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JEL : F13, F18

Keywords: international trade, trade policy, green growth

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Abstract

This paper estimates to what extent “green” crisis-era measures have an impact on the “climate-friendliness” of imports in the Asia-Pacific region. Testable predictions and the empirical strategy are derived from the seminal paper of Eaton and Kortum (2002). The empirical results show that at the intensive margin implemented “green” measures are associated with an increase of sourcing from more rather than less energy intensive countries. One reason for this surprising result may be that governments have presented the state interventions as being “green” although the main purpose was not the environment. At the extensive margin, results are slightly more promising. The implementation of “green” measures seems to decrease the likelihood that imports are sourced from a relatively more energy intensive origin. However, the results are not very strong as to statistical and economic significance. In sum, only limited evidence for environmental benefits of “green” crisis-era interventions through the import channel exist. The implementation of such measures may in fact be associated with an environmental degradation of imports. Moreover, supplier countries being “close” competitors to the interventionist country (in terms of technology levels) relatively loose import share if discriminatory “green” measures are implemented. Stated differently, the alleged “green” measures protect domestic against foreign suppliers with similar technology levels.

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1 Introduction

The economic momentum prior to the global economic crisis has to a great extent been driven by ever increasing exports in particular in the Asia-Pacific region. The recent economic recovery in that region and also in more developed regions has proved that economic stimuli continue to be driven by export-led growth strategies (Evenett et al., 2011). This leads to a renewed and sharp expansion of (fossil-fuel intensive) production and cargo transportation, which results in a considerable surge in greenhouse gas emissions. The scientific consensus that these emissions accelerate climate change and its potentially tremendous impacts (such as rising sea levels, glacial melt, tropical cyclones, changes in monsoon patterns, floods and droughts) points to the urgent need of mitigation and adaptation actions (IPCC, 2007 and WTO-UNEP, 2009). Besides efforts in finding a multilateral post-Kyoto agreement, developed and developing countries started to implement unilateral climate change policies such as carbon taxes, emission trading schemes and "green" subsidies, which are all targeted to mitigate or to adapt to climate change (Wermelinger and Barnes, 2010).

As a consequence of the global economic crisis and thus struggling industries at home, many governments intervened to help and save domestic industries. The introduced state measures took the form of bailouts, export subsidies, local content requirements and investment incentives, among others. Many of these state actions also involve some clause as to climate mitigation or energy reduction objectives.

How bad this kind of state intervention, often called "murky" protectionism, is for the recovery and the long run strength of global growth is subject of an ongoing debate in the literature (see, for example, Evenett and Wermelinger, 2010). One important aspect mentioned in this academic discussion is whether state measures (often subsidy-like measures) provided under the mask of "green growth" strategies indeed do target or promote "green" production, consumption or investment. Or whether the use of such measures is just a consensual way to introduce new discrimination against some or all trading partners - especially if climate change mitigation action is widely supported around the globe (Aggarwal and Evenett, 2010). It is not the objective of this paper to measure the size of discrimination involved in "green" crisis-era subsidies. Given the fact that climate change is taking place and thus economic activity has to adapt to less emission-intensive production, this paper estimates the impact of "green" crisis-era measures on patterns of imports or more specifically on the "climate-friendliness" of imports in the Asia-Pacific region.

If it can be shown that such state intervention contribute to the "greening" of Asian imports, one may argue that the loss introduced through the mercantilist approach is balanced by the environmental benefits. Furthermore it would give strong incentives to improve environmental standards of production for all potential players in the global supply chain. However, if one shows that imports do not become "greener", or even get more energy- or emission-intensive, the presumably negative mercantilist characteristic of these policies, the new barrier to economic efficiency, may dominate. One extension in section 5.3 in fact tests the protectionist role of these "green" measures.

The paper proceeds as follows. The next section provides an overview of "green" crisis-era state measures implemented globally and in the Asia-Pacific region in particular since November 2008, when the G-20 members agreed not to engage in protectionism. Section 3 describes four channels through which "green" measures, mostly subsidy-like measures, may contribute to climate change mitigation or greenhouse gas emission reduction and shows how international trade is likely to be affected through these channels. At the time being, data is sufficiently available to study the effects on imports - but not exports - of "green" crisis-era measures. More formally, section 4 gets therefore granular on import effects providing theoretical predictions and deriving the empirical strategy. Section 5 gives a detailed description of the data and presents the results. Section 6 concludes and states the implications for policy.

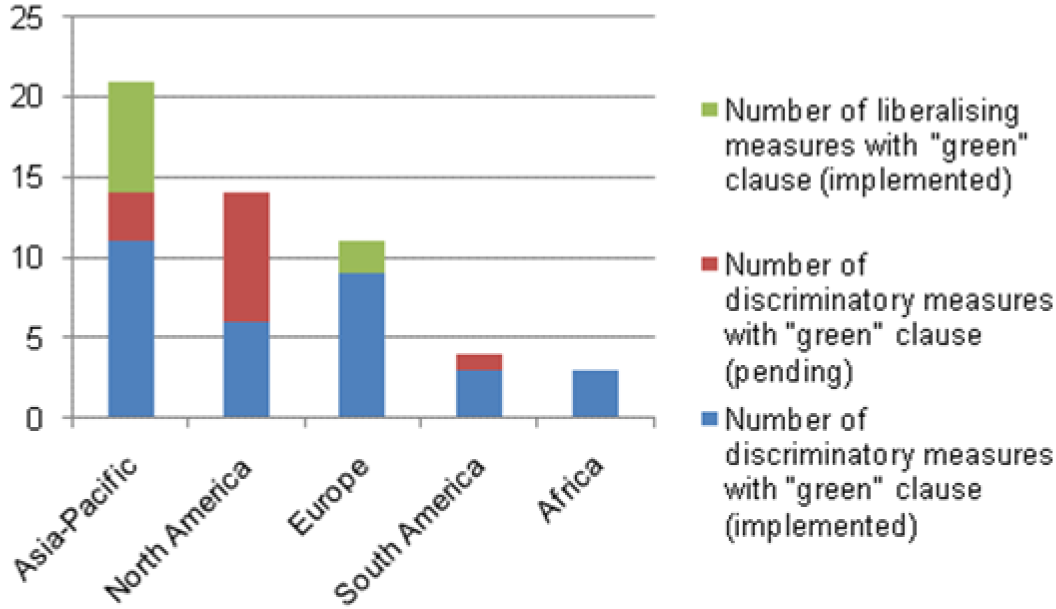
2 "Green" crisis-era state measures: A glance at the data

This section examines to what extent state interventions since the beginning of the global economic crisis were provided under the mask of "green growth" strategies in the Asia-Pacific region and elsewhere and whether these interventions are likely to be beneficial for both trade and the environment.

Figure 1 illustrates that the Asia-Pacific region used "green" clauses most often - both by introducing new discrimination against commercial interests of their trading partners and by liberalising trade or introducing beneficial effects for the partner countries[1]. Looking

[1] The analysis presented in this section is also published in Wermelinger (2011). The data is taken from the Global Trade Alert (GTA) website (www.globaltradealert.org). GTA measures are identified as "green"-clause measures if, firstly, one of the following keywords is found in GTA's description of the

Figure 1: Which regions use "green" clauses most often?



Source: Global Trade Alert and author's calculations.

closer to the interventions of the region at least four patterns stand out (see appendix tables A1 a-c). Firstly, "green" clauses are introduced by many Asian countries and in combination with discriminatory measures (implemented and pending) they are most prominently used in the Republic of Korea (4 measures), China (3 measures), Japan (2 measures) and the Russian Federation (2 measures). Secondly, discriminatory measures under the "green"-clause category are most often introduced through "murky"-forms of trade discrimination, in particular bailouts and export subsidies. By contrast, "green" liberalisations were most often enacted as tariff cuts or tariff exemptions. Thirdly, for two-third of the discriminatory measures "green"-clauses are combined with several other (mostly harmful) policies that have no climate or environmental purpose[2]. This finding supports the argument that it is more accepted to use discriminatory measures and to protect domestic from foreign producers (particularly during economic downturns and during heated debate on climate change), if some environmental or climate objective is mentioned in the regulation. Interestingly, the "green"-aspect is the main purpose of implementation for most liberalising measures and thereby shows nicely that climate-friendly and trade-enhancing policies can

measures: green, environment, energy, climate, emissions, electricity, wind or solar (necessary condition). Secondly, if a clear statement for climate mitigation, energy reduction or other environmental objectives can be found for those measures (sufficient condition).

[2]Column "Main" in appendix tables A1 a-c indicates whether the "green" clause was the main purpose of implementation.

in fact be merged. Finally, 46 trading partners (ATP), 6 sectors (AS) and 42 product lines (ATL) are on average affected by distortionary "green"-clause measures. This illustrates the likely economic and political importance of these measures.

3 Four channels and the effects on trade

As shown in the previous section, most discriminatory crisis-era state measures introduced under the mask of "green growth" strategies take the form of "murky" measures such as bailouts, export subsidies, local content requirements or investment incentives. All of these measure types can be regarded as subsidy-like measures as they support domestic industries selectively and are distortionary against foreign commercial interests. "Green" subsidies may contribute to climate change mitigation or greenhouse gas emission reduction through the following for four channels[3]:

1. **Fostering research and development of "green" goods and technologies.** "Green" subsidies may be provided to domestic firms for research and development of "green" goods and technologies.

2. **Using "green" technologies for the production of other goods.** Domestic firms may receive financial support from their governments if they improve production processes by using new technologies and thus reducing energy consumption of production.

3. **Using "green" inputs into production.** Subsidies may be provided if domestic goods are produced with "green" inputs (or "green" intermediary goods), that is, inputs that are themselves produced with less energy and better technologies.

4. **Consuming "green" goods.** More generally and related to the third channel, "green" subsidies should increase consumption of all "green" goods, or at least, increase the relative consumption share of "green" goods. Thus, similar effects can be expected for both firms and final good consumers, depending on the outline of specific measures.

"Green" goods (and technologies) are either goods that are *per se* regarded as environmental friendly or climate smart. Among others, ESCAP (2011) provide a list of 64 climate smart

[3]This section ends with an argument for this paper to focus on channel 2 and 3.

goods and technologies; wind turbines or solar collectors are examples. Or, goods produced more energy efficiently by one firm or one country compared to the same (or similar) goods somewhere else are regarded as "green" goods. For example, Thailand produces electronics more energy efficiently than the Russian Federation and thus Thai electronics are "green" in comparison to their Russian equivalents. But, Australia is more energy efficiently than Thailand in the same sector and therefore Australian electronics are "green" compared to Thai[4]. This paper makes use of the second (and comparative) definition of "green" goods and technologies.

All described channels also influence patterns of international trade - or the "climate friendliness" of trade. While increased research and development in the "green" sector (channel 1) should attract foreign expertise through consulting activities, all other channels are likely to increase the share of imports of "green" goods and/or technologies. Subsequently, subsidy implementing countries' exports should become "greener" as a result of channels 1-3: Domestic goods will be produced more energy efficiently due to newly developed or acquired technologies. And inputs into production are "greener" and thus domestic goods exports can ultimately be regarded as more energy efficiently (with regard to their complete production cycle).

It is still an early stage to investigate the effects of "green" crisis-era state measures on trade or patterns of trade in the post-crisis period. The implementation process and the allocation of funds are likely to take several months and thus changes in the sourcing patterns of inputs, for example, are also lagged. One therefore has to be careful with regard to how fast an effect of such subsidies could be measured in yearly trade data. The fact is that the approvals of these subsidies have taken place throughout the crisis, i.e. mostly throughout the year 2009, and thus it is unclear whether their implementation has already influenced trade in 2009. It is probably most appropriate to argue that they have influenced imports in 2010 and the effect on exports can not be studied to date: For interventions affecting goods in the production sector , it can be argued that the pattern of imports of inputs (parts and components or raw materials) and technologies (for example, machinery for production) should adapt faster than the pattern of exports. Only after the full implementation of the new and "green" production processes it is likely that the pattern of exports would be "greener" as well. Due to this sequence of effects and the fact that the implementation of "green" crisis-era subsidies is still recent, this study will exclusively

[4]This classification is made with 2004 GTAP data on energy consumption at country and industry levels.

consider the likely effects on patterns of imports of inputs (channel 3) and technologies (channel 2).

The effects on imports through channel 1 are not investigated as data on services trade is not available to the author. None of the measures affect final consumers exclusively (channel 4). The import effects through channel 4 are however studied in combination with the effects through channels 2 and 3; predictions as to the sign of the effect are the same. It should further be noted that predictions of import effects for "green" measures of other types, for example tariffs, are symmetric to those of "green" subsidies (see also section 4). Hence, liberalising "green" state measures, which were to a great extent implemented in the form of tariffs, can be studied likewise: if duties on "green" goods are decreased, one expects that the share of imports from suppliers producing these goods more energy efficiently would increase.

Finally, it has to be recalled that the aim of this paper is not to estimate to what extent these subsidies discriminate against foreign compared to domestic commercial interests, that is, it could be that all necessary "green" inputs (or technologies) are sourced from domestic suppliers and the pattern of imports would accordingly not change or would even become less "climate-friendly". Stated differently, it is not observed to what extent domestic compared to foreign suppliers are given preference, but it is observed to what extent "climate-friendly" foreign suppliers are preferred compared to less "climate-friendly" ones.

4 Import effects of "green" production subsidies: theory and empirical strategy

4.1 Prediction for imports

The argumentation for "green" production subsidies is supported by a simple extension to the Eaton and Kortum (2002) model of international trade. Recalling that the probability, $\pi_{n,i}$, that country i supplies a good at the lowest price in country n is:

$$\pi_{n,i} = \frac{T_i * [c_i * d_{n,i}]^{-\theta}}{\Phi_n}, \tag{1}$$

where $T_i > 0$ and $\theta > 1$. Distributions are treated as independent across countries. The country-specific parameter T_i governs the location of the distribution. A bigger T_i implies that a high efficiency draw for any good is more likely. The parameter θ (which is treated as common for all countries) reflects the amount of variation within the distribution. A bigger θ implies less variability of efficiency levels. It is useful that these parameters allow to depict a world of many countries that differ in the basic Ricardian ways of absolute (T_i) and comparative advantage (θ) across a continuum of goods. In particular, the parameter θ regulates heterogeneity across goods in countries' relative efficiencies. Furthermore, c_i denote production costs in country i and $d_{n,i}$ denote trade constraints with regard to exports from country i to n. The parameter Φ_n of country n's price distribution is: $\Phi_n = \sum_{i=1}^{N} T_i(c_i d_{n,i})^{-\theta}$. The model assumptions further yield that $\pi_{n,i}$ is also the fraction of goods that country n buys from country i and $\pi_{n,i} = E(X_{n,i}/X_n)$, where $X_{n,i}/X_n$ is the fraction of country n's expenditures on goods from country i.

Equation (1) is adjusted to derive predictions for the argumentation in this paper. A measure of energy intensity, EI_i, is added and explains how energy intense a certain source country i is, which then determines country i's production costs, $c_i(EI_i)$, as well as its constraint to export to another country n, $d_{n,i}(EI_i, Green_n)$. Ultimately, energy intensity of a source country also affects the probability that country i turns out to be the supplier to market n of a particular good:

$$\pi_{n,i}(EI_i, Green_n) = \frac{T_i * [c_i(EI_i) * d_{n,i}(EI_i, Green_n)]^{-\theta}}{\Phi_n}. \quad (2)$$

It can further be noted that production costs, $c_i(EI_i)$, are assumed to increase with energy intensity, EI_i. Furthermore, it is assumed that energy intensity has *per se* no impact on trade constraints $d_{n,i}(EI_i, Green_n)$, however, once an importing country n provides "green" subsidies, $Green_n$, it is assumed that trade constraints would decrease the less energy intense a source country i is. More formally, it is expected that

$$\partial d_{n,i}/\partial Green_n < 0 \mid EI_i < E_n(EI), \quad (3)$$

where $E_n(EI)$ is the average energy intensity (in production) of imports of country n. Provided that trade constraints decrease due to the subsidy, the model predicts that probability $\pi_{n,i}$ increases. The following comparative static assumption can thus be derived:

$$\partial \pi_{n,i}/\partial Green_n > 0 \mid EI_i < E_n(EI). \quad (4)$$

4.2 Quantification of the "green" subsidy effect

The empirical strategy to quantify the "green" subsidy effect for imports of intermediary goods and technologies is derived from equation (2). Natural logarithms are taken on both sides and the time dimension, t, is added to the model:

$$E(imp_{n,i,t}) = tech_i + patt_n + time_t + \gamma_1 cost_{i,t} + \gamma_2 tconstraint_{n,i,t}, \quad (5)$$

where $E(imp_{n,i,t})$ is the expected value of the logarithm of the fraction of imports from i to n in period t of total imports to n in t, $tech_i$ are dummies for each source and control for differences of average levels of technologies between source countries, $patt_n$ are dummies for each importing country and absorb the differences in the overall import pattern between countries, $time_t$ are time dummies to take account of cyclical changes in the economic environment (other than "green" subsidies), $cost_{i,t}$ stands for production costs of i in t and $tconstraint_{n,i,t}$ denotes trade constraints between importer n and source i in period t[5] [6].

The main argument in this paper is that trade constraints, $tconstraint_{n,i,t}$, change due to the provision of "green" subsidies, $green_{n,t-1}$, of country n in period $t-1$. The time lag is introduced due to the assumption that the effects of subsidies on trade are lagged. The direction and size of this change depend on the energy intensity, $enintens_i$, of source country i. Therefore, the main coefficients of interest in the estimations are those related to subsidies and energy intensities, which are used as proxies for trade constraints, $tconstraint_{n,i,t}$. Additional proxies for trade constraints (like standard gravity variables) as well as proxies for production costs are not further described. The estimation model ensues as follows:

$$E(imp_{n,i,t}) = tech_i + patt_n + time_t + \beta_1 enintens_i + \beta_2 (enintens_i * green_{n,t-1}) + X_{n,i,t}, \quad (6)$$

where $enintens_i$ controls for the effect that energy intensity of a source country i may have on the level of its exports to any country. This variable is likely to absorb some of the effect that the technology dummies have. The interaction term $(enintens_i * green_{n,t-1})$ stands for the change in trade constraints that "green" subsidies are likely to induce depending on

[5] More formally, $imp_{n,i,t}$ is derived from $ln(X_{n,i}) - ln(X_n)$, $tech_i$ is derived from $ln(T_i)$, $patt_n$ is derived from $ln(\Phi_n)$, $cost_{i,t}$ is derived from $ln(c_i)$ and $tconstraint_{n,i,t}$ is derived from $ln(d_{n,i})$.

[6] The error term is omitted as equation 6 is written down as an expected value, where the error term is zero on average.

the level of energy intensity of the source country i. The expected sign is negative, i.e. the more energy intense source i is, the less it is expected to export to n given that n provides "green" subsidies. $X_{n,i,t}$ subsumes all other factors that may impact import fractions.

5 Empirics

5.1 Data

The dataset is retrieved from four sources: UN Comtrade for import data, Global Trade Alert (GTA) database for data on the characteristics of "green" crisis-era state measures, Global Trade Analysis Project (GTAP) database for data on energy intensity of goods production in 2004 and CEPII for distances between trading partners.

Dependent variables

For each considered "green" state measure of the Asia-Pacific region, the dataset includes yearly bilateral import shares between importers having implemented the (liberalising and discriminatory) measures and their source countries for the period 2005-2010. Import shares are calculated for the sum of all product lines affected by a specific state measure[7]. For example, Japan's "Green tax incentive on environmentally friendly cars" affects 17 product lines and thus the US import share in Japan is calculated for total imports in these product lines. One dependent variable used in the estimations is the log of import shares and is henceforth reported as ***Log import share***. Models using this dependent variable show how "green" measures affect import shares at the intensive margin.

Source countries with positive import shares in at least one year between 2005 and 2010 will be considered as separate observations for all six periods. Import shares will have zero value if no imports were reported in a specific year. Herewith, one cannot only study the intensive, but also the extensive margin. An alternative dependent variable is thus a dummy indicating whether or not affected goods are imported from a specific source in a specific year. The variable is reported as ***Import dummy***.

[7] A product line is defined at the HS 4-digit level, which is the level of disaggregation reported by the Global Trade Alert.

Independent variables

Patterns of "green" crisis-era state measures in the Asia-Pacific region are described in section 2 and listed in appendix tables A1, separately for (a) discriminatory and implemented, (b) discriminatory and pending as well as (c) liberalising and implemented measures. The last column of these tables indicate whether or not a specific measure is included in the dataset for the estimations below. Measures may not be included if the date of implementation is after 30 June 2010 (after 30 June 2009 for the Republic of Korea[8]) and if measures are only announced and not yet implemented (all measures in table A1 b). It is assumed that measures have to be implemented in the first half of the year in order to have an *immediate* effect on import patterns, that is, an effect on import patterns in the year of implementation. Measures implemented in the second half of the year may *immediately* affect import patterns only the next year. For example, China's "Restructuring of equipment in the manufacturing industry" measure was implemented on 12 May 2009 and thus immediately affects import shares in 2009 and 2010. But, Russia's "Injection of 4.33 billion rubles into Russian RUSHYDRP (green energy) company" implemented on 2 November 2009 immediately affects import shares only in 2010.

The *immediate* "green" measure, or "green" clause, dummy is henceforth reported as ***Green clause***. The assumption of a *lagged* green measure effect means that measures have to be implemented in the first half of a year and affect import shares of the next year. The Chinese measure mentioned above would thus lead to a *lagged* "green" clause effect in 2010 and the Russian measure would be dropped as 2011 data was not yet available at the time of editing this paper. The *lagged* "green" clause dummy is reported as ***Green clause, lag***. The two dummies are always used separately and are always interacted with an energy intensity measure. This is due to the theoretical derivations in section 4.

Moreover, one should differentiate between different types of "green" crisis-era measures. Firstly, it will be differentiated with regard to the strictness of the "green" objective of the measure. While some schemes introduce clear-cut criteria how the environmental standard has to improve in order to receive the subsidy or decrease tariffs on *per se* "green" goods, others have simply a superficial "green" justification and are less clear with defining environmental criteria. The column "Main" in the appendix tables A1 a-c indicates whether or not the "green" clause was the main purpose of implementing a specific measure.

[8]At the time of writing this paper (June 2011) 2010 import data for the Republic of Korea was not available and thus the influence of measures implemented after 30 June 2009 on import patterns cannot be analyzed.

In order to evaluate the "climate-friendliness" of imports, measures of energy intensity for the production of goods and their transportation is needed. Energy intensity levels for the production of goods (in toe/1'000$) are available for the year 2004, for all GTAP sectors and for 213 countries. Product lines affected by "green" measures are linked to the closest GTAP sectors. Energy intensity measures of these "affected" GTAP sectors are calculated for each source country. It is assumed that energy efficiencies are rigid and are therefore treated as constant across the whole study period. In fact, the use of energy efficiency data in the past, i.e. for the year 2004, is preferable as the endogeneity problem of energy efficiency is abolished: trade data in the period 2005-2010 has no influence on energy efficiencies in 2004. The simple variable is reported as ***Log energy intensity of production*** and the interaction terms with the "green" clause dummies are labeled as ***(Log energy intensity)(Green clause)*** and ***(Log energy intensity)(Green clause, lag)***.

Importing countries may also contribute to climate mitigation by sourcing their goods from trading partners, which are geographically closer and thus emissions from transportation are reduced. It is quite a challenge to quantify the exact level of emissions, or energy intensity, of transportation as the means of transportation vary from one trade relationship to another and from one good traded to another. Truong and Mikic (2010) provide an elegant calculation of trade emission intensity indexes incorporating both emissions from production and transportation. Cristea et al. (2011) also provide detailed comparisons of greenhouse gas emissions associated with output versus international transportation of traded goods. They found that transport is responsible for 33 percent of worldwide trade-related emissions and over 75 percent of emissions for major manufacturing categories like machinery, electronics and transport equipment. As detailed data for emissions of transportation is not available to the author, section 5.3 uses distance as a simple proxy for transportation emissions. In particular, ***Log distance*** and ***(Log distance)(Green clause)*** are introduced as variables. Proxing transportation emissions with distance does not yield the correct size of the effect, but it should be sufficient to identify the correct direction of the transportation emission effect (or energy intensity of transportation). Stated differently, the estimated coefficients of the two interaction terms with "green" clause dummies cannot simply be summed up to get the total import share effect of "green" measures. However, if the coefficients yield the same sign, one can conclude that the total effect of "green" measures also has that sign and is bigger in magnitude than the one found in the specifications without the distance variables.

Another extension in section 5.3 tests whether source countries with technology (or cost) levels closer to those of interventionist countries are more negatively affected than those with technologies further apart. Thereby, it will be shown that the alleged "green" measures protect domestic against foreign suppliers with similar levels of technologies. Technology or cost level differences between affected sectors in source and interventionist countries are proxied by the absolute values of differences in log energy intensity levels. The introduced variables are ***|Diff. log energy intensity|*** and ***(|Diff. log energy intensity|)(Green clause)***.

Naive mean comparison tests

In order to get a feeling for the data and the likely effects of "green" crisis-era measures on import shares and on the propensity of importing, a simple (and naive) mean comparison test is introduced. The average *Log import shares* (as well as average values of the *Import dummies*) are calculated before and after the implementation of "green" subsidies for the subgroup of observations with energy intensity levels below average. This exercise is done for the *immediate* and *lagged* cases. Table 1 shows that for the group of below average energy intensities, import shares (or *Log import shares*) are on average lower before the implementation of "green" crisis measures compared to after their implementation. This difference is highly significant for the immediate case and not significant for the lagged case. Against the expectations, this simple check gives some indication that "green" crisis-era measures may not be beneficial to the "greening" of trade, at least not at the intensive margin. The "green" suppliers (below average energy intensity) have lost market share after the state intervention.

At the extensive margin, "green" crisis-era measures may be more effective. According to this simple mean analysis, the propensity of importing from "green" suppliers has increased after the implementation of "green" clause measures. Again, the difference is highly significant for the immediate case and not significant for the lagged case. The results give some hope that "green" state interventions contribute to the "greening" of imports at the extensive margin.

The next section presents the results of the more fundamental empirical analysis.

Table 1: Mean comparisons of *Log import shares* and *Import dummies* for the group of below average energy intensities: before and after the implementation of "green" clause measures

	Timing	After	Before	Diff	Std err
Log import share	Immediate	-9.30	-9.04	-0.26*	0.16
Log import share	Lagged	-9.69	-9.62	-0.07	0.26
Import dummy	Immediate	0.88	0.86	0.02	0.01
Import dummy	Lagged	0.87	0.85	0.02	0.02

*** p<0.01, ** p<0.05, * p<0.1

5.2 Results

The presentation of the benchmark results (models without distance variables) is structured as follows. Table 2 and table 3 report OLS regression results with *Log import share* as the dependent variable and thus show the effects of "green" crisis-era measures at the intensive margin of importing. Due to the log linearisation all zero trade shares are dropped in the estimations. Table 4 and 5 present Probit results with *Import dummy* as the dependent variable[9]. These tables show the effects of "green" crisis-era measures at the extensive margin. Or stated differently, the change in the propensity of importing from a specific exporting country due to the "green" measures is estimated. Each table provides results for six different sub-samples. All sub-samples, except the one used in specification 4, include yearly data for the time period 2005 to 2010. The first specification includes the full dataset described in section 5.1 and thus indicates the overall average effect of "green" crisis-era state measures. While column 2 reports the results for the sub-sample affected (at some point during the investigated period) by liberalising "green" measures, column 3 shows the results for the sub-sample affected at some point by discriminating "green" measures. In model 4, all observations prior to 2007 are dropped.

[9]Notice that the coefficients reported are marginal effects for infinitesimal changes from the mean of each independent variable.

As described in the previous section, “green” measures are classified into measures where the “green” clause is the main purpose of implementation and measures where it is not. Specifications 5 and 6 take account of this aspect. Finally, all models include importer-exporter pair as well as time dummies[10]. Robust standard errors are reported in parentheses.

Simple effects of energy intensity

As expected, the simple effect of the energy intensity of production on import shares (intensive margin) as well as on the propensity of exporting (extensive margin) is positive across most specifications (see tables 2-5, models 1, 3, 4 and 6). The more energy intensive production is, the lower the costs of production generally are, and thus the more likely the importing country is to source from such low cost exporting countries. A 10 percent increase in the energy intensity of production in a source country is associated with a 5 percent increase in the import share of that source if the effects of “green” clause measures are immediate (table 2) and with a 10 percent increase in the import share if the effects of “green” clause measures are lagged (table 3). At the extensive margin, an increase from the average energy intensity level, 0.5, to 0.6 (an increase of 10 percentage points from the mean) is associated with a 1-2 percentage point increase in the probability of importing if the effects of “green” clause measures are immediate (table 4) and with a 3 percentage point increase if the effects of “green” clause measures are lagged (table 5).

However, intensive margin results indicate that the simple effect of energy intensity is negative if the “green” clause is the main purpose of implementation (see table 2 and 3, model 5) and if measures are classified as liberalising (at least in the case of a lagged “green” clause effect, see table 3, model 2). This is not surprising as “green” liberalisations and measures with “green” clauses as the main purpose of implementation mainly concern *per se* “green” goods and technologies[11], which are traditionally produced in countries with less energy intensive production and which are thus also predominately sourced from these countries. A 10 percent increase in the energy intensity of production is associated with a decrease in the import share between 2 and 12 percent, depending on the sample and model specification used.

[10]Notice that using importer-exporter pair dummies is preferred to dummies for importers and exporters separately as, for example, the fixed effect of an exporter may be different for each importer. The results for the variables of interest are robust to the way of controlling for importer and exporter fixed effects (see appendix tables A2-A5).

[11]Notice that all “green” liberalisations in the sample are classified as measures with “green” clauses as the main purpose of implementation.

Effects of "green" measures depending on energy intensities

The results for the effects of "green" measures depending on energy intensity levels are surprising. At the intensive margin, again the model with the full sample, the model focusing on dicriminations only, the model reduced to the period from 2007 to 2010 and the one taking account of the measures for which the "green" clause is not the main purpose of implementation (tables 2 and 3, models 1, 3, 4 and 6) show similar patterns. All of these models yield positive and mostly strongly significant effects for the interaction between energy intensity levels and the event of a "green" clause measure. Given that a "green" measure is implemented, the more energy intensive production is, the more importers are likely to source from such producing countries. In the models without lags (table 2), a 10 percent increase in energy intensity yields a 1 percent increase in import shares for the overall effect in the full sample and the one reduced to 2007 and 2010 data (models 1 and 4). The effect is doubled to around 2 percent for models focusing on dicriminations and "Not main purpose"-measures. Each of these effects is again increased by 1 percent in the models with lags (table 3, models 1, 3, 4 and 6).

These findings give strong evidence that import share effects through channels 2 and 3 in section 3 are in general not as one would expect from the implementation of "green" measures. The second extension in section 5.3 shows that the protectionist aspect of these state interventions may be the reason for this outcome. Given that the positive effect is strongest in column 6 further illustrates that governments have often argued for state interventions as being "green" although the main purpose of implementation was not the environmental aspect[12]. Finally, the stronger effects in the lagged models (table 3) compared to the immediate models shows that it takes in fact time until firms and sectors benefit from subsidies.

If one looks at the models focusing on liberalisations and "Main purpose"-measures in table 2 and 3, it can be learned that in those samples the event of "green" measures does not influence sourcing patterns with regard to energy intensity. None of the coefficients is statistically significantly different from zero. It is, however, interesting that the coefficients have negative signs in both models without lags (table 2, model 2 and 4) and in the liberalization case with lags (table 3, model 2). Thus, the coefficients' signs point at least in the right direction in models for which *per se* expectations for climate benefits were

[12]The extension in section 5.3 investigates a second explanation for this unexpected "green" measure effect. In particular, it is studied whether source countries with technology levels closer to those of the interventionist country are more negatively affected than those with technologies further apart.

most likely.

The results for models looking at extensive margins of importing are more promising, but are not very strong as to statistical and economic significance. All models yield the expected negative sign: given that "green" measures are implemented, an importing country is less likely to source from a relatively energy intensive country. The effect is statistically insignificant for all models with immediate "green"-clause effects (table 4) and is significant for some specifications in the lagged effect models (table 5). Taking the full sample model 1 as an example, an increase from the average energy intensity level, 0.5, to 0.6 (an increase of 10 percentage points from the mean) is associated with a 0.5 percentage point decrease in the probability of importing. While at the intensive margin "green" crisis-era measures are not making imports "climate-friendly" through the investigated channels 2 and 3 from section 3, there is some evidence that these measures have some beneficial effects as to the "climate-friendliness" of imports at the extensive margin.

Table 2: (Immediate) effect of green measures on import shares for different sub-samples

OLS regressions with *Log import share* as dependent variable						
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Liberal.	Discrim.	Only 07-10	Main	Not main
Log energy intensity of production	0.437***	0.861***	0.479***	0.512***	-0.867***	0.474***
	(0.0746)	(0.0550)	(0.110)	(0.0909)	(0.0491)	(0.108)
(Log energy intensity)(Green, weighted)	0.178***	-0.0310	0.266***	0.159**	0.0356	0.329***
	(0.0595)	(0.0558)	(0.0790)	(0.0673)	(0.0434)	(0.109)
Constant	-7.155***	-10.53***	-6.998***	-6.514***	-17.30***	-6.911***
	(0.411)	(0.0888)	(0.435)	(0.432)	(0.114)	(0.449)
Importer-exporter pair dummies	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Observations	4,072	1,730	2,342	2,753	2,434	1,638
R-squared	0.809	0.926	0.793	0.812	0.912	0.747

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 3: (Lagged) effect of green measures on import shares for different sub-samples

OLS regressions with *Log import share* as dependent variable						
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Liberal.	Discrim.	Only 07-10	Main	Not main
Log energy intensity of production	1.042***	-1.152***	1.030***	1.143***	-0.189***	1.022***
	(0.130)	(0.0237)	(0.129)	(0.171)	(0.0335)	(0.128)
(Log energy intensity)(Green, lag)	0.237***	-0.0538	0.304***	0.227**	0.0360	0.355***
	(0.0836)	(0.107)	(0.0990)	(0.0962)	(0.0687)	(0.125)
Constant	-5.659***	-17.78***	-5.697***	-5.199***	-18.98***	-5.684***
	(0.462)	(0.248)	(0.458)	(0.537)	(0.151)	(0.464)
Importer-exporter pair dummies	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Observations	1,924	397	1,527	1,313	828	1,096
R-squared	0.812	0.914	0.784	0.816	0.932	0.731

Robust standard errors in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 4: (Immediate) effect of green measures on propensity of importing for different sub-samples

Probit regression with *Import dummy* as dependent variable						
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Liberal.	Discrim.	Only 07-10	Main	Not main
Log energy intensity of production	0.110***	-0.0288	0.186***	0.0967***	0.0602	0.149***
	(0.0221)	(0.0504)	(0.0425)	(0.0275)	(0.0599)	(0.0351)
(Energy intensity)(Green, weighted)	0.0222	-0.0205	-0.0268	0.0305	0.0269	-0.00678
	(0.0195)	(0.0362)	(0.0243)	(0.0208)	(0.0274)	(0.0250)
Importer-exporter pair dummies	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Observations	2,027	646	994	1,168	1,203	593

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

The coefficients report marginal effects of infinitesimal changes from the mean of each independent variable.

Table 5: (Lagged) effect of green measures on propensity of importing for different sub-samples

Probit regression with *Import dummy* as dependent variable

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Liberal.	Discrim.	Only 07-10	Main	Not main
Log energy intensity of production	0.316***	0.0863**	0.315***	0.327***	0.0700**	0.288***
	(0.0549)	(0.0339)	(0.0554)	(0.0734)	(0.0354)	(0.0514)
(Log energy intensity)(Green, lag)	-0.0559**	-0.115*	-0.0362	-0.0497*	-0.0713	-0.0207
	(0.0272)	(0.0639)	(0.0299)	(0.0287)	(0.0452)	(0.0325)
Importer-exporter pair dummies	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Observations	881	180	701	504	456	425

Robust standard errors in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

The coefficients report marginal effects of infinitesimal changes from the mean of each independent variable.

5.3 Extensions

Taking account of energy intensity of transportation

One could argue that the results above are less meaningful because importing countries may contribute to climate mitigation by sourcing their goods from trading partners, which are geographically closer and thus emissions from transportation are reduced. Tables 6-9 report the results from all specifications of tables 2-5 including distance variables as proxies for energy intensity of transportation. The conclusions at the intensive margin remain existent (tables 6 and 7). Firstly, the size and sign of the coefficients for *(Log energy intensity)(Green clause)* are the same as in the benchmark specifications. Secondly, statistical significance levels for the original variables also remain symmetrically existent. Thirdly, the signs of the coefficients for *(Log distance)(Green clause)* are the same as for *(Log energy intensity)(Green clause)* across all specifications[13]. Therefore, one can argue that findings for the intensive margin effects of "green" measures discussed above are confirmed rather than reversed when including proxies for transportation emissions.

At the extensive margin conclusions are more ambiguous. Firstly, it holds for all specifications (table A8 and A9) that given "green" measures are implemented, the further away a producing country is, the more it is likely to be selected as a source to the implementing country. One explanation for such an outcome would be that countries further away are strong (and potentially "green") suppliers of the affected goods and therefore "green" measure give an impulse to source more from those countries. For the studied case, this argument may actually hold. Countries further away from Asia, like in North America and Europe, are on average more energy efficient in their production than countries in the Asia-Pacific region. Secondly, the coefficients for *(Log energy intensity)(Green clause)* remain negative and similar in size as in the benchmark specifications. Thirdly, coefficients for the models without lag are still insignificant and still only limited evidence for statistical significance of the effects is found in the models with lag. Therefore, the conclusion is ambiguous. The limited evidence of a "green" measure impulse to source from more energy efficient countries and the strong evidence of a "green" measure impulse to source from countries further away, make unclear whether "green" measures are in fact beneficial for the environment at the extensive margin as it is unclear which effect may dominate.

[13] This also holds for the lagged specifications.

Table 6: (Immediate) effect of green clause measures on import shares for different sub-samples

OLS regressions with *Log import share* as dependent variable						
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Liberal.	Discrim.	Only 07-10	Main	Not main
Log distance	2.088***	-1.914***	-0.855***	2.764***	-1.922***	0.0718
	(0.259)	(0.0624)	(0.104)	(0.166)	(0.0594)	(0.190)
(Log distance)(Green, weighted)	0.164***	-0.0382	0.296***	0.186***	-0.0176	0.402***
	(0.0355)	(0.0379)	(0.0497)	(0.0398)	(0.0283)	(0.0587)
Log energy intensity of production	0.383***	0.638***	0.303***	0.420***	0.631***	0.242**
	(0.0759)	(0.0492)	(0.114)	(0.0944)	(0.0439)	(0.114)
(Energy intensity)(Green, weighted)	0.308***	-0.0661	0.449***	0.316***	0.0145	0.480***
	(0.0744)	(0.0674)	(0.0909)	(0.0858)	(0.0566)	(0.113)
Constant	-27.22***	7.009***	0.501	-33.09***	7.086***	-8.534***
	(2.359)	(0.509)	(0.809)	(1.450)	(0.492)	(1.753)
Importer-exporter pair dummies	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Observations	4,072	1,730	2,342	2,753	2,434	1,638
R-squared	0.810	0.927	0.798	0.815	0.912	0.756

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 7: (Lagged) effect of green clause measures on import shares for different sub-samples

OLS regressions with *Log import share* as dependent variable						
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Liberal.	Discrim.	Only 07-10	Main	Not main
Log distance	-0.550***	-1.227***	-0.555***	-0.594***	-4.159***	0.265
	(0.168)	(0.0912)	(0.178)	(0.170)	(0.126)	(0.175)
(Log distance)(Green, lag)	-0.0747	-0.0712	-0.0847	-0.0261	-0.141	-0.0755
	(0.139)	(0.185)	(0.163)	(0.143)	(0.152)	(0.177)
Log energy intensity of production	1.045***	-1.038***	1.034***	1.145***	0.183***	1.025***
	(0.130)	(0.0256)	(0.130)	(0.172)	(0.0373)	(0.129)
(Log energy intensity)(Green, lag)	0.234***	-0.0588	0.302***	0.226**	0.0263	0.356***
	(0.0844)	(0.106)	(0.0996)	(0.0973)	(0.0699)	(0.125)
Constant	-0.431	-5.833***	-0.416	0.429	21.55***	-8.161***
	(1.380)	(0.886)	(1.499)	(1.417)	(1.215)	(1.545)
Importer-exporter pair dummies	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Observations	1,924	397	1,527	1,313	828	1,096
R-squared	0.812	0.914	0.784	0.816	0.932	0.731

Robust standard errors in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 8: (Immediate) effect of green clause measures on propensity of importing for different sub-samples

Probit regression with *Import dummy* as dependent variable						
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Liberal.	Discrim.	Only 07-10	Main	Not main
Log distance	-0.0496	0.144	0.0469	-0.0379	0.0139	0.0361
	(0.106)	(0.138)	(0.0869)	(0.147)	(0.109)	(0.0732)
(Log distance)(Green, weighted)	-0.00972	0.0638***	0.00582	-0.0116	0.00575	0.00904
	(0.00978)	(0.0227)	(0.0155)	(0.0106)	(0.0137)	(0.0151)
Log energy intensity of production	0.112***	0.0203	0.184***	0.100***	0.0627	0.146***
	(0.0222)	(0.0507)	(0.0428)	(0.0276)	(0.0660)	(0.0356)
(Energy intensity)(Green, weighted)	0.0168	0.0214	-0.0252	0.0241	0.0319	-0.00544
	(0.0203)	(0.0404)	(0.0248)	(0.0217)	(0.0300)	(0.0255)
Importer-exporter pair dummies	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Observations	2,027	646	994	1,168	1,203	593

Robust standard errors in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

The coefficients report marginal effects of infinitesimal changes from the mean of each independent variable.

Table 9: (Lagged) effect of green clause measures on propensity of importing for different sub-samples

Probit regression with *Import dummy* as dependent variable.

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Liberal.	Discrim.	Only 07-10	Main	Not main
Log distance	0.0458	-0.189	0.0518	0.0720	0.116	0.0239
	(0.0942)	(0.123)	(0.0953)	(0.122)	(0.0861)	(0.0891)
(Log distance)(Green, lag)	0.00217	-0.225	-0.0326	0.0205	-0.130	0.120
	(0.0484)	(0.304)	(0.0429)	(0.0666)	(0.0831)	(0.0817)
Log energy intensity of production	0.316***	0.100***	0.314***	0.327***	0.0580*	0.289***
	(0.0549)	(0.0328)	(0.0553)	(0.0734)	(0.0352)	(0.0518)
(Log energy intensity)(Green clause, lag)	-0.0561**	-0.102	-0.0331	-0.0513*	-0.0567	-0.0298
	(0.0271)	(0.0626)	(0.0298)	(0.0288)	(0.0455)	(0.0329)
Importer-exporter pair dummies	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Observations	881	180	701	504	456	425

Robust standard errors in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

The coefficients report marginal effects of infinitesimal changes from the mean of each independent variable.

The role of technology differences for the intensive margin effects

As described above, the intensive margin results are unexpected. Given the implementation of "green" measures, import shares of more energy intensive sources are generally increased rather than decreased. This section elaborates on this result and tests, whether source countries with technology (or cost) levels closer to those of interventionist countries are more negatively affected than those with technologies further apart. In such a case, one could argue that the alleged "green" measures protect domestic against foreign suppliers with similar levels of technologies. Stated differently, the "closer" foreign competitors (in terms of costs and technologies) are discriminated and thus the less direct competitors can relatively increase their market shares in the interventionist country. Technology or cost level differences between affected sectors in source and interventionist countries are proxied by the absolute values of differences in log energy intensity levels. The higher the differences are the less domestic firms compete with foreign firms in the market of the interventionist country.

The results in tables 10-13 support the stated hypothesis. The models estimated in tables 10 and 11 use the absolute value of differences between the log energy intensity of local suppliers (suppliers from the "green"-measure-implementing country) and foreign suppliers as well as the interaction term of this variable with the "green" clause dummy (both for the immediate case, table 10, and the lagged case, table 11). The models in tables 12 and 13 devide the two variables into cases where the local supplier is always less energy intensive than foreign suppliers and vice versa.

The estimated coefficients for the simple absolute value differences show that in most models bigger energy intensity gaps between local and foreign suppliers are associated with smaller import shares of foreign sources (models 1, 3, 4 and 6). This finding demonstates a stiff competition with some "close" foreign competitors in the market: import shares of "close" competitiors are on average higher than import shares of less direct competitiors. Interestingly, the coefficients have the opposite sign in the sample of liberalising measures (table 10, models 2 and 5) and the sample in which the the environmental aspect was the main purpose of implementing "green" measures (table 11, model 2). As competition is not very stiff in these markets (less direct competitors have higher import shares), governments face less opposition from lobbies to liberalise or to implement "green" measures, which are in fact likely to have benefical environmental effects.

In the immediate case (table 10), the coefficients of the interaction terms are statistically significant at conventional levels and have a positive sign in most models (1, 3, 4 and 6). As expected in the hypothesis above, import shares of less direct competitors relatively gain market share in the importing markets in which "green" measures have been implemented. For example, a 10 percent increase of the absolute value differences of energy intensity in the sample of dicriminatory measures is associated with a 2 percent increase of the import share. Similarly, a 10 percent increase of the absolute value differences of energy intensity in the sample in which the environmental aspect is not the main purpose of the "green" measure implementation is associated with a 5 percent increase of the import share. Stated differently, the alleged "green" measures in these samples have discriminated against commercial interests of "closer" foreign competitors.

Again as expected, such a development is not observed in samples with liberalising measures and in the "Main purpose"-samples. The estimated coefficients are not statistically significant there. Furthermore, the comparison of the coefficients for the interaction terms in table 10 and 11 shows that the immediate effects are statistically significant, whereas the lagged effects are not. This result underscores that "green" measures may have been used during the crisis to immediatly protect local suppliers against close foreign suppliers.

Investigating these effects separately for the case in which local suppliers are less energy intensive than foreign suppliers and vice versa, the above described results are confirmed for both sub-groups in the immediate case. However, in the immediate case (table 12) the relative gain from "green" measures of more energy intensive foreign suppliers compared to foreign suppliers close to the energy intensity levels of local suppliers is bigger in magnitude and finds stronger statistical support than in the opposite case with less energy intensive foreign suppliers compared to local suppliers. For example in model 6, a 10 percent increase of the difference if the local suppliers are less energy intensive is associated with a 3.5 percent increase of the import share. And symmetrically, a 10 percent increase of the difference if the local suppliers are more energy intensive is associated with a 2 percent increase of the import share, but the coefficient is not signifiant. Hence, besides the confirmed discrimination against close competitors, these measures may on top actually decrease the "climate-friendliness" of imports, which has also been found in section 5.2. For the lagged case (table 13), it is not clear whether less direct and more energy intensive foreign suppliers or less direct and less energy intensive foreign suppliers relatively gain more compared to so-called "close" foreign competitiors.

Table 10: (Immediate) effect of “green” measures: the role of technology differences

OLS regressions with *Log import share* as dependent variable

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Liberal.	Discrim.	Only 07-10	Main	Not main
|Diff. log energy intensity|	-0.526***	-0.142*	-1.384***	-0.565***	-0.164***	-1.433***
	(0.0871)	(0.0749)	(0.171)	(0.110)	(0.0622)	(0.167)
(|Diff. log energy intensity|)(Green, weighted)	0.138*	-0.0992	0.247***	0.177**	-0.0576	0.597***
	(0.0711)	(0.0906)	(0.0877)	(0.0813)	(0.0642)	(0.148)
Constant	-6.461***	-13.62***	-3.528***	-5.895***	-13.53***	-3.810***
	(0.417)	(0.433)	(0.631)	(0.457)	(0.388)	(0.594)
Importer-exporter pair dummies	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Observations	4,072	1,730	2,342	2,753	2,434	1,638
R-squared	0.809	0.927	0.803	0.811	0.912	0.762

Robust standard errors in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 11: (Lagged) effect of "green" measures: the role of technology differences

OLS regressions with *Log import share* as dependent variable

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Liberal.	Discrim.	Only 07-10	Main	Not main
|Diff. log energy intensity|	-1.291***	0.205***	-1.300***	-1.286***	-1.343***	-1.328***
	(0.272)	(0.0579)	(0.271)	(0.364)	(0.0690)	(0.268)
(|Diff. log energy intensity|)(Green clause, lag)	0.128	-0.109	0.194	0.137	0.0195	0.390**
	(0.105)	(0.157)	(0.125)	(0.115)	(0.0923)	(0.192)
Constant	-3.515***	-20.14***	-3.550***	-3.322**	-6.771***	-3.619***
	(0.989)	(0.329)	(0.973)	(1.290)	(0.156)	(0.949)
Importer-exporter pair dummies	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Observations	1,924	397	1,527	1,313	828	1,096
R-squared	0.809	0.914	0.781	0.811	0.932	0.727

Robust standard errors in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 12: (Immediate) effect of "green" measures: the role of technology differences, separately

OLS regressions with *Log import share* as dependent variable

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Liberal.	Discrim.	Only 07-10	Main	Not main
If local supplier less energy intensive:						
|Diff. log energy intensity|	-0.769***	-1.026***	-3.244***	-0.815***	-0.229***	-3.260***
	(0.0951)	(0.0966)	(0.185)	(0.119)	(0.0868)	(0.180)
(|Diff. log energy intensity|)(Green, weighted)	0.176**	-0.168	0.122	0.225***	-0.0944	0.385***
	(0.0703)	(0.125)	(0.0794)	(0.0820)	(0.0625)	(0.132)
If local supplier more energy intensive:						
|Diff. log energy intensity|	-0.0926	-0.177**	0.977***	-0.114	-0.224***	0.974***
	(0.112)	(0.0743)	(0.188)	(0.142)	(0.0821)	(0.186)
(|Diff. log energy intensity|)(Green, weighted)	0.134	-0.0522	0.0588	0.174	0.0274	0.0897
	(0.113)	(0.0893)	(0.155)	(0.122)	(0.101)	(0.202)
Constant	-5.672***	-13.55***	3.022***	-5.090***	-13.41***	2.691***
	(0.420)	(0.431)	(0.701)	(0.462)	(0.403)	(0.654)
Importer-exporter pair dummies	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Observations	4,072	1,730	2,342	2,753	2,434	1,638
R-squared	0.812	0.927	0.841	0.815	0.913	0.813

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 13: (Lagged) effect of "green" measures: the role of technology differences, separately
OLS regressions with *Log import share* as dependent variable

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Liberal.	Discrim.	Only 07-10	Main	Not main
If local supplier less energy intensive:						
|Diff. log energy intensity|	-3.744***	-0.616***	-3.753***	-3.781***	-1.327***	-3.783***
	(0.292)	(0.0425)	(0.290)	(0.381)	(0.0688)	(0.284)
(|Diff. log energy intensity|)(Green, lag)	0.134	-0.108	0.201*	0.133	-0.00264	0.424**
	(0.0972)	(0.163)	(0.114)	(0.104)	(0.0940)	(0.173)
If local supplier more energy intensive:						
|Diff. log energy intensity|	1.116***	1.868***	1.110***	1.234***	-1.568***	1.121***
	(0.248)	(0.0432)	(0.247)	(0.343)	(0.0363)	(0.245)
(|Diff. log energy intensity|)(Green, lag)	0.0754	-0.112	0.116	0.101	0.124	0.0674
	(0.161)	(0.116)	(0.191)	(0.169)	(0.185)	(0.271)
Constant	4.972***	-15.57***	4.929***	5.314***	-6.746***	4.788***
	(1.065)	(0.254)	(1.050)	(1.349)	(0.156)	(1.028)
Importer-exporter pair dummies	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Observations	1,924	397	1,527	1,313	828	1,096
R-squared	0.852	0.914	0.834	0.855	0.932	0.799

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

6 Conclusion

This paper estimates to what extent "green" crisis-era state measures have an impact on patterns of imports or more specifically on the "climate-friendliness" of imports in the Asia-Pacific region. The Asia-Pacific is the most active region as to introducing new discrimination against foreign commerical interests and as to liberalising trade under the disguise of "green" growth strategies since the beginning of the global economic crisis.

These state interventions may contribute to climate change mitigation through the following channels: fostering research and development of "green" goods and technologies, using "green" technologies for the production of other goods, using "green" inputs into production and consuming "green" goods more generally. All of these channels also influence patterns of international trade - both imports and exports. As it is too early to investigate post-crisis effects of "green" measures on exports, the paper studies solely the effects on the "climate-friendliness" of Asian imports.

Testable predictions and the empirical strategy are derived from the seminal paper of Eaton and Kortum (2002). For each "green" state measure of the Asia-Pacific region, the panel includes bilateral import patterns between importers having implemented the measures and their source countries on a yearly basis for the period 2005 - 2010. Bilateral import patterns are retrieved only for imports affected by a measure, not for total imports.

At least at the intensive margin, the results are surprising. Implemented "green" measures are associated with an increase of sourcing from more (rather than less) energy intensive countries. Depending on the model specification, a 10 percent increase in energy intensity yields an import share increase of 1-3 percent. These findings are against the intuition that "green" crisis-era measures should decrease the share of imports from energy intensive producers. Stated differently, the efforts of governments to mitigate climate change through "green" crisis-era measures have in general not resulted in the "greening" of imports at the intensive margin. One reason may be that governments have often lobbied for state interventions as being "green" although the main purpose of implementation was not the environmental aspect. This explanation is nicely supported by the strongest effect in the "wrong" direction in the sub-sample of "Not main purpose"-measures.

The effect points at least in the right direction in specifications for which *per se* expectations for climate benefits are most likely, that is, in the sub-sample of liberalisations and the sub-sample of measures for which the "green" clause was the main purpose of implementation. None of the estimated effects is, however, statistically significantly different from zero.

The results for models looking at the extensive margin of importing, that is, the propensity of importing from a specific source, are slightly more promising. All models yield the expected negative sign: given that "green" measures are implemented, the more energy intensive a source is, the less an importing country is likely to import from that source. The results are, however, not very strong as to statistical and economic significance.

In sum, energy intensive insiders (intensive margin) may benefit and energy intensive outsiders (extensive margin) may loose from "green" policies. Overall, evidence for environmental benefits of "green" crisis-era interventions through the import channel is however limited. For some cases, the implementation of such measures is in fact associated with an environmental degradation of imports. The negative and mercantilist characteristic of "green" policies - at least of the discriminatory ones - may thus dominate the "greening" trade aspects.

One extenstion finally shows that import shares of less direct competitors relatively gain market share if (discriminatory) "green" measures are implemented. Stated differently, the alleged "green" measures protect domestic against foreign suppliers with similar levels of technologies (proxied by energy intensity levels).

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Appendix

Table A1 (a): Overview of "green" crisis-era measures

discriminatory and implemented							
Implementing jurisdiction	**Measure title**	**Measure type**	**Main**	**ATP**	**AS**	**ATL**	**Incl**
Belarus	Temporary tariff measures on trucks and tractors imports	Tariff measure	no	39	1	3	yes
China	Accreditation of suppliers of certain high-tech products	Local content requirement	no	33	1	2	yes
China	General Analysis on Several Opinions of the State Council on Further Utilizing Foreign Capital	Investment measure	no	na	3	200	yes
China	Restructuring of equipment manufacturing industry	Export subsidy	no	125	13	213	yes
Japan	Green tax incentive on environmentally friendly cars	Non tariff barrier	yes	32	4	17	yes
Kazakhstan	State Program for the Forced Industrial Development for 2010-2014	Export subsidy	no	na	18	na	no
Malaysia	Trade implications of the 2011 Budget	Export subsidy	no	37	10	44	no
Republic of Korea	Special financing scheme for "Hidden National Champions"	Trade finance	no	na	8	na	no
Republic of Korea	Joint financing initiative for trade and investment in "green" products	Bail out / state aid measure	yes	45	6	17	yes
Russian Federation	Injection of 4,33 billion rubles (96 million Euro) into Russian RUSHYDRO (green energy) company	Bail out / state aid measure	yes	4	1	1	yes
Russian Federation	The Strategy of the power machine building for 2010-2020 and up to 2030	Export subsidy	no	55	3	na	no

Table A1 (b): Overview of "green" crisis-era measures

discriminatory and pending							
Implementing jurisdiction	**Measure title**	**Measure type**	**Main**	**ATP**	**AS**	**ATL**	**Incl**
Japan	New stimulus package	Bail out / state aid measure	no	na	na	na	no
Republic of Korea	Key Economic Policy Statement for 2010	Bail out / state aid measure	yes	56	6	24	no
Republic of Korea	Tax plans for 2010	Investment measure	no	9	1	2	no

Table A1 (c): Overview of "green" crisis-era measures

liberalising and implemented							
Implementing jurisdiction	**Measure title**	**Measure type**	**Main**	**ATP**	**AS**	**ATL**	**Incl**
Belarus, Kazakhstan, Russian Federation	Import duty reduction on some materials used for production of solar energy modules	Tariff measure	yes	19	2	2	yes
China	Removal of local content requirement on wind turbines	Local content requirement	yes	41	2	4	yes
India	Union Budget 2010-11 announces Tariff measures	Tariff measure	no	23	8	50	yes
Pakistan	Tariff reductions on intermediate products, tariff exemption of energy saver lamps	Tariff measure	yes	31	6	11	yes
Republic of Korea	Tariff reductions on "green goods"	Tariff measure	yes	16	3	2	yes
Thailand	Import duty reduction for green cars and components	Tariff measure	yes	37	3	7	yes
Thailand	Reduction of import duties on eco-car parts and materials.	Tariff measure	yes	3	4	16	yes

Table A2: (Immediate) effect of green measures on import shares for different sub-samples

OLS regressions with *Log import share* as dependent variable

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Liberal.	Discrim.	Only 07-10	Main	Not main
Log energy intensity of production	0.138**	-0.227*	0.0555	0.173**	-0.135*	0.164
	(0.0561)	(0.123)	(0.0752)	(0.0693)	(0.0795)	(0.108)
(Log energy intensity)(Green, weighted)	0.102	-0.115	0.213**	0.0744	-0.0499	0.321***
	(0.0715)	(0.101)	(0.0893)	(0.0775)	(0.0780)	(0.118)
Constant	-17.78***	-18.60***	-18.21***	-16.65***	-17.91***	-17.62***
	(0.795)	(1.338)	(0.939)	(0.721)	(1.233)	(1.014)
Importer dummies	yes	yes	yes	yes	yes	yes
Exporter dummies	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Observations	4,072	1,730	2,342	2,753	2,434	1,638
R-squared	0.660	0.726	0.675	0.659	0.698	0.692

Robust standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A3: (Lagged) effect of green clause measures on import shares for different sub-samples

OLS regressions with *Log import share* as dependent variable

	(1) All	(2) Liberal.	(3) Discrim.	(4) Only 07-10	(5) Main	(6) Not main
Log energy intensity of production	0.347***	-1.152***	0.402***	0.379***	-0.210	0.467***
	(0.0857)	(0.0237)	(0.0965)	(0.112)	(0.542)	(0.131)
(Log energy intensity)(Green clause, lag)	0.227**	-0.0538	0.246**	0.220*	0.0911	0.355***
	(0.107)	(0.107)	(0.119)	(0.118)	(0.143)	(0.138)
Constant	-18.11***	-17.78***	-18.00***	-15.92***	-18.05***	-17.66***
	(1.450)	(0.248)	(1.464)	(1.145)	(3.759)	(1.517)
Importer dummies	yes	yes	yes	yes	yes	yes
Exporter dummies	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Observations	1,924	397	1,527	1,313	828	1,096
R-squared	0.635	0.914	0.630	0.623	0.807	0.638

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A4: (Immediate) effect of green clause measures on propensity of importing for different sub-samples

Probit regression with *Import dummy* as dependent variable						
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Liberal.	Discrim.	Only 07-10	Main	Not main
Log energy intensity of production	0.00410	-0.0508**	-0.000500	0.00209	-0.0278**	0.0225**
	(0.00552)	(0.0245)	(0.00645)	(0.00758)	(0.0120)	(0.0109)
(Log energy intensity)(Green clause)	0.0104	-0.0176	-0.00619	0.0126	0.0166	-0.00257
	(0.00713)	(0.0244)	(0.00709)	(0.00816)	(0.0133)	(0.0114)
Importer dummies	yes	yes	yes	yes	yes	yes
Exporter dummies	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Observations	4,165	1,159	2,134	2,462	2,419	917

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

The coefficients report marginal effects of infinitesimal changes from the mean of each independent variable.

Table A5: (Lagged) effect of green clause measures on propensity of importing for different sub-samples

Probit regression with *Import dummy* as dependent variable						
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Liberal.	Discrim.	Only 07-10	Main	Not main
Log energy intensity of production	0.0131	0.0863**	0.0136	0.0177	0.0826	0.0660***
	(0.0106)	(0.0339)	(0.0122)	(0.0149)	(0.0576)	(0.0181)
(Log energy intensity)(Green clause, lag)	-0.0172	-0.115*	-0.0113	-0.0181	-0.0428	-0.0108
	(0.0114)	(0.0639)	(0.0126)	(0.0134)	(0.0343)	(0.0176)
Importer dummies	yes	yes	yes	yes	yes	yes
Exporter dummies	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Observations	1,834	180	1,411	1,082	731	635

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

The coefficients report marginal effects of infinitesimal changes from the mean of each independent variable.