Are international environmental agreements effective? The case of trade in hazardous chemicals and persistent organic pollutants

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Abstract

The main rationale for signing International Environmental Agreements (IEAs) is to prevent developing countries from becoming pollution or waste havens. Recent attempts to evaluate the effectiveness of existent international environmental agreements found difficult to provide credible identification strategies. This paper estimates the effectiveness of two prominent examples of international conventions, namely the Rotterdam Convention (RC) on hazardous chemicals (HCs) and the Stockholm Convention (SC) on persistent organic pollutants (POPs). A transparent identification strategy is use in light of the latest developments in the gravity model literature that consists on using dyadic fixed effect and country and time dummies to isolate the effects of ratification and adoption of these agreements on imports of the targeted products. Our results are twofold. Firstly, ratification of the SC is associated with lower imports of POPs sent from developed to developing countries if the importer ratifies. Secondly, in the case of the RC, a significant decrease on imports of HCs is observed if both trading partners ratify and also when imports of POPs are from developed to developing countries. Both results point toward the partial effectiveness of the conventions.

Keywords: `Hazardous chemicals, persistent organic pollutants, environmental agreements, international trade, gravity model and log-linear.`

JEL codes: F13, F14, F18, Q53, Q56, Q58.

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1 Introduction

Developing countries have a great incentive to sign International Environmental Agreements (IEAs) to prevent themselves to becoming pollution or waste havens. However, the may fail in effectively enforcing the obligations derived from ratified IEAs. Consequently, unscrupulous individuals and firms could take advantage of these lax or non-existent regulations to send hazardous chemicals (HCs) and persistent organic pollutants (POPs) among other dangerous products to developing countries. To prevent this from happening, IEAs could act as a vehicle through which a better institutional framework is established in the sending countries. This could help prevent these firms from sending these dangerous or harmful products to developing countries.

In this paper we evaluate the effects on trade from two other existing conventions on hazardous chemicals and pesticides, namely the Rotterdam Convention and the Stockholm Convention. We hypothesize that the ratification of these conventions should have had a direct effect on trade in the products in question, which are HCs in the case of the Rotterdam Convention and POPs in the case of the Stockholm Convention. Both conventions deal with products that could be harmful to human health and are therefore undesirable without the appropriate use and treatment to reduce or eliminate the damage they may cause. In particular, HCs (as classified by the American Occupational Safety and Health Administration) are both toxic and reactive and have great potential in causing damaging health effects when they are released. Relatively low-level exposures to these substances are linked to cancer, birth defects, genetic damage, miscarriages and even death. In regards to the products covered by the second convention, POPs, it has been shown that these products also have non-negligible negative effects on human health and the environment. Some of the identified effects are cardiovascular disease, cancer, obesity, and diabetes. They are also considered hormone

As a political response to the growing export of toxic waste from developed to developing countries, the Basel Convention on the control of transboundary movements of hazardous waste and their disposal was adopted in 1989 and enforced starting in 1992. The convention mainly contained certain commitments and guiding principles, e.g. trade was to be agreed upon and consented to (Prior Informed Consent Procedure) by the importing country and signatory states should refrain from trade in hazardous waste with non-signatory countries. Given its lack of effectiveness, the Ban Amendment (still not enacted because it lacks sufficient signatory parties) was added in 1995 by a few signatory countries in order to ban

exports from OECD to non-OECD countries, but since large exporters of waste did not ratify it (e.g. the US) and it is still not adopted, it may have led to the emergence of trade diversion effects.

Most of the early research evaluating the effects of MEAs found that they were generally ineffective, confirming the outcomes of the corresponding theoretical models (Barrett (1994); Carraro and Siniscalco (1993)). A good survey of such research is presented in Mitchell (2003). However, the question of the effectiveness of the agreements continues to be relevant and ultimately it remains an empirical question. To the best of our knowledge, the effects of the most recent agreements concerning waste have only been evaluated by Kellenberg and Levinson (2014). They investigate whether the Basel Convention and the Ban have resulted in less waste being traded among ratifying countries. The paper finds that the Basel Convention and Ban seem to have had no effect on the growth of international hazardous waste and almost no effect on shipments from developed to developing countries. As a consequence, the author suggests linking the IEAs to trade sanctions to strengthen their effectiveness.

In this paper we go a step further and evaluate the effects on trade from two other existing conventions on hazardous chemicals and pesticides, namely the Rotterdam Convention and the Stockholm Convention. We hypothesise that the ratification of these conventions should have had a direct effect on trade in the products in question, which are HCs in the case of the Rotterdam Convention and POPs in the case of the Stockholm Convention. Both conventions deal with products that could be harmful to human health and are therefore undesirable without the appropriate use and treatment to reduce or eliminate the damage they may cause. In particular, HCs (as classified by the American Occupational Safety and Health Administration) are both toxic and reactive and have great potential in causing damaging health effects when they are released.

Relatively low-level exposures to these substances are linked to cancer, birth defects, genetic damage, miscarriages and even death. In regards to the products covered by the second convention, POPs, it has been shown that these products also have non-negligible negative effects on human health and the environment. Some of the identified effects are cardiovascular disease, cancer, obesity, and diabetes. They are also considered hormone disrupts, which can alter the normal functioning of the endocrine and reproductive systems in humans and wildlife.

To investigate whether the entry into force of the conventions alter trade flows in the products in question, we estimate a gravity model of trade using highly disaggregated trade data (6-digit Harmonised System (HS) Classification) of HCs and POPs among 88 countries and over the period from 1995 to 2012. More specifically, we would like to find out whether shipments from OECD to non-OECD countries have been reduced when the

trading partners have ratified either of the two agreements.

The results indicate that when the exporter ratifies the Rotterdam Convention fewer hazardous chemicals are shipped from OECD countries to non-OECD countries. In the case of the Stockholm Convention, smaller amounts of persistent organic pollutants are shipped from OECD-ratifying countries to non-OECD countries when the importer ratifies the treaty. Moreover, the results are robust to the inclusion of country and time fixed effects and country-pair-product fixed effects, which control for Multilateral Resistance Factors (MRF) and time-invariant and product specific unobservable heterogeneity. These results are substantially different to Kellenberg and Levinson (2014) and point towards the effectiveness of both conventions in reducing trade in waste.

The rest of the paper is structured as follows. Section 2 presents the related theories and main hypotheses, summarises the closely related empirical literature and describes the conventions. Section 3 describes the data and variables and outlines the empirical strategy and model specification. Next, Section 4 presents the main results and Section 5 outlines the results of several robustness checks. Finally, Section 6 concludes.

2 Environmental treaties on waste, hazardous chemicals and persistent organic pollutants: Theory and Evidence

2.1 Theory and main hypotheses

A number of authors have investigated the effectiveness of MEAs in reducing pollution or improving environmental quality. The early theoretical models conclude that most MEAs tend to be ineffective due to the free-rider problem.[1] Indeed, the findings tend to show that global agreements can only work if the abatement targets are far below the optimum level (Barrett (1994); Carraro and Siniscalco (1993)). The free-rider problem could be overcome by establishing a central authority with coercive power, but in the case of international environmental issues, this solution seems unlikely. Nevertheless, more recent literature (summarised in Carraro (2014)) suggests that these predictions might be too strong and pessimistic. For instance, if countries involved in the agreements are risk averse and the environmental damage attached to non-compliance is uncertain, countries may be willing to comply and to cooperate. This could be the case of hazardous waste, since most countries are aware of the detrimental effects on the environment and individual's health.

[1] Here the free-rider problem occurs when some countries can benefit from lower global emissions without investing in clean technologies or implementing environmental regulations, because other countries do it for them.

In these cases, it could be enough to have the right institutions to encourage cooperation and compliance (Carraro and Siniscalco (1998); and Ecchia and Mariotti (1998)). Some countries may show more interest in controlling or stopping these activities than others and non-state actors may also play an important role. As such, the ratification of agreements will be influenced by different incentives. Indeed, already in 1994, developing countries (G-77) and environmental NGOs argued for a decision to ban the trade of waste at the Second Conference of Parties held in Geneva that materialized in the Basel Ban Amendment. According to Battaglini and Harstad (2016) under incomplete contracting environment and considering that MEAs fit this setting, significant participation is feasible under well-specified conditions and hence the free-rider problem could be substantially reduced.

The effectiveness of the MEAs also depends on the existence of optimal environmental policies at the country level. One reason why the authors find that MEAs fail to be effective is the existence of differences between countries in terms of environmental regulations and the fact that poor countries are in many cases not able to internalise the environmental externalities generated by producing or using products that can cause a negative environmental externality. According to Rauscher (1997), international trade in hazardous waste might be biased towards the importing country if environmental externalities are not internalised. In this case, waste -or dangerous products- producing countries may have incentives to export their waste to countries with lower environmental standards for waste disposal (Fikru (2012)). Moreover, the attraction of *bad*-products imports by developing countries could be supported by the prevalence of low-cost disposal and organized crime (Clapp (1997)), and the latter is negatively correlated with the level of environmental regulations (Kellenberg and Levinson (2013)).

The pollution haven hypothesis (PHH) states that polluting industries will tend to export their pollution to countries with less stringent environmental regulations. Applied to waste, the PHH (or waste haven effect, according to Kellenberg (2012)) implies that increasing differences in environmental standards between countries will cause a greater trade flow of waste from a more stringent country to a lax country. Improvements in the international monitoring of waste could have unexpected consequences on the movement of waste across countries, depending on the presence of an illegal channel and of the possibility to reclassify waste as used goods (Bernard, 2015).

According to Bernard (2015), larger differences in environmental regulations between trading countries induce polluting industries to delocalize where the standards are relatively weak. This, together with the fact that institutions often fail to create the necessary environmental regulations in developing countries, results in the need to implement additional mechanisms to control and deter trade in dangerous goods. Another option to overcome the lack of adequate institutions or regulatory framework in developing countries could be based on a developed-country policy approach. Yokoo and Kinnaman (2013) find that a tax

imposed on the consumption of new durable goods in developed countries combined with a waste tax set below the domestic external cost of disposal, could be sufficient to achieve global efficiency. In order to effectively do so, MEAs could be used as additional policy instruments to prevent the imports of dangerous substances by developing countries.

In general, we expect more stringent regulations concerning the production and use of hazardous products to generate an incentive to send those dangerous substances to countries with lax environmental regulations. In the case of the two conventions examined in this paper, the Rotterdam and the Stockholm conventions, we hypothesise that the ratification of these conventions should have had a negative direct-effect on trade in the products covered by the conventions that are respectively HCs in the former and POPs in the latter. More specifically, we expect the amount of dangerous substances sent from OECD countries to ratifier-non-OECD countries to decrease, according to the PHH. Hence, the effect will materialize for North-South trade rather than for North-North trade, given that the environmental standards and facilities for disposal are more similar in developed countries and that the conventions will mainly have an effect on trade between countries with very different environmental regulations Kellenberg and Levinson (2014).

2.2 Empirical evidence

This subsection summarises the main results found in the related literature regarding the empirical evaluation of the influence of MEAs. We begin with the general findings and then narrow the focus to papers that evaluate the effectiveness of treaties and conventions on hazardous waste and products.

A general and fairly complete overview of the effects of environmental agreements is offered by Mitchell (2003), Mitchell (2006). He finds that bearing in mind the number of existing agreements (more than 1000 MEAs in 2013), only a subset of them have been empirically evaluated. There are several reasons for the lack of scientific research in this area. First, the available data on the relevant environmental quality indicators has been scarce until recent years and it is somewhat difficult to identify the expected effects of specific agreements. Second, some agreements target multiple environmental problems and it is not obvious which environmental indicator should be investigated. Finally, the endogeneity of participation in the agreement hinders the precise identification of the effect.

Mitchell (2003) points to somewhat mixed results regarding the identifiable effectiveness of MEAs. For some, there is clear evidence of a positive effect on the targeted environmental-quality indicator, as is the case of Parson (2003), Wettestad (2001) and Greene (1998), which evaluated the ozone agreements and found a reduction in the consumption of chlorofluorocarbons (CFCs) in industrialised countries, perhaps also due to the existence of

close substitutes for these products or to the fact that the manufacturing sector has been declining in these countries.

In other cases, the evaluations show no effect, for example concerning the international whaling agreements, which was widely believed to have had an impact in the current stable stock levels until Schneider and Pearce (2004) showed that market forces -and not the ratification of the agreement- were leading to the declining catch. Skjaerseth (2001) and Haas (1990) show the Mediterranean Pollution Plan to have had little effect on marine pollution. Finally, some conflicting outcomes are put forward in Munton et al. (1999), who emphasize that the results of many studies are highly susceptible to the chosen methodology.

Another major international agreement is the Kyoto protocol, for which a few authors have found mixed evidence of its effectiveness. Aichele and Felbermayr (2012) analyse the impact of ratifying the Kyoto Protocol on countries' CO2 emissions between 1997 and 2007. In order to overcome the problem of self-selection into the protocol, the authors use a country's membership in the International Criminal Court (ICC) to instrument the Kyoto variable, its spatial lag and restrict the data to a sample of 40 countries. Their findings indicate that countries with Kyoto commitments emit on average about 8 percent less CO2 than countries without. Using an alternative identification strategy that is able to address the self-selection issue, namely a matching diff-in-diff estimator, Grunewald and Martinez-Zarzoso (2016) consistently find a 7-10 percent reduction in CO2 emissions to being attributable to the adoption of the Kyoto protocol. Mazzanti and Musolesi (2009) also find the Kyoto Protocol has a negative effect on CO2 emissions for the northern EU country group. This stands in contrast to the Almer and Winkler (2015) study, in which they test for the existence of a reduction in emissions in 15 Annex B countries with binding emission targets and find that CO2 emissions are not below what they would have been in the absence of the protocol. They claim that binding emission targets violates the common trend assumption made in previous studies and that not addressing the opposing trend could invalidate the results. However, Grunewald and Martinez-Zarzoso (2016) could not reject the parallel trend assumption when restricting the sample to high-income countries (see figure 2, page 11). The possible divergence in the results could be instead due to the way in which the counterfactual sample is constructed in Almer and Winkler (2015).

Given the diversity of the agreements in terms of content, scope and targeted environmental outcomes, we now focus on papers that evaluate the effectiveness of agreements involving the trade of waste, hazardous chemicals and persistent organic pollutants. Trade in waste and dangerous substances is a relatively new area of research and Baggs (2009) was one of the first authors to study this topic. He analyses the determinants of hazardous waste using a gravity model with country characteristics for the period from 1994 to 1997. He interprets the negative coefficient of per capita income (only significant at the ten percent level) for

the importer countries as an indication of the existence of a waste haven effect. Behind this interpretation is the idea that GDP per capita could be a proxy for the stringency of environmental regulations. Hence, assuming that citizens demand more environmental quality when they become richer, lower amounts of waste should be exported to countries with higher GDP per capita. Since there were no multilateral agreements limiting trade in waste in the study period, the author cannot analyse their effects on bilateral trade. Additionally, no environmental regulation differences are explicitly included in the analysis, and proxying those with GDP per capita might be problematic, given that differences in income per capita may also reflect wage differences across countries.

Assuming that environmental regulation differences matter, Kellenberg (2012) uses waste imports for a cross-section of 92 countries in 2004 consisting of 62 HS categories of waste at the 6-digit product disaggregation (HS) level. He finds that the ten largest exporters are OECD countries, while China, Turkey and South Korea are the largest importers. He also estimates a gravity model that includes a Basel ratification dummy, which is statistically significant and negative in two specifications. However, the authors are not able to control for the endogeneity of the Basel-ratification in a cross-sectional setting, and for this reason, the results cannot be interpreted as causal.

Subsequently, Kellenberg and Levinson (2014) estimate the effect of the Basel Convention and the following Ban Amendment on waste trade for a sample of 60 waste HS6 products using data for 117 countries over the period from 1988 to 2008. The authors aggregate the annual tonnes of waste traded for the 60 categories and omit the country pairs with zero waste trade. The main results, after controlling for multilateral resistance terms (MRT) and endogeneity by using panel data techniques and time invariant controls, show no clear evidence supporting the effectiveness of the Basel Convention and the Ban Amendment. In particular, no decrease in bilateral waste trade was observed for country-pairs that have ratified the Basel Convention. Only when using a restricted sample, is some evidence found. In our empirical application, we will follow a similar estimation strategy to Kellenberg and Levinson (2014) to analyse the effectiveness of the Stockholm and Rotterdam conventions in reducing the trade of their respective targeted products. The main difference in strategy is that we estimate the gravity model using trade at the 6 digit disaggregation level - without aggregating- to be able to control for any unobserved heterogeneity that is country-pair-product specific and time-invariant and that could represent factors such as product-specific differences in comparative advantages or in production techniques among a pair of countries.

2.3 The Conventions

The Basel Convention emerged as a result of the claim by developing countries, especially African countries, that waste was being improperly disposed of in their territory. This convention was adopted in 1989 and entered into force in May 1992. Its main objective was to control international shipments of hazardous waste and the development of appropriate management techniques.

The instrument used at the beginning was a mandatory Prior Informed Consent (PIC). The available evidence shows that the Basel Convention was not a strong enough commitment to reassure all involved parties. It drew further criticism from developing countries for the fact that the PIC provision of the Basel Convention legitimated a waste trade that had previously been illegal Kellenberg (2012). As a result, a few signatory countries added the Ban Amendment in 1994. Nevertheless, this Amendment, which was intended as a ban on all waste trade from OECD countries to non-OECD countries, is still not enforced today. This means that there may still be hazardous waste shipments to developing countries from industrialised ones, especially since the United States of America, one of the largest waste exporters, has not yet ratified the Basel Convention Kellenberg (2012). Moreover, its effectiveness is also unclear according to Kellenberg and Levinson (2014).

On the other hand, there is clear awareness about the potential threat of products such as HCs and POPs. Some of these products are more production by-products, rather than dangerous waste in its pure definition, but they have also been linked to health and environmental problems. The Rotterdam and the Stockholm conventions emerged in response to problems posed by these products, which we will discuss in greater detail below.

The urgency of controlling and restricting trade in these substances relies on the fact that being exposed to some pollutants remains a major source of health risks throughout the world, though these risks are generally higher in developing countries, where poverty and lack of investment in modern technology combined with weak environmental regulations cause higher pollution-related health problems Briggs (2003). More specifically, Johnson (1997) states that uncontrolled hazardous waste and other sources of unplanned releases of hazardous substances into the environment are a concern due to its impact on human health and ecological damage. Infants and young children are the most vulnerable to these effects (Gavidia et al. (2009)).

Studies have also linked POP exposure to population declines, diseases and abnormalities in a number of wildlife species. Wildlife can also act as sentinels for human health, highlighting the potential effects on humans. Some evidence has led scientists to investigate POP exposure in humans; it is known that individuals are mainly exposed to POPs through contaminated foods, less common exposure include drinking contaminated water and direct

contact with the chemicals. In people and other mammals alike, POPs can be transferred through the placenta and breast milk to developing offspring.[2] [3]

The Rotterdam Convention is an answer to food security and pesticides use. One of the first voluntary Codes of Conduct in support of increased food security, to protect human health and the environment was adopted in 1985 in a Food and Agriculture Organization Conference. Due to the considerable growth in chemical production and trade during the past three decades, concerns have been raised about the potential risks posed by hazardous chemicals and pesticides. Countries lacking adequate infrastructure to monitor the import and use of these chemicals are particularly vulnerable. The main aim of the convention was to establish voluntary standards of conduct for all public and private entities engaged in, or associated with, the distribution and use of pesticides.[4] A list of products subject to the convention according to Annex III of the convention can be found in Table 9 in the Appendix.

The Rotterdam Convention replaced the PIC, a procedure requiring the creation of voluntary codes of conduct and information exchange systems on hazardous chemicals and pesticides introduced with the Basel Convention, with a mandatory PIC procedure. It was adopted in 1998, ratification began in 1999 and entered into force in 2004, at which time it became legally binding for its parties (see Table 8 in the Appendix for ratification dates by country). It has a narrower focus than the Basel Convention and the Ban, and it may also have different implications for trade. More specifically, the Rotterdam Convention applies to chemicals that are banned or severely restricted by a party, including 28 hazardous pesticides and 11 chemicals (See Table 9 in Appendix). The chemical review committee (CRC) is the subsidiary body in charge of assessing the products that should be subject to the PIC procedure. The procedure is similar to that of the early days of the Basel Convention; parties can exchange those HCs with prior agreement between the parties involved. Although it does not yet include an explicit ban on the products traded, the importers can decide against importing a given product subject to the PIC procedure (see the next two paragraphs). As shown in Kellenberg (2012), waste trade increased after the parties ratified the Basel Convention, but fell after the Ban amendment was added. For these reasons, one might expect to see an increase in trade in HCs after ratification of the Rotterdam Convention. More specifically, the Rotterdam Convention encourages the

[2] It should be noted, however, that despite this potential exposure, the known benefits of breast-feeding far outweigh the suspected risks.

[3] "Persistent Organic Pollutants: A Global Issue, A Global Response" (United States Environmental Protection Agency. Content created in 2002 and updated in December 2009.),https://www.epa.gov/international-cooperation/persistent-organic-pollutants-global-issue-global-response.

[4] "Scope of the Chemicals and Waste Subprogram" (UNEP and Harmful Substances at a glance Division of Technology, Industry and Economics United Nations Environment Program (UNEP) International Environment House. June 2010),http://www.unep.org/chemicalsandwaste/About/tabid/258/Default.aspx.

sharing of responsibilities and cooperation between the countries in international trade of dangerous chemicals, including some pesticides and industrial chemicals. Pesticides chemicals used to fight against organisms considered harmful includes insecticides, fungicides, herbicides and parasiticides (e.g. they prey on insect pests, respectively, fungi, "weeds" and parasitic worms). HCs are those, among others, which have the virtue of limiting the flammability of products. Food is the primary source of exposure mainly through animal products, namely fish, meat, eggs, and dairy products. Both substances are undesirable due to its persistence in the environment (long life), bioaccumulation potential, its high toxicity and its ability to travel long distances via atmospheric transport.

The obligations that ratifying the Rotterdam Convention carries, refer to the future imports of chemicals listed in the Annex III (Art. 10 of the convention). Ratifying parties have the obligation to submit to the Secretariat any import decision concerning the future import of a given chemical within 9 months after the date of dispatch. A database with all import responses submitted by the parties is available on the convention's website. On the database it is shown that the final decision for most chemicals is a "non consent to import" among most countries. For example, for Aldrin there have been 120 submissions since 1993 (only 40 after 2004), out of which 113 have resulted in a "non consent to import" response, only 4 have received a "consent to import" (the importers were Congo, Nepal, Tanzania and Zimbabwe), and the remaining 3 obtained a "consent to import only subject to specific conditions" (Korea, Singapore and Zambia). Interestingly, all the final decisions after 2004 received a negative answer.

The Stockholm Convention was adopted in 2001 and entered into force in May 2004. It covers chemicals that are highly toxic, persistent, bio-accumulate and move long distances in the environment (POPs). The main aim of the convention is to restrict or eliminate the production and use of all intentionally produced POPs and the minimization of unintentionally produced POPs (e.g. dioxins and furans). The list of products subject to the convention includes the pesticides used to control the pests and diseases for various crops (aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene (HCB), mirex and toxaphene) and the industrial chemical polychlorinated biphenyls (PCBs), with the latter slated for elimination. Both types of chemicals have unforeseen effects on human health and the environment.

The subsidiary body responsible for assessing whether additional products should be subject to the convention and for making recommendations is the Persistent Organic Pollutants Review Committee (POPRC).

Among the intentionally produced POPs are chemicals used in agriculture, disease control, manufacturing or industrial processes (e.g., in electrical transformers and large capacitors, as hydraulic and heat exchange fluids, and as additives to paints and lubricants) and DDT,

which is still used to control mosquitoes that carry malaria in some parts of the world. Otherwise, dioxins are unintentionally produced as a result from some industrial processes and from combustion (e.g. municipal and medical waste incineration and backyard burning of trash.[5])

Regarding the obligations of the parties in the Stockholm Convention, they must take the necessary measures to eliminate the production and use of the chemicals listed under Annex A, to restrict the production and use of those listed under Annex B and to reduce the release of those listed under Annex C.

The parties are also obliged to ensure that the export and import of POPs listed in annex A (see Table 10 in the Appendix) or B [6] of the convention, comply with the strict requirements laid out. In particular, imports are only allowed for the purpose of environmentally sound disposal or for a specific use permitted for the party under the convention, whereas exports are only permitted when safer alternatives are not available in the market. Nevertheless, there is no specific procedure defined under the Stockholm Convention for the international trade of POPs. In the case where a POP fall within the scope of the Basel or the Rotterdam conventions (as for example aldrin), the control procedures provided by these conventions apply to the import, transit or export of the corresponding product. Moreover, exporting to a non-party of the convention is only allowed when the non-party has provided an annual certification to the exporting party that ensures a minimization or prevents releases, disposes of the chemicals in an environmentally sound manner and respects provisions of Annex B. A registry of specific exemptions is maintained and regularly updated after decisions adopted after the Conference of the Parties, which also takes into account expired exceptions (Art. 4 of the convention). A list of exemptions is provided in parts VI and VII of Annex A, as well in Annex B. In addition to these obligations concerning Annex A and B POPs, parties must also take measures to reduce the unintentional release of POPs listed under Annex C,[7] with the ultimate purpose of minimizing and eventually eliminating their use.

Summarising, the conventions focus on explicit lists of products and the reduction or elimination of production and trade in said products. We thus restrict the sample of products in our analysis of waste trade to only these products. This will allow us to

[5] https://www.epa.gov/international-cooperation/persistent-organic-pollutants-global-issue-global-responsepops.

[6] Parties must take measures to restrict the production and use of the chemicals listed under Annex B in light of any applicable acceptable purposes and/or specific exemptions listed in the Annex. Annex B includes the pesticide DDT and the industrial chemical Perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOS-F).

[7] Chemicals listed under Annex C are Hexachlorobenzene (HCB), Pentachlorobenzene, Polychlorinated biphenyls (PCB), Polychlorinated dibenzo-p-dioxins (PCDD), Polychlorinated dibenzofurans (PCDF) and Polychlorinated naphthalenes.

analyse the two existent provisions in place for these conventions, the PIC used in the Rotterdam Convention and the Ban (elimination) in the Stockholm Convention and will facilitate the comparison with results from previous studies, particularly with Kellenberg and Levinson (2014). The Stockholm Convention is expected to have a greater impact than the Rotterdam Convention due to the stronger provisions in the former.

3 Empirical Strategy

3.1 Data and Variables

The first step in evaluating the effectiveness of the conventions is the correct identification of the products involved. Since there were a number of changes in the product codes in the harmonised system during the period under study (1995-2012), we make use of the different versions of the HS classification, namely the 1992, 1996, 2002, 2007, 2012 versions and follow the same products over time. To select the products affected by the two conventions, we take the list of products published in the corresponding text of the conventions.[8]

The text of the Rotterdam Convention was written before 1998 and refers to the HS codes in the 1996-HS system (6 digits); those codes are then converted into 1992-HS using BACI.[9]

Original trade data are provided by the United Nations Statistical Division (COMTRADE database). BACI is constructed using a procedure that reconciles the declarations of the exporter and the importer. The data that we use in this study are coded using the 1992-HS classification. International trade data contain import and export flows, as reported by each country in its national statistics. We choose to work with import data (as reported by the importer) because it is known in the literature for being of better quality than reported exports, as imports are often reported in detail in order to allow customs to apply duties, taxes or regulatory controls.

In the case of the Stockholm Convention, ratification began in 2002 and the convention entered into force in 2004, as with the Rotterdam Convention (see Table 8 in the Appendix for ratification dates by country). Since this convention only published the Chemical

[8] http://www.pic.int/ and http://chm.pops.int/ respectively.

[9] BACI is the World trade database developed by CEPII (Center for International Prospective Studies referred to by its French acronym CEPII) at a high level of product disaggregation. http://www.cepii.fr/cepii/.

Abstracts Service Registry Number (CASRN), these CASRN codes were converted into the 2012-HS codes (6 digits), and then re-converted into 1992-HS codes.[10]

Import flows, as well as other gravity variables (distance, common border, common language and colonial links), are extracted from the BACI dataset compiled by CEPII for 88 exporters and 88 importers between 1995 and 2012. GDP and population data are from the World Development Indicators, while the RTA and common currency dummies are from De Sousa (2012).

The dummy variables representing ratification of the Stockholm and the Rotterdam conventions have been constructed using the information available on their respective websites as shown in Table 8 in the Appendix. The year of ratification has been used in the empirical analysis irrespective of the specific month in which the ratification was completed. Table 1 presents summary statistics of the main variables.

The dependent variable deserves further explanation. It has been constructed using the volume imported for the specific products (at the 6-digit disaggregation level) that are subject to each convention using the 1992-HS6 codes definitions provided in Table 9 for the Rotterdam Convention and the definition of the products for the Stockholm Convention (listed in Table 10). It is worth mentioning that there are many countries that do not trade certain products for the entire period under study and hence those countries are excluded from the main analysis. Some of the countries that trade certain products targeted by the two conventions only report trade for a few years.

3.2 Stylised facts

To better illustrate our data, we plotted total annual shipments of HCs and POPs in Figure 1. In this figure, imports of both HCs products and POPs show a positive trend over time and indicate that a large part of non-OECD countries' imports come from OECD countries. It also indicates a more pronounced increase in the total amount imported after 2004 in comparison to the evolution of imports before this date. However, when looking at the flow from OECD countries to non-OECD countries, the evolution of imports is rather flat after 2004 in the left part of the figure (HCs) and increases only slightly in the right part (POPs). Since the main question at hand is whether developed countries have indeed

[10] On the European Commission website there is a tax and customs union section that contains a customs inventory of chemical substances ECICS. It also contains a guide to the classification of chemicals in the combined nomenclature with the Harmonised system code at the 6-digit level of disaggregation corresponding to the Chemical Abstracts Service Registry Number (CASRN) presented by the Stockholm Convention. More information about the procedure is available from the authors. For the conversion from CAS codes to HS-6 codes, please refer to: $http://ec.europa.eu/taxation_customs$ and for the conversion from 2012-HS6 codes to 1992-HS6, the information is available in: $http://unstats.un.org/unsd/trade/conversions/HS$

Variable	Obs.*	Mean	Std. Dev.	Min	Max
Rotterdam Convention					
ln(imports)	209 951	2,718	2,843	-6,911	12,497
Importer ratifies	209 951	0,469	0,499	0	1
Exporter Ratifies	209 951	0,510	0,500	0	1
Both Ratify	209 951	0,369	0,482	0	1
Stockholm Convention					
ln(imports)	91 673	1,793	3,073	-6,908	1,308
Importer ratifies	91 673	0,426	0,495	0	1
Exporter Ratifies	91 673	0,426	0,495	0	1
Both Ratify	91 673	0,337	0,473	0	1
Ln(gdp) importer	137 808	11,319	1,899	7,242	1,660
Ln(gdp) exporter	137 808	11,319	1,899	7,242	1,660
Ln(distance)	137 808	8,690	0,869	4,742	9,886
Contiguity	137 808	0,027	0,163	0	1
Common language	137 808	0,123	0,328	0	1
Colony ties	137 808	0,045	0,208	0	1
RTA	137 808	0,180	0,384	0	1
WTO	137 808	1,744	0,473	0	2
Common currency	137 808	0,011	0,106	0	1

* Number of observations differ because of disaggregation level when aggregating completely we obtain 137.808 observations (88*87*18)

Table 1: Summary statistics

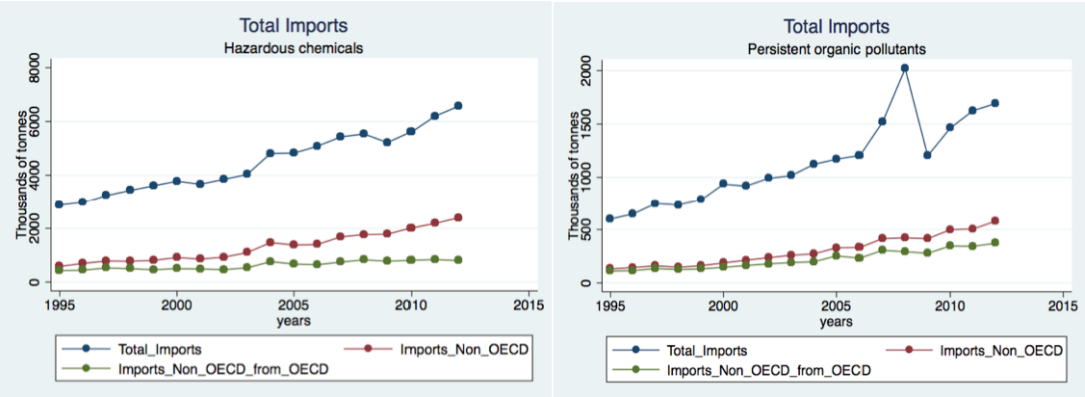


Figure 1: Trade in time of HCs and POPs (BACI)

reduced the amount of these products exported to developing countries as a consequence of ratification and subsequent adoption of the conventions, we now present the evolution of imports in Figure 2 for the different groups of countries, before and after ratification and compare the figures for the group of countries that ratify with those that do not.

Figure 2 shows the average annual shipments of HCs and POPs, when the importer ratifies, the exporter ratifies, or neither does, separately. We define year zero as the point in time in which the convention was ratified. In the case of HCs, for countries that do not ratify the Rotterdam Convention, a dramatic increase in their imports is observed at year zero, followed by a sharp decrease. For cases in which at least one of the countries ratifies, there is a slight increase until the convention enters into force and then a sharp decrease followed by a stabilisation period and then a slight increase. For the POPs (right-hand side of Figure 2), there is a similar pattern for cases where at least one country ratified. However, in the case of the non-ratifiers, there is a sharp increase in year zero, followed by a period of stabilisation.

In the case or the Rotterdam Convention, the non-ratifiers show a big peak when the convention enters into force, followed by a decrease and then, six years later, a drop in HCs imports. When it is only the importer or only the exporter that ratifies, a big drop is shown when the convention enters into force and five years later a small increase, suggesting that countries may have started to relax their behaviour with respect to HCs imports.

Concerning POPs, the results are similar but there is no increase in imports after five years since the ratification of the Stockholm Convention. This could be explained by the fact that the convention uses a clear ban or import prohibition instead of only controlling the flows.

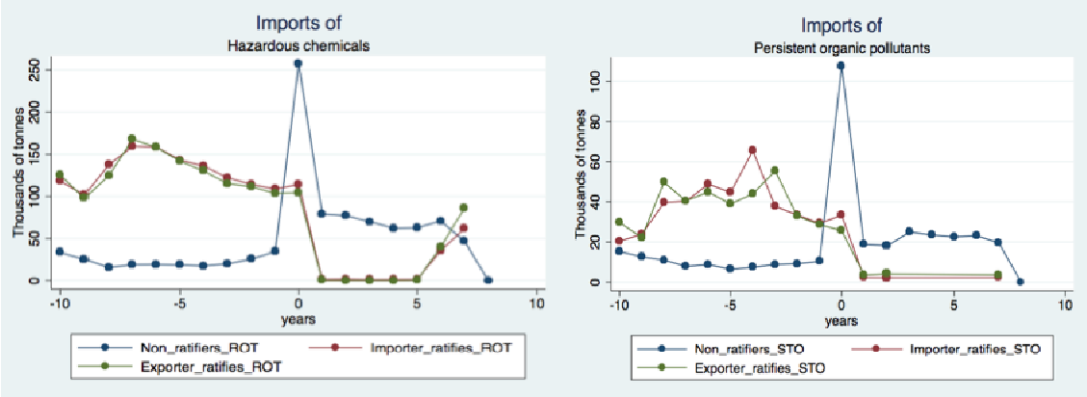


Figure 2: Trade in HCs and POPs before and after ratification, by ratification-status of the Rotterdam Convention (ROT) or Stockholm Convention (STO)

In Figure 2 we notice that a sudden increase in imports is shown for non-ratifiers in the year in which other countries ratify (year zero). Since countries know that they will not be able to trade HCs and POPs (at least not with ratifiers) in the next periods, countries that produce HCs and POPs could behave strategically by shipping those substances to the countries that have not yet ratified, once the ratification date is known. Moreover, given that we have yearly data and ratification is done in a specific month of the year, the pick in imports, could be the result of the last importation before ratification in year zero.[11]

The analysis of the total annual shipments of HCs and POPs made 10 years before and after countries ratified the conventions reveal an interesting picture for both conventions (Figure 2), and we hope the econometric model will capture this more accurately. Since figures 1 and 2 show only trends in the data, we aim to employ our modelling strategy to investigate whether the conventions have been effective in reducing imports of the corresponding products that they target.

3.3 Model specification

The gravity model of trade has long been considered the workhorse in estimating the effect of policy-based bilateral agreements on bilateral trade flows (Feenstra (2003)). In particular, it has been widely used since the 1960s to estimate the effects of free trade agreements (FTAs), economic integration agreements (EIAs) and monetary unions (MUs). More recently, it has also been used to estimate the effects of MEAs on trade (Kellenberg

[11]The date of ratification used to draw the graphs is according to the years indicated in Table 8

and Levinson (2014)) and in most cases the methodology has been borrowed from the literature on trade agreements. We base our main state-on-the-art specification of the gravity model on Baier and Bergstrand (2007), but due to the shorter time span for which MEAs have been enforced, we will only be able to capture short-term MEA effects. As explained by Baier and Bergstrand (2007), EIAs can take more than ten years for their full impact on bilateral trade to materialise, hence we will not be able to estimate the long-run effects in our application since the MEAs under analysis have been in force only since 2004 and because the data is only available until 2012.

An important issue in the estimation of the effects of MEAs on trade is the fact that self-selection of country pairs into MEAs possibly creates an endogeneity bias in the estimates. For instance, trade partners that ratify the conventions might be those for which trade in HCs or in POPs is not growing. As suggested by Baier and Bergstrand (2007), panel data techniques can be used to avoid endogeneity bias by incorporating bilateral effects in a log-levels specification. A second issue that is well known in the trade literature is that it is necessary to include the so-called MRF (Anderson and van Wincoop (2004)) in the model, which represents the relative price differences across countries with respect to all of their trading partners. Since these factors vary over time in a panel-data framework, they could be proxied using time-varying exporter and importer fixed effects and will capture not only price effects, but also all the unobservable heterogeneity that varies over time for each origin and for each destination. In what follows, we specify a theoretically founded gravity model of trade that will be estimated in the next section.

According to the underlying theory that has been reformulated and extended by Anderson and van Wincoop (2004), our model assumes a constant elasticity of substitution and product differentiation by place of origin. In addition, prices differ among locations due to symmetric bilateral trade costs. The reduced form of the model is specified as:

$$M_{ijt} = \frac{Y_{it}Y_{jt}}{Y_t^W}(\frac{t_{ijt}}{P_{it}P_{jt}})^{1-\sigma} \tag{1}$$

where M_{ijt} are the bilateral imports from country i to country j in year t, and Y_{it} , Y_{jt} and Y_t^W is the respective GDP of the exporting country, the importing country and the world in year t. t_{ijt} denotes trade costs between the exporter and the importer in year t, and P_{it} and P_{jt} are the so-called MRF. σ is the elasticity of substitution between all goods.

The empirical specification in log-linear form is given by:

$$lnM_{ijt} = lnY_{it} + lnY_{jt} - lnY_t^W + (1-\sigma)lnt_{ijt} - (1-\sigma)lnP_{it} - (1-\sigma)lnP_{jt} \quad (2)$$

The estimation of equation 2 is not straightforward due to the presence of trade costs and MRF. In the gravity literature the trade cost function, t_{ijt} is assumed to be a linear function of a number of trade barriers, namely, the time-invariant determinants of trade flows, including distance, common border, common colonial past and common language dummies and the time-varying policy variables (membership in multilateral agreements such as RTAs, MEAs, WTO, etc.). It takes the form:

$$\begin{aligned} t_{ijt} = d_{ij}^{\alpha_3} exp(\alpha_4 Contig_{ij} + \alpha_5 Comlang_{ij} + \alpha_6 Comcol_{ij} + \alpha_7 RTA_{ij} \\ + \alpha_8 Comcur_{ij} + \alpha_9 WTO_{ij} + \alpha_{10} MEA_{ij}) \end{aligned} \quad (3)$$

Substitution of the trade cost function 3 into equation 2 and adding group, product and time dummy variables and an idiosyncratic error term gives the following estimation:

$$\begin{aligned} lnM_{ijkt} = \alpha_0 + \alpha_1 lnY_{it} + \alpha_2 lnY_{jt} - \alpha_3 lnDist_{ij} + \alpha_4 Contig_{ij} + \alpha_5 Comlang_{ij} \\ + \alpha_6 Comcol_{ij} + \alpha_7 Comcur_{ij} + \alpha_8 RTA_{ijt} + \alpha_9 WTO_{ijt} + \alpha_{10} MEA_{ijt} \\ + \alpha_{11} \sum Group_{ij} + \alpha_{12} \sum d_{iy} I_{iy} + \alpha_{13} \sum d_{jy} I_{jy} + \gamma_t + \theta_k + \mu_{ijkt} \end{aligned} \quad (4)$$

where lnM_{ijkt} are the log of quantity imported (in tonnes) of the products subject to each convention shipped from country i to country j in year t; $lnDist_{ij}$ denotes geographical distance between country i and country j in logs; $Comlang_{ij}$ and $Comcol_{ij}$ take the value of one when countries i and j share an official language or have ever had a colonial relationship, respectively, and zero otherwise; $Contig_{ij}$ takes the value of one when the trading countries share a border, zero otherwise; RTA_{ijt} takes the value of one when the trading countries are members of an RTA, zero otherwise; WTO_{ijt} takes the value of one if country i or country j are WTO members and two if both are members; and $Comcur_{ij}$ takes the value of one when countries i and j belong to the same currency union. MEA_{ijt} takes the value of one when the trading countries have ratified the corresponding convention (Sto for the Stockholm Convention and Rot for the Rotterdam Convention),[12] γ_t denotes a set of year dummies

[12](In the estimations without price effects that are presented in the next section three membership dummies are included: The Äúimporter (or exporter) ratifiesÄù variable is encoded as a dummy variable equal to one if the importer (or exporter) ratifies independently of what the exporter does) and zero

that proxy for business cycle and other time-variant common factors (globalization) that affect all trade flows in the same manner. $\sum Group_{ij}$ are $g = 3$ dummy variables that represent trade from OECD to non-OECD countries, from non-OECD to OECD countries and from OECD to OECD countries, respectively, in order to partially control for group-specific bilateral unobservable heterogeneity. Since the model is estimated using product-level trade data, we add a k subscript that denotes a given product at the 6-digit HS disaggregation level and also add dummy variables that are product specific to control for any unobserved product-characteristics that are constant across bilateral flows and over time. In line with recent gravity literature, the price terms (lnP_{it}, lnP_{jt}) MRF are modelled as time-varying country-specific dummies. Hence, in equation (4) we also introduce two sets of dummies, d_{iy} and d_{jy}, for exporters and importers. We construct country-and-time dummies that vary every five years (y) instead of yearly (t) in an attempt to account for factors that vary slowly over time and are country specific such as domestic environmental regulations, political stability and industrial policies (Gylfason et al. (2015))).

Finally, in an additional specification, rather than adding the usual time-invariant gravity variables to control for differences in trade costs (distance, etc.), we use country-pair-product fixed effects θ_{ijk} to control for bilateral unobserved characteristics. The equation is given by:

$$\begin{aligned} lnM_{ijkt} = \alpha_0 + \alpha_1 RTA_{ijt} + \alpha_2 WTO_{ijt} + \alpha_3 MEA_{ijt} + \alpha_4 \sum Group_{ij} \\ + \alpha_5 \sum d_{iy} I_{iy} + \alpha_6 \sum d_{jy} I_{jy} + \gamma_t + \theta_{ijk} + \mu_{ijkt} \end{aligned} \tag{5}$$

Our estimation strategy follows Baier and Bergstrand (2007), Gylfason et al. (2015) and Head and Mayer (2014) by using country-pair-product fixed effects to mitigate the possible endogeneity of the agreement effects (introduced in equation 5), as well as exporter-and-time and importer-and-time dummy variables to control for MRF (already introduced in equation 4 and kept in 5). In this way the gravity models that we estimate in this paper control for the possibility of endogeneity present in the ratification variables, which could result if countries self-select themselves into both the ratification process and the time of ratification, depending on their volume of trade in the corresponding pollutant. In summary, in the most comprehensive specification, given by equation 5, we exploit the panel nature of the data and include three sets of fixed effects (dummy variables) that account for unobserved factors that vary over time for the exporter and the importer separately and across the country-pair-product dimension (country-pair- or "dyadic"-product fixed effects). For comparison, we present the traditional gravity model estimations with eco-

otherwise. The Äúboth ratifyÄù dummy takes the value of one when the two trade partners are ratifier countries in a given year.

nomic and bilateral variables and product fixed effects (instead of dyadic-product fixed effects) and with common time effects instead of MRF.

4 Main Results

In this section the estimation results are presented separately for each convention. Table 2 presents the results obtained for the Rotterdam Convention and Table 3 the results for the Stockholm Convention.

Table 2 presents the results obtained by estimating equation 4 above with the inclusion of dummy variables for three groups of trading partners (OECD to non-OECD, OECD to OECD and Non-OECD to OECD), and origin and destination effects for our target variable (Rotterdam Convention ratification) and its interaction with the group of OECD amd non-OECD trading partners (North-South dummy). This latter term is added to analyse if the amount of trade between OECD and non-OECD members that ratified, decreased following ratification. This could occur because the ratification process between trade partners may exert a greater impact on the countries that have to adapt to considerable differences in environmental regulations related to standards of use of these hazardous chemicals.

More specifically, for comparative purposes columns 1 and 2 present estimates of the traditional gravity model (specification (4) of the gravity model but without country-and-time dummies (MRF)). In column (1) group dummies are included, whereas in column (2) the interaction between the North-South dummy and ratification status are added. Columns 3 and 4 incorporate MRF with and without interaction terms, respectively. Column 5 presents estimations of equation 5, which includes "dyadic" or bilateral-product time-invariant fixed effects and group dummies and finally, column (6) adds additional interaction terms (between the North-South dummy and ratification status, as in columns (2) and (4)).

According to the results, in the model that includes interactions, shipments are lower when the exporter ratifies the Rotterdam Convention (row 8, columns 2, 4 and 6). That is, the interaction between the ratification dummy and the group dummy OECD to non-OECD countries is negative and statistically significant. The magnitude of the effect is a cumulative decrease in imports of HCs of about 7 percent (column 6), which given the time span since ratification is not very long, the effect should as such be considered a short-run effect. These results highlight the importance of the exporter ratifying the convention. The additional gravity controls have the expected signs and indicate that countries with higher GDPs, as well as those with shared border, an official language or a colonial history, trade

more.[13]

The results shown in columns 1 and 2, which only include group dummies but not bilateral-product (ijk) fixed effects, are biased due to the fact that we only partially control for endogeneity issues and do not control for MRF. Similarly, the results shown in columns 3 and 4 include the MRF but still do not incorporate the bilateral-product fixed effects. For these reasons, we focus on the interpretation of the results in columns 5 and 6. The results show that whereas in column 5 the dummy "both ratify" is negative and statistically significant, in column 6 it is indeed the interaction dummy that captures this effect, meaning that only trade from OECD countries to non-OECD countries is lower when the exporter ratifies. Interestingly, the estimated effects are similar to those found in columns 2 and 4, but lower in magnitude, confirming our suspicion of a possible endogeneity bias, which in this case magnifies the effect.

Table 3 shows the results for the Stockholm Convention regression obtained for the gravity model estimated using the imported products that are affected by this convention. The structure of the table is similar to Table 2. Columns 1 and 2 are for specification 4 of the gravity model but without country-and-time dummies (MRF), 3 and 4 include MRF and columns 5 and 6 also incorporate bilateral-product time-invariant fixed effects as in equation 4. As in Table 2, interactions between the North-South dummy and ratification dummies are also added in columns 2, 4 and 6.

[13] Full results tables can be found in Table 11 in the Appendix.

Main results Rotterdam Convention

	Gravity variables		Country-time5 dummies		Country-time5 dummies & ijk FE	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**
OECD to non-OECD	**-1.104*** **	**-1.115*** **	**3.674*** **	**3.682*** **		
	(0.0436)	(0.0487)	(0.506)	(0.508)		
OECD to OECD	**-1.648*** **	**-1.642*** **	**7.030*** **	**6.962*** **		
	(0.0560)	(0.0561)	(0.595)	(0.597)		
Non-OECD to OECD	**-1.272*** **	**-1.265*** **	**2.755*** **	**2.728*** **		
	(0.0599)	(0.0599)	(0.318)	(0.318)		
Importer ratifies ROT	**0.106** **	0.0109				
	(0.0432)	(0.0511)				
Exporter ratifies ROT	**0.0655***	**0.148*** **				
	(0.0396)	(0.0470)				
Both ratify ROT	**-0.142*** **	**-0.134** **	-0.0548	-0.0447	**-0.0542** **	-0.0310
	(0.0474)	(0.0599)	(0.0363)	(0.0424)	(0.0218)	(0.0268)
Imp ratifies ROT x OECD		**0.295*** **		0.0426		-0.00195
to non-OECD		(0.0738)		(0.0681)		(0.0477)
Exp ratifies ROT x OECD		**-0.184*** **		**-0.111** **		**-0.0730** **
to non-OECD		(0.0550)		(0.0522)		(0.0359)
Both ratify ROT x OECD		-0.0740		-0.0440		-0.0513
to non-OECD		(0.0895)		(0.0825)		(0.0584)
Observations	209,951	209,951	209,951	209,951	209,951	209,951
R-squared	0.255	0.255	0.349	0.349	0.067	0.067
Time dummies	YES	YES	YES	YES	YES	YES
Product dummies	YES	YES	YES	YES	YES	YES
Country-and-time dummies	NO	NO	YES	YES	YES	YES
Dyadic-sector fixed effects	NO	NO	NO	NO	YES	YES
Rat.-country group int. terms	NO	YES	NO	YES	NO	YES
Number of ijk					25,9	25,9

Note: Robust standard errors are in brackets, ***, **, * denotes statistical significance at the 1, 5 and 10 percent level, respectively. In column (1)-(4) other gravity controls, namely distance, common border, common language and colonial ties, are also included, but the coefficients are not shown to save space. Full results can be found in Table A.5 in the Appendix. The "importer (or exporter) ratifies" variable is encoded as a dummy variable equal to one if the importer (or exporter) ratifies (independently of what the exporter does) and zero otherwise. The "both ratify" dummy takes the value of one when the two trade partners are ratifier countries in a given year. i denotes importer, j denotes exporter and k denotes sector.

Table 2: Main Results of the Rotterdam Convention

The main results differ from those found for the Rotterdam Convention. This is not surprising due to the different aims of the conventions and the products affected. In particular, contrary to what we found in Table 2, significant effects are found in Table 3 (row 7, columns 4 and 6) when the importer ratifies the Stockholm Convention and the flow is from OECD to non-OECD countries. It shows a decrease in POPs shipped from OECD to non-OECD countries after the non-OECD importer has ratified the convention. Comparing the results in columns 4 and 6 -with and without bilateral-product fixed effects- it can be observed that the magnitude of the effect decreased from 0.253 to 0.157, indicating the importance of controlling for endogeneity in the model to avoid biased results. Similar to Table 2, the rest of the gravity controls have the expected signs and a reasonable magnitude.[14] It is not surprising that the effect of the Stockholm Convention is bigger in magnitude, especially since this research focuses on the products that are to be eliminated and so are subject to stronger provisions.

To assess whether there is an aggregation bias when the estimations are carried out for data that is more aggregated, we performed similar estimations summing all flows at the four-digit level for the Rotterdam Convention, at the two-digit level for the Stockholm Convention[15] and finally with completely aggregated data.

The main results are shown in Table 4 and in the Appendix (Table 13 and 14 for two- and four-digit aggregation, respectively, and 15 and 16 for full aggregation). When aggregating the data we sum of all type of HCs in case of Rotterdam Convention and all type of POPs for Stockholm Convention, and not being able to distinguish among products we implicitly induce a bias due to some under or over-representation of a specific product in the sample. To our knowledge, previous research has mainly analyzed waste in an aggregated manner. Our study results show that the use of disaggregated data allows us to better isolate and identify the magnitude of the effect. Otherwise, we would have claimed that the ratification of the Rotterdam Convention was effective and the effects bigger in magnitude than in our disaggregated analysis. In particular, the results from aggregating all products (column (2) of Table 4) indicate that when the exporter ratifies Rotterdam Convention and trade flows from OECD to non-OECD, imports of HCs are around 15.7 percent lower (compared with 7 percent obtained using product-level data at 6-digits HC).

Concerning the Stockholm Convention, there is no significant effect at the aggregated level, indicating that the average effect is not statistically different from zero. However, the effect using two-digits is similar to the one found at the six-digit level and also statistically significant, but slightly higher. Hence highlighting the importance of using disaggregated

[14] Full results tables are in the 12.

[15] For the Stockholm Convention, it is not straightforward to estimate at the four-digit disaggregation level. Performing the estimation at the two-digit level keeps the product disaggregation but somewhat mitigates the zero problem.

trade data when estimating the effects of the conventions in order to be able to properly isolate the effects, taking into account the possible unobserved factors that affect specific products differently.

Our main model seeks to infer whether ratification influences imports by taking into account the ratification date of each country (countries ratify at different points in time), ratifying countries are included in the treatment group and the control group includes those that do not ratify at that moment of time or at any time (Countries that do not ratify Rotterdam Convention are: Algeria, Bangladesh, Egypt, Iceland, Malta, Tunisia, Turkey, US; and Stockholm Convention: Israel, Italy, Malaysia, Malta, US). Nevertheless, the convention(s) was not implemented until 2004, the period of study being from 1995 until 2012. See Table 8 for a list of countries, its ratification status and the date of ratification. Hence, in the next section we will analyse the timing of the impacts from ratifying the conventions, to infer when the effects could be seen in terms of lower imports.

Main results Stockholm Convention

	Gravity variables		Country-time5 dummies		Country-time5 dummies & ijk FE	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**
OECD to non-OECD	**-1.188*** **	**-1.221*** **	**4.913*** **	**5.051*** **		
	(0.0784)	(0.0838)	(0.832)	(0.837)		
OECD to OECD	**-1.427*** **	**-1.428*** **	**9.344*** **	**9.469*** **		
	(0.0961)	(0.0961)	(0.989)	(0.992)		
Non-OECD to OECD	**-0.405*** **	**-0.407*** **	**4.545*** **	**4.553*** **		
	(0.109)	(0.109)	(0.552)	(0.551)		
Importer ratifies STO	**-0.147***	**-0.163***				
	(0.0801)	(0.0931)				
Exporter ratifies STO	**0.237*** **	**0.254*** **				
	(0.0765)	(0.0916)				
Both ratify STO	-0.0208	-0.0413	0.00223	-0.0436	0.0143	0.0209
	(0.0871)	(0.109)	(0.0650)	(0.0732)	(0.0381)	(0.0439)
Imp ratifies STO x OECD to non-OECD		0.0613		**-0.253** **		**-0.157** **
		(0.113)		(0.103)		(0.0798)
Exp ratifies STO x OECD to non-OECD		-0.0509		0.0286		-0.0820
		(0.103)		(0.0877)		(0.0601)
Both ratify STO x OECD to non-OECD		0.0721		**0.267** **		0.0887
		(0.149)		(0.133)		(0.0988)
Observations	91,673	91,673	91,673	91,673	91,673	91,673
R-squared	0.219	0.219	0.318	0.318	0.069	0.069
Time dummies	YES	YES	YES	YES	YES	YES
Product dummies	YES	YES	YES	YES	YES	YES
Country-and-time dummies	NO	NO	YES	YES	YES	YES
Dyadic-sector fixed effects	NO	NO	NO	NO	YES	YES
Ratification-country group interaction terms	NO	YES	NO	YES	NO	YES
Number of ijk					11,675	11,675

Note: Robust standard errors are in brackets, ***, **, * denotes statistical significance at the 1, 5 and 10 percent level, respectively. In column (1)-(4) other gravity controls, namely distance, common border, common language and colonial ties, are also included, but the coefficients are not shown to save space. Full results can be found in Table A.5 in the Appendix. The "importer (or exporter) ratifies" variable is encoded as a dummy variable equal to one if the importer (or exporter) ratifies (independently of what the exporter does) and zero otherwise. The "both ratify" dummy takes the value of one when the two trade partners are ratifier countries in a given year. i denotes importer, j denotes exporter and k denotes sector.

Table 3: Main Results of the Stockholm Convention

With respect to Kellenberg and Levinson (2014), there are three main differences in our analysis. First, our database contains fewer countries (88 versus 117) and highly disaggregated data, meaning that we have very detailed information concerning the type of product and that we can control for unobserved factors that are time invariant and product-specific. Instead, Kellenberg and Levinson (2014) aggregated all imports and applied the gravity model to the aggregated shipments. We claim that the use of data at the product level allows us to identify the effectiveness of the conventions without incurring in an aggregation bias. We are also able to identify an "aggregation effect" as described above that indicates that results substantially differ depending on the degree of aggregation used in the estimations.

Second, the time period is also likely to matter in explaining the different results obtained. Whereas Kellenberg and Levinson (2014)) use trade data over the period from 1988 to 2008, our time periods spans from 1995 to 2012. The starting year is 1995 because positive trade flows are found for more countries beginning in the mid 1990s, and because using highly disaggregated data we were facing a trade-off between extending the time period to past years or including more countries. In the end, we decided in favour of more countries.

Finally, the treaties differ clearly in their scope and implementation strategy. We believe that an important factor is the instrument defined in each convention. We suspect that imposing a Ban (as in the Stockholm Convention for Annex A products) or a PIC system (as in the Rotterdam Convention), or both at different times (as in the Basel Convention or for products subject to both, the Rotterdam and the Stockholm conventions) is likely to matter, bans could possibly be more effective in reducing trade of hazardous products. When comparing the results in Kellenberg and Levinson (2014) with those we find for aggregated data and the Stockholm Convention, we find that there is neither fundamental difference nor a statistically significant effect on imports.

	Rotterdam Convention		**Stockholm Convention**	
	(1)	(2)	(3)	(4)
Disaggregation level:	**Both Ratify**	**Exp. Rat x OECD-Non-OECD**	**Both Ratify**	**Imp. Rat x OECD-Non-OECD**
6-digits	-0.0542**	-0.0730**	0.0143	-0.157**
2/4 digits	-0.0134***	-0.102*	-0.0033	-0.195**
Aggregated	-0.119***	-0.171***	-0.0294	-0.172

Note: The coefficient shown are from columns (5) and (6) of Tables 2 and 3 for the first row,Tables A6 and A7 for the second row and Tables A8 and A9 for the last column. The "importer (or exporter) ratifies" variable is encoded as a dummy variable equal to one if the importer (or exporter) ratifies (independently of what the exporter does) and zero otherwise. The "both ratify" dummy takes the value of one when the two trade partners are ratifier countries in a given year.

Table 4: Summary table of main results at different aggregation levels

5 Robustness

As a first robustness test, we estimate the model including interactions between the years and the ratification dummies. Results are shown in Tables 5 and 6 for the Rotterdam and Stockholm conventions, respectively. Next, we estimate regressions separating the sample into three groups of developing countries, see results in Table 7. In these three tables (5 6 7), we focus on the preferred model specification that uses the three sets of fixed-effects and only the coefficients of the target variables are shown.

The results obtained with time-varying treatment effects, before and after the ratification date for the Rotterdam Convention, are shown in Table 5. These results could show some possible anticipation strategy of the countries importing more the years before the enforcement of the convention was implemented.

The results indicate that the coefficients are mostly non-significant before 2004, and we observe only a single coefficient that is positive and significant at the ten percent level in 2001 if there is an interaction between when exporter ratifies and the north-south dummy (column (3), second row in Table 5). However, there are negative and significant effects in 2003 and 2004 when both countries ratify the convention (column (1), rows 4 and 5 in Table 5) and when the exporter ratifies and exports flow from OECD to non-OECD countries from 2004 onwards and for most years. It is shown that the magnitude of the effects increased over the years, with the highest coefficient in 2011 (-0.486) showing a lower level of imports in hazardous Chemicals for this trade flow (See also Figure 3). Our interpretation for the positive effect in 2001 is that firms anticipated ratification of their respective country and also of other countries, and tried to trade more of those substances as much as possible before ratification.

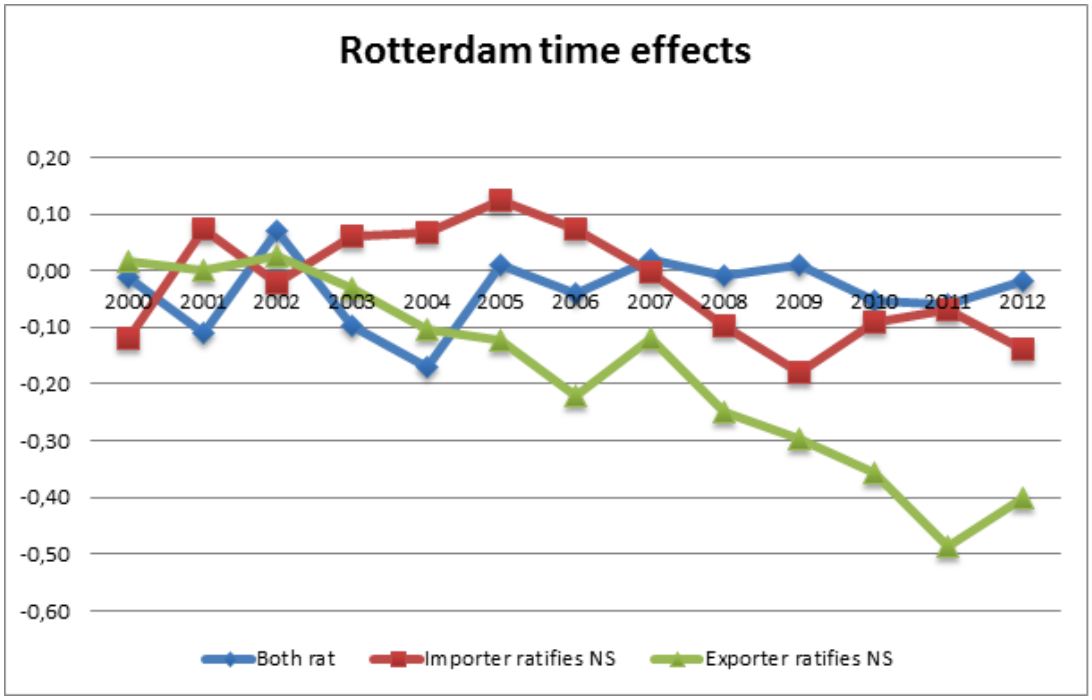
Table 6 shows that in the case of the Stockholm Convention, imports were higher in 2002 when both countries ratify the convention (column (1)), whereas for the years after ratification, we only find significant and negative coefficients for the year 2011 when the importer ratifies and exports go from OECD to non-OECD countries and for the year 2012 for the same exporters and importers in the case of the exporter having ratified the convention. For this convention, there are also some negative and significant results for the year 2002 (Column (4)). These could be interpreted as anticipation effects.

Additionally, Table 7 shows estimations for specific groups of countries. We observe that in the case of the Rotterdam Convention, there are negative and significant effects for African and American developing countries, but no effect for Asian developing countries. Regarding the Stockholm Convention, there is no significant effect observed by individual groups of developing countries but rather as a unified group. One explanation could be that the characteristics of developing countries that may affect the average results, are due

	Country-time5 dummies & ijk FE			
	Both Rat.	Imp. Rat. NS	Exp. Rat. NS	Both Rat. NS
	(1)	(2)	(3)	(4)
Year	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**
2000	-0.0131	-0.121	0.0176	0.543
	(0.193)	(0.116)	(0.0896)	(0.385)
2001	-0.111	0.0741	0.105*	-0.0611
	(0.113)	(0.107)	(0.0620)	(0.258)
2002	0.0693	-0.0225	0.0262	-0.133
	(0.0554)	(0.0640)	(0.0498)	(0.122)
2003	-0.0962*	0.0606	-0.0272	0.000720
	(0.0499)	(0.0600)	(0.0520)	(0.110)
2004	-0.170***	0.0673	-0.104**	0.0633
	(0.0396)	(0.0764)	(0.0473)	(0.103)
2005	0.0101	0.124	-0.123	-0.0946
	(0.0521)	(0.0923)	(0.0797)	(0.117)
2006	-0.0403	0.0717	-0.218***	0.0284
	(0.0527)	(0.0947)	(0.0824)	(0.122)
2007	0.0234	-0.00190	-0.121	0.000283
	(0.0543)	(0.0986)	(0.0859)	(0.130)
2008	-0.0123	-0.0966	-0.245***	0.167
	(0.0571)	(0.0973)	(0.0933)	(0.135)
2009	0.00772	-0.179*	-0.298***	0.220
	(0.0579)	(0.0987)	(0.0974)	(0.140)
2010	-0.0540	-0.0911	-0.357***	0.144
	(0.0698)	(0.115)	(0.116)	(0.158)
2011	-0.0616	-0.0736	-0.486***	0.269
	(0.0820)	(0.126)	(0.138)	(0.183)
2012	-0.0164	-0.137	-0.400***	0.196
	(0.0853)	(0.132)	(0.145)	(0.194)

Note: Robust standard errors are in brackets, ***, **, * denotes statistical significance at the 1, 5 and 10 percent level, respectively. Only the coefficients for the ratification dummies and interactions with the group dummy are shown. Both Rat. denotes interactions between time dummies and a dummy variable that takes the value of 1 when both countries ratify the convention, zero otherwise. Imp. Rat. denotes interactions between time dummies and a dummy variable that takes the value of 1 when importer country ratifies the convention zero otherwise. Exp. Rat. denotes interactions between time dummies and a dummy variable that takes the value of 1 when exporter country ratifies the convention, zero otherwise Both Rat. NS denotes interactions between time dummies and a dummy variable that takes the value of 1 when both countries ratify the convention, zero otherwise. NS stand for North and South meaning imports of Non-OECD countries from OECD countries. i denotes importer, j denotes exporter and k denotes sector.

Table 5: Time-varying ratification effects. Rotterdam Convention



Note: Importer ratifies denotes interactions between time dummies and a dummy variable that takes the value of 1 when importer country ratifies the convention zero otherwise. Exporter ratifies denotes interactions between time dummies and a dummy variable that takes the value of 1 when exporter country ratifies the convention, zero otherwise. Both rat. denotes interactions between time dummies and a dummy variable that takes the value of 1 when both countries ratify the convention, zero otherwise. NS stand for North and South meaning imports of Non-OECD countries from OECD countries. Only the effects that were jointly significant are shown.

Figure 3: Evolution over time of the coefficients in Table 4.5

to other reasons different to the geographical location.

As a final robustness test, we estimate the gravity model using the Helpman et al. (2008) method, which also considers the existence of zero trade flows. Methodologically, this is done by estimating a probit model for each year in a first step to infer whether the ratification of the agreements influences the probability deciding whether or not to import a given product (HCs and POPs, respectively) and in a second step, some elements of the first estimation (the inverse Mills ratio and the yearly predictions of the probit) are incorporated to the gravity model as specified in equation (5). The results indicate that the effect of the ratification of the Rotterdam Convention is slightly higher for imports of OECD from non-OECD countries when the extensive margin of imports is considered (coefficient equals 0.09), whereas the effect of the Stockholm Convention is not statistically significant in the second step, but the coefficient still maintains the direction of the change.[16] More research is needed to be able to properly identify separate effects for the extensive and intensive margins of trade.

[16] Available upon request from the authors.

Country-time5 dummies & ijk FE				
	Both Rat.	Imp. Rat. NS	Exp. Rat. NS	Both Rat. NS
	(6)	(6)	(6)	(6)
Year	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**
2002	0.188*	0.0117	0.119	-0.158*
	(0.108)	(0.198)	(0.364)	(0.0811)
2003	-0.0381	-0.105	0.112	-0.104
	(0.0810)	(0.175)	(0.262)	(0.0744)
2004	-0.0718	-0.166	0.0474	-0.0648
	(0.0654)	(0.114)	(0.174)	(0.0905)
2005	0.0239	0.0381	0.0588	-0.107
	(0.0746)	(0.132)	(0.200)	(0.151)
2006	0.0765	-0.0512	-0.0535	0.140
	(0.0757)	(0.140)	(0.199)	(0.143)
2007	0.0838	-0.0710	-0.228	0.222
	(0.0803)	(0.135)	(0.226)	(0.178)
2008	0.0201	-0.229	0.0875	0.110
	(0.0832)	(0.142)	(0.259)	(0.213)
2009	0.190**	-0.0955	-0.0367	-0.000255
	(0.0893)	(0.145)	(0.329)	(0.288)
2010	0.0274	-0.212	0.194	-0.109
	(0.191)	(0.177)	(0.358)	(0.311)
2011	0.0976	-0.459**	-0.429	0.642
	(0.198)	(0.188)	(0.493)	(0.461)
2012	0.205	-0.143	-1.202**	0.987*
	(0.202)	(0.191)	(0.591)	(0.561)

Note: Robust standard errors are in brackets, ***, **, * denotes statistical significance at the 1, 5 and 10 percent level, respectively. Only the coefficients for the ratification dummies and interactions with the group dummy are shown. Both Rat. denotes interactions between time dummies and a dummy variable that takes the value of 1 when both countries ratify the convention, zero otherwise. Imp. Rat. denotes interactions between time dummies and a dummy variable that takes the value of 1 when importer country ratifies the convention zero otherwise. Exp. Rat. denotes interactions between time dummies and a dummy variable that takes the value of 1 when exporter country ratifies the convention, zero otherwise Both Rat. NS denotes interactions between time dummies and a dummy variable that takes the value of 1 when both countries ratify the convention, zero otherwise. NS stand for North and South meaning imports of Non-OECD countries from OECD countries. i denotes importer, j denotes exporter and k denotes sector.

Table 6: Time-varying ratification effects. Stockholm Convention

	(5)	(6)	(5)	(6)	(5)	(6)
	Country-time5 dummies & ijk FE					
	Africa		**Asia**		**America**	
Rotterdam Convention (Regions)	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**
Both ratify ROT	-0.0392	-0.0189	-0.0392	-0.0389	-0.0392	0.0119
	(0.0280)	(0.0300)	(0.0280)	(0.0302)	(0.0280)	(0.0313)
Imp. ratifies ROT x OECD to non-OECD		**-0.192****		0.0796		0.00473
		(0.0915)		(0.102)		(0.0887)
Exp. ratifies ROT x OECD to non-OECD		**-0.131****		-0.0914		-0.0642
		(0.0637)		(0.0613)		(0.0588)
Both ratify ROT x OECD to non-OECD		-0.000189		-0.0468		**-0.194****
		(0.104)		(0.113)		(0.0984)
Observations	111,849	111,849	111,849	111,849	111,849	111,849
R-squared	0.088	0.088	0.088	0.088	0.088	0.088
Number of ijk	14,370	14,370	14,37	14,37	14,370	14,370
Stockholm Convention (Regions)	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**
Both ratify STO	-0.0456	-0.0428	-0.0456	-0.0332	-0.0456	-0.0475
	(0.0544)	(0.0583)	(0.0544)	(0.0592)	(0.0544)	(0.0587)
Imp. ratifies STO x OECD to non-OECD		-0.0292		-0.0679		0.234
		(0.135)		(0.154)		(0.180)
Exp. ratifies STO x OECD to non-OECD		-0.206		-0.128		0.0639
		(0.180)		(0.104)		(0.0991)
Both ratify STO x OECD to non-OECD		0.161		4.50e-06		-0.193
		(0.220)		(0.174)		(0.197)
Observations	42,011	42,011	42,011	42,011	42,011	42,011
R-squared	0.087	0.087	0.087	0.088	0.087	0.088
Time dummies	YES	YES	YES	YES	YES	YES
Product dummies	YES	YES	YES	YES	NO	NO
Country-and-time dummies	YES	YES	YES	YES	YES	YES
Dyadic-sector fixed effects	YES	YES	YES	YES	YES	YES
Rat.-country group int. terms	NO	YES	NO	YES	NO	YES
Number of ijk	6,113	6,113	6,113	6,113	6,113	6,113

Note: Robust standard errors are in brackets, ***, **, * denotes statistical significance at the 1, 5 and 10 percent level, respectively. The "importer (or exporter) ratifies" variable is encoded as a dummy variable equal to one if the importer (or exporter) ratifies (independently of what the exporter does) and zero otherwise. The "both ratify" dummy takes the value of one when the two trade partners are ratifier countries in a given year. i denotes importer, j denotes exporter and k denotes sector.

Table 7: Estimations by region of developing countries

6 Conclusions

The main findings of this paper indicate that both the Stockholm and Rotterdam conventions have been effective in reducing trade in HCs and POPs. This result is in contrast to the outcomes reported in the previous literature concerning other MEAs.

More specifically, we find that when the exporter ratifies the Rotterdam Convention and the flow is from OECD to non-OECD countries, a significant reduction of imports in hazardous chemicals is observed after ratification. The magnitude of the effect is a cumulative decrease in imports of about 7 percent, which is not particularly high but may increase further as long as the convention remains enforced. This effect is found after controlling for different sources of unobservable heterogeneity and is robust to changes in the specification.

In the case of the Stockholm Convention, the results show significant reductions in trade in POPs for importers that ratify the convention and for POPs shipped from OECD to non-OECD countries, with trade decreasing after the non-OECD-importer has ratified the convention. We observe a reduction of around 17 percent, which is nearly double the effect found for the Rotterdam Convention, which was expected due to the different obligations set by the respective conventions. However, while the import reducing effect of the Rotterdam Convention is robust to the inclusion of zero trade flows and to changes in the aggregation level of import flows, the one of the Stockholm Convention fades away when using aggregated imports and when including zero trade in the model. Since there are products that are subject to both conventions and others that are only affected by one of them, ideally each product-case should be investigated separately. We leave for further research a detailed analysis with product-specific ratification effects for each convention, in which the registry of final decisions taken for individual PICs for specific trading countries is also considered.

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Appendix

Convention ratification					
Country	**Rotterdam Convention**	**Stockholm Convention**	**Country**	**Rotterdam Convention**	**Stockholm Convention**
Algeria	NR	2006	Madagascar	2004	2005
Argentina	2004	2005	Malawi	2009	2009
Australia	2004	2004	Malaysia	2002	NR
Austria	2002	2002	Malta	NR	NR
Bangladesh	NR	2007	Mauritius	2005	2004
Belgium	2002	2006	Mexico	2005	2003
Bolivia	2003	2003	Morocco	2011	2004
Brazil	2004	2004	Mozambique	2010	2005
Bulgaria	2000	2004	Netherlands	2000	2002
Canada	2002	2001	New Zealand	2003	2004
Chile	2005	2005	Nicaragua	2008	2005
China	2005	2004	Nigeria	2001	2004
Colombia	2008	2008	Norway	2001	2002
Costa Rica	2006	2007	Pakistan	2005	2008
Croatia	2007	2007	Panama	2000	2003
Czech Republic	2000	2002	Paraguay	2005	2004
Denmark	2004	2003	Peru	2005	2005
Dominican Republic	2006	2007	Philippines	2006	2004
Ecuador	2004	2004	Poland	2005	2008
Egypt	NR	2003	Portugal	2005	2004
El Salvador	1999	2008	Romania	2003	2004
Estonia	2006	2013	Russian Federation	2011	2011
Ethiopia	2003	2003	Senegal	2001	2003
Finland	2004	2002	Singapore	2005	2005
France	2004	2004	Slovakia	2007	2002
Germany	2001	2002	Slovenia	1999	2004
Greece	2003	2006	South Africa	2002	2002
Guatemala	2010	2008	Spain	2004	2004
Honduras	2011	2005	Sri Lanka	2006	2005
Hungary	2000	2008	Sweden	2003	2002
Iceland	NR	2002	Switzerland	2002	2003
India	2005	2006	Thailand	2002	2005
Indonesia	2013	2009	Trinidad and Tobago	2009	2002
Ireland	2005	2010	Tunisia	NR	2004
Israel	2011	NR	Turkey	NR	2009
Italy	2002	NR	Uganda	2008	2004
Jamaica	2002	2007	Ukraine	2002	2007
Japan	2004	2002	United Kingdom	2004	2005
Jordan	2002	2004	United States of America	NR	NR
Kenya	2005	2004	Uruguay	2003	2004
Korea, Republic of	2003	2007	Venezuela (Bolivarian Republic of)	2005	2005
Latvia	2003	2004	Viet Nam	2007	2002
Lithuania	2004	2006	Zambia	2011	2006
Macedonia, Republic of	2010	2004	Zimbabwe	2012	2012

Table 8: Status of ratification of the conventions

Note: NR= Not ratified. Source: Rotterdam Convention Website.
http://www.pic.int/Countries/Statusofratifications/tabid/1072/language/en-US/Default.aspx.
Stockholm Convention Website:
http://chm.pops.int/Countries/StatusofRatifications/PartiesandSignatoires/tabid/4500/Default.aspxs.

Harmonized System Codes assigned to chemicals in Annex III to the Rotterdam Convention		
Annex III Chemicals and Pesticides	**HS Code Pure Substance**	**HS Code (*3) Mixtures, Preparations containing Substance**
2,4,5-T and its salts and esters	2918.91	3808.50 (*1)
Alachlor	See below (*4)	
Aldicarb	See below (*4)	
Aldrin	2903.82	3808.50 (*1)
Binapacryl	2916.16	3808.50 (*1)
Captafol	2930.50	3808.50 (*1)
Chlordane	2903.82	3808.50 (*1)
Chlordimeform	2925.21	3808.50 (*1)
Chlorobenzilate	2918.18	3808.50 (*1)
DDT	2903.92	3808.50 (*1)
Dieldrin	2910.40	3808.50 (*1)
DNOC and its salts (such as **ammonium salt, potassium salt and sodium salt)¬†**	.92	.50 (*1)
DNOC and its salts (such as ¬†*ammoniumsalt, potassiumsalt* and sodium salt)	.92	.50 (*1)
Dinoseb and its salts	2908.91	3808.50 (*1)
Dinoseb acetate	2915.36	3808.50 (*1)
,2-dibromoethane (EDB)	.31	3808.50 (*1) 3811.11, 3811.19
Endolsulfan	See below (*4)	
Ethylene dichloride	2903.15	3808.50 (*1)
Ethylene oxide	.10	3808.50 (*1) 3824.81
Fluoroacetamide	2924.12	3808.50 (*1)
HCH (mixed isomers)	2903.81	3808.50 (*1)
Heptachlor	2903.82	3808.50 (*1)
Hexachlorobenzene	2903.92	3808.50 (*1)
Lindane	2903.81	3808.50 (*1)
Mercury compounds including inorganic mercury compounds, alkyl mercury compounds and alkyloxyalkyl and aryl mercury compounds (CAS numbers)	.10	.50 (*1)
Monocrotophos	2924.12	3808.50 (*1)
Parathion	2920.11	3808.50 (*1)
Pentachlorophenol and its salts and esters	.11 Pentachlorophenol 2908.19 salts of Pentachlorophenol	.50 (*1)
Toxaphene		3808.50 (*1)
Dustable powder formulations containing a combination of : benomyl at or above 7 per cent, carbofuran at above 10 per cent, thiram at or above 15 per cent		.50(*1)
Methamidophos (Soluble liquid **formulations of the substance that exceed 600¬†*gactive* ingredient/l)**	.50	.50 (*1)
Phosphamidon (Soluble liquid **formulations of the substance that exceed 1000 g active ingredient/l)**	.12	.50 (*1)
mixture, (E)&(Z) isomers)		
(Z)-isomer		
(E)-isomer		
Methyl-parathion (emulsifiable **concentrates (EC) with 19.5%, 40%, 50%, 60% active ingredient and dusts containing 1.5%, 2% and 3% active ingredient)**	.11	.50 (*1)
Asbestos		6811.40 Containing asbestos.
	2524.10 Crocidolite 2524.90 Other(*2)	6812.91 Clothing, clothing accessories, footwear and headgear 6812.92 Paper, millboard and felt 6812.93 Compressed asbestos fibre jointingm in sheets or rolls 6812.99 Other
		6813.20 Containing asbestos.
Crocidolite	.10	The same as Asbestos other than heading 68.12 (*2)
		6812.80
Actinolite	.90	The same as Asbestos (*2) 6812.91 Clothing, clothing accessories, footwear and headgear
Anthophyllite	2524.90	6812.92 Paper, millboard and felt
Amosite	.90	6892.93 Compressed asbestos fibre jointing in sheets or rolls
Tremolite	2524.90	6892.99 Other
Polybrominated biphenyls (PBB)		2710.91
(hexa-)		3824.82
(octa-)		
(deca-)		
Polychlorinated biphenyls (PCB)		2710.91 3824.82
Polychlorinated terphenyls (PCT)		2710.91 3824.82
Tetraethyl lead	.10	e.g., 3811.11 Anti-knock preparations based on lead compounds
Tetramethyl lead	.10	e.g., 3811.11 Anti-knock preparations based on lead compounds
Tris (2,3-dibromopropyl) phosphate	.10	.83
Tributyl tin compounds	2931.20	3808.50 (*1)

Note: (*1) Subheading 3808.50 covers only goods of heading 38.08, containing one or more of the following substances : aldrin (ISO); binapacryl (ISO); camphechlor (ISO) (toxaphene); captafol (ISO); chlordane (ISO); chlordimeform (ISO); chlorobenzilate (ISO); DDT (ISO) (clofenotane (INN), 1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane); dieldrin (ISO, INN); 4,6-dinitro-o-cresol (DNOC (ISO)) or its salts; dinoseb (ISO), its salts or its esters; ethylene dibromide (ISO) (1,2-dibromoethane); ethylene dichloride (ISO) (1,2-dichloroethane); fluoroacetamide (ISO) (1,2-dibromoethane); ethylene dichloride (ISO) (1,2-dichloroethane); fluoroacetamide (ISO); heptachlor (ISO); hexachlorobenzene (ISO); 1,2,3,4,5,6-hexachlorocyclohexane (HSH (ISO)), including lindane (ISO), INN); mercury compounds; methamidophos (ISO); monocrotophos (ISO); oxirane (ethylene oxide); parathion (ISO);) parathion-methyl (ISO) (methyl-parathion); pentachlorophenol (ISO), its salts or its esters; phosphamidon (ISO); 2,4,5-T (ISO) (2,4,5-trichlorophenoxyacetic acid), its salts or its esters; tributyltin compounds. Subheading 3808.50 also covers dustable powder formulations containing a mixture of benomyl (ISO), carbofuran (ISO) and thiram (ISO). (*2) Asbestos is a natural mineral substance produced by the decomposition of certain rocks. (*3) The list of HS codes in the column for "HS Code Mixtures, Preparations containing Substance" is not exhaustive. (*4) This substance has entered into Annex III in 2011. HS code for this substance is expected to be assigned by WCO in 2017.

Table 9: Harmonized System Codes Assigned to Annex III Chemicals. Rotterdam Convention

Stockholm Convention			
Annex A			**ELIMINATION**
Chemical	**HS code**	**Activity**	**Specific exemptions**
Aldrin*		Production	None
CAS No: 309-00-2	290382	Use	Local ectoparasiticide Insecticide
Alpha hexachlorocyclohexane*		Production	None
CAS No: 319-84-6	290381	Use	None
Beta hexachlorocyclohexane*		Production	None
CAS No: 319-85-7	290381	Use	None
Chlordane*		Production	As allowed for the Parties listed in the Register
CAS No: 57-74-9	290382	Use	Local ectoparasiticide Insecticide Termiticide Termiticide in buildings and dams Termiticide in roads Additive in plywood adhesives
Chlordecone*		Production	None
CAS No: 143-50-0	291470	Use	None
Dieldrin*		Production	None
CAS No: 60-57-1	291040	Use	In agricultural operations
Endrin*		Production	None
CAS No: 72-20-8	291090	Use	None
Heptachlor*		Production	None
CAS No: 76-44-8	290382	Use	Termiticide Termiticide in structures of houses Termiticide (subterranean) Wood treatment In use in underground cable boxes
Hexabromobiphenyl*		Production	None
CAS No: 36355-01-8	290399	Use	None
Hexabromodiphenyl ether* and heptabromodiphenyl ether*		Production	None
		Use	Use Articles in accordance with the provisions of Part IV of this Annex
Hexachlorobenzene		Production	As allowed for the Parties listed in the Register
CAS No: 118-74-1	290392	Use	Intermediate Solvent in pesticide Closed system site limited intermediate2
Lindane*		Production	None
CAS No: 58-89-9	290381	Use	Human health phar. for control of head lice and scabies as second line treatment
Mirex*		Production	As allowed for the Parties listed in the Register
CAS No: 2385-85-5	290389	Use	Termiticide
Pentachlorobenzene*		Production	None
CAS No: 608-93-5	290399	Use	None
Polychlorinated biphenyls (PCB)*		Production	None
		Use	Articles in use in accordance with the provisions of Part II of this Annex
Tetrabromodiphenyl ether* and pentabromodiphenyl ether*		Production	None
		Use	Articles in accordance with the provisions of Part V of this Annex
Toxaphene*		Production	None
CAS No: 8001-35-2	380850	Use	None

Table 10: CAS and HS codes. Stockholm Convention

	Gravity variables		Country-time5 dummies		Country-time5 dummies & ijk FE	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**
Ln(GDP) importer	0.450***	0.449***				
	(0.0102)	(0.0102)				
Ln(GDP) exporter	0.615***	0.615***				
	(0.0114)	(0.0115)				
OECD to non-OECD	**-1.104*** **	**-1.115*** **	**3.674*** **	**3.682*** **		
	(0.0436)	(0.0487)	(0.506)	(0.508)		
OECD to OECD	**-1.648*** **	**-1.642*** **	**7.030*** **	**6.962*** **		
	(0.0560)	(0.0561)	(0.595)	(0.597)		
Non-OECD to OECD	**-1.272*** **	**-1.265*** **	**2.755*** **	**2.728*** **		
	(0.0599)	(0.0599)	(0.318)	(0.318)		
Ln(distance)	-0.478***	-0.480***	-0.825***	-0.822***		
	(0.0214)	(0.0214)	(0.0262)	(0.0261)		
Contiguity	0.537***	0.536***	0.472***	0.475***		
	(0.0639)	(0.0640)	(0.0635)	(0.0635)		
Common language	0.238***	0.236***	0.0803*	0.0804*		
	(0.0403)	(0.0403)	(0.0468)	(0.0468)		
Colony ties	0.149*	0.135	-0.0648	-0.0661		
	(0.0835)	(0.0832)	(0.0943)	(0.0942)		
RTA	0.290***	0.290***	0.171***	0.171***	0.134***	0.135***
	(0.0388)	(0.0389)	(0.0435)	(0.0435)	(0.0333)	(0.0334)
WTO	0.119***	0.114***	0.156***	0.153***	0.174***	0.174***
	(0.0334)	(0.0333)	(0.0455)	(0.0455)	(0.0429)	(0.0430)
Common currency	0.687***	0.685***	0.452***	0.435***	0.160**	0.138**
	(0.0742)	(0.0744)	(0.0813)	(0.0817)	(0.0633)	(0.0632)
Importer ratifies ROT	**0.106** **	0.0109				
	(0.0432)	(0.0511)				
Exporter ratifies ROT	**0.0655***	**0.148*** **				
	(0.0396)	(0.0470)				
Both ratify ROT	**-0.142*** **	**-0.134** **	-0.0548	-0.0447	**-0.0542** **	-0.0310
	(0.0474)	(0.0599)	(0.0363)	(0.0424)	(0.0218)	(0.0268)
Imp. ratifies ROT x OECD to non-OECD		**0.295*** **		0.0426		-0.00195
		(0.0738)		(0.0681)		(0.0477)
Exp. ratifies ROT x OECD to non-OECD		**-0.184*** **		**-0.111** **		**-0.0730** **
		(0.0550)		(0.0522)		(0.0359)
Both ratify ROT x OECD to non-OECD		-0.0740		-0.0440		-0.0513
		(0.0895)		(0.0825)		(0.0584)
Observations	209,951	209,951	209,951	209,951	209,951	209,951
R-squared	0.255	0.255	0.349	0.349	0.067	0.067
Time dummies	YES	YES	YES	YES	YES	YES
Product dummies	YES	YES	YES	YES	YES	YES
Country-and-time dummies	NO	NO	YES	YES	YES	YES
Dyadic-sector fixed effects	NO	NO	NO	NO	YES	YES
Ratification-country group interaction terms	NO	YES	NO	YES	NO	YES
Number of ijk					25,9	25,9

Note: Robust standard errors are in brackets, ***, **, * denotes statistical significance at the 1, 5 and 10 percent level, respectively. The Äúimporter (or exporter) ratifiesÄù variable is encoded as a dummy variable equal to one if the importer (or exporter) ratifies (independently of what the exporter does) and zero otherwise. The Äúboth ratifyÄù dummy takes the value of one when the two trade partners are ratifier countries in a given year.

Table 11: Full results Rotterdam Convention (six-digit disaggregation)

	Gravity variables		Country-time5 dummies		Country-time5 dummies & ijk FE	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**
Ln(GDP) importer	0.603***	0.602***				
	(0.0181)	(0.0181)				
Ln(GDP) exporter	0.812***	0.812***				
	(0.0195)	(0.0196)				
OECD to non-OECD	**-1.188*** **	**-1.221*** **	**4.913*** **	**5.051*** **		
	(0.0784)	(0.0838)	(0.832)	(0.837)		
OECD to OECD	**-1.427*** **	**-1.428*** **	**9.344*** **	**9.469*** **		
	(0.0961)	(0.0961)	(0.989)	(0.992)		
Non-OECD to OECD	**-0.405*** **	**-0.407*** **	**4.545*** **	**4.553*** **		
	(0.109)	(0.109)	(0.552)	(0.551)		
Ln(distance)	-0.362***	-0.363***	-0.647***	-0.651***		
	(0.0368)	(0.0369)	(0.0437)	(0.0438)		
Contiguity	0.399***	0.399***	0.599***	0.598***		
	(0.0933)	(0.0933)	(0.0918)	(0.0918)		
Common language	0.166**	0.166**	0.0167	0.0155		
	(0.0686)	(0.0686)	(0.0814)	(0.0813)		
Colony ties	0.376***	0.372***	-0.0762	-0.0644		
	(0.141)	(0.141)	(0.173)	(0.173)		
RTA	0.0237	0.0187	-0.0542	-0.0517	0.00556	0.00658
	(0.0703)	(0.0705)	(0.0799)	(0.0799)	(0.0567)	(0.0567)
WTO	0.0701	0.0688	0.359***	0.361***	0.457***	0.458***
	(0.0595)	(0.0594)	(0.0852)	(0.0852)	(0.0754)	(0.0754)
Common currency	0.795***	0.799***	0.163	0.167	0.226**	0.215**
	(0.0969)	(0.0973)	(0.114)	(0.114)	(0.0960)	(0.0960)
Importer ratifies STO	**-0.147***	**-0.163***				
	(0.0801)	(0.0931)				
Exporter ratifies STO	0.237***	0.254***				
	(0.0765)	(0.0916)				
Both ratify STO	-0.0208	-0.0413	0.00223	-0.0436	0.0143	0.0209
	(0.0871)	(0.109)	(0.0650)	(0.0732)	(0.0381)	(0.0439)
Imp ratifies STO x OECD to non-OECD		0.0613		**-0.253** **		**-0.157** **
		(0.113)		(0.103)		(0.0798)
Exp ratifies STO x OECD to non-OECD		-0.0509		0.0286		-0.0820
		(0.103)		(0.0877)		(0.0601)
Both ratify STO x OECD to non-OECD		0.0721		**0.267** **		0.0887
		(0.149)		(0.133)		(0.0988)
Observations	91,673	91,673	91,673	91,673	91,673	91,673
R-squared	0.219	0.219	0.318	0.318	0.069	0.069
Time dummies	YES	YES	YES	YES	YES	YES
Product dummies	YES	YES	YES	YES	NO	NO
Country-and-time dummies	NO	NO	YES	YES	YES	YES
Dyadic-sector fixed effects	NO	NO	NO	NO	YES	YES
Ratification-country group interaction terms	NO	YES	NO	YES	NO	YES
Number of ijk					11,675	11,675

Note: Robust standard errors are in brackets, ***, **, * denotes statistical significance at the 1, 5 and 10 percent level, respectively. The ÄúimporterÄù (or exporter) ratifiesÄù variable is encoded as a dummy variable equal to one if the importer (or exporter) ratifies (independently of what the exporter does) and zero otherwise. The ÄúbothratifyÄù dummy takes the value of one when the two trade partners are ratifier countries in a given year.

Table 12: Full results Stockholm Convention (six-digit disaggregation)

	Gravity variables		Country-time5 dummies		Country-time5 dummies & ijk FE	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**
Ln(GDP) importer	0.610***	0.609***				
	(0.0189)	(0.0189)				
Ln(GDP) exporter	0.921***	0.921***				
	(0.0200)	(0.0200)				
OECD to non-OECD	**-1.247*** **	**-1.209*** **	**5.159*** **	**5.223*** **		
	(0.0811)	(0.0880)	(0.869)	(0.874)		
OECD to OECD	**-1.935*** **	**-1.932*** **	**10.48*** **	**10.38*** **		
	(0.108)	(0.108)	(1.015)	(1.018)		
Non-OECD to OECD	**-1.699*** **	**-1.689*** **	**4.510*** **	**4.459*** **		
	(0.105)	(0.106)	(0.527)	(0.526)		
Ln(distance)	-0.732***	-0.734***	-1.234***	-1.230***		
	(0.0405)	(0.0405)	(0.0473)	(0.0472)		
Contiguity	0.769***	0.768***	0.510***	0.513***		
	(0.132)	(0.132)	(0.128)	(0.128)		
Common language	0.476***	0.474***	0.179**	0.179**		
	(0.0762)	(0.0762)	(0.0794)	(0.0795)		
Colony ties	0.328**	0.311**	0.0220	0.0181		
	(0.154)	(0.153)	(0.171)	(0.171)		
RTA	0.314***	0.319***	0.184**	0.185**	0.0816	0.0825
	(0.0745)	(0.0746)	(0.0784)	(0.0786)	(0.0524)	(0.0525)
WTO	0.146**	0.140**	0.230***	0.225***	0.245***	0.244***
	(0.0613)	(0.0612)	(0.0737)	(0.0738)	(0.0675)	(0.0676)
Common currency	0.869***	0.863***	0.573***	0.542***	0.180	0.132
	(0.158)	(0.158)	(0.146)	(0.146)	(0.111)	(0.111)
Importer ratifies ROT	**0.199*** **	0.126				
	(0.0770)	(0.0874)				
Exporter ratifies ROT	**0.233*** **	**0.384*** **				
	(0.0716)	(0.0839)				
Both ratify ROT	**-0.238*** **	**-0.303*** **	**-0.143** **	**-0.129***	**-0.134*** **	**-0.0778***
	(0.0844)	(0.104)	(0.0611)	(0.0698)	(0.0364)	(0.0449)
Imp ratifies ROT x OECD to non-OECD		**0.256***		-0.00420		-0.0300
		(0.138)		(0.118)		(0.0759)
Exp ratifies ROT x OECD to non-OECD		**-0.346*** **		**-0.216** **		**-0.102***
		(0.0972)		(0.0856)		(0.0591)
Both ratify ROT x OECD to non-OECD		0.0740		-0.0212		-0.117
		(0.166)		(0.142)		(0.0943)
Observations	72,176	72,176	72,176	72,176	72,176	72,176
R-squared	0.311	0.312	0.480	0.480	0.101	0.102
Time dummies	YES	YES	YES	YES	YES	YES
Product dummies	YES	YES	YES	YES	YES	YES
Country-and-time dummies	NO	NO	YES	YES	YES	YES
Dyadic-sector fixed effects	NO	NO	NO	NO	YES	YES
Ratification-country group interaction terms	NO	YES	NO	YES	NO	YES
Number of ijhs6					7,254	7,254

Note: Robust standard errors are in brackets, ***, **, * denotes statistical significance at the 1, 5 and 10 percent level, respectively. The Äúimporter (or exporter) ratifiesÄù variable is encoded as a dummy variable equal to one if the importer (or exporter) ratifies (independently of what the exporter does) and zero otherwise. The Äúboth ratifyÄù dummy takes the value of one when the two trade partners are ratifier countries in a given year.

Table 13: Rotterdam Convention two digits aggregation

	Gravity variables		Country-time5 dummies		Country-time5 dummies & ijk FE	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**
Ln(GDP) importer	0.591***	0.590***				
	(0.0203)	(0.0202)				
Ln(GDP) exporter	0.766***	0.766***				
	(0.0225)	(0.0226)				
OECD to non-OECD	**-1.099*** **	**-1.115*** **	**5.295*** **	**5.470*** **		
	(0.0887)	(0.0946)	(0.776)	(0.784)		
OECD to OECD	**-1.364*** **	**-1.363*** **	**9.727*** **	**9.858*** **		
	(0.108)	(0.108)	(1.032)	(1.038)		
Non-OECD to OECD	**-0.486*** **	**-0.488*** **	**4.521*** **	**4.523*** **		
	(0.122)	(0.122)	(0.683)	(0.683)		
Ln(distance)	-0.309***	-0.310***	-0.604***	-0.607***		
	(0.0412)	(0.0412)	(0.0507)	(0.0507)		
Contiguity	0.374***	0.374***	0.548***	0.548***		
	(0.111)	(0.111)	(0.111)	(0.111)		
Common language	0.123	0.122	-0.000910	-0.00224		
	(0.0801)	(0.0801)	(0.0967)	(0.0966)		
Colony ties	0.421***	0.416***	-0.0679	-0.0559		
	(0.143)	(0.143)	(0.180)	(0.180)		
RTA	0.0350	0.0309	-0.0401	-0.0370	-0.0160	-0.0147
	(0.0784)	(0.0787)	(0.0895)	(0.0896)	(0.0595)	(0.0596)
WTO	0.134**	0.131**	0.409***	0.413***	0.493***	0.497***
	(0.0670)	(0.0668)	(0.0876)	(0.0876)	(0.0787)	(0.0787)
Common currency	0.821***	0.823***	0.155	0.158	0.206**	0.192*
	(0.112)	(0.112)	(0.134)	(0.134)	(0.102)	(0.102)
Importer ratifies STO	-0.138	-0.156				
	(0.0903)	(0.105)				
Exporter ratifies STO	**0.265*** **	**0.302*** **				
	(0.0853)	(0.102)				
Both ratify STO	-0.0148	-0.0382	-0.00893	-0.0451	-0.00331	0.0223
	(0.0975)	(0.122)	(0.0713)	(0.0809)	(0.0398)	(0.0458)
Imp ratifies STO x OECD to non-OECD		0.0731		**-0.280** **		**-0.195** **
		(0.129)		(0.115)		(0.0828)
Exp ratifies STO x OECD to non-OECD		-0.103		0.0142		-0.0412
		(0.113)		(0.0963)		(0.0624)
Both ratify STO x OECD to non-OECD		0.0804		0.253*		0.0420
		(0.167)		(0.150)		(0.102)
Observations	80,720	80,720	80,720	80,720	80,720	80,720
R-squared	0.181	0.181	0.284	0.284	0.075	0.075
Time dummies	YES	YES	YES	YES	YES	YES
Product dummies	YES	YES	YES	YES	NO	NO
Country-and-time dummies	NO	NO	YES	YES	YES	YES
Dyadic-sector fixed effects	NO	NO	NO	NO	YES	YES
Ratification-country group interaction terms	NO	YES	NO	YES	NO	YES
Number of ijhs6					9,862	9,862

Note: Robust standard errors are in brackets, ***, **, * denotes statistical significance at the 1, 5 and 10 percent level, respectively. The Äúimporter (or exporter) ratifiesÄù variable is encoded as a dummy variable equal to one if the importer (or exporter) ratifies (independently of what the exporter does) and zero otherwise. The Äúboth ratifyÄù dummy takes the value of one when the two trade partners are ratifier countries in a given year.

Table 14: Stockholm Convention fourth digits aggregation

	Gravity variables		Country-time5 dummies		Country-time5 dummies & ijk FE	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**
Ln(GDP) importer	0.586***	0.585***				
	(0.0204)	(0.0204)				
Ln(GDP) exporter	0.980***	0.980***				
	(0.0215)	(0.0215)				
OECD to non-OECD	**-1.230*** **	**-1.243*** **	**5.721*** **	**5.773*** **		
	(0.0879)	(0.0967)	(0.878)	(0.884)		
OECD to OECD	**-2.047*** **	**-2.045*** **	**11.04*** **	**10.93*** **		
	(0.117)	(0.117)	(1.015)	(1.019)		
Non-OECD to OECD	**-1.916*** **	**-1.906*** **	**4.412*** **	**4.374*** **		
	(0.113)	(0.114)	(0.511)	(0.512)		
Ln(distance)	-0.832***	-0.835***	-1.366***	-1.362***		
	(0.0421)	(0.0421)	(0.0473)	(0.0473)		
Contiguity	0.883***	0.880***	0.520***	0.522***		
	(0.134)	(0.134)	(0.131)	(0.131)		
Common language	0.616***	0.613***	0.216***	0.217***		
	(0.0815)	(0.0815)	(0.0782)	(0.0782)		
Colony ties	0.298*	0.276	0.106	0.0996		
	(0.176)	(0.175)	(0.190)	(0.191)		
RTA	0.413***	0.417***	0.300***	0.301***	0.102*	0.105*
	(0.0775)	(0.0777)	(0.0779)	(0.0782)	(0.0542)	(0.0542)
WTO	0.231***	0.225***	0.284***	0.281***	0.272***	0.273***
	(0.0662)	(0.0662)	(0.0824)	(0.0825)	(0.0768)	(0.0769)
Common currency	0.564***	0.563***	0.283**	0.243*	0.212*	0.142
	(0.167)	(0.166)	(0.133)	(0.134)	(0.110)	(0.110)
Importer ratifies ROT	**0.177** **	0.0575				
	(0.0820)	(0.0930)				
Exporter ratifies ROT	**0.205*** **	**0.323*** **				
	(0.0777)	(0.0896)				
Both ratify ROT	-0.133	-0.144	**-0.137** **	-0.0869	**-0.119*** **	-0.0602
	(0.0890)	(0.109)	(0.0572)	(0.0653)	(0.0362)	(0.0451)
Imp. ratifies ROT x OECD to non-OECD		**0.412*** **		0.0545		-0.102
		(0.148)		(0.116)		(0.0752)
Exp. ratifies ROT x OECD to non-OECD		**-0.261** **		**-0.218*** **		**-0.171*** **
		(0.105)		(0.0823)		(0.0601)
Both ratify ROT x OECD to non-OECD		-0.101		-0.150		-0.0646
		(0.176)		(0.136)		(0.0923)
Observations	53,268	53,268	53,268	53,268	53,268	53,268
R-squared	0.353	0.354	0.582	0.582	0.139	0.140
Time dummies	YES	YES	YES	YES	YES	YES
Country-and-time dummies	NO	NO	YES	YES	YES	YES
Dyadic-sector fixed effects	NO	NO	NO	NO	YES	YES
Ratification-country group interaction terms	NO	YES	NO	YES	NO	YES
Number of ij					4,888	4,888

Note: Robust standard errors are in brackets, ***, **, * denotes statistical significance at the 1, 5 and 10 percent level, respectively. The Äúimporter (or exporter) ratifiesÄù variable is encoded as a dummy variable equal to one if the importer (or exporter) ratifies (independently of what the exporter does) and zero otherwise. The Äúboth ratifyÄù dummy takes the value of one when the two trade partners are ratifier countries in a given year.

Table 15: Rotterdam Convention. Aggregated imports

	Gravity variables		Country-time5 dummies		Country-time5 dummies & ijk FE	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**	**Ln(Imports)**
Ln(GDP) importer	0.801***	0.801***				
	(0.0284)	(0.0284)				
Ln(GDP) exporter	1.174***	1.174***				
	(0.0300)	(0.0300)				
OECD to non-OECD	**-0.995*** **	**-1.003*** **	**8.622*** **	**8.943*** **		
	(0.133)	(0.141)	(1.255)	(1.265)		
OECD to OECD	**-1.165*** **	**-1.166*** **	**15.53*** **	**15.72*** **		
	(0.159)	(0.159)	(1.733)	(1.743)		
Non-OECD to OECD	**-1.062*** **	**-1.063*** **	**6.458*** **	**6.451*** **		
	(0.183)	(0.182)	(1.194)	(1.199)		
Ln(distance)	-0.477***	-0.478***	-0.908***	-0.910***		
	(0.0562)	(0.0561)	(0.0611)	(0.0611)		
Contiguity	0.597***	0.597***	0.696***	0.699***		
	(0.155)	(0.155)	(0.141)	(0.140)		
Common language	0.393***	0.392***	0.253**	0.252**		
	(0.113)	(0.113)	(0.109)	(0.109)		
Colony ties	0.788***	0.785***	0.0663	0.0817		
	(0.213)	(0.213)	(0.271)	(0.270)		
RTA	0.215**	0.213**	0.0648	0.0706	-0.0573	-0.0537
	(0.106)	(0.106)	(0.107)	(0.107)	(0.0830)	(0.0832)
WTO	0.0602	0.0590	0.393***	0.398***	0.370***	0.377***
	(0.0983)	(0.0980)	(0.130)	(0.130)	(0.117)	(0.117)
Common currency	0.602***	0.603***	0.0750	0.0712	0.162	0.125
	(0.181)	(0.181)	(0.161)	(0.161)	(0.161)	(0.161)
Importer ratifies STO	**-0.260** **	**-0.268***				
	(0.126)	(0.144)				
Exporter ratifies STO	0.0893	0.126				
	(0.117)	(0.140)				
Both ratify STO	0.171	0.141	0.0108	-0.00547	-0.0294	0.0740
	(0.136)	(0.168)	(0.0852)	(0.0961)	(0.0573)	(0.0661)
Imp. ratifies STO x OECD to non-OECD		0.0404		**-0.407*** **		-0.172
		(0.184)		(0.150)		(0.108)
Exp. ratifies STO x OECD to non-OECD		-0.0935		-0.0708		-0.0912
		(0.159)		(0.119)		(0.0844)
Both ratify STO x OECD to non-OECD		0.0859		0.275		-0.159
		(0.234)		(0.188)		(0.134)
Observations	32,562	32,562	32,562	32,562	32,562	32,562
R-squared	0.349	0.349	0.537	0.537	0.111	0.112
Time dummies	YES	YES	YES	YES	YES	YES
Country-and-time dummies	NO	NO	YES	YES	YES	YES
Dyadic-sector fixed effects	NO	NO	NO	NO	YES	YES
Ratification-country group interaction terms	NO	YES	NO	YES	NO	YES
Number of ij					3,346	3,346

Table 16: Stockholm Convention. Aggregated imports