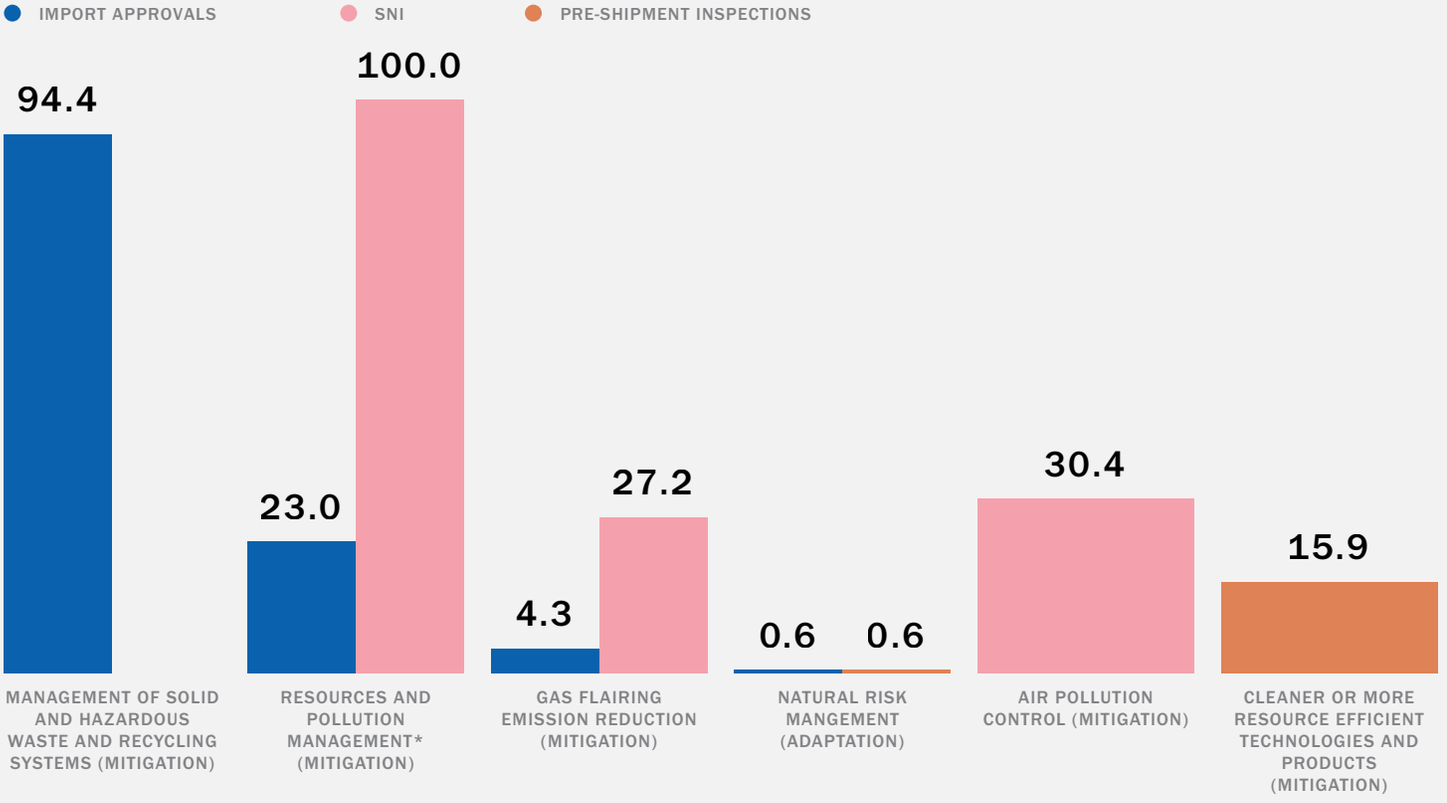
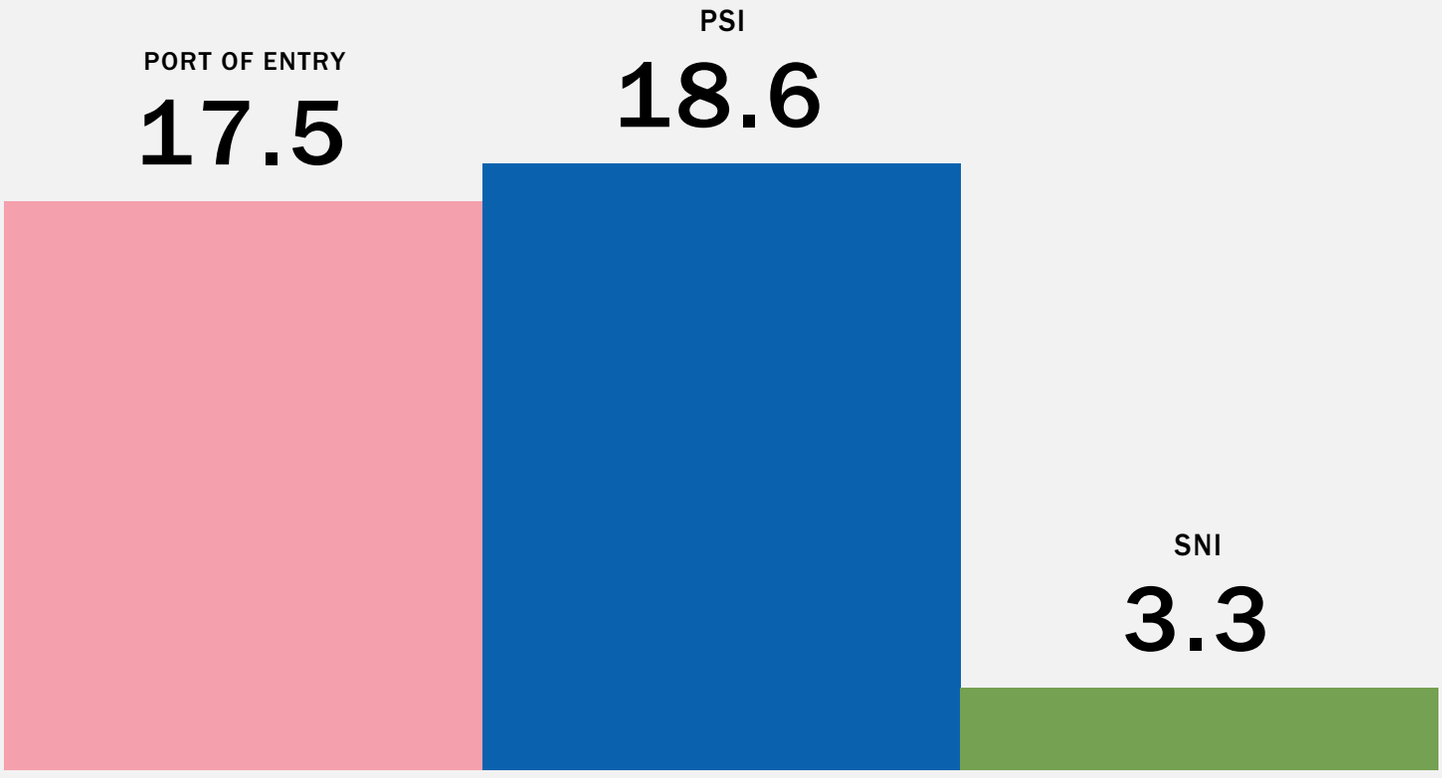


FIG 43 TARIFF EQUIVALENTS OF MOST PROBLEMATIC NTMS (PERCENT)



Source: Fig 40, 41, 42, and 43 are World Bank staff estimates based on GTN data and World Bank NTM data for Indonesia available at World Bank data catalog (link) Fig 42 and Fig 43 sample period is 2008-2018.

FIG 44 TARIFF EQUIVALENT OF MOST PROBLEMATIC NTMS ON GREEN GOODS RELATIVE TO EAP (AVE DIFFERENCE)



Note: This chart plots the ad-valorem equivalent for green goods for Indonesia relative to other EA countries. SNI result is not statistically significant. Countries included: Brunei Darussalam, Cambodia, China, Indonesia, South Korea, Lao PDR, Malaysia, Myanmar, Philippines, Thailand, and Vietnam.
Source: World bank staff estimates based on ERIA-UNCTAD data for ASEAN countries

Environmental Provisions in Indonesia's Trade Agreements

The inclusion of environmental provisions in preferential trade agreements (PTAs) is not a recent or an uncommon phenomenon–close to 90 percent of trade agreements currently in force include some form of commitments concerning the environment. Prior to the 1990s, however, environmental provisions in PTAs did not establish any binding obligation for environmental protection. Rather, these provisions took the form of environmental exception clauses to trade policy commitments–such as those to protect the conservation of natural resources. This progressively changed in the 1990s and, with much stronger emphasis, in the late 2000s when PTAs increasingly included commitments to environmental protection.

In contrast to global trends, among Indonesia's 11 trade agreements only four contain environmental provisions, of which none are legally enforceable. The ASEAN-Republic of Korea, ASEAN-Japan, Indonesia-Chile, and Indonesia-Japan trade agreement all include some form of environmental provisions; however, these are not legally enforceable (Table 1). Of these, only the Indonesia-Chile and ASEAN-Japan agreements include environmental provisions with weak legal enforceability. For example, in the Indonesia-Chile trade agreement that went into effect in August 2019, the two countries commit to "effectively enforce environmental laws and not weaken or reduce levels of environmental protection with the sole intention to encourage investment or to seek or to enhance a competitive trade advantage." In addition, the parties commit to ensure that "environmental laws, regulations and policies not be used for trade protectionist purposes" and that they will cooperate to "prevent or reduce the contamination, and degradation of ecosystems and natural resources through developing and endorsing special programs and projects for the transfer of knowledge and technology."[45]

In May 2021, Indonesia ratified a trade agreement with the EFTA states that strengthens its certification and MRV systems for trade of sustainable palm oil. It is a mechanism through which the implicit carbon pricing from EFTA tariffs on Indonesian palm oil varies according to the carbon intensity of Indonesian palm oil production–as captured by the certification system. In the agreement, EFTA countries will then use this information to vary their tariff rate on palm oil imported from Indonesia. This agreement presents a possible solution for carbon pricing for land uses. This is among the first carbon border adjustment mechanisms (CBAM) for land uses. Although a very small market for Indonesia (for instance Switzerland has less than 0.5 percent share of each of Indonesia's imports and exports), the design could scale. There is evidence that trade agreements with environmental provisions do indeed mitigate deforestation (Box 1) and this could be a positive step towards reducing Indonesia's high carbon content of trade.[46] In the past, similar policies such as the EU's Forest Law Enforcement, Governance and Trade (FLEGT) worked well, as Indonesia was the first country to export "verified legal" timber to the EU through this licensing system for the certification of wood.

45 Indonesia-Chile Comprehensive Economic Association Agreement.

46 See Policy Note 2.

TABLE 1 ENVIRONMENTAL PROVISIONS IN INDONESIA'S TRADE AGREEMENTS

Agreement	Environmental provision is mentioned but is not legally enforceable?	Environmental provision is mentioned and has weak legal enforceability?
ASEAN-Hong Kong, China	No	No
ASEAN Free Trade Area	No	No
ASEAN-Australia-New Zealand	No	No
ASEAN-India	No	No
ASEAN-Republic of Korea	Yes	No
ASEAN-China	No	No
ASEAN-Japan	Yes	Yes
Indonesia-Chile	Yes	Yes
Indonesia-Australia	No	No
Indonesia-Pakistan	No	No
Indonesia-Japan	Yes	No
Total Share	**36%**	**18%**

Source: World Bank Deep Trade Agreements database.

BOX 1 TRADE AGREEMENTS WITH ENVIRONMENTAL PROVISIONS MITIGATE DEFORESTATION

Deforestation is one of the most pressing environmental challenges of the modern era, and very relevant for Indonesia, given that the largest share of carbon emissions originates from changes in land use.[47] Globally, the extent of forest loss over the past 30 years has been unprecedented: the world lost an approximately net 178 million hectares of forest area between 1990 and 2020 (FAO 2020).

This box details the findings of Abman et al. (2021) who provide new causal evidence that environmental provisions included in PTAs are effective in limiting deforestation. The authors exploit high-resolution, satellite-derived estimates of deforestation and identify the content of environmental provisions in PTAs using a new World Bank Deep Trade Agreements database (Mattoo et al. 2020).

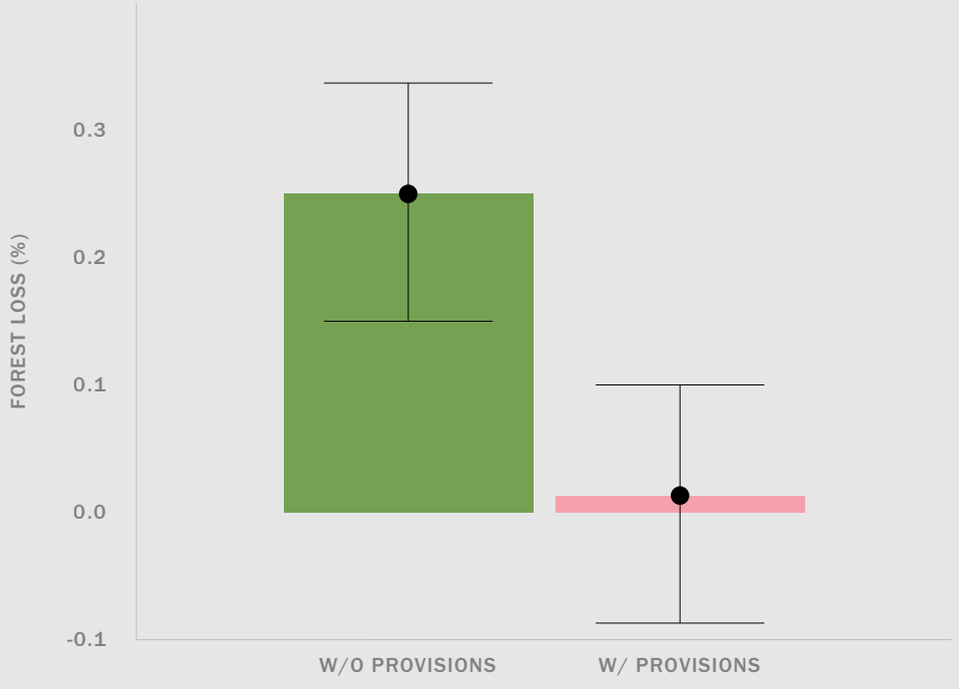
Results show that there are large and significant net increases in annual forest loss following the entry into force of PTAs without environmental provisions (23 percent). Results, however,

47 Its emissions stem from deforestation and peatland megafires and, to a lesser extent, the burning of fossil fuels for energy. From 2000 to 2015, Indonesia lost an average of 498,000 hectares of forest each year–making it the world's second biggest deforester after Brazil (link).

also show that the inclusion of environmental provisions entirely offsets the rise in forest loss (Figure 45). The mitigating effect of environmental provisions on deforestation is largely driven by changes to forest loss in tropical, developing countries with high levels of biodiversity–the locations where deforestation is of greatest concern.

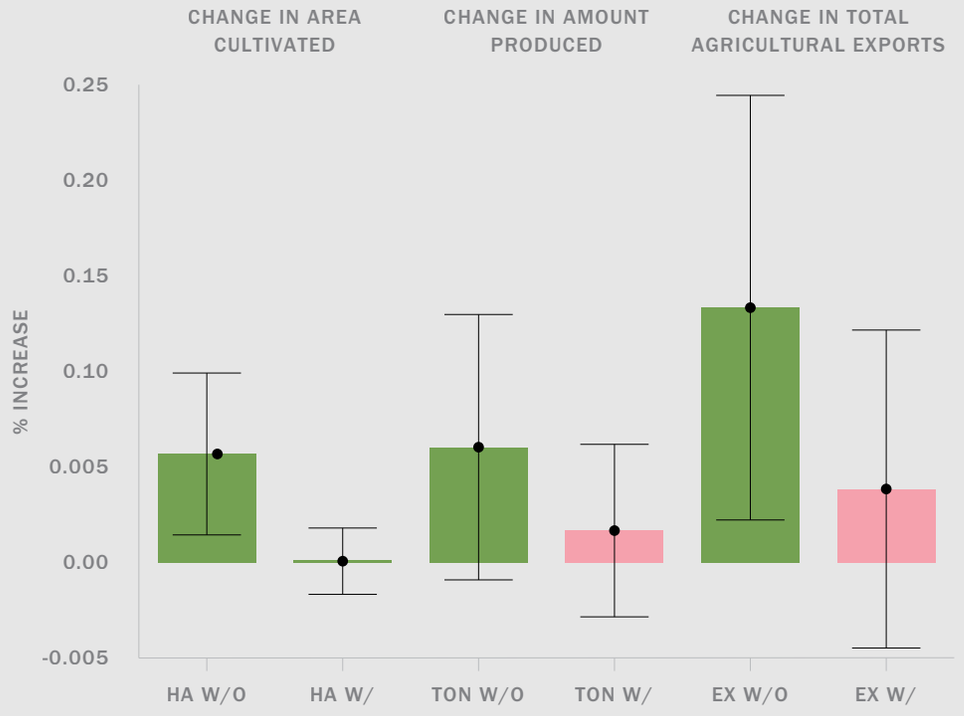
The study also investigates the mechanisms through which forestry and biodiversity provisions in PTAs mitigate environmental damage. It is found that PTAs without these environmental provisions lead to an average 5 percent increase in the annual land area harvested, while there is no evidence of an increase in agricultural extensification following PTAs that include these provisions. Trade liberalization also leads to increases in agricultural output (as measured in tonnes harvested) that is partially, but not completely, offset by the inclusion of forestry and biodiversity provisions (Figure 46). This suggests that environmental provisions may limit agricultural land expansion, but not intensification. Net increases in agricultural exports are also lower in PTAs with environmental provisions, but not entirely offset.

FIG 45 **CHANGE IN AVERAGE ANNUAL FOREST LOSS AFTER PTA ENACTMENT**



Source: World Bank staff calculations.

FIG 46 **CHANGES IN AGRICULTURAL LAND USE, PRODUCTION AND EXPORTS**



Source: World Bank staff calculations.

The effectiveness of forest-related PTA provisions at limiting deforestation arising from trade liberalization is also evaluated. It is found that there are no changes in net annual deforestation following implementation of agreements that include provisions aimed at protecting forests and/or biodiversity while agreements without these provisions see substantial increases in net forest loss–that is, provisions reduce forest loss relative to PTAs that do not include them. Rough calculations indicate that the forest and biodiversity provisions prevented approximately 7,500 square kilometers of deforestation from 2003–14 which is greater than the entire forested area of countries like Belgium or Ireland.

The findings suggest that these types of environmental provisions provide a mechanism to defray the environmental costs that can arise from international trade integration. While on the one hand the inclusion of such provisions may incur some bargaining costs in the negotiation phases of trade agreements, they appear to provide an institutional framework that allows member countries to commit to policies that encourage more sustainable patterns of trade integration and economic growth.

The Untapped Benefits of Liberalizing Green Goods Trade

To estimate the effects of potential liberalization scenarios of tariffs on green goods trade for Indonesia, a partial equilibrium trade model is used. The modeling framework underlying the simulations is a modified version of the Global Simulation Analysis Model (GSIM) (Francois and Hall 2009). The model is calibrated on green goods trade data at the HS6 product level for all bilateral country pairs, explicitly representing global export and import flows for 358 HS6 level green products, with more than 401,000 observations. The model is specified based on the assumption of national product differentiation–that is, Armington (1969) preferences, according to which goods produced by different countries are imperfect substitutes, and thereby allowing for two-way trade between countries exporting the same goods. The elasticity of substitution is held equal and constant across products from different sources, while the elasticity of demand in aggregate is also constant. Import demand and export supply equations are cleared by a market price that is directly affected by tariffs.

Four increasingly more ambitious scenarios are considered, representing Indonesia's unilateral, regional, and multilateral liberalization of tariffs on green goods trade. The scenarios are as follows. Scenario One assumes the full unilateral liberalization of tariffs on green goods imports by Indonesia; Scenario Two represents the full regional liberalization of tariffs on green goods among APEC countries; Scenario Three depicts the implementation of the WTO EGA without Indonesia's participation; finally, Scenario Four assumes the full liberalization of tariffs on green goods under the WTO EGA with Indonesia's participation.

Under Scenario One, unilateral liberalization of tariffs on green goods by Indonesia would boost the competitiveness of Indonesian firms that already use these as inputs into their production by boosting firm's access to cheaper environmental technologies. This could, in turn, incentivize the private sector's transition to the use of green technologies. Overall, imports of green goods are estimated to increase by 3 percent or US$521 million. The overall effects are muted as Indonesia already applies low tariffs on imports of green goods. Imports of Cleaner or More Resources Efficient Technologies and Natural Risk Management are estimated to increase the most–by 8 percent and 7.4 percent, respectively (Figure 47). On the one hand, this unilateral liberalization would boost Indonesia's trade with important partners such as the United States (42 percent), Taiwan, China (49 percent), and India (22 percent), while at the same time slightly reduce imports from countries with already low tariffs on green goods such as Japan, China, Singapore, and others in the EAP region.

Scenario Two (full regional liberalization of tariffs on green goods trade among APEC countries) is estimated to boost Indonesia's exports of green goods by 0.2 percent or US$15 million and imports by 1.2 percent or US$214 million. While the increase in imports under this scenario is more muted than under unilateral liberalization, regional APEC liberalization of green goods trade would ensure Indonesia not only access to lower prices and quality imported environmental technologies but also improved market access for its exports. Indonesian exporters of green goods such as for Energy Efficiency; Resource and Pollution Management; and Water Supply are estimated to benefit the most, with an increase in exports by 4.3 percent,

1.7 percent, and 1.6 percent, respectively (Figure 48). Conversely, imports of Natural Risk Management and Cleaner or More Resource Efficient products increase the most. Regional liberalization would benefit trade with the United States; Hong Kong SAR, China; Canada; and Mexico the most.

The implementation of the WTO EGA without Indonesia's participation (Scenario Three) would hurt not only Indonesian exporters but also importers of green goods. Due to trade diversion effects, Indonesia's exports and imports of green goods decline by 0.3 percent (US$29 million) and 0.8 percent (US$129 million), respectively. Except for exports of green goods for Water Supply; Noise and Vibration Abatement; Air Pollution Control and Natural Risk Management, all of Indonesia's export and imports are estimated to be hurt (Figure 49). Interestingly, results also show that, while Indonesia's trade with non-participating countries increases (for example, Thailand, Vietnam, and India), these increases are outweighed by the contraction in trade with major trading partners such as the United States, Japan, and China.

By joining the WTO EGA (Scenario Four), exports would significantly expand the benefits of participation in a regional APEC liberalization and boost Indonesia's green goods exports by 1.1 percent (US$99 million) and imports by 1.2 percent (US$214 million). On the one hand, eliminating remaining tariffs on green goods would boost imports of products categories such as Natural Risk Management; Cleaner or More Resource Efficient Products; and Environmentally Preferable Products by 6.2 percent, 4.6 percent, and 2 percent, respectively (Figure 50). Conversely, improved market access to participating countries markets would benefit exporters of green goods such as Energy Efficiency; Cleaner or More Resource Efficient Products; and Natural Resource Protection.

There are additional benefits from freeing up trade in green goods not captured in this analysis, including in terms of promoting competition and innovation within Indonesia. This analysis provides the impact of tariff liberalization using largely static and of partial equilibrium assumptions. There are additional benefits from freeing up trade not only through tariffs but also crucially, NTMs on environmental products and technologies as demonstrated earlier. In addition, environmental products must be well-defined for the measures to be effective.

FIG 47

THE IMPACT OF UNILATERAL LIBERALIZATION OF GREEN GOODS IMPORTS (PERCENT CHANGE) (SCENARIO ONE)

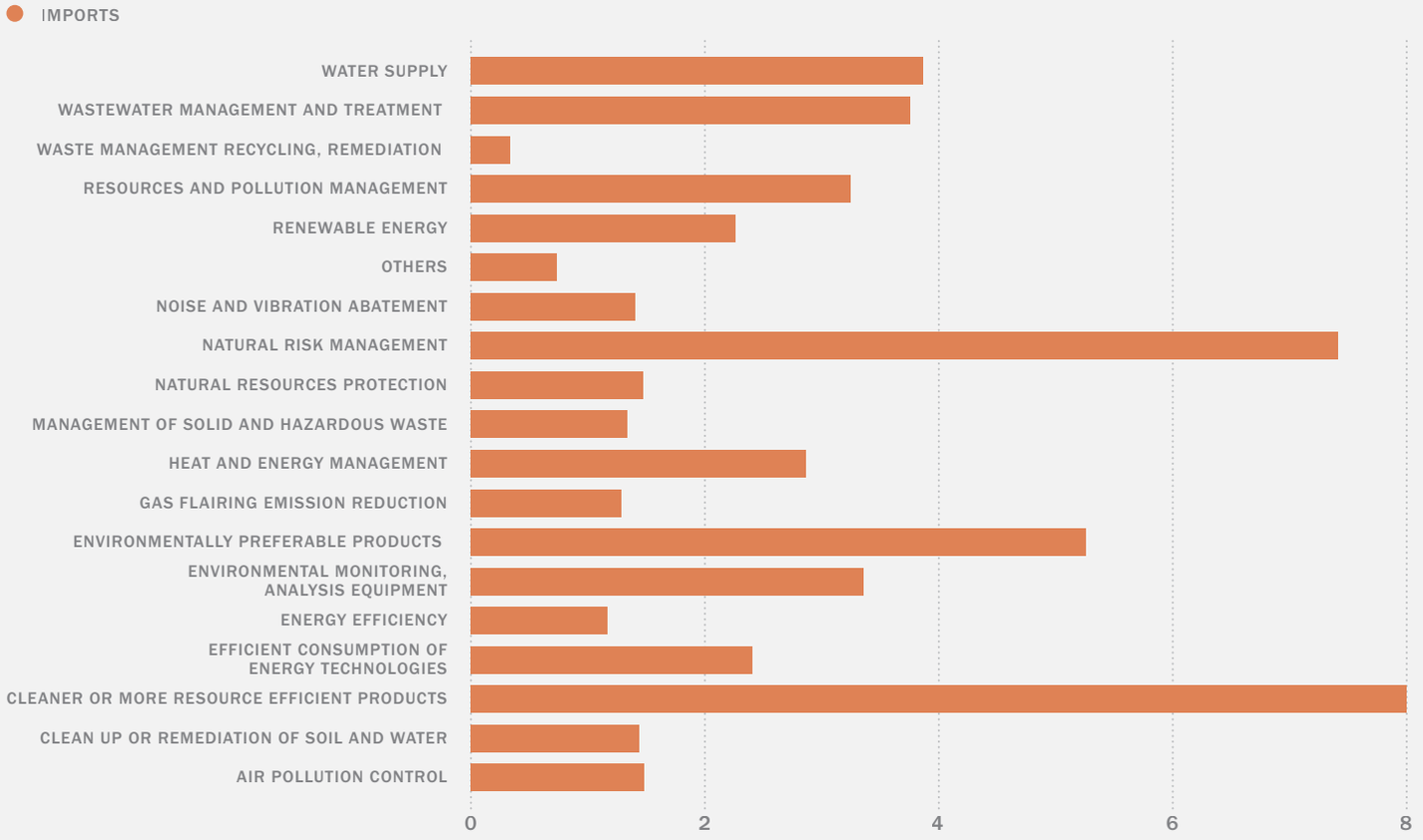


FIG 48

THE IMPACT OF REGIONAL LIBERALIZATION OF GREEN GOODS TRADE AMONG APEC COUNTRIES (PERCENT CHANGE) (SCENARIO TWO)

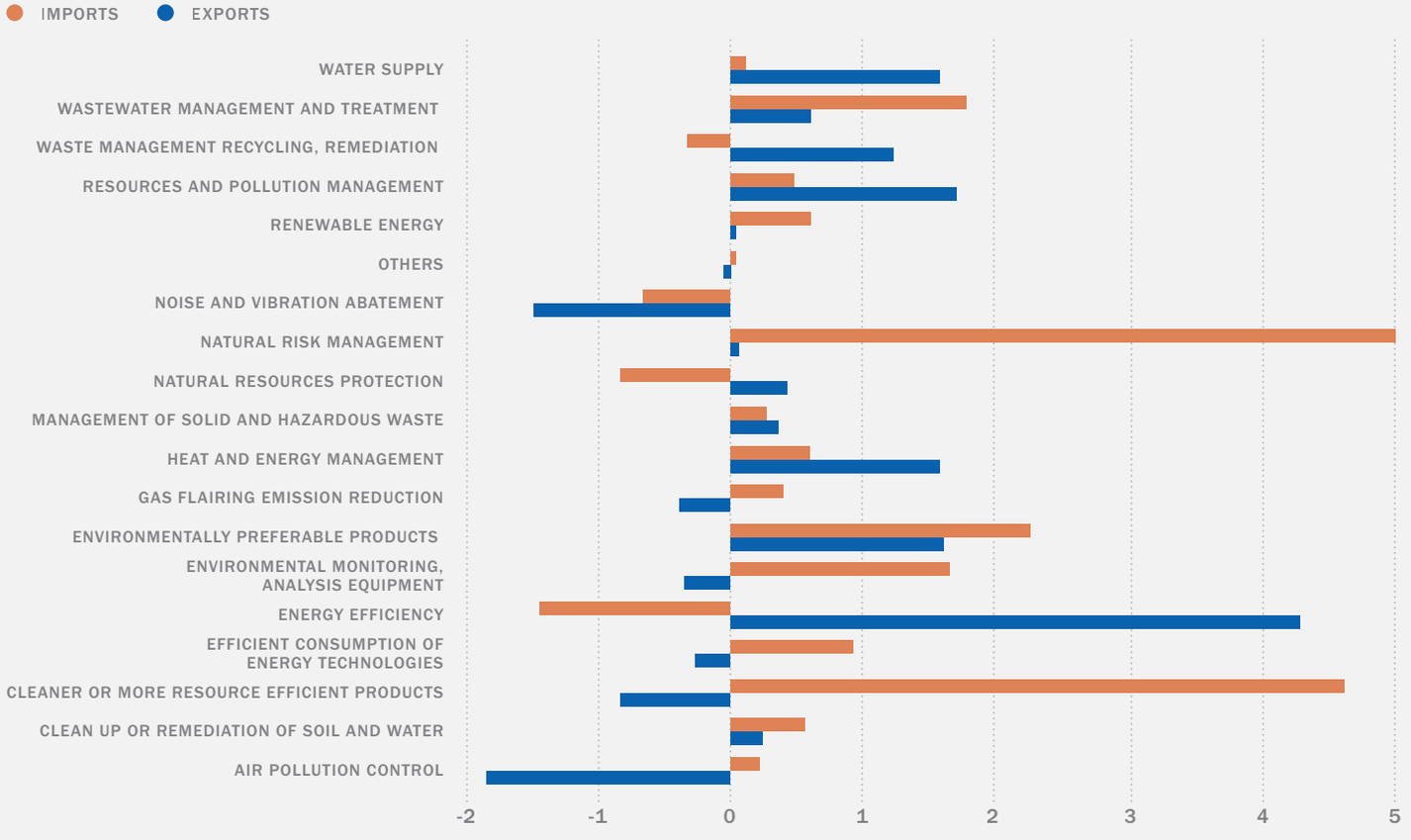


FIG 49

THE IMPACTS OF THE WTO EGA WITHOUT INDONESIA ON GREEN GOODS TRADE (PERCENT CHANGE) (SCENARIO THREE)

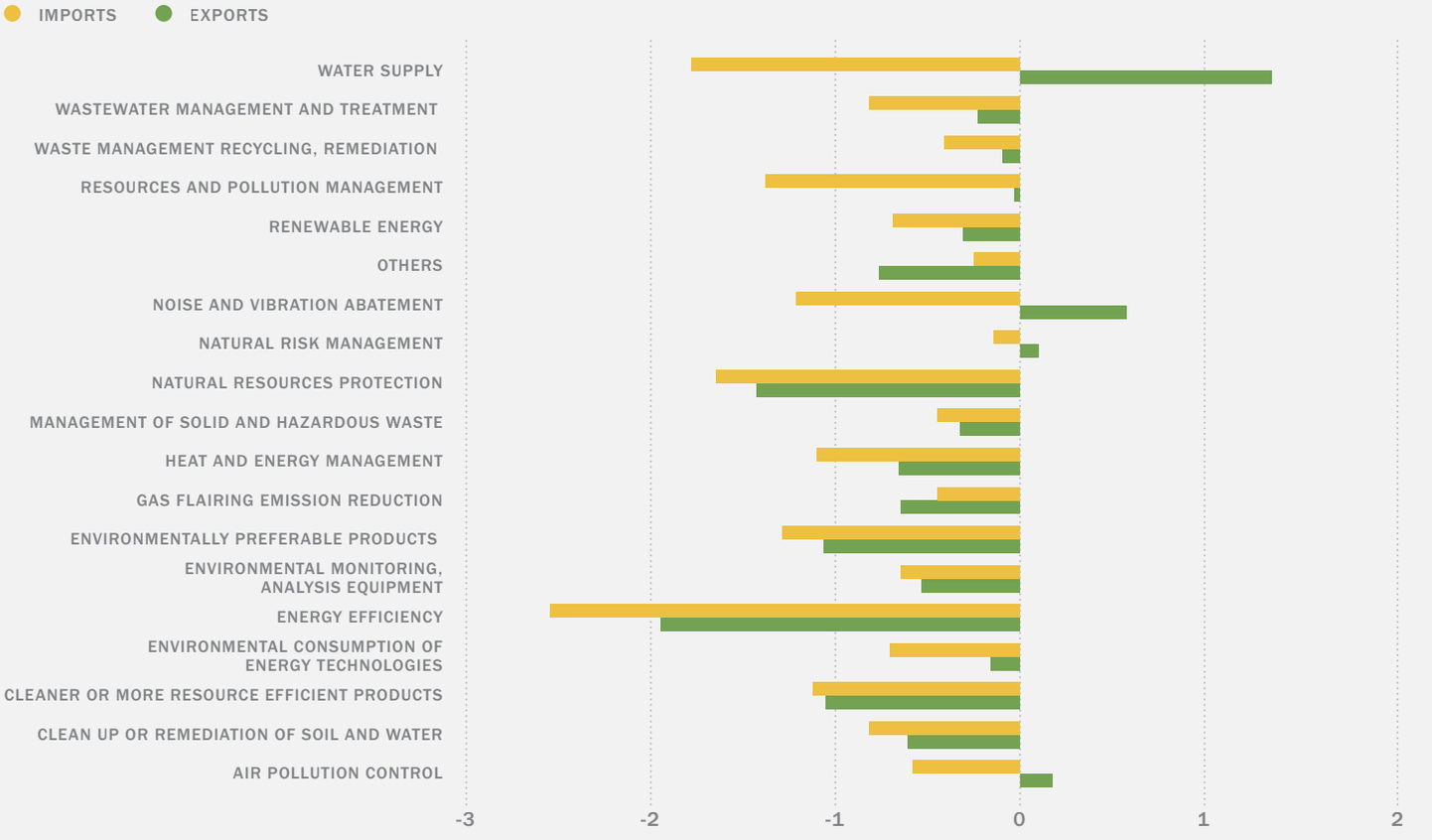
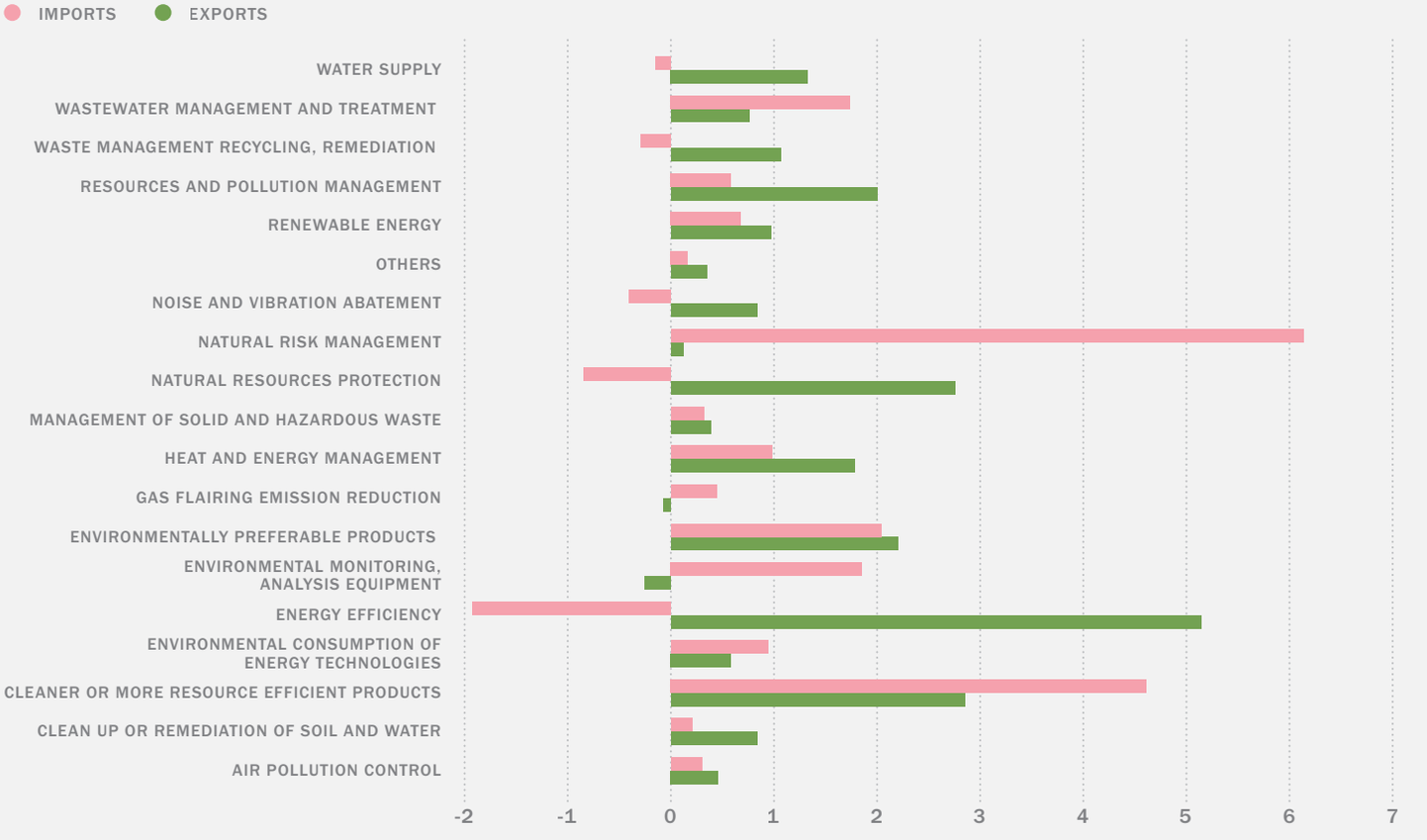


FIG 50

THE IMPACTS OF THE WTO EGA WITH INDONESIA ON GREEN GOODS TRADE (PERCENT CHANGE) (SCENARIO FOUR)



Source: Figure 47-50 World Bank staff calculations using WITS and GTN data.

Conclusions and Recommendations

This analysis focuses on the role of tariff and non-tariff measures is facilitating Indonesia's green transition through access to foreign environmental goods and technologies. The findings suggest that non-tariff measures pose significant costs on green goods trade and supply in Indonesia, with specific measures such as pre-shipment inspections, port of entry requirements and compliance with national standards being more costly compared to other countries. The analysis also finds that unilateral, regional, and multilateral liberalization of tariffs on green goods trade would have previously untapped benefits for Indonesia.

The recommendations emerging from the findings are as follows:

Fully liberalize remaining tariffs on imports of green goods, including through multilateral participation. Reducing import tariffs on green goods will reduce their price and boost access to lower-cost and more energy-efficient technologies. This may be particularly important for industries that must comply with climate change mitigation policies.

Streamline NTMs on green goods and eliminate unnecessary ones. Specific NTMs could be implemented more cost-effectively, such as import approvals and compliance with SNI. Some NTMs that are redundant could be removed entirely, such as pre-shipment inspections and port of entry restrictions. Over time, more NTM measures could be entirely phased out as a robust National Single Window and integrated risk management system would make some measures obsolete while improving remaining NTMs.

Harmonize existing local standards with international ones and develop new standards that are aligned with international standards and practices. The majority of SNI are not aligned with international product standards.[48] As a result, these are among the most distortive types of NTMs, imposing significant additional costs on exporters and

48 See Policy Note 2: Opportunities and Challenges of Green Goods Trade for Firms in Indonesia where firms trading in green goods reported a lack of harmonization with international standards as a key challenge.

increase the time required to bring a green goods to market. Working toward a harmonization of product standards across markets could be a supportive policy to encourage not only imports of green goods, but also boost Indonesian exports in new export markets with comparable standards.

Reduce the stringency of LCR. LCRs are prohibited under WTO law as they violate several WTO provisions including the national treatment principle. High LCRs prior to establishment of a market large enough to achieve domestic manufacturing economies of scale will not achieve the desired result. The market must be allowed to develop to a point where domestic production could achieve the economies of scale required to keep prices affordable.

Include enforceable environmental provisions in trade agreements and participate in plurilateral and multilateral trade policy initiatives on green goods. On the one hand, environmental provisions and commitments will need to become more detailed in terms of scope and ambition. On the other hand, direct participation in multilateral and plurilateral environment-related trade policy initiatives would not only allow Indonesian exporters to benefit from improved market access in destination markets but would also give Indonesia a seat at the table to shape the content and course of discussions.

Strengthen the mutual complementarity between trade and climate policies. Among others, this could include more and better collaboration across countries on the design, use, and implementation of environmental provisions in trade agreements.

Appendix One

Table 2: Top Environmental Goods, Examples and Climate Change/Environmental Role

Green Good Description, Examples, and Climate Change Role	Top 10 Products in 2020 Exports	Rank
Air Pollution Control (Mitigation) For example: Parts of vacuum pumps, compressors, fans, blowers, hoods. Used for: (i) air handling equipment; (ii) transport or extraction of polluted air, corrosive gases, or dust; and (iii) transport or extraction of polluted air and corrosive gases or dust.	Compressors used for automotive air conditioners.	1
	Cylinder block; crank case for vehicle of Chapter 87, other than of heading 87.01 & 87.11.	2
	Part of vehicle of Chapter 87, other than carburetor, piston, cylinder, other than of heading 87.01 & 87.11.	3
	Cylinder liner with internal diameter <= 50mm or <= 155 mm for marine propulsion engine of a power > 22.38 kW.	4
	Parts of marine propulsion engine of a power > 22.38 kW, other than piston & cylinder.	5
	Compressor exclusively for refrigerating equip, air, gas in oil drill operation, automotive AC & sealed unit for AC machine.	6
	Other automatic service-vending machines, not electrically operated.	7
	Machinery, plant & equipment other than for making hot drink/cooking/heating food, electrically operated.	8
	Other automatic service-vending machines, electrically operated.	9
	Laminar airflow cabinets fitted with filters in horizontal side > 120 cm.	10
Clean Up or Remediation of Soil and Water (Mitigation, Adaptation) For example: Water filtering or purifying machinery or apparatus. Environmental benefit: Used to filter and purify water for a variety of environmental, industrial, and scientific applications, including water treatment plants and wastewater treatment facilities. Other Environmental categories: Efficient Consumption of Energy Technologies and Carbon Capture and Storage (ECETCCS): Wastewater Management and Potable Water Treatment.	Remote control apparatus, other than radio remote control apparatus.	1
	Other equipment/machine for removal of dust particles & curing material by UV light for manufacturing of printed circuit boards.	2
	Other floating structures.	3
	Smart cards.	4
	Filtering/purifying machine & apparatus, other than for medical/surgical/laboratory, sugar manufacture & oil drilling operation.	5
	Purifying machinery and apparatus of a capacity <= 500 l/hfor domestic use.	6
	Light-emitting diode (LED) lamps.	7
	Centrifuge machinery other than used for sugar manufacture.	8
	Filtering or purifying machinery and apparatus for water of a capacity > 500 l/h, electrically operated.	9
	Oil filter other than for medical/surgical/laboratory use, sugar manufacture & oil drilling operations.	10

Green Good Description, Examples, and Climate Change Role	Top 10 Products in 2020 Exports	Rank
Cleaner or More Resource Efficient Technologies and Products (Mitigation) For example: Railway/tramway rails, iron, or steel. Environmental benefit: Cleaner or more resource efficient technologies and products. Environmental categories: Cleaner or more resource-efficient technologies and products.	Other motorcycles (including mopeds).	1
	Primary cells and primary lithium batteries.	2
	Chain wheels and cranks; other parts for bicycles designed to be used by children.	3
	Other bicycles not motorized.	4
	Other primary cells and primary batteries not zinc-carbon, having an external volume > 300 cm3.	5
	Electrical machines, domestic other than vacuum cleaner, floor polisher, grinder, mixer, juice extractor, kitchen waste disposers.	6
	Other primary cells and primary batteries zinc-carbon, having an external volume <= 300 cm3.	7
	Railway/tramway passenger coach & other special purpose railway or tramway coaches not self-propelled.	8
	Brakes and parts thereof of motorcycles (incl mopeds).	9
	Self-propelled railway or tramway coaches, van, and truck powered from internal source of electricity.	10
Efficient Consumption of Energy Technologies and Carbon Capture and Storage (ECETCCS) (Mitigation) For example: Parts of gas turbine engines except turbo-jet/prop. Environmental benefit: Gas turbines for electrical power generation from recovered landfill gas, coal mine vent gas, or biogas (clean energy system). Other environmental categories: Renewable energy.	Static converters other than UPS, battery chargers, inverters and rectifiers.	1
	Part of other gas turbines.	2
	Cylinder block; crank case for vehicle of Chapter 87, other than of heading 87.01 & 87.11.	3
	Part of vehicle of Chapter 87, other than carburetor, piston & cylinder, excluding heading 87.01 & 87.11.	4
	Cylinder liner with <= 50 mm internal diameter <= 155 mm for marine propulsion engine of a power > 22.38 kW.	5
	Other parts undefined of gasoline engine for other vehicles of chapter 87, other than 87.01 or 87.11.	6
	Liquid dielectric transformers, power capacity >30.000 kVA.	7
	Uninterruptible power supplies (UPS), not automatic data processing machines & units thereof, telecommunications apparatus.	8
	Parts of marine propulsion engine of a power > 22.38 kW, other than piston & cylinder.	9
	Other parts undefined of gasoline engine for vehicles of heading 87.11.	10

Green Good Description, Examples, and Climate Change Role	Top 10 Products in 2020 Exports	Rank
Energy Efficiency (Mitigation) For example: Electric lamps, lighting fittings. Environmental benefit: Compared with the conventional fluorescent or incandescent lamps, they are long life, low power consumption, energy saving and no toxic substance (mercury free). Other environmental categories: Heat and energy management.	Pilot lamp with fitting for electro-thermic domestic applications of heading 85.16.	1
	Other lighting fittings.	2
	Other fluorescent lamps and lighting fittings other than for operating rooms.	3
	Lamps of electric table, desk, bedside/ floor-standing lamps.	4
	Fluorescent lamps and lighting fittings.	5
	Other exterior lighting.	6
	Searchlights.	7
	Other electric lamps, of a kind used for lighting public open space/thoroughfares.	8
	Other electric lamps of spotlights.	9
	AC machinery of cooling capacity >21.10kW & air flow rate >67.96m3/min, incorporating refrigerating & reversible heat pump, in marine.	10
Environmental Monitoring, Analysis and Assessment Equipment (Broader Environmental Protection) For example: Monocular, telescopes, etc. Environmental benefit: Applications in environmental monitoring, analysis. And assessment equipment.	Other instruments & apparatus other than exposure meters, electrically operated.	1
	Other automatic regulating/controlling instruments & applications, not electrically operated.	2
	Other instruments, appliances and machines, other cable tester.	3
	Water meters.	4
	Thermometers & pyrometers, electrically operated, other temperature gauges for motor vehicles.	5
	Other optical instruments and appliances for other purposes.	6
	Microtomes, not electrically operated.	7
	Thermostats, electrically operated.	8
	Parts & accessories (not specified/incl elsewhere in this chapter) for machines, applications of Chapter 90 for electrically operated equipment.	9
	Thermometers & pyrometers, elect operated, temperature gauges for motor vehicles.	10

Green Good Description, Examples, and Climate Change Role	Top 10 Products in 2020 Exports	Rank
Environmentally Preferable Products based on End-Use or Disposal Characteristics (Broader Environmental Protection) For example: Vegetable fiber, processed not spun, tow & waste. Environmental benefit: More biodegradable than synthetic fiber alternatives and made from a renewable resource.	Assembled flooring panels other than of bamboo or with at least the top layer (wear layer) of bamboo, multilayer.	1
	Other assembled flooring panels.	2
	Coconut fibers (coir) and abaca fibers, other coconut fibers.	3
	Gas turbines of a power > 5,000 kW.	4
	Coconut fibers (coir) and abaca fibers, coconut fibers, raw.	5
	Twine, cordage, ropes, cables, other than of jute/other textile bast fibers of head 53.03.	6
	Vegetable textile fibers other than 5305.00.10-23.	7
	Sacks and bags, of a kind used for the packing of goods, new, of other textile bast fibers of heading 53.03, excluding jute.	8
	Sisal & other textile fibers of the genus agave, tow & waste of these fibers.	9
	Gas turbines of a power <= 5,000 kW.	10
Gas Flaring Emission Reduction (Mitigation) For example: Industrial furnace, oven, incinerator non-electric. Environmental benefit: Used to destroy solid and hazardous wastes. Catalytic incinerators are designed for the destruction of pollutants by heating polluted air and oxidation of organic components. Other environmental categories: Several.	Other automatic regulating/controlling instruments & applications, not electrically operated.	1
	Machinery, plant & equipment, other than for making hot drink/cooking/heating food, electrically operated.	2
	Thermostats, electrically operated.	3
	Parts & accessories (not specified/incl elsewhere in this chapter) for machines, appliances of Chapter 90 for electrically operated equipment.	4
	Filtering/purifying machinery & apparatus for gases.	5
	Instrument & apparatus other than automatic regulating voltage units (stabilizers), electrically operated.	6
	Part of evaporator/condenser for AC machine for motor vehicle with a cooling capacity <= 21.10 kW.	7
	Parts & accessories for electrically operated instruments & apparatus, measure/check the flow level, pressure.	8
	Part of filtering/purifying machinery & apparatus for liquid/gas of 8421.21.19-90,8421.29.10,8421.29.30-40,8421.29.90,8421.39.20.	9
	Other instruments/apparatus for measuring/checking the flow, level, pressure, electrically operated.	10

Green Good Description, Examples, and Climate Change Role	Top 10 Products in 2020 Exports	Rank
Heat and Energy Management (Mitigation) For example: Thermostats. Environmental benefit: Used to control the efficiency of air conditioning, refrigeration, or heating systems. Other environmental categories: ECETCCS; Environmental monitoring, analysis and assessment equipment; gas flaring	Pilot lamp with fitting for electro-thermic domestic application of heading 85.16.	1
	Water meters.	2
	Thermostats, electrically operated.	3
	Kilowatt hour meters (kwh).	4
	Phenolic resins, other than molding compounds, other than phenol formaldehyde.	5
	Slag wool, rock wool & similar mineral wools in bulk/ sheets/rolls.	6
	Part of evaporator/condenser for AC machine for motor vehicle with a cooling capacity <= 21.10 kW.	7
	Flagstones, reinforced or not.	8
	Other lighting fittings.	9
	Acrylonitrile butadiene styrene (ABS) sheets of a kind used in the manufacture of refrigerators.	10
Management of Solid and Hazardous Waste and Recycling Systems (Mitigation) For example: Film not cellular/ reinforced polymers of ethylene. Environmental benefit: Membrane systems have multiple uses including: (i) to line landfills to prevent leachate (water run-off) from contaminating groundwater resources; (ii) to cover landfills and prevent methane from escaping into atmosphere; and (iii) for the reinforcement and protection of soil, including under oil refineries and gas stations.	Other electronic integrated circuits.	1
	Biaxially oriented polypropylene (BOPP) film.	2
	Processor & controller of electronics integrated circuits.	3
	Plates & sheets of polymers of ethylene, unreinforced, laminated, supported or similarly combined with other materials, unrigid.	4
	Plates & sheets, of polymers of propylene, unreinforced, laminated, supported or similarly combined with other materials.	5
	Film, foil and strip, of polymers of ethylene, unreinforced, laminated, supported or similarly combined with other materials.	6
	Other aluminum casks, drums, cans, boxes & containers for any material.	7
	Brooms consisting of twig/other vegetable materials bound together.	8
	Other automatic service-vending machines, not electrically operated.	9
	Film, foil & strip, of polymers of propylene, unreinforced, laminated, supported or similarly combined with other materials.	10

Green Good Description, Examples, and Climate Change Role	Top 10 Products in 2020 Exports	Rank
Natural Resource Protection (Mitigation) For example: Binder or baler twine, of sisal or agave. Environmental benefit: More biodegradable than synthetic fiber alternatives and made from a renewable resource. Other environmental categories: Environmentally preferable products.	Made up fishing nets of manmade textile materials.	1
	Fishhooks, whether/not snelled.	2
	Twine, cordage or rope, knotted netting, of other than man-made textiles, other than of net bags.	3
	Twine, cordage or rope, knotted netting, of other than man-made textiles, net bags.	4
	Twine, binder or baler twine, of sisal or other textile fibers of the genus agave	5
Natural Risk Management (Adaptation) For example: Surveying, instruments nes Environmental benefit: Used for measuring the ozone layer and to monitor, measure and assist planning for natural risks such as earthquakes, cyclones, and tsunamis. Other environmental categories: ECETCCS; Environmental monitoring.	Other instruments & appliances other than radio sonde and radio wind apparatus.	1
	Parts & accessories of surveying instruments & appliances.	2
	Photogrammetrically surveying instruments and appliances.	3
Noise and Vibration Abatement (Broader Environmental Protection) For example: Locks, sheets, strip and tiles of agglomerated cork. Environmental benefit: Assists in the reduction of noise levels in buildings.	Cylinder block; crank case for vehicle of Chapter 87, other than of heading 87.01 & 87.11.	1
	Part of vehicle of Chapter 87, other than carburetor, piston & cylinder, excluding heading 87.01 & 87.11.	2
	Cylinder liner with <= 50mm internal diameter <= 155 mm for marine propulsion engine of a power > 22.38 kW.	3
	Other parts undefined of gasoline engine for other vehicle of Chapter 87, other than 8701 or 87.11.	4
	Parts of marine propulsion engine of a power > 22.38 kW, other than piston & cylinder.	5
	Other parts undefined of gasoline engine for vehicles of heading 87.11.	6
	Carburetors and parts of gasoline engines, for vehicles of Chapter 87, other than 87.01 or 87.11.	7
	Piston rings and gudgeon pins for other vehicles of Chapter87, other than 87.01 or 87.11.	8
	Compressor excluding for refrigerating equipment, air, gas in oil drill operation, automotive AC & sealed unit for AC machine.	9
	Laminar airflow cabinets fitted with filters in horizontal side > 120 cm.	10

Green Good Description, Examples, and Climate Change Role	Top 10 Products in 2020 Exports	Rank
Others (Broader Environmental Protection) For example: Distilling or rectifying plant. Environmental benefit: Desalination plants remove salt from water and are important in conditions of water scarcity. Biogas refinement equipment "upgrades" biogas resulting from organic matter to give it the same properties as natural gas. Allows the recovery and reuse of solvents, (for example, solvents used in the printing, painting or dry-cleaning industries). Other environmental categories: Several.	Machinery, plant & equipment, other than for making hot drink/cooking/heating food, electrically operated.	1
	Machines for working by removal of material, by laser/other light/photon beam in the production of semiconductor wafers.	2
	Distilling or rectifying plant, electrically operated.	3
	Machines for bending, folding, and straightening semiconductor leads.	4
	Other laser cutters for cutting contacting tracks in semiconductor production by laser beam.	5
	Epitaxial deposition machines, spinners for coating photographic emulsions on semiconductor wafers.	6
	Spin dryers for semiconductor wafer processing.	7
	Grinding, polishing, and lapping machines for processing of semiconductor wafers.	8
	Resistance heated furnaces and ovens for the manufacture of semiconductor devices on semiconductor wafers.	9
	Machinery for processing material by heating, for the manufacture of PCB/PWB/PCA, electrically operated.	10
Renewable Energy (Mitigation) For example: Heat exchange units, non-domestic, non-electric. Environmental benefit: Provide cooling effect to heat exchangers in solar collector or solar system controllers to avoid overheating. Some are specifically designed for use with renewable energy sources such as geothermal energy. Other environmental categories: ECETCCS; gas flaring emission reduction; Heat and energy management.	Primary cells and primary lithium batteries.	1
	Switchboard & control panels: use for other purposes.	2
	Other guardrails of iron or steel.	3
	Static converters other than UPS, battery chargers, inverters rectifiers.	4
	Part of other gas turbines.	5
	Other towers of iron or steel.	6
	Other primary cells and primary batteries not zinc-carbon, having an external volume > 300 cm3.	7
	Other board for electrical control for voltage <1,000 volts.	8
	Other primary cells and primary batteries zinc-carbon, having an external volume <= 300 cm3.	9
	Switchboard & control panels: use in distributed control systems.	10

Green Good Description, Examples, and Climate Change Role	Top 10 Products in 2020 Exports	Rank
Resources and Pollution Management (Mitigation) For example: Valves, safety or relief. Environmental benefit: Used for handling and transport of wastewater or slurries during treatment. Environmental categories: ECETCCS; Wastewater management and potable water treatment.	Swing check-valves, of cast iron, with an inlet of <=4cms, internal diameter =60 cm.	1
	Other fuel cut-off valves for vehicles of copper/alloy.	2
	Other manually operated gate valves of cast iron.	3
	Other taps, cocks, valves & similar appliances for pipes, boiler shells, tanks, vats, or the like.	4
	Other parts of housing for sluice or gate valves.	5
	Parts of table, floor, wall, window, ceiling/roof fans &explosion-proof air fans.	6
	Other swing check-valves, of cast iron, with an inlet of <=4cms, internal diameter =60 cms.	7
	Mixing taps and valves.	8
	Housings for sluice or gate valves with inlet or outlet of 50 mm, an internal diameter <=400 mm.	9
	Part of free piston generator, oil drilling gas/automotive AC/sealed unit AC compressor, electrically operated.	10
Waste Management, Recycling and Remediation (Broader Environmental Protection) For example: Mats, matting and screens, vegetable plaiting material. Environmental benefit: Used for soil erosion as a soil cover, biodegradable from waste.	Mats, matting and screens of vegetable materials of rattan.	1
	Mats, matting, and screens of vegetable materials other than bamboo and rattan.	2
	Parts for steam/other vapor-generating boilers, other than boiler bodies, shells or casings.	3
	Mats, matting and screens of vegetable materials of bamboo.	4
	Boiler bodies, shells or casings, parts for steam or other vapor-generating boilers.	5
Wastewater Management and Potable Water Treatment (Mitigation, Broader Environmental Protection) For example: Porcelain bathroom, kitchen, & other sanitary fixtures. Environmental benefit: Waterless urinals and composting toilets minimize water use. Composting toilets also provide self-contained sewage treatment on site, with no need for sewers and treatment plants. These items also do not pollute ground or surface water or soil (unlike septic tanks or pit latrines) and produce safe, useful compost.	Anhydrous ammonia.	1
	Compressors used for automotive air conditioners.	2
	Babies garments and clothing accessories, knitted or crocheted, of cotton.	3
	Remote control apparatus, other than radio remote control apparatus.	4
	Other women's or girls' protective work garments (excluding those used for protection from fire/chemical substances/radiation).	5
	Parts of other electrical machines and apparatus, having individual functions.	6
	Surgical masks.	7
	Other made-up articles excluding umbrella covers/surgical masks/safety harnesses/fans & handscreens/laces, shoes, boots, and corsets.	8
	Baby napkins and pads for incontinence, of paper, paper pulp, cellulose wadding or webs of cellulose fibers.	9
	Other articles of plastics & other materials of headings 39.01 to 39.14. other than 3926.10.00-3926.90.92.	10

Green Good Description, Examples, and Climate Change Role	Top 10 Products in 2020 Exports	Rank
Water Supply For example: Mineral and aerated waters not sweetened or flavored. Environmental benefit: Potable water supply and distribution.	Naphthenic acids, their water insoluble salts and their esters.	1
	Other nucleic acids their salts, whether/not chemically defined, other heterocyclic components other than HS29341000-29349950.	2
	Biodiesel, not containing petroleum oil, coconut methyl ester (CME), with ester alkyl content 96.5% or more but <98%.	3
	Other acetone oil, chemical preparations containing monosodium glutamate (MSG), Other chemical preparation used in manufacturing of foodstuffs.	4
	Mineral waters.	5
	Biodiesel, not containing petroleum oil, coconut methyl ester (CME), with ester alkyl content exceeding 98%.	6
	In addition to biodiesel, containing petroleum oil.	7
	Peptones & their derivatives, other protein substances, not specified or included, hide powder, chromed or not.	8
	Carbides, whether or not chemically defined, other than of calcium & silicon.	9
	Oxadiazon, with a purity of 94% or more.	10

Source: World Bank staff calculation based on GTN list of green goods and BPS trade data.

Appendix Two

Table 3: Top EGs Traded in 2020 (Ranked by Value)

No.	8-digit HS code	Description	EG Category (Climate Change/ Environmental Role)	Exports (2020) (millions of US$)	8-digit code	Description	EG Category (Climate Change Role)	Imports (2020) (millions of US$)
1	87141090	Other motorcycles (including mopeds)	Cleaner or more resource efficient technologies and products (mitigation)	438.9	38220090	Diagnostic/ laboratory reagents on a backing prepared diagnostic/ laboratory reagents	Wastewater management and potable water treatment (Broader Environmental Protection)	496.5
2	28141000	Anhydrous ammonia	Wastewater management and potable water treatment (Broader Environmental Protection)	386.9	84068100	Steam turbines and other vapor turbines. output > 40 MW, other than for marine propulsion	Renewable energy (mitigation)	472.6
3	85065000	Primary cells and primary batteries (lithium)	Cleaner or more resource efficient technologies and products (mitigation)	191.1	85423100	Processor & controller of electronics integrated circuits	Management of solid and hazardous waste and recycling systems (mitigation)	332.2
4	85423900	Other electronic integrated circuits	Management of solid and hazardous waste and recycling systems (mitigation)	151.1	85423900	Other electronic integrated circuits	Wastewater management and potable water treatment (Broader Environmental Protection)	322.8
5	85371099	Switchboard & control panels: use for other purposes	Renewable energy (mitigation)	145.4	85143090	Other furnaces and ovens	Air pollution control (mitigation)	310.5
6	73089099	Other guardrails of iron or steel	Renewable energy (mitigation)	135.5	84818099	Other fuel cut-off valves for vehicles of copper/ alloy	Wastewater management and potable water treatment (Broader Environmental Protection)	288.0
7	85044090	Static converters other than UPS, battery chargers, inverters, rectifiers	Renewable energy (mitigation)	132.3	84798939	Other automatic service-vending machines, electrically operated	Air pollution control (mitigation)	273.2

No.	8-digit HS code	Description	EG Category (Climate Change/ Environmental Role)	Exports (2020) (millions of US$)	8-digit code	Description	EG Category (Climate Change Role)	Imports (2020) (millions of US$)
8	87149994	Chain wheels and cranks; other parts for bicycles designed to be used by children	Cleaner or more resource efficient technologies and products (mitigation)	126.4	84118200	Gas turbines of a power > 5,000 kW	Environmentally preferable products based on end use or disposal characteristics (Broader Environmental Protection)	260.3
9	39202010	Biaxially oriented polypropylene (BOPP) film	Management of solid and hazardous waste and recycling systems (mitigation)	123.3	84178000	Furnace & oven including incinerators for laboratory, non-electric	Air pollution control (mitigation)	258.1
10	87120030	Other bicycles not motorized	Cleaner or more resource efficient technologies and products (mitigation)	112.1	85023939	Other generating sets other-powered of 10,000 kVA < output< 12,500 kVA	Renewable energy (mitigation)	243.3
11	84148042	Compressors used for automotive air conditioners	Air pollution control (mitigation)	110.2	87141090	Other of motorcycles (including mopeds)	Cleaner or more resource-efficient technologies and products (mitigation)	230.6
12	61112000	Babies garments and clothing accessories, knitted or crocheted, of cotton	Wastewater management and potable water treatment (Broader Environmental Protection)	107.6	73089099	Other guard-rails of iron or steel	Renewable energy (mitigation)	222.6
13	85437020	Remote control apparatus, other radio remote controlled apparatus	Clean up or remediation of soil and water (mitigation, adaptation)	105.9	84798210	Mixing, kneading, crushing, grinding, screening, sifting, homogenizing, emulsifying/ stirring machines, electrically operated	Management of solid and hazardous waste and recycling systems (mitigation)	218.3

No.	8-digit HS code	Description	EG Category (Climate Change/ Environmental Role)	Exports (2020) (millions of US$)	8-digit code	Description	EG Category (Climate Change Role)	Imports (2020) (millions of US$)
14	62105090	Other women's or girls' protective work garments (excluding those used for protection from fire/ chemical substances/ radiation)	Wastewater management and potable water treatment (Broader Environmental Protection)	98.3	84069000	Part steam and other vapor turbines	Renewable energy (mitigation)	216.6
15	84119900	Part of other gas turbines	Renewable energy (mitigation)	89.9	29051100	Methanol (methyl alcohol)	Renewable energy (mitigation)	213.3

Appendix Three The Estimation of Ad Valorem Equivalents for NTMs on Green Goods

We estimate the ad valorem equivalent of NTMs using a two-step approach. The rationale for the two step estimations is that trade policy to its very core would affect both volumes and prices of goods. One needs to have a concrete and consistent answer on how trade volume will adjust given the nature of trade policies that present in different forms. The reasonable way by Kee et al (2009). is to use the GDP function approach due to its capability to be generalized to a multi-country setting. It requires net outputs, factor endowments, and prices. This will give us the price effect of imports and import demand elasticities in a broad sense as the first step. Next, we introduce a particular trade restriction into the analysis, in this case NTMs.

We follow these estimations, also similar to Cali et al. (2021), but using the subset of green goods in the estimation. The specification for the first step of estimation is as follows:

$$\ln(m_{pqy}) - \hat{\varepsilon}_p \ln(1 + t_{pqy}) = \beta^n NTM_{pqy}^n + \gamma^n NTM_{pqy}^{-n} + \alpha_p + \alpha_{qy} + \kappa_{pqy} \quad \text{(E1)}$$

where m_{pqy} is the import value of an environmental product p (at HS 2007 10 digits) in quarter q of year y, ε_p is the price elasticity of import for product p, t_{pqy} is the ad valorem tariff on good p in a given qy, NTM_{pqy}^n is a dummy that takes value 1 if NTM of type n is applied to p in a given qy pair, NTM_{pqy}^{-n} is a dummy that takes value 1 if NTM of type other than n is applied to p in a given qy pair in order to control for other NTMs applied to the product, α_p is a product dummy that allows to control for product-specific characteristics, α_{qy} is a quarter-year dummy that accounts for shocks specific to a given quarter-year and common across products, and κ_{pqy} is the error term. The price elasticities of import ε_p are estimated using the methodology proposed by Soderbery (2015).

The coefficient $(e^{\beta^n} - 1)$ implies that if an NTM $n$applied to a product p then its import changes by $(e^{\beta^n} - 1)$ percent, more formally $\frac{\partial lnm_{pqy}}{\partial NTM_{pqy}^n} = (e^{\beta^n} - 1)$.

The next step is to use these estimates to calculate the change in the domestic price of product p, $\frac{\partial lnp_{pqy}^d}{\partial NTM_{pqy}^n}$. This price change is referred to as ad valorem equivalent (AVE) of NTMs. Kee et al. (2009) find a simple way to compute it by noting that the elasticity of import to NTMs can be rewritten as

the product between the price elasticity of import and the elasticity of the domestic price to NTM, as follows:

$$\frac{\partial lnm_{pqy}}{\partial NTM^{n}_{pqy}} = \frac{\partial lnm_{pqy}}{\partial lnp^{d}_{pqy}} * \frac{\partial lnp^{d}_{pqy}}{\partial NTM^{n}_{pqy}} = \frac{\partial lnm_{pqy}}{\partial lnp^{d}_{pqy}} * ave^{n}_{p} \quad \text{(E2)}$$

so that,

$$ave^{n}_{p} = \frac{\partial lnm_{pqy}}{\partial NTM^{n}_{pqy}} \frac{\partial lnm_{pqy}}{\partial lnp^{d}_{pqy}} = \frac{(e^{\beta^{n}} - 1)}{\varepsilon_{p}} \quad \text{(E3)}$$

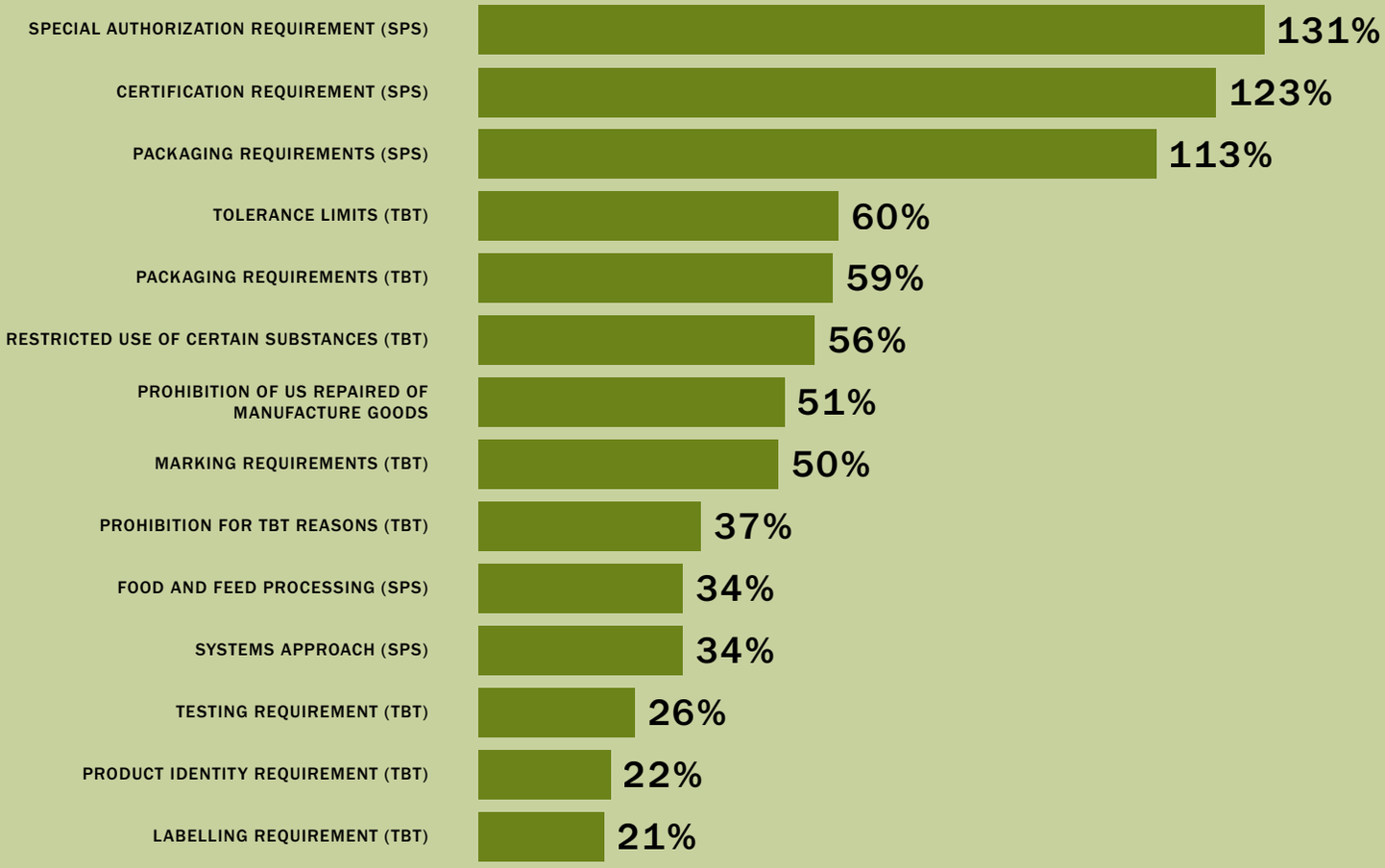
E.3 provides AVE for a specific product-NTM pairs. The final step is to derive a unique AVE for each NTM by taking the weighted average of product-specific AVE for each NTM. The import share of each product over all products exposed to NTM is used as weight: $\frac{M_{p|n=1}}{M_{|n=1}}$, where $M_{p|n=1}$ is the total import of product p on which an NTM was implemented at any point of the sample period and $M_{|n=1} = \Sigma_{p} M_{p|n=1}$. The AVE for each NTM n is computed as follows:

$$\bar{ave}^{n} = \sum_{p} \frac{M_{p|n=1}}{M_{|n=1}} \frac{(e^{\beta^{n}} - 1)}{\varepsilon_{p}} \quad \text{(E4)}$$

Table 4: Full List of All Green Products and Climate Change Role

Product Category	Energy Transition (Mitigation)	Agriculture And Land Use Transition/NRM (Mitigation)	Waste Management (Mitigation)	Adaptation	Broader Environmental Protection
Air Pollution Control	*				
Clean Up or Remediation of Soil and Water		*		*	
Cleaner or More Resource Efficient Technologies and Products	*				
Efficient Consumption of Energy Technologies and Carbon Capture and Storage	*				
Energy Efficiency	*				
Environmental Monitoring, Analysis, and Assessment Equipment					*
Environmentally Preferable Products based on End-Use or Disposal Characteristics					*
Gas Flaring Emission Reduction	*				
Heat and Energy Management	*				
Management of Solid and Hazardous Waste and Recycling Systems			*		
Natural Resource Protection		*			
Natural Risk Management				*	
Noise and Vibration Abatement					*
Others					*
Renewable Energy	*				
Resources and Pollution Management		*			
Waste Management, Recycling and Remediation			*		
Wastewater Management and Potable Water Treatment					*
Water Supply		*			*

FIG 51 TARIFF EQUIVALENT OF NTMS ON ALL GREEN GOODS



Source: World Bank staff estimations.

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