Environmental Lobbying on International Trade in Waste: Theory and Evidence

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Abstract

This paper investigates the role played by environmental lobby groups on international trade in waste, an externality generated by production activities in the global North that can be exported to the South for disposal. A theoretical framework is presented, emphasizing the potential impact of environmental lobbies on environmental and trade policies and how waste trade flows are affected through these policy channels. We show that the politically chosen policies are ambiguous relative to the socially optimal levels, depending on the heterogeneity of environmental preferences and the degree of pollution damages from waste. This in turn leads to ambiguous effects of environmental lobbying on North-to-South waste trade. Bringing theory to empirics using novel data on the bilateral waste trade and the number of environmental NGOs as a proxy for the strength of environmental lobby groups, we exploit two different empirical strategies. The first one is a gravity specification that exploits within-country and cross-country variations. The results show that a 10% increase in the number of environmental NGOs in the North will lower North-to-South waste exports by 3.52%, whereas a similar increase in the South can reduce waste exports by 8.74%. The second one employs a triple difference estimation strategy, which exploits the policy change brought by EU Waste Shipment Regulation (WSR). Evidence shows that environmental lobby groups exert a statistically significant impact on waste exports reduction by EU developed countries. Thus, strengthening environmental NGOs can represent an important strategy in reducing international waste trade.

Keywords: Trade in waste; Environmental lobbying; Political economy; Externality;

JEL Codes: D72, F14, F18, Q53, Q56, Q58

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1 Introduction

Growing waste generation coupled with a highly globalised economy has led to increased volumes of waste being shipped across borders. The global South, in desperate need of the employment and foreign exchange offered by waste trade, have often been targeted by the North as a dumping haven to absorb their excessive waste. However, developing countries are typically ill-equipped to handle the recycling and recovery of material that is often highly toxic, and consequently, much of the waste is dumped or discarded directly into the environment (Kellenberg, 2012). With the shocking sight of towering waste piles in the neighborhoods of developing countries and giant garbage patches floating on the ocean, there is extensive documentation of adverse environmental and public health problems caused by waste.[1]

Along with the environmental degradation happening in the South is the emergence of various environmental lobby groups and their rising impacts in shaping the political landscape (Wapner, 1995; Fredriksson et al., 2005). Galvanised by the growing pace and scale brought by environmental change, environmental lobby groups have increased significantly both in size and strength over the past few decades.[2] They have also become important political actors, extensively participating in all major international trade and environmental negotiations and pressuring national governments and world organizations to take more decisive actions to protect the environment. Large amount of empirical evidence seem to also support that green lobbies play a strong role in determining government policies and achieving better environmental outcomes (Kalt and Zupan, 1984; Cropper et al., 1992; Riddel, 2003; Binder and Neumayer, 2005; Fredriksson et al., 2005). In light of the increasing transboundary waste shipments and given the success of environmental lobbying, this paper examines whether strengthening environmental lobby groups can represent an important strategy in reducing North-to-South waste trade.

To answer this question, we start by developing a theoretical model that captures the role of environmental lobbies in international waste trade. Specifically, we build a

[1] For example, Trafigura, a Dutch oil trading company with additional offices in Great Britain, dumped hundreds of tons of waste at Abidjan, Côte d'Ivoire (Ivory Coast) in 2006, and caused nausea, headaches, vomiting, violent rashes, and even death among thousands of people living near the dump sites. See https://www.business-humanrights.org/en/latest-news/trafigura-lawsuit-re-hazardous-waste-disposal-in-côte-divoire-filed-in-the-netherlands/. More recently in 2019, the dragging Canada-Philippines garbage dispute finally came to an end after Canada agreed to take back its trash sent to Philippines 6 years ago, which were falsely labelled as recyclable scrap but instead contained household waste. Tonnes of rotting refuse have sat festering on the docks of Manila, causing port congestion and posing health hazard risk. See https://www.nytimes.com/2019/05/23/world/asia/philippines-canada-trash.html.

[2] For instance, up to date, the Environmental Defense Fund has an active membership of 2.5 million with operations in 28 countries and operating expenses reaching a record $216 million in 2020. See https://www.edf.org/about. The other leading environmental NGO, Greenpeace, has also expanded massively with national and regional organisations across the world.

political economy model of the kind introduced by Grossman and Helpman (1994) to investigate how green lobbies affect the determination of environmental and trade policies and through these policy channels how waste trade flows are affected . We focus on two representative small open economies that are linked by trade in waste, where waste is modelled as an environmentally harmful byproduct generated during the production process in a developed-country market. This byproduct is tolerated at some level and subjected to a pollution tax domestically, and can be exported to a developing country for disposal with a fee. The developing country may want to restrict some waste imports and thus imposes a tariff rate to avoid the country from becoming a waste dump. In both countries, an organized environmental and industry lobby group with heterogeneous environmental preferences confront the incumbent governments with contribution schedules contingent on the governments' policies on waste. The respective governments then try to balance the competing interests of different lobby groups and choose the policy to maximize a weighted sum of social welfare and campaign contributions received from lobby groups.

We show that the politically chosen tax (tariff) in the North (South) is ambiguous relative to the socially optimal level, depending on the heterogeneity of environmental preferences and the degree of pollution damages from waste. This political distortion arises from two facts: one is that lobby groups offer campaign contributions to an electorally motivated government in exchange for particular political favours (Aidt, 1998), and the other is that lobby groups with heterogeneous environmental attitudes respond differently to various degrees of waste-induced environmental damages. While environmentalists always push for more stringent environmental standards, capitalists typically use their lobbying power to entirely block or slow down any proposed environmental regulations. Because of the relative lower environmental valuation and the additional incentive to reduce the negative policy effect on profits that do not accrue to environmentalists, capitalists will lobby more aggressively for a less stringent policy, which eventually dominates any countervailing efforts from environmentalists. The resulting equilibrium policy level will typically be lower than the socially optimal one. However, if environmental damage caused by waste is significant enough, it will play an increasing role in both lobby groups' welfare calculations, inducing capitalists to diminish their lobbying efforts while triggering a more aggressive response from environmentalists. Consequently, the political equilibrium policy may equal or even overshoot the social optimum.

We then investigate how strengthening green lobbies – as measured by an increase in the number of environmentalists and the joining members' environmental valuation – might affect the policy stringency and by extension firms' decision on waste trade. This can be interpreted as an environmental movement where growing environmental awareness has arguably enabled environmentalists to mobilize more ordinary people to join forces and exert pressure on governments to take more actions. Ambiguous theoretical predictions emerge from the model about the effects of environmental lobbying on waste trade.

We show that when capitalists have a dominating lobbying power that leads to a downward distorted policy that is inefficiently weak, strengthening environmental lobbies will lead to a higher tax (tariff) in the North (South) and thereby result in more (less) waste to be exported from North to South. Indeed, as more people become environmentally concerned and join the green lobbying while the number of capitalists is fixed, this translates into more power exercised by the environmental lobby group. As a result, the government will respond to this boosted political pressure by increasing regulation on the externality. This in turn leads to a higher tax in the North and a higher tariff in the South, where the former increases the cost of disposing waste domestically and thereby induces firms to export more waste out of border for disposal, and the latter effectively deters more waste from being imported. McAusland (2008) draws a similar conclusion, demonstrating that when facing an increased political pressure from lobby groups, regulators have an incentive to increase regulation on pollution that is a by-product of consumption activities and thereby induce firms to export waste to locations with lower environmental regulation. This result resembles the so-called "Green Paradox" (Sinn, 2008; Jensen et al., 2015; Van der Ploeg and Withagen, 2015). Within the waste trade context, a well-intended movement to strengthen environmental protection leads to increased domestic environmental stringency and more waste – often highly toxic– to be shipped to countries that are less equipped to deal with it, possibly exacerbating the environmental damages.

However, in the case where environmentalists lobby more aggressively while capitalists diminish their lobbying efforts that leads to an upward distorted policy that is inefficiently strict, a strengthening of environmental lobby groups may unexpectedly lead to a lower tax (tariff) and result in less (more) North-to-South waste exports . While this result may seem counterintuitive, the main intuition behind it is that we are starting with a situation where the tax or tariff is already set very high, meaning that the marginal benefit for any extra efforts to increase the policy stringency would be very small, but the marginal loss of doing so could be significant. While environmentalists enjoy saving the country from suffering too much environmental damage caused by waste, they also derive utility from consumption. When the extra savings from environmental damages cannot exceed their loss from happiness of consumption, they would like to exchange some environmental protection for more consumption, which relaxes the policy stringency. As the number of the members increases, the desire for the tradeoff also increases, which further reduces the tax or tariff. As the pollution tax in the North decreases, the cost of disposing waste domestically goes down and thereby less waste will be exported to other countries; while a lower tariff rate in the South will induce firms to import more waste. Eventually when all workers become environmentalists, the equilibrium will equal the socially optimal level, leading to a political internalization of the environmental externality (Aidt, 1998).

The model provides us some insights into the relationship between the strength of environmental lobby group, the policy stringency, and firms' decision on waste trade. However, the theory does not yield unambiguous predictions without making any further assumptions. To better understand the role played by environmental lobby group on trade in waste, we take the theory seriously and bring it to data for empirical clarity. Using novel data on the bilateral waste trade and the number of environmental NGOs as a proxy for the strength of environmental lobby groups, we employ two different empirical strategies to identify the effects of environmental lobbying on North-to-South waste exports. The first one is a gravity specification that explores within-country and cross-country variations; the second one uses a triple difference estimation strategy, which exploits the policy change brought by EU Waste Shipment Regulation (WSR).

The gravity estimation results suggest that a strong environmental lobby group in either developed or developing country will result in less North-to-South waste exports. More specifically, a 10% increase in the number of ENGOs in the developed country will lower waste exports by 3.52%, whereas a similar increase in the developing country can reduce waste exports by 8.74%. Exploring differences in waste exports between EU developed countries and non-EU developed countries, before and post the EU-WSR, and in environmental lobbying strength across countries, compelling evidence is found that environmental lobby groups exert a statistically significant impact on waste exports reduction by EU developed countries. These empirical results provide robust evidence that strengthening environmental NGOs can represent an important strategy in reducing international waste trade. Therefore, it may be worthwhile for international donor organizations to provide support for the development of environmental NGOs all over the world (Binder and Neumayer, 2005; Fredriksson et al., 2005).

Our paper contributes to several strands of literature. The first one is to the large literature on the political economy approach of endogenous trade policy[3] that has been later extended to endogenous environmental policy-making (Fredriksson, 1997; Aidt, 1998; Schleich, 1999; Conconi, 2003; Fredriksson et al., 2005; Fünfgelt and Schulze, 2016). However, these studies generally assume that only environmentalists are concerned about the environment or that all individuals have identical environmental preferences, while neglecting the fact that people with the same income may also have heterogeneous preferences for environmental quality. This is particularly true given that we are living in a diverse world where some individuals are serious about environmental protection while others do not care at all. The strength of such feelings for the environment are not correlated with income levels and the diversity of such attitudes is largely considered as a source of social conflict (Cassing and Long, 2021). We add to the literature by incorporating heterogeneous environmental preferences to better reflect the reality, and provide some

[3]See Grossman and Helpman (2020) for a review of the literature.

new insights into the politically distorted equilibrium. Our paper is closely related to Cassing and Long (2021),[4] but extends their work in a number of dimensions: (i) we include a waste-receiving country, whose optimal choice of the tariff rate on imported waste is also governed by a politically determined process; (ii) we relax some of the restrictive assumptions about the ranking of environmental attitudes among lobby groups and show that the politically chosen policy can be even tighter than the socially optimal one if environmental damages caused by waste are large enough; (iii) we demonstrate and discuss explicitly how lobby groups might affect waste trade through the mechanism of a politically determined tax and tariff; and (iv) we bring the theory to data for empirical clarity of the effects of environmental lobbying on trade in waste.

Our research also contributes to the empirical trade literature that examines factors affecting international trade in waste.[5] Previous studies have estimated the effects of various economic factors on transboundary waste shipments, including income and capital-labour ratio (Baggs, 2009), recycling cost (Kellenberg, 2012), environmental regulation (Baggs, 2009; Kellenberg, 2012), wage and population (Higashida and Managi, 2014) and Basel Convention (Kellenberg and Levinson, 2014). However, these econometric analyses are built upon the conventional economic line that governments are benevolent in always maximizing social welfare while ignoring other factors such as lobby groups and political contributions (Goldberg and Maggi, 1999; Gawande and Bandyopadhyay, 2000; Pacca et al., 2021). We contribute to this literature by taking the political economy approach and investigate the role of environmental lobby groups in international waste trade.

Finally, our findings contribute to the policy discussions that aim to reduce transboundary waste shipments. The existing policy approach includes international treaties such as the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal and its subsequent Ban Amendments,[6] the Rotterdam Convention on hazardous chemicals and the Stockholm Convention on persistent organic pollutants, as well as individual countries' own restrictions and environmental regulations.[7] However, ample evidence suggests that these approaches are falling short. Like any other international environmental agreements (IEAs), the above-mentioned treaties also suffer the free-riding problem and some of them are merely seen as an attempt by countries to bolster their international image without active ratification or enforcement. The US, one

[4]While Cassing and Long (2021) assume that individuals have heterogeneous environmental preference within and across different groups, we consider the situation where environmental preference only differs across groups but remains the same within the group, so our case can be considered as a special one of theirs. One reason for doing so is that it allows us to analytically investigate the effect of environmental movement.

[5]For an overview of this literature, see Kellenberg (2015).

[6]See https://www.csis.org/analysis/basel-convention-hazardous-waste-plastic-pollution for a detailed description.

[7]For example, both Canada and the European Union have introduced the extended producer responsibility program, which makes producers accountable for waste disposal costs and responsible for establishing recycling and reuse objectives (Bernard, 2015).

of the largest waste exporters, has yet to sign any of the agreements. Even though many jurisdictions such as Australia, Canada, the UK and the European Union have ratified them, millions of tonnes of waste are still heading their way to developing countries each year. Using annual bilateral waste shipments among countries before and after one of the trading partners ratifies the Basel Convention, Kellenberg and Levinson (2014) find no evidence that the Convention has resulted in less waste being traded. Note that unlike most of the other transboundary pollution problems such as climate change that need global cooperation, the waste problem arises from the fact that the externality is intentionally and consciously packed and shipped anywhere in the world that is willing to accept it. The deliberate and voluntary nature of these actions raises hope for a possible solution. Our paper contributes to the literature by providing the first such evidence of environmental lobbying and highlighting their positive effects on reducing waste trade.

The remainder of the paper is structured as follows. Section 2 presents the theoretical framework. Section 3 provides information on the data and some descriptive statistics. Section 4 illustrates our empirical work and the main results. Finally, Section 5 concludes with a summary of our findings.

2 The theoretical framework

In this section, we present a political economy model with the simplest possible structure that captures much of the essential elements of international trade in waste. We analyze two representative small open economies on the highly-integrated world markets, which thus do not affect the market prices of waste, e.g. consider Canada and the Philippines.[8] This is a sensible assumption which we consider true for most economies in terms of waste trade. Indeed, on the waste supply side, suppliers are fairly competitive in taking the price of waste treatment as given; on the waste demand side, there is considerably more competition as many firms in the developing countries vie for those waste-disposal contracts. We model waste as a production externality generated in the global North that can be exported with a fee to the South for disposal. In both North and South, there is an organized environmental lobby group and industry lobby group, who seek to influence the governments' policies. The governments do not simply maximize social welfare, but balance competing interests in their support-maximizing calculus according to the political influence of different lobby groups (Grossman and Helpman, 1994). We then characterize the political economy equilibrium in each country and compare it with the socially optimal level. Finally, we investigate the effects of environmental lobbying on policy stringency

[8] See Cassing and Kuhn (2003) for the case of market power when both waste-importing and waste-exporting countries act strategically to utilize national environmental policies to attach rents arising from trade in waste.

and how waste trade is affected through the policy channel.

2.1 The North: waste supply

A small open competitive economy in the North has 2 sectors. The first one is a clean sector, which produces a numeraire good using labor only with constant returns to scale and a one-to-one input-output ratio. The other one is a polluting sector that uses capital and labor to produce a manufacturing output according to the neoclassical production function $Y = F(K, L)$ that exhibits constant returns to scale with positive and diminishing marginal products and convex isoquants. During the manufacturing process, a negative externality or by-product called "waste" is generated. For simplicity, we assume that each unit of output is accompanied by a unit of waste, denoted by $E = Y$. Suppose the North can ship $Q \leq Y$ units of its waste to the South at a constant unit price $\mu > 0$. For Q units of waste exported, firms incur a cost $\eta(Q)$ in collecting, sorting as well as packaging and transportation of waste, where η is strictly convex with $\eta(0) = 0, \eta'(Q) > 0$ and $\eta''(Q) > 0$.[9] We assume that the North is endowed with a fixed supply of capital and labor, denoted by $\bar{K}$ and $\bar{L}$, respectively, and that labour is perfectly mobile across sectors and full employment prevails. Suppose the domestic and world prices of the numeraire good are set equal to one, then the economy wide wage rate is fixed at $w = 1$.

The economy is populated by a large number of individuals n, each endowed with $\bar{l}$ units of labor, where $\bar{L} = n\bar{l}$. Each individual i derives utility from consumption of both goods, denoted by a quasi-linear and additively separable utility function:

$$U_i = x_i + u(y_i),$$

where x_i, y_i denotes the consumption of numeraire and manufactured good, respectively, and $u' > 0, u'' < 0$. However, discomfort arises from seeing the pollution caused by waste in the country, so the welfare of individual i is given by

$$W_i(x_i, y_i, Z) = x_i + u(y_i) - \beta_i D(Z),$$

where $D(Z)$ is a positive and convex damage function with $D(0) = 0, D'(Z) > 0, D''(Z) > 0$, $Z = Y - Q$ is the amount of waste or pollution that remains in the country, and β_i denotes individual i's preference for environmental quality. Let $\bar{\beta} = \frac{1}{n}\sum_{i=1}^{n} \beta_i$ represent the society's average environmental preference, then it follows that the social marginal cost of a unit of waste is

$$\frac{\partial \sum_{i=1}^{n} W_i}{\partial Z} = n\bar{\beta}D'(Z).$$

[9] One can also interpret $\eta(Q)$ as the amount of labor that is required for these activities.

Suppose the n individuals in this economy can be categorized into 3 groups. Among them, group 1 consists of $m_1 < n$ individuals who own capital, which we refer to as capitalists. For simplicity, we assume that all the capitalists have the same environmental preference, denoted by $\beta_C \in (0, \bar{\beta}]$, and each of them has an equal endowment of capital, $\bar{K}/m_1$. Group 2 consists of m_2 non-capitalists who share the same strong preference for environmental quality, which we refer to as environmentalists, with $\beta_E \geq \bar{\beta}$. In this paper, we assume that environmentalists are those who care only about local pollution and do not have global concerns – referred to as NIMBYs (not in my backyard). Finally, the remaining m_3 non-capitalists, which we refer to as workers, constitute Group 3, with the same moderate preference for environmental quality at $\beta_W \in [\beta_C, \beta_E]$, but whether β_W is greater than $\bar{\beta}$ or not remains unknown.

Suppose individuals with similar interests can overcome the free-riding problem (Olson, 1965), and are formed as organized lobby groups to further their interest by taking collective action to influence government policies. We adopt the structure of the two-stage common agency game developed by Bernheim and Whinston (1986) and later employed by Grossman and Helpman (1994) on endogenous trade policies. In the first stage of the game, each of the organized groups simultaneously and non-cooperatively offers to the incumbent government a campaign contribution contingent on the pollution tax selected by the government to correct for the externality. While a group who prefers low taxes will always make more political donations the lower is the announced tax, a group that stands to gain in terms of its own welfare with respect to a higher tax will always increase its contributions. Within the context, the not-in-my-back-yard environmentalists will typically push for a higher environmental tax to avoid too much pollution in the country, while capitalists will only lobby for a lower tax if doing so increases their welfare. By definition, individuals in an unorganized group do not have enough stake in the policy outcome and thus make no campaign contributions. In the second stage of the game, the government takes the "announced contribution schedules" as given and choose an environmental tax t on the manufacturing output to maximize a weighted sum of social welfare and its receipt of campaign contributions:

$$\max_t G(t) = \delta J(t) + \sum_{h \in \Lambda} \psi_h(t),$$

where $J(t) = \sum_{i=1}^{n} J_i(t)$ is the aggregate social welfare, $\psi_h(t)$ is the campaign contribution made by organized lobby group $h \in \Lambda$ and $\delta > 0$ is an exogenously given weight that the government attributes to social welfare relative to political contributions.

Finally, the domestic firms will receive a tax refund t for every unit of waste that is being exported, i.e., the government will only tax the pollution that remains within the country. This can be seen as a form of border tax adjustment (Keen and Kotsogiannis, 2014; Cosbey et al., 2020). Another way to interpret this tax refund is that firms will save an equivalent per unit cost of t in administrating these exported waste. As for the remaining tax revenue, the government will distribute it as a lump-sum tax transfer to all the individuals in the economy. Refunding environmental charges back to the polluting industry and consumers are quite often and typically reduces resistance from the polluters, making the policy more politically acceptable than a standard tax. See, for example, the refunded emission payment scheme in Sweden (Sterner and Isaksson, 2006), the carbon tax rebate programs in Canada, and other examples in Aidt (2010).

In the following, we solve the problems of firms, consumers, lobby groups and the government, respectively. First, taking as given the consumer price of the manufactured good p_c, the unit waste absorption fee μ, and the environmental tax t on manufacturing output, which is also the refund per unit of waste exported, each competitive manufacturing firm chooses the input levels (K_j, L_j) and waste export level (Q_j) to maximize its profit:

$$\max_{K_j, L_j, Q_j} \pi_j = (p_c - t)F(K_j, L_j) - wL_j - rK_j + (t - \mu)Q_j - \eta(Q_j),$$

where $w = 1$ is the wage rate and r is the rental rate. With the constant returns to scale assumption and $\sum_j K_j = \bar{K}$, we know that for the manufacturing industry as a whole, the industry's employment of labor L and waste exports Q must be determined by maximizing the aggregate return to the capital stock. Thus, the firms' problem can be reformulated as

$$\max_{L,Q} \Pi = (p_c(t) - t)F(\bar{K}, L) - L + (t - \mu)Q - \eta(Q).$$

Assuming an interior solution, the first order conditions with respect to Q and L are respectively

$$t - \mu = \eta'(Q), \tag{1}$$

and

$$(p_c(t) - t)F_L(\bar{K}, L) = 1, \tag{2}$$

where F_L denotes the marginal product of labor in manufacturing. Equation (1) says that at the optimal waste export level $\hat{Q}$, the marginal benefit must be equal to the marginal cost of exporting waste. As long as $t > \mu$, firms would want to export waste abroad. Equation (2) says that at the optimal labor allocation $\hat{L}$, the value of marginal product of labor is equated to the wage rate. Given $\hat{Q}$ and $\hat{L}$, the maximized aggregate return to capital is

$$\hat{\Pi} = (p_c(t) - t)\hat{Y} - \hat{L} + (t - \mu)\hat{Q} - \eta(\hat{Q}), \quad \text{where } \hat{Y} = F(\bar{K}, \hat{L}).$$

After solving for firms' problem, we now turn to the consumer's problem. Each consumer i is maximizing the utility subject to her budget constraint:

$$\max_{x_i, y_i} [x_i + u(y_i)], \quad s.t. \quad x_i + p_c y_i = M_i,$$

where M_i is the income of consumer i. Every consumer in the economy receives income from two sources: first, she supplies her endowment of labour inelastically to the competitive labour market and thus earns the wage income $w\bar{l}$; second, she receives $1/n$ of the government's net tax revenue $t(\hat{Y} - \hat{Q})$ as a lump sum transfer. However, a capitalist has one additional income source from her endowment of capital, which claims $\frac{\hat{\Pi}}{m_1}$. Therefore, the income of a representative non-capitalist, i.e., environmentalist or worker, is given by

$$M_j = \bar{l} + t(\hat{Y} - \hat{Q})/n, \tag{3}$$

while that of a representative capitalist is

$$M_k = \hat{\Pi}/m_1 + \bar{l} + t(\hat{Y} - \hat{Q})/n. \tag{4}$$

Utility maximization yields the first order condition:

$$u'(y_i) = p_c. \tag{5}$$

Thus, the demand for the manufactured good and numeraire good are respectively:

$$\hat{y}_i = (u')^{-1}(p_c) \equiv \hat{y}(p_c), \quad \hat{x}_i = M_i - p_c \hat{y}_i,$$

and the indirect utility function of consumer i is

$$V_i = M_i - p_c \hat{y}(p_c) + u(\hat{y}(p_c)) = M_i + CS(\hat{y}(p_c)),$$

where $CS(\hat{y}(p_c)) = u(\hat{y}(p_c)) - p_c \hat{y}(p_c)$ is the consumer surplus with

$$\frac{dCS(\hat{y}(p_c))}{dp_c} = -\hat{y}(p_c).$$

The resulting welfare level of consumer i is

$$W_i = M_i + CS(\hat{y}(p_c)) - \beta_i D(\hat{Z}),$$

where $\hat{Z} = \hat{Y} - \hat{Q}$ and M_i is given by equation (3) for a non-capitalist and equation (4) for a capitalist. Therefore, the gross welfare of each group can be expressed as

$$J_1(t) = m_1\left[\hat{\Pi}(t)/m_1 + \bar{l} + t(\hat{Y}(t) - \hat{Q}(t))/n + CS(p_c(t))\right] - m_1\beta_C D(\hat{Y}(t) - \hat{Q}(t)),$$

$$J_2(t) = m_2\left[\bar{l} + t(\hat{Y}(t) - \hat{Q}(t))/n + CS(p_c(t))\right] - m_2\beta_E D(\hat{Y}(t) - \hat{Q}(t)),$$

$$J_3(t) = m_3\left[\bar{l} + t(\hat{Y}(t) - \hat{Q}(t))/n + CS(p_c(t))\right] - m_3\beta_W D(\hat{Y}(t) - \hat{Q}(t)).$$

and the aggregate social welfare is

$$J(t) = n\left[\bar{l} + t(\hat{Y}(t) - \hat{Q}(t))/n + CS(\hat{y}(t))\right] + \hat{\Pi}(t) - n\bar{\beta}D(\hat{Y}(t) - \hat{Q}(t)), \tag{6}$$

where by definition,

$$n\bar{\beta} = m_1\beta_C + m_2\beta_E + m_3\beta_W.$$

Before we proceed to characterize the two-stage subgame perfect equilibrium, it will be useful to derive the socially optimal environmental tax so that we have a benchmark to compare to. Also, it will be helpful to compute the comparative statics of $\hat{L}, \hat{Y}, \hat{Q}, \hat{Z}, \hat{\Pi}$ with respect to t, which constitute a building block to analyze the effects of environmental lobbying on tax and by extension trade in waste. But first note that in equilibrium, the total consumption of the manufactured good must be equal to that sector's total output, i.e.,

$$n\hat{y} = \hat{Y} = F(\bar{K}, \hat{L}) \iff \hat{y} = \frac{\hat{Y}}{n}, \tag{7}$$

and we have

$$\begin{aligned}
\frac{dJ_1}{dt} &= \frac{d\hat{\Pi}}{dt} + \frac{m_1}{n}\left[\hat{Y} - \hat{Q} + t\left(\frac{d\hat{Y}}{dt} - \frac{d\hat{Q}}{dt}\right)\right] + m_1\frac{dCS(p_c)}{dp_c}\frac{dp_c}{dt} - m_1\beta_C D'(\hat{Z})\left(\frac{d\hat{Y}}{dt} - \frac{d\hat{Q}}{dt}\right) \\
&= \left[\frac{dp_c}{dt} - 1\right]\hat{Y} + \hat{Q} + \frac{m_1}{n}\left[\hat{Y} - \hat{Q} + t\left(\frac{d\hat{Y}}{dt} - \frac{d\hat{Q}}{dt}\right)\right] - m_1\frac{\hat{Y}}{n}\frac{dp_c}{dt} - m_1\beta_C D'(\hat{Z})\left(\frac{d\hat{Y}}{dt} - \frac{d\hat{Q}}{dt}\right),
\end{aligned}$$

$$\frac{dJ_2}{dt} = \frac{m_2}{n}\left[\hat{Y} - \hat{Q} + t\left(\frac{d\hat{Y}}{dt} - \frac{d\hat{Q}}{dt}\right)\right] - m_2\frac{\hat{Y}}{n}\frac{dp_c}{dt} - m_2\beta_E D'(\hat{Z})\left(\frac{d\hat{Y}}{dt} - \frac{d\hat{Q}}{dt}\right),$$

$$\frac{dJ_3}{dt} = \frac{m_3}{n}\left[\hat{Y} - \hat{Q} + t\left(\frac{d\hat{Y}}{dt} - \frac{d\hat{Q}}{dt}\right)\right] - m_3\frac{\hat{Y}}{n}\frac{dp_c}{dt} - m_3\beta_W D'(\hat{Z})\left(\frac{d\hat{Y}}{dt} - \frac{d\hat{Q}}{dt}\right),$$

and

$$\begin{aligned}\frac{dJ}{dt} &= \left[\frac{dp_c}{dt} - 1\right]\hat{Y} + \hat{Q} + \left[\hat{Y} - \hat{Q} + t\left(\frac{d\hat{Y}}{dt} - \frac{d\hat{Q}}{dt}\right)\right] - \hat{Y}\frac{dp_c}{dt} - n\bar{\beta}D'(\hat{Z})\left(\frac{d\hat{Y}}{dt} - \frac{d\hat{Q}}{dt}\right)\\ &= \left(t - n\bar{\beta}D'(\hat{Z})\right)\left(\frac{d\hat{Y}}{dt} - \frac{d\hat{Q}}{dt}\right).\end{aligned}$$

2.1.1 Pigovian tax

Without any political considerations, a benevolent government only cares about the aggregate welfare level of its country and thus welfare maximization is the main force that drives the environmental policy decisions. Maximizing (6) with respect to t yields the optimal environmental tax, i.e.,

$$\frac{dJ}{dt} = \left(t - n\bar{\beta}D'(\hat{Z})\right)\left(\frac{d\hat{Y}}{dt} - \frac{d\hat{Q}}{dt}\right) = 0,$$

or

$$t^* = n\bar{\beta}D'(\hat{Z}).$$

That is, the socially optimal or Pigovian tax is equal to the social marginal cost of waste.

2.1.2 Comparative statics with respect to tax

The equilibrium demand for labour in the manufacturing sector, $\hat{L}$, is implicitly given by equation (2): $(p_c(t) - t)F_L(\bar{K}, L) = 1$. This, combined with equation (5): $u'(y_i) = p_c$ and equation (7): $\hat{y} = \frac{\hat{Y}}{n} = \frac{F(\bar{K},\hat{L})}{n}$, yields a unique equation that determines $\hat{L}$ as a function of t:

$$\left[u'\left(\frac{F(\bar{K},\hat{L})}{n}\right) - t\right]F_L(\bar{K},\hat{L}) - 1 = 0. \tag{8}$$

Totally differentiate (8) with respect to $\hat{L}$ and t yields

$$dL\left[u''(\hat{y})\frac{F_L}{n}\cdot F_L + (u'(\hat{y}) - t)F_{LL}\right] + dt\left[-F_L\right] = 0.$$

Since $F_L > 0, F_{LL} < 0, u' > 0, u'' < 0$, we must have

$$\frac{d\hat{L}}{dt} = \frac{F_L}{u''F_L^2/n + F_{LL}/F_L} < 0.$$

Then,

$$\frac{d\hat{Y}}{dt} = F_L\frac{d\hat{L}}{dt} = \frac{F_L^2}{u''F_L^2/n + F_{LL}/F_L} = \frac{1}{u''/n + F_{LL}/F_L^3} < 0.$$

and

$$\frac{dp_c}{dt} = \frac{u''}{n}\frac{d\hat{Y}}{dt} = \frac{u''F_L^2/n}{u''F_L^2/n + F_{LL}/F_L} < 0,$$

with

$$\frac{dp_c}{dt} - 1 = \frac{-F_{LL}/F_L}{u''F_L^2/n + F_{LL}/F_L} = -\frac{1}{\frac{u''}{n}\frac{F_L^3}{F_{LL}} + 1} = -\frac{F_{LL}}{F_L^3}\frac{d\hat{Y}}{dt} < 0.$$

The equilibrium waste exports, $\hat{Q}$, can be implicitly obtained from equation (1): $t - \mu = \eta'(Q)$ as a function of t. Totally differentiate (1) with respect to $\hat{Q}$ and t yields

$$\frac{d\hat{Q}}{dt} = \frac{1}{\eta''(Q)} > 0.$$

Therefore, the equilibrium pollution level is $\hat{Z}(t) = \hat{Y}(t) - \hat{Q}(t)$ with

$$\frac{d\hat{Z}}{dt} = \frac{d\hat{Y}}{dt} - \frac{d\hat{Q}}{dt} < 0.$$

Finally, using the envelope theorem, we can get

$$\frac{d\hat{\Pi}}{dt} = \left[\frac{dp_c}{dt} - 1\right]\hat{Y} + \hat{Q} = \hat{Q} - \hat{Y}\frac{F_{LL}}{F_L^3}\frac{d\hat{Y}}{dt},$$

which can be rearranged as

$$\frac{dp_c}{dt} - 1 = \frac{\frac{d\hat{\Pi}}{dt} - \hat{Q}}{\hat{Y}} < 0. \tag{9}$$

Intuitively, a higher pollution tax increases firms' burden and would typically lead to a lower aggregate industry profits or producer surplus. Thus, by construction,

$$\frac{d\hat{\Pi}}{dt} < 0 \Longleftrightarrow \hat{Q} < \hat{Y}\frac{F_{LL}}{F_L^3}\frac{d\hat{Y}}{dt}.$$

2.1.3 Political economy tax

In this paper, we only consider two organized lobby groups – capitalists and environmentalists, while workers are not organized.[10] We now investigate how the pressure exercised by an environmental and industry lobby group could result in a political economy equilibrium and characterize the government's optimal choice of environmental tax.

The incumbent government's action is the unit pollution tax and the lobby groups' actions are contribution schedules that map each tax policy into a contribution level. The

[10] When all groups are organized, the political economy equilibrium tax is efficient and identical to the Pigovian tax, see e.g., Aidt (1998) or Cassing and Long (2021).

political equilibrium thus consists of a set of feasible contribution functions $(\{\psi_h(t^{**})\}_{h\in\Lambda})$ and the environmental tax policy (t^{**}). Following Bernheim and Whinston (1986), we focus on the interior equilibrium contribution schedules that truthfully reflect the gains expected by the pressure groups such that $\psi_h(t) = J_h(t) - B_h$, where $B_h > 0$ is a constant.[11] Then, t^{**} must be the solution of the problem

$$\max_t \hat{G}(t) = (1+\delta)\Big[J_1(t) - B_1 + J_2(t) - B_2\Big] + \delta J_3(t).$$

The first-order condition yields

$$\frac{d\hat{G}(t)}{dt} = (1+\delta)\left(\frac{dJ_1}{dt} + \frac{dJ_2}{dt}\right) + \delta\frac{dJ_3}{dt} = 0,$$

or

$$\frac{dJ_1}{dt} + \frac{dJ_2}{dt} + \delta\frac{dJ}{dt} = 0.$$

That is,

$$\left[\frac{dp_c}{dt} - 1\right]\hat{Y} + \hat{Q} + \frac{m_1+m_2}{n}\left[\hat{Y} - \hat{Q} + t\left(\frac{d\hat{Y}}{dt} - \frac{d\hat{Q}}{dt}\right)\right] - \frac{m_1+m_2}{n}\hat{Y}\frac{dp_c}{dt}$$

$$-(m_1\beta_C + m_2\beta_E)D'(\hat{Z})\left(\frac{d\hat{Y}}{dt} - \frac{d\hat{Q}}{dt}\right) + \delta\left(t - n\bar{\beta}D'(\hat{Z})\right)\left(\frac{d\hat{Y}}{dt} - \frac{d\hat{Q}}{dt}\right) = 0.$$

This equation reduces to

$$\frac{m_3}{n}\hat{Y}\left[\frac{dp_c}{dt} - 1\right] + \frac{m_3}{n}\hat{Q} + \left(\frac{m_1+m_2}{n}t - (m_1\beta_C + m_2\beta_E)D'(\hat{Z})\right)\left(\frac{d\hat{Y}}{dt} - \frac{d\hat{Q}}{dt}\right)$$

$$+\delta\left(t - n\bar{\beta}D'(\hat{Z})\right)\left(\frac{d\hat{Y}}{dt} - \frac{d\hat{Q}}{dt}\right) = 0.$$

Substitute with equation (9):

$$\frac{dp_c}{dt} - 1 = \frac{\frac{d\hat{\Pi}}{dt} - \hat{Q}}{\hat{Y}},$$

and use the result

$$m_1\beta_C + m_2\beta_E = n\bar{\beta} - m_3\beta_W = \frac{m_1+m_2+m_3}{n}n\bar{\beta} - m_3\beta_W = \frac{m_1+m_2}{n}n\bar{\beta} - \frac{m_3}{n}(n\beta_W - n\bar{\beta}),$$

[11] We do not derive the equilibrium condition here. For a detailed description of the common-agency game, please refer to Bernheim and Whinston (1986) and see Proposition 1 in Grossman and Helpman (1994) for the necessary and sufficient conditions of the subgame-perfect Nash equilibrium.

the equation becomes

$$\frac{m_3}{n}\frac{d\hat{\Pi}}{dt}+\left[\frac{m_1+m_2}{n}t-\left(\frac{m_1+m_2}{n}n\bar{\beta}-\frac{m_3}{n}(n\beta_W-n\bar{\beta})\right)D'(\hat{Z})\right]\left(\frac{d\hat{Y}}{dt}-\frac{d\hat{Q}}{dt}\right)$$

$$+\delta\Big(t-n\bar{\beta}D'(\hat{Z})\Big)\left(\frac{d\hat{Y}}{dt}-\frac{d\hat{Q}}{dt}\right)=0.$$

Define $\lambda_0=\frac{m_1+m_2}{n}$ as the fraction of the population that belong to the organized group, then

$$(1-\lambda_0)\frac{d\hat{\Pi}}{dt}+\left[\lambda_0\Big(t-n\bar{\beta}D'(\hat{Z})\Big)+(1-\lambda_0)(n\beta_W-n\bar{\beta})D'(\hat{Z})\right]\left(\frac{d\hat{Y}}{dt}-\frac{d\hat{Q}}{dt}\right)$$

$$+\delta\Big(t-n\bar{\beta}D'(\hat{Z})\Big)\left(\frac{d\hat{Y}}{dt}-\frac{d\hat{Q}}{dt}\right)=0.$$

Combine terms, we have

$$\frac{d\hat{G}(t)}{dt}=(\lambda_0+\delta)\Big(t-n\bar{\beta}D'(\hat{Z})\Big)\left(\frac{d\hat{Y}}{dt}-\frac{d\hat{Q}}{dt}\right)+(1-\lambda_0)\left[\frac{d\hat{\Pi}}{dt}+(n\beta_W-n\bar{\beta})D'(\hat{Z})\left(\frac{d\hat{Y}}{dt}-\frac{d\hat{Q}}{dt}\right)\right]=0.$$

Thus, when both environmentalists and capitalists are organized, the political economy equilibrium tax t^{**} is characterized by the following equation:

$$\frac{\frac{d\hat{G}(t)}{dt}}{(\lambda_0+\delta)\frac{d\hat{Z}}{dt}}=\Omega\equiv\Big[t-n\bar{\beta}D'(\hat{Z})\Big]+\frac{1-\lambda_0}{\delta+\lambda_0}\left\{(n\beta_W-n\bar{\beta})D'(\hat{Z})+\frac{d\hat{\Pi}}{d\hat{Z}}\right\}=0, \qquad (10)$$

where

$$\frac{d\hat{Z}}{dt}=\frac{d\hat{Y}}{dt}-\frac{d\hat{Q}}{dt}<0,\quad \frac{d\hat{\Pi}}{d\hat{Z}}=\frac{d\hat{\Pi}/dt}{d\hat{Z}/dt}>0.$$

Note that for t^{**} to be a maximum, we need to ensure that the second order condition of the government's maximization with respect to t is negative, i.e.,

$$\frac{d^2\hat{G}(t)}{dt^2}=(\lambda_0+\delta)\frac{d^2\hat{Z}}{dt^2}\Omega+(\lambda_0+\delta)\frac{d\hat{Z}}{dt}\frac{d\Omega}{dt}<0.$$

Since $\Omega=0$ and $\frac{d\hat{Z}}{dt}<0$, we must have

$$\frac{d\Omega}{dt}=1-n\bar{\beta}D''(\hat{Z})\frac{d\hat{Z}}{dt}+\frac{1-\lambda_0}{\delta+\lambda_0}\left((n\beta_W-n\bar{\beta})D''(\hat{Z})\frac{d\hat{Z}}{dt}+\frac{\frac{d^2\hat{\Pi}}{dt}\frac{d\hat{Z}}{dt}-\frac{d\hat{\Pi}}{dt}\frac{d^2\hat{Z}}{dt^2}}{(\frac{d\hat{Z}}{dt})^2}\right)>0.$$

Now, we are ready to compare the outcome of this political equilibrium with the benchmark outcome under a benevolent social planner. Clearly, from equation (10), the political equilibrium tax is indeterminate in size relative to the Pigovian one. If $\beta_W \geq \bar{\beta}$, i.e., the society has a disproportionally large number of capitalists or capitalists have an extremely low environmental valuation, with $D'(\hat{Z}) > 0$ and $\frac{d\hat{\Pi}}{d\hat{Z}} > 0$, then we have $t^{**} < t^* = n\bar{\beta}D'(\hat{Z})$. So the pressure exercised by the lobby groups creates a politically downward distortion of environmental policy that is inefficiently weak. While environmentalists always push for a higher environmental tax, capitalists typically lobby in the opposite direction for a less stringent one. Because of the additional incentive to reduce the negative effect of a higher tax on its profits that do not accrue to environmentalists and the relative lower valuation of environmental damages, the capitalists will lobby more aggressively for the tax that moves in favor of its direction. As a result, the politically determined tax when balancing the opposing effects of an organized environmental lobby group and industry lobby group will be lower than the Pigovian one.

However, if instead, we assume $\beta_C \leq \beta_W < \bar{\beta} \leq \beta_E$ (i.e., the society has a disproportionally large number of environmentalists or environmentalists have an extremely high preference for a clean environment), then $(n\beta_W - n\bar{\beta})D'(\hat{Z}) < 0$ and we may have different cases where the political equilibrium tax is above, equal or less than the Pigovian level. Denote $A \equiv (n\beta_W - n\bar{\beta})D'(\hat{Z}) + \frac{d\hat{\Pi}}{d\hat{Z}}$, then we can rewrite A as

$$\underbrace{(n\beta_W - n\bar{\beta})D'(\hat{Z})\frac{d\hat{Z}}{dt}}_{>0} + \underbrace{\frac{d\hat{\Pi}}{dt}}_{<0},$$

where the first term is the positive effect of tax on social environmental valuations (i.e., savings from environmental damages), and the second term is the negative effect of tax on industry profits. If $D'(\hat{Z})$ is small enough, then $A < 0$ and thus $t^{**} < t^* = n\bar{\beta}D'(\hat{Z})$. The same intuition as earlier applies here. However, if $D'(\hat{Z})$ is large enough, then we may have a situation where the two effects cancelled out or even the former effect dominates, i.e., $A \leq 0$. In this case, we would have $t^{**} \geq t^* = n\bar{\beta}D'(\hat{Z})$. This is because the significant environmental damage caused by waste plays an increasing role in both lobby groups' welfare calculation. From the capitalists' perspective, the loss from environmental damages caused by waste can be so severe as to dominate any profit gains due to a lower tax. As a result, capitalists will diminish their lobbying efforts for a lower tax. Meanwhile, in response to the significant environmental damages, environmentalists will lobby more aggressively for a higher tax. Consequently, the political tax may overshoot the Pigovian level. We can thus summarize these findings in Proposition 1:

Proposition 1. *If group 3 is not organized, when $\beta_W \geq \bar{\beta}$, or $\beta_W < \bar{\beta}$ but $D'(\hat{Z})$ is small enough, the political economy equilibrium tax on the externality is below the Pigovian one. However, when $\beta_W < \bar{\beta}$ and $D'(\hat{Z})$ is large enough, the political tax can be equal or above the Pigovian level.*

It will prove helpful to demonstrate the model and the findings of the above proposition with some specific functional forms and numerical examples. We provide several examples in Appendix A.1 for illustration.

2.1.4 The effects of environmental lobbying on tax and waste exports

In this section, we analyse how a strengthening of environmental lobby group – measured by an increase in the number of environmentalists and the joining members' associated environmental valuation – might impact the environmental tax and by extension firms' decision to export waste. This can be interpreted as a situation where increased environmental awareness has enabled environmentalists to mobilize more ordinary people to join forces and exert pressure on governments to take more actions.

Assume that the number of capitalists (m_1) and the total population (n) are fixed, but more workers (m_3) become environmentalists (m_2) and their associated environmental preference (β_W) also increases to β_E. Given $n = m_1 + m_2 + m_3$, we must have

$$\frac{dm_1}{dm_2} = \frac{dn}{dm_2} = 0, \quad \frac{dm_3}{dm_2} = -1, \quad \frac{d\lambda_0}{dm_2} = \frac{1}{n}$$

$$\frac{d\frac{1-\lambda_0}{\delta+\lambda_0}}{dm_2} = \frac{-\frac{1}{n}(\delta+\lambda_0) - \frac{1}{n}(1-\lambda_0)}{(\delta+\lambda_0)^2} = \frac{-\frac{1}{n}(\delta+1)}{(\delta+\lambda_0)^2} < 0$$

$$\frac{d\beta_C}{dm_2} = \frac{d\beta_W}{dm_2} = \frac{d\beta_E}{dm_2} = 0, \quad \frac{dn\bar{\beta}}{dm_2} = \frac{d(m_1\beta_C + m_2\beta_E + m_3\beta_W)}{dm_2} = \beta_E - \beta_M > 0.$$

It follows that the effect of strengthening environmental lobbying on tax is given by

$$\frac{dt}{dm_2} = \frac{\frac{1+\delta}{\delta+\lambda_0}\frac{1}{m_3}\left[m_3(\beta_E - \beta_W)D'(\hat{Z}) - \left(t - n\bar{\beta}D'(\hat{Z})\right)\right]}{\frac{d\Omega}{dt}}. \tag{11}$$

Proof. See Appendix B. □

Since $\frac{d\Omega}{dt} > 0$, the sign of $\frac{dt}{dm_2}$ is determined by the two terms in the square bracket: $m_3(\beta_E - \beta_W)D'(\hat{Z}(t))$ and $\left(t - n\bar{\beta}D'(\hat{Z})\right)$. Note that $(\beta_E - \beta_W)$ measures how much environmental valuation increases when one worker becomes an environmentalist, so the first term $m_3(\beta_E - \beta_W)D'(\hat{Z}(t)) > 0$ captures the marginal environmental savings from this strengthening of environmental lobby group, or the social marginal benefit of environmental movement, whereas the second term $\left(t - n\bar{\beta}D'(\hat{Z})\right)$ captures the political distortion from the social optimal level, therefore representing the social marginal loss from lobbying.

Suppose we are starting with a situation where $t < n\bar{\beta}D'(\hat{Z})$. This corresponds to the above-mentioned case where the capitalists have a dominating lobby power (i.e., when $\beta_W \geq \bar{\beta}$, or $\beta_W < \bar{\beta}$ but $D'(\hat{Z})$ is small enough), which creates a downward distortion of environmental policy that is inefficiently weak. Since $t - n\bar{\beta}D'(\hat{Z}) < 0$, then the numerator must be positive, so we have

$$\frac{dt}{dm_2} > 0,$$

and by extension,

$$\frac{d\hat{Q}}{dm_2} = \frac{d\hat{Q}}{dt}\frac{dt}{dm_2} > 0.$$

This result is highly intuitive. As more people become environmentally concerned and join the environmental lobbying while the number of capitalists is fixed, this translates into more power exercised by the environmental lobby group. As a result, government will respond to this boosted political pressure by increasing the stringency of environmental policy. This ultimately pushes up the cost of disposing waste domestically, thereby resulting in more waste to be exported to other countries. This conclusion is similar to McAusland (2008), which demonstrates that when facing an increased political pressure exercised by the organized interest groups, regulators have an incentive to increase regulation on pollution that is a by-product of consumption activities and thereby induce firms to export waste to lower environmental regulation locations. Eventually, when environmentalists are able to mobilize all the workers to join force, the resulting equilibrium tax will equate the social optimum.

This finding resembles the so-called "Green Paradox" (Sinn, 2008; Jensen et al., 2015; Van der Ploeg and Withagen, 2015), in which increased environmental stringency leads to accelerated fossil fuel extraction and therefore greater pollution. Similarly, within the waste trade context, a well-intended movement to strengthen environmental protection leads to increased domestic environmental stringency and more waste – often highly toxic– to be shipped to countries that are less equipped to deal with it, possibly exacerbating the environmental damages.

However, if $t > n\bar{\beta}D'(\hat{Z})$, this corresponds to the situation where the environmentalists lobby more aggressively while the capitalists diminish their lobbying efforts (i.e., when $\beta_W < \bar{\beta}$ and $D'(\hat{Z})$ is large enough), creating a upward distorted environmental policy that is inefficiently strict. Now both the terms $m_3(\beta_E - \beta_W)D'(\hat{Z}(t))$ and $t - n\bar{\beta}D'(\hat{Z})$ are positive. If the former exceeds the latter, then still we have

$$\frac{dt}{dm_2} > 0, \quad \frac{d\hat{Q}}{dm_2} = \frac{d\hat{Q}}{dt}\frac{dt}{dm_2} > 0.$$

However, if the former is less than the latter, i.e., $m_3(\bar{\beta}_E - \bar{\beta}_M)D'(\hat{Z}(t)) < \left(t - n\bar{\beta}D'(\hat{Z})\right)$, then we would have

$$\frac{dt}{dm_2} < 0, \quad \frac{d\hat{Q}}{dm_2} = \frac{d\hat{Q}}{dt}\frac{dt}{dm_2} < 0.$$

This is quite surprising as one would expect that a strengthening of environmental lobby groups should always lead to a higher tax. While this result may seem counterintuitive, the main intuition behind it is that we are starting with a situation where the equilibrium tax is already set very high, meaning that the marginal benefit for any extra efforts to increase the environmental stringency would be very small, but the marginal loss of doing so could be significant. While environmentalists enjoys saving the country from suffering too much environmental damage caused by waste, they also derives utility from the consumption of the manufacturing good. When the extra savings from environmental damages cannot exceed their loss from happiness of consumption, they would like to trade off the two and exchange some environmental protection for more consumption, which drives down the tax. As the number of the members increases, the desire for the tradeoff also increases, which further reduces the tax. As the pollution tax decreases, the cost of disposing waste domestically goes down and thereby less waste will be exported to other countries. Eventually when all workers become environmentalists, the equilibrium tax will equate the social optimum level. This result is similar to Aidt (1998) where he demonstrates that the competitive political process and the fact that some lobby groups adjust their economic objectives to reflect environmental concerns will lead to the political internalization of environmental externalities.

We can thus summarize these results in the following proposition:

Proposition 2. *In the political economy equilibrium, if the pollution tax is inefficiently weak, then a strengthening of environmental lobby group will lead to a higher tax and more waste to be exported, resulting in a "waste green paradox". However, if the pollution tax is inefficiently strict and the marginal benefit of environmental movement is less than the marginal loss from lobbying, then strengthening environmental lobbying may result in a lower tax and less waste to be exported.*

Proposition 2 shows that the effect of environmental movement depends on the political equilibrium pollution tax relative to the efficient Pigovian level, which in turn crucially depends on the strength of environmental lobby group and the degree of environmental damages caused by waste. In the following, we will present the waste demand side – a small open economy in the South that imports the waste from the North.

2.2 The South: waste demand

Consider a corresponding small open economy in the South with a very similar structure to that in the North. For notational convenience, the superscript argument, S, is omitted throughout this entire section, but it should be understood that all variables are denoting the South to be distinguished from the North.[12] To focus on trade in waste, we assume that the manufactured good is non-traded and cannot be produced in the South.

[12]For example, the number of population n should be interpreted as n^S, and the environmental preference β_i should be understood as β_i^S, etc.

The South also has two sectors: a clean sector and a waste-disposal sector. Both sectors use labor as the only inputs. The clean sector produces the same numeraire good as North with constant returns to scale but is less productive. The competitive waste-disposal sector offers the North a "waste absorption" service at a constant price $\mu > 0$ per unit of waste imported, but incurs an increasing treatment cost at $C(I)$, where I is the amount of waste imported, with $C'(I) > 0$ and $C''(I) > 0$. We assume that the South is endowed with a fixed supply of labor $\bar{L}$ and labor is perfectly mobile across sectors, and that full employment prevails. Thus, labour becomes irrelevant in firms' problem, and in terms of the conventional trade model, the North exports the numeraire good, and imports the South's waste disposal service.

The economy is also populated by a large number of individuals n, each endowed with $\bar{l}$ units of labor, where $\bar{L} = n\bar{l}$. Each individual i derives utility from the consumption of the numeraire good x_i, but the imported waste itself or the waste treatment process causes environmental damages $D(I)$, so the welfare of individual i is given by

$$W_i(x_i, I) = U(x_i) - \beta_i D(I) = x_i - \beta_i D(I),$$

where for simplicity $U(x_i)$ is assumed to be linear in x_i, and $D(0) = 0, D'(I) > 0, D''(I) > 0$, and β_i denotes individual i's preference for a clean environment. Denote $\bar{\beta} = \frac{1}{n}\sum_{i=1}^{n} \beta_i$, then it follows that the social marginal cost of waste is given by

$$\frac{d\sum_{i=1}^{n} W_i}{dI} = n\bar{\beta}D'(I).$$

Among the n individuals in the economy, $m_1 < n$ capitalists own the waste-disposal factories and for simplicity, we assume that each capitalist owns only one waste-disposal factory; m_2 environmentalists have strong preferences for environmental quality, with the remaining $m_3 = n - m_1 - m_2$ workers having moderate preferences for environmental quality. Let β_C, β_E and β_W denote the environmental preference for each capitalist, environmentalist and worker, respectively, with $\beta_C \leq \beta \leq \beta_E$ and $\beta_W \in [\beta_C, \beta_E]$, but whether β_W is larger than $\bar{\beta}$ remains unknown. Suppose capitalists and environmentalists can overcome the free-riding problem and are formed as organized lobby groups to further their interest by taking collective actions to influence the government's policies. Within the context, the government imposes an ad valorem tariff rate τ on the imported waste to avoid the country from becoming a garbage dump and distributes all the tariff revenue to its citizens as a lump sum transfer. Following Grossman and Helpman (1994), we adopt the structure of a two-stage common agency game between the lobbies and the government. In the first stage, each of the organized lobby groups confronts the incumbent government with contribution schedules, $\psi_h(\tau)$, that are contingent on the government's choice of tariff rate on waste, while ordinary workers are not organized and do not take any actions. In the second stage, the government takes the announced contribution schedules as given and chooses τ to maximize a weighted sum of social welfare $J(\tau)$ and its receipt of campaign contributions:

$$\max_{\tau} G(\tau) = \delta J(\tau) + \sum_{h \in \Lambda} \psi_h(\tau),$$

where $\delta > 0$ is an exogenously given weight that the government places on the aggregate social welfare relative to total campaign contributions.

Taking as given the per unit waste disposal fee μ and the tariff rate τ on the imported waste, the waste-disposal firms must decide on how much waste to be imported, so firms solve the following profit maximization problem

$$\max_{I > 0} \Pi = (1 - \tau)\mu I - C(I).$$

The first order condition with respect to I yields

$$(1 - \tau)\mu = C'(I), \tag{12}$$

which says that at the optimal waste import level $\hat{I}(\tau)$, the marginal benefit must be equal to the marginal cost of importing waste. The equilibrium waste demand, $\hat{I}$, can thus be implicitly expressed as a function of τ. Totally differentiate (12) with respect to $\hat{I}$ and τ yields

$$\frac{d\hat{I}}{d\tau} = -\frac{\mu}{C''(I)} < 0.$$

Given $\hat{I}(\tau)$, the maximized aggregate profit of waste-disposing firms is

$$\hat{\Pi}(\tau) = (1 - \tau)\mu \hat{I}(\tau) - C(\hat{I}(\tau)).$$

Each consumer derives income from working at either sector and receives an equally distributed lump-sum government transfer of the tariff revenue, but an capitalist earns an extra income from the ownership of the waste-disposal factories. Therefore, the income of a representative capitalist is

$$M_k = \hat{\Pi}/m_1 + \bar{l} + \tau\mu\hat{I}/n,$$

and the income of a representative non-capitalist is

$$M_j = \bar{l} + \tau\mu\hat{I}/n.$$

Given the linearity of the utility function, the welfare of each group is thus

$$J_1(\tau) = m_1\left[\hat{\Pi}(\tau)/m_1 + \bar{l} + \tau\mu\hat{I}(\tau)/n\right] - m_1\beta_C D(\hat{I}(\tau)),$$

$$J_2(\tau) = m_2\left[\bar{l} + \tau\mu\hat{I}(\tau)/n\right] - m_2\beta_E D(\hat{I}(\tau)),$$

$$J_3(\tau) = m_3\left[\bar{l} + \tau\mu\hat{I}(\tau)/n\right] - m_3\beta_W D(\hat{I}(\tau)),$$

and the social welfare is the sum of the three groups:

$$J(\tau) = \sum_{i=1}^{3} J_i(\tau) = \bar{L} + \tau\mu\hat{I}(\tau) + \hat{\Pi}(\tau) - n\bar{\beta}D(\hat{I}(\tau)),$$

where by definition,

$$n\bar{\beta} = m_1\beta_C + m_2\beta_E + m_3\beta_W.$$

Note that

$$\frac{dJ_1}{d\tau} = \frac{d\hat{\Pi}(\tau)}{d\tau} + \frac{m_1\mu}{n}\left(\hat{I}(\tau) + \tau\frac{d\hat{I}(\tau)}{d\tau}\right) - m_1\beta_C D'(\hat{I}(\tau))\frac{d\hat{I}(\tau)}{d\tau},$$

$$\frac{dJ_2}{d\tau} = \frac{m_2\mu}{n}\left(\hat{I}(\tau) + \tau\frac{d\hat{I}(\tau)}{d\tau}\right) - m_2\beta_E D'(\hat{I}(\tau))\frac{d\hat{I}(\tau)}{d\tau},$$

$$\frac{dJ_3}{d\tau} = \frac{m_3\mu}{n}\left(\hat{I}(\tau) + \tau\frac{d\hat{I}(\tau)}{d\tau}\right) - m_3\beta_W D'(\hat{I}(\tau))\frac{d\hat{I}(\tau)}{d\tau},$$

$$\frac{d\hat{\Pi}(\tau)}{d\tau} = -\mu\hat{I}(\tau) + \left[(1-\tau)\mu - C'(\hat{I}(\tau))\right]\frac{d\hat{I}(\tau)}{d\tau} = -\mu\hat{I}(\tau) < 0,$$

and thus

$$\begin{aligned}\frac{dJ}{d\tau} &= \frac{d\hat{\Pi}(\tau)}{d\tau} + \mu\left(\hat{I}(\tau) + \tau\frac{d\hat{I}(\tau)}{d\tau}\right) - n\bar{\beta}D'(\hat{I}(\tau))\frac{d\hat{I}(\tau)}{d\tau} \\ &= \left(\mu\tau - n\bar{\beta}D'(\hat{I}(\tau))\right)\frac{d\hat{I}(\tau)}{d\tau}.\end{aligned}$$

2.2.1 Social optimal tariff

Without any political distortion, a benevolent government chooses the tariff rate to maximize the aggregate social welfare, i.e.,

$$\frac{dJ(\tau)}{d\tau} = \left(\mu\tau - n\bar{\beta}D'(\hat{I}(\tau))\right)\frac{d\hat{I}(\tau)}{d\tau} = 0,$$

which yields

$$\tau^* = \frac{n\bar{\beta}D'(\hat{I})}{\mu}.$$

Note that μ is the waste disposal price the North has to pay to the South for each unit of waste imported and $n\bar{\beta}D'(\hat{I})$ is the social marginal cost of waste. That is, the social optimal tariff rate is equal to ratio of the marginal social cost of waste over the private marginal cost of waste.

2.2.2 Political economy tariff

In this section, we investigate how the pressure exercised by an organized environmental and industry lobby group could result in a political economy equilibrium and characterize the government's optimal choice of the tariff rate on waste. Following Bernheim and Whinston (1986), we focus on the interior equilibrium contribution schedules that truthfully reflect the gains expected by the pressure groups such that $\psi_h(\tau) = J_h(\tau) - B_h$, where $B_h > 0$ is a constant. Then, τ^* must be the solution of the problem

$$\max_{\tau} \hat{G}(\tau) = \delta J(\tau) + \Big[J_1(\tau) - B_1 + J_2(\tau) - B_2\Big].$$

The first-order condition yields

$$\frac{d\hat{G}(\tau)}{d\tau} = \frac{dJ_1}{d\tau} + \frac{dJ_2}{d\tau} + \delta\frac{dJ}{d\tau} = 0.$$

That is,

$$-\mu\hat{I}(\tau) + \frac{(m_1+m_2)\mu}{n}\left(\hat{I}(\tau) + \tau\frac{d\hat{I}(\tau)}{d\tau}\right) - (m_1\beta_C + m_2\beta_E)D'(\hat{I}(\tau))\frac{d\hat{I}(\tau)}{d\tau}$$

$$+\delta\Big(\mu\tau - n\bar{\beta}D'(\hat{I}(\tau))\Big)\frac{d\hat{I}(\tau)}{d\tau} = 0.$$

Use the result of

$$m_1\beta_C + m_2\beta_E = n\bar{\beta} - m_3\beta_W = \frac{m_1+m_2+m_3}{n}n\bar{\beta} - m_3\beta_W = \frac{m_1+m_2}{n}n\bar{\beta} - \frac{m_3}{n}(n\beta_W - n\bar{\beta}),$$

the equation reduces to

$$-\frac{m_3}{n}\mu\hat{I}(\tau) + \left[\frac{m_1+m_2}{n}\mu\tau - \left(\frac{m_1+m_2}{n}n\bar{\beta} - \frac{m_3}{n}(n\beta_W - n\bar{\beta})\right)D'(\hat{I}(\tau))\right]\frac{d\hat{I}(\tau)}{d\tau}$$

$$+\delta\Big(\mu\tau - n\bar{\beta}D'(\hat{I}(\tau))\Big)\frac{d\hat{I}(\tau)}{d\tau} = 0.$$

Define

$$\lambda_0 = \frac{m_1 + m_2}{n}, \quad 1 - \lambda_0 = \frac{m_3}{n},$$

then we have

$$-(1-\lambda_0)\mu\hat{I}(\tau) + \left[\lambda_0\Big(\mu\tau - n\bar{\beta}D'(\hat{I}(\tau))\Big) + (1-\lambda_0)(n\beta_W - n\bar{\beta})D'(\hat{I}(\tau))\right]\frac{d\hat{I}(\tau)}{d\tau}$$

$$+\delta\Big(\mu\tau - n\bar{\beta}D'(\hat{I}(\tau))\Big)\frac{d\hat{I}(\tau)}{d\tau} = 0.$$

Combine terms, then

$$\frac{d\hat{G}(\tau)}{d\tau} = (1-\lambda_0)\left[-\mu\hat{I}(\tau) + (n\beta_W - n\bar{\beta})D'(\hat{I}(\tau))\frac{d\hat{I}(\tau)}{d\tau}\right] + (\lambda_0+\delta)\Big(\mu\tau - n\bar{\beta}D'(\hat{I}(\tau))\Big)\frac{d\hat{I}(\tau)}{d\tau} = 0.$$

Therefore, when both environmentalists and capitalists are organized, the political economy equilibrium tariff rate τ^{**} is characterized by the following equation:

$$\frac{\frac{d\hat{G}(\tau)}{d\tau}}{(\lambda_0+\delta)\frac{d\hat{I}}{d\tau}} = \Omega \equiv \left[\mu\tau - n\bar{\beta}D'(\hat{I})\right] + \frac{1-\lambda_0}{\delta+\lambda_0}\left[(n\beta_W - n\bar{\beta})D'(\hat{I}) + \frac{d\hat{\Pi}}{d\hat{I}}\right] = 0, \qquad (13)$$

where

$$\frac{d\hat{\Pi}}{d\hat{I}} = \frac{\frac{d\hat{\Pi}(\tau)}{d\tau}}{\frac{d\hat{I}(\tau)}{d\tau}} = \frac{-\mu\hat{I}(\tau)}{\frac{d\hat{I}(\tau)}{d\tau}} > 0.$$

Note that for τ^{**} to be a maximum, we need to ensure that the second order condition of the government's maximization with respect to τ is negative, i.e.,

$$\frac{d^2\hat{G}(\tau)}{d\tau^2} = (\lambda_0+\delta)\frac{d^2\hat{I}}{d\tau^2}\Omega + (\lambda_0+\delta)\frac{d\hat{I}}{d\tau}\frac{d\Omega}{d\tau} < 0.$$

Since $\Omega = 0$ and $\frac{d\hat{I}}{d\tau} < 0$, we must have

$$\frac{d\Omega}{d\tau} = \mu - n\bar{\beta}D''(\hat{I})\frac{d\hat{I}}{d\tau} + \frac{1-\lambda_0}{\delta+\lambda_0}\left((n\beta_W - n\bar{\beta})D''(\hat{I})\frac{d\hat{I}}{d\tau} + \frac{\frac{d^2\hat{\Pi}}{d\tau}\frac{d\hat{I}}{d\tau} - \frac{d\hat{\Pi}}{d\tau}\frac{d^2\hat{I}}{d\tau^2}}{(\frac{d\hat{I}}{d\tau})^2}\right) < 0.$$

Up to now, equation (13) should look very familiar. Clearly, the political chosen tariff rate is ambiguous relative to the socially optimal tariff rate. Following our earlier discussion for the tax in North, we can directly summarize the relationship between the political economy equilibrium tariff and the social optimal one in the following proposition.

Proposition 3. *If group 3 is not organized, when $\beta_W \geq \bar{\beta}$, or $\beta_W < \bar{\beta}$ but $D'(\hat{I})$ is small enough, the political economy equilibrium tariff on the imported externality is below the social optimal one.*

However, when $\beta_W < \bar{\beta}$ and $D'(\hat{I})$ is large enough, the political tariff can be equal or above the social optimum.

In the former case, because of the relative lower valuations for environmental damages and the additional incentive to counter the negative impact of higher tariff rate on profits that is missing in environmentalists' welfare calculation, the capitalists will launch massive lobbying blitz for a lower tariff, which eventually dominates any countervailing efforts from environmentalists. In the latter case, the significant environmental damages caused by imported waste play a much bigger role in both groups' welfare consideration, inducing capitalists to diminish their lobbying efforts for a lower tariff, while triggering a more aggressive lobbying response by environmentalists for a higher tariff. The resulting tariff rate can thus be equal or higher than the social optimum. We illustrate the above findings with some specific functional forms and numerical examples in Appendix A.2.

2.2.3 The effects of environmental lobbying on tariff and waste imports

In this section, we analyse how the environmental movement might impact the import tariff and by extension firms' decision to import waste. Following our conclusion from North, it's not hard to obtain the effect of environmental lobbying on tariff as

$$\frac{d\tau}{dm_2} = \frac{\frac{1+\delta}{\delta+\lambda_0}\frac{1}{m_3}\left[m_3(\beta_E - \beta_W)D'(\hat{I}) - \left(\mu\tau - n\bar{\beta}D'(\hat{I})\right)\right]}{\frac{d\Omega}{d\tau}},$$

and we can observe the following:

Proposition 4. *In the political economy equilibrium, if the import tariff is inefficiently weak, then a strengthening of environmental lobby group will lead to a higher tariff and result in less waste to be imported. However, if the import tariff is inefficiently strict and the marginal benefit of environmental movement is less than the marginal loss from lobbying, then strengthening environmental lobbying may result in a lower tariff and more waste to be imported.*

In the former case, as more people become environmentally concerned and join the environmental lobbying while the number of capitalists is fixed, this translates into more power exercised by the environmental lobby group. As a result, government will respond to this boosted political pressure by increasing the tariff rate, which effectively deters more waste to be imported. In the latter case, we are starting with a situation where the tariff is already set very high, which means that the marginal benefit for any extra efforts to increase the tariff would be very small, but the marginal loss of doing so could be significant. When the extra savings from environmental damages cannot exceed their loss of income (or utility from consumption), environmentalists would like to sacrifice some environmental protection for more income, which pushes down the tariff rate. As the number of the members increases, the desire for the tradeoff also increases, which further reduces the tariff. As the tariff decreases, more waste will be imported. Eventually when all workers become environmentalists, the equilibrium tariff rate will be equal to the social optimum, leading to a political internalization of environmental externality (Aidt, 1998).

3 Data and descriptive statistics

The simple model presented above provides us some insights on the relationship between the strength of the environmental lobby group, the policy stringency and firms' decision on waste exports or imports. However, the theory does not give unambiguous predictions without making any further assumptions. To better understand the role played by environmental lobby groups on trade in waste, we take the theory seriously and bring it to data for empirical clarity. We build the sample for our empirical analysis from a variety of sources. Below is a detailed description on how each variable is sourced and constructed.

3.1 Waste exports

We retrieve information of waste exports between country pairs from the UN Comtrade database for the periods of 1992 to 2019. The bilateral waste data can date back to 1962 from this database. However, the Harmonized System (HS) Codes for commodity classification was not uniformly adopted until 1992. Even though several countries retrospectively reported trade data from prior years using the 1992 HS codes, we believe many countries didn't and this may yield inconsistencies on the description of the product traded and result in measurement errors. Thus, we choose to start with the year 1992. Another reason is that environmental protectionism hasn't become pronounced until more recently.

An alternative source of waste trade data is the Basel Convention, whose goal was to reduce shipments of hazardous waste to countries that were unable to safely and adequately dispose of it. Under the rules of the Convention, member countries are required to self-report data on their shipments of hazardous waste to the Basel Convention Secretariat each year. This self-reported hazardous waste trade data has been used by Baggs (2009) to explore the role that differences in the size of the economy (measured by GDP), capital/labor ratios, and GDP per capita (proxy for regulatory stringency) across countries play in determining bilateral trade in hazardous waste. But as Kellenberg (2012) has pointed out, including only hazardous waste defined under the classification of the Basel Convention may miss a large proportion of other waste categories that may seem harmless but pose severe environmental and health consequences when disposed improperly. Also, countries may have an incentive to under-report the true extent of hazardous waste shipments, particularly when being shipped to low environmental regulation countries

(Kellenberg, 2012).

Following Kellenberg (2012) and Kellenberg and Levinson (2014), we define waste exports as all six-digit HS categories where waste and/or scrap are the only categorization of a product in the UN Comtrade database. Upon searching the key words "waste", "scrap", "slag", "residue", and "ash" as the primary descriptors of the product in the six-digit HS codes, we obtain the waste exports for a total of 87 categories, which can be found in Table C1 of Appendix C. For each of the 87 waste products, there are two measures of trade between country-pairs – the total weight (in kg) and the total value (in US dollars). We use the size of waste as the main observation suggested by the model, and then sum up the total weight of waste traded between country-pairs across all 87 HS categories, yielding the aggregate waste exports between country pairs for each year. This comprises our original waste trade dataset of 196 countries for 28 years.

3.2 Environmental lobbying strength

There is no direct measure for the strength of environmental lobby groups within a country, which largely depends on the active membership base and financial resources. However, data is not readily available for the budget and membership numbers of many environmental lobby groups, and attempting to collect this information for a cross-country time-series study is prohibitively difficult. We choose to use the number of environmental NGOs as a proxy, c.f. Binder and Neumayer (2005); Fredriksson et al. (2005). However, unlike the cross-country approach taken by Fredriksson et al. (2005) that focuses on a specific year and the panel study of Binder and Neumayer (2005) that focuses on a limited set of countries with time dimension covering 1977-1988 for which environmental protectionism hasn't become pronounced, we provide a novel dataset that covers a large number of countries with more recent time periods that better capture the growing trend of global environmental awareness.

More specifically, we derive information on the number of environmental NGOs in a given country from two independent sources – *The Directory* and *The Encyclopedia*. *The Directory*, first released by the Sierra Club in 1973 and published regularly thereafter, provides basic information on governmental and nongovernmental environmental organizations across the world, including name, address, contact information, and founding date. Organizations listed in the Directory include citizens' environmental groups, environmentally oriented development organizations, and academic research centers involved in either environmental policy work or information dissemination. We then document the number of environmental NGOs for each country given the available information from this source. *The Encyclopedia* includes a broad range of nongovernmental organizations from around the world, which is documented in the Gale Group's Associations Unlimited database

(Gale, 2001, 2012). We use Gale's keywords to identify groups that have an environmental focus, which gives us another dataset of environmental NGOs. We then combine these two data sets, filling in any missing information from either source and correcting for any mismatch between the two sources. This yields a final coverage of 213 countries from 1971 to 2011 on environmental NGOs.[13]

3.3 Control variables

The focus of this paper is to examine the effects of environmental lobbying on North-to-South waste trade. We control for other factors that may also affect trade in waste. The control variables might include a set of time-varying country specific characteristics as well as time-invariant bilateral trade characteristics that are all potentially correlated with both waste trade flows among country pairs and the probability that more people become environmentalists. Examples might include (i) the industry lobbying strength and population as suggested by the model; (ii) the traditional gravity variable – GDP that captures the scale effect – as larger countries typically generate larger volumes of waste and have more available disposal capacity, and thus more waste should be traded; (iii) geographic and cultural factors such as bilateral distance between country pairs, whether countries share a common border, a common official language, and have ever had colonial ties, to proxy trade costs; (iv) trade facilitation factors such as whether both countries are members of the WTO or in some regional trade agreements; (v) capital-labor ratios in Baggs (2009) that reflect the technological capabilities of the recycling sectors across countries; (vi) whether both countries ratified the Basel Convention (Kellenberg and Levinson, 2014), which is aimed at reducing trade in hazardous waste to countries that were unable to safely and adequately recycle or dispose of it.

There is no direct measure for the countervailing effects of the industry lobby group within a country. Similar to Binder and Neumayer (2005), we choose to employ the commercial energy use (kg of oil equivalent per capita) as a proxy. This data along with other country-specific characteristics including GDP, population and labour force are obtained from the World Development Indicators Database, which covers 264 countries from 1960 to 2020. The capital stock data is sourced from International Monetary Fund (IMF), which provides three types of capital stock – general government capital stock, private capital stock and public-private partnership capital stock – over the period of 1960-2019 for 170 countries.[14] We then derive the aggregate country-level capital stock by summing up these three types, and divide it by the labour force to get the capital-labour

[13] I am deeply indebted to Professor Wesley Longhofer from Emory University for sharing his Environmental NGO data with me. For a more detailed description of some of the data limitations, please refer to Longhofer and Schofer (2010) and Longhofer et al. (2016).

[14] See https://data.imf.org/?sk=1CE8A55F-CFA7-4BC0-BCE2-256EE65AC0E4.

ratio across countries.

Bilateral variables such as geographical distance between country pairs, and dummy variables indicating whether country pairs share a common border, a common official language, or have ever had colonial ties are directly obtained from the CEPII website, which consists of 224 unique bilateral country pairs.[15] Data on Basel Convention ratification status comes from the Basel Convention website, which includes a total of 188 signatories with only Haiti and the USA as the two exceptions.[16] Data on WTO membership is directly taken from the WTO website, which covers information on 164 members and 25 observers.[17] Data on whether a bilateral country-pair was in one of the regional trade agreements was obtained from Prof. Mario Larch's website, which covers all multilateral and bilateral regional trade agreements (RTA) as notified to the World Trade Organization for the last 70 years from 1950 to 2019 between 280 country-pairs.[18] Then three respective dummy variables to indicate whether both countries are ratified members of the Basel Convention, members of the WTO, and in some regional trade agreements in year t are constructed.

3.4 Waste trade trends and evolution of environmental NGOs

Having obtained all the data that is needed for our empirical analysis and considering the limitations of each dataset, we focus on 122 countries that had at least some positive quantity of waste trade for the period from 1992 to 2011. Our main concern is the growing waste shipments from developed countries to developing countries that are incapable to disposal waste in a sound way. Thus, it is important to distinguish between developed and developing countries. However, there is no commonly agreed definition of developed and developing country status in the literature. To identify whether a country belongs to a developed or developing country, we follow the IMF's definition of country status and categorize an advanced economy as the developed country while consider an emerging economy or developing economy as the developing country.[19] We end up with 35 developed countries and 87 developing countries in our sample, documented in Table C2 of

[15] See the dist-cepii.dta data file, http://www.cepii.fr/anglaisgraph/bdd/distances.htm.

[16] See http://www.basel.int/Countries/StatusofRatifications/PartiesSignatories/tabid/4499/Default.aspx

[17] See https://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm.

[18] See https://www.ewf.uni-bayreuth.de/en/research/RTA-data/index.html.

[19] IMF takes several different factors into account when determining whether a nation is an advanced economy, an emerging market and developing economy, or a low-income developing country. The main three criteria are: (1) per capita income level, (2) export diversification – so oil exporters that have high per capita GDP would not make the advanced classification because around 70% of its exports are oil, and (3) degree of integration into the global financial system. For details, please see https://www.imf.org/external/pubs/ft/weo/faq.htm.

Appendix C.[20]

The complex annual data on waste volumes shipped in each direction between each pair of countries, differentiated by country status, reveal a number of interesting and stark facts about international trade in waste. There are two types of exporters and importers (developed versus developing), yielding 4 different types of annual waste shipments. As described in Table 1, a total of 2.9 billion tonnes of waste were shipped among countries over the 20-year period from 1992 to 2011. More than half of this waste trade were among developed countries themselves, whereas developed to developing waste shipments constituted the second largest component with one quarter of the trade volume. As for the shipments from developing countries (Column 4 and 5), they only made up for a small proportion of the total waste trade. In fact, international trade in waste has been growing so much that these cross-section differences in Table 1 may be obscured by the overall growth. Figure 1 plots the total annual waste exports between country pairs, which shows that the global waste trade has grown substantially from 1992 to 2011. Although waste trade among developed countries has been steadily increasing over the years, it is not hard to observe that much of the world growth should be attributed to shipments from developed to developing countries – the ones that are most concerning.

Table 1: Waste shipments among country pairs from 1992 to 2011

	All	D to D	D to U	U to D	U to U
Total (million tonnes)	2922.18	1,529.75	848.76	262.15	281.53
Annual average (million tonnes)	146.11	76.49	42.44	13.11	14.08
	(73.85)	(28.01)	(33.72)	(6.51)	(9.79)

Note: Based on Author's own calculations from the UN Comtrade data. D and U refer to developed and developing countries, respectively. Standard deviation in parentheses.

These stylized facts have highlighted the important role of North-to-South waste trade in the global system. To get a better idea of where waste has been shipped, we document in Table 2 the largest waste exporters and importers by aggregate volume from 1992 to 2011. Table 2a shows that the top 10 waste exporters make up more than 70% of all waste exported worldwide. Among them, 9 are developed countries with Russia as the only exception being an developing country. Perhaps more surprisingly is a similar trend observed in Table 2b. With the only exception of China and Turkey, all of the top 10 waste importers are also developed countries, which account for a total of 42.5% of global waste imported. Contrary to the common but somewhat misleading belief that developing

[20]In many other classifications, EU member countries such as Poland and Hungary will be typically considered as developed, but this is not the case according to the IMF standard. Nevertheless, we conduct several robustness check with the inclusion of these two countries as developed countries and our regression results remain very robust.

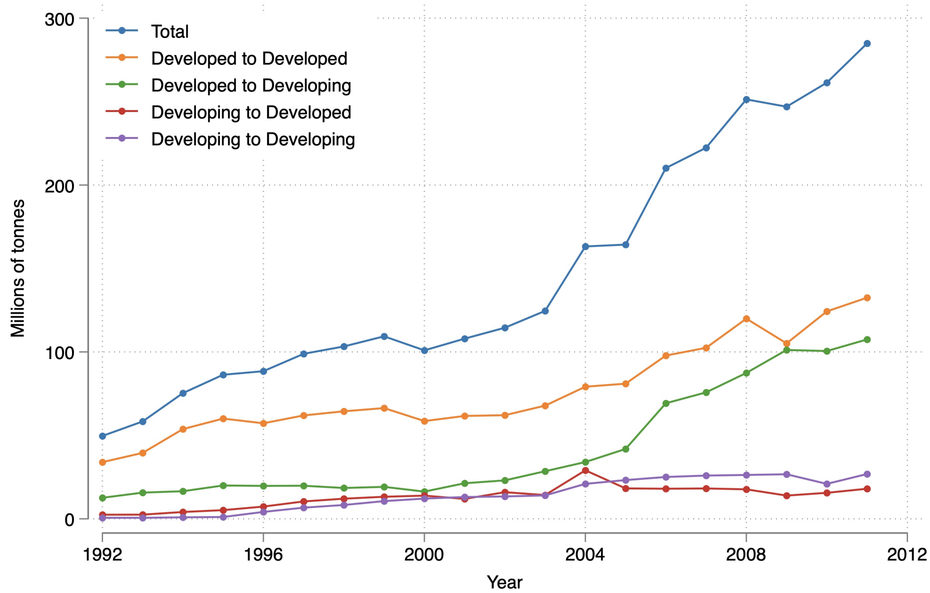

Figure 1: Total annual waste exports in million tonnes

countries are the main waste recipients, developed countries do import a large proportion of worldwide waste. If so, where does the rest of waste go and do developing countries play an important role in the waste trade? Table 2c answers this question by reporting the top 10 developing country waste importers, which shows that they collectively import more than 32% of global traded waste – a significant share.

A similar story can be found if we look at all countries in our sample. Table 3 presents the share of world GDP, world waste exports and imports, and the average number of environmental NGOs for developed and developing countries, respectively. Whereas developed countries produce 75% of world's income (measured by GDP) and supply around 82% of world waste exports, developing countries only make up for 18% of global waste exports with around 25% of world income share. That is, countries with larger capacity to produce and consume also tend to supply more waste to international markets. Indeed, both Baggs (2009) and Higashida and Managi (2014) have found positive and significant effects of GDP on bilateral trading pairs for waste. However, if we move to compare the income and imports share, evidence seems to confirm that developing countries import a disproportionately large share of world waste (38.68%) relative to their income share (24.72%).

One possible explanation for this disparity could be the differences in terms of environmental lobby groups (proxyed by environmental NGOs) between developed and developing countries. A close look at the the last columns of Table 2 and Table 3 indicate that developed countries in general have a substantially higher number of environmental NGOs than developing countries. For example, the UK and US have the largest average number of environmental NGOs with 183 and 170 respectively, nearly 15 times more than the ones in Turkey, Indonesia and many other developing countries. Therefore, one reason for developing countries to import a larger share of waste could be their lack of environmental NGOs who lobby aggressively for environmental protection. So, if we strengthen the environmental NGOs in those developing countries, will it result in less waste to be imported?

Before we answer this question thoroughly, we explore further on the number of environmental NGOs over time and across countries. Figure 2 plots the evolution of aggregate number of environmental NGOs over the 20-year period, which shows that there have been a steady increase for both developed and developing countries. This fact is consistent with the growing environmental awareness worldwide. Figure 3 plots the number of environmental NGOs over the period of 1992 to 2011 for a selected sample of countries. Whereas large differences exist between countries, nearly all countries experience only a slight increase for the number of environmental NGOs over time. That is, there is much cross-country variation but little within-country variation in environmental lobbying strength.

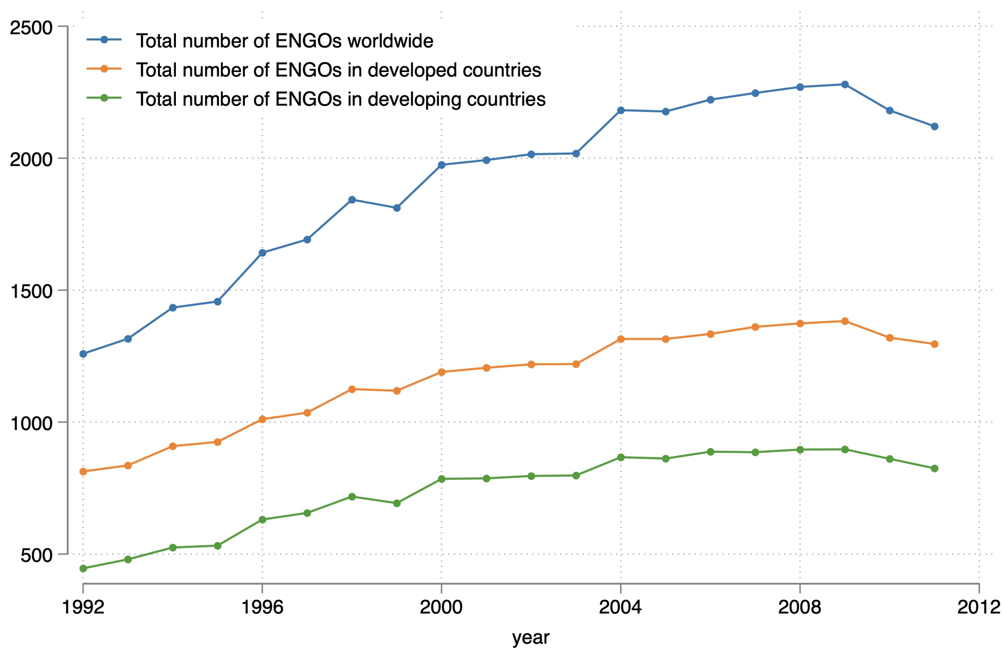

Figure 2: Total number of environmental NGOs from 1992 to 2011

Table 2: Largest waste exporters, importers and environmental NGOs (ENGOs)

(a) Top 10 waste exporters by aggregate volume from 1992 to 2011

Ranking	Country	Exports (million tonnes)	World share (%)	Average number of ENGOs
1	Germany	438.52	15.01	41
2	United States	437.68	14.98	170
3	Japan	218.67	7.48	34
4	France	189.97	6.50	41
5	United Kingdom	164.47	5.63	183
6	Netherlands	161.68	5.53	37
7	Belgium	136.14	4.66	32
8	Russia	127.86	4.38	20
9	Canada	113.45	3.88	94
10	Hong Kong SAR	74.03	2.53	6
	Total (Average)	2062.48	70.58	(66)

(b) Top 10 waste importers by aggregate volume from 1992 to 2011

Ranking	Country	Imports (million tonnes)	World share (%)	Average number of ENGOs
1	China	431.72	14.77	14
2	Turkey	208.66	7.14	12
3	Germany	182.03	6.23	41
4	Netherlands	177.94	6.09	37
5	South Korea	166.14	5.69	10
6	Italy	152.71	5.23	34
7	United States	150.07	5.14	170
8	France	142.51	4.88	41
9	Spain	137.39	4.70	25
10	Belgium	137.02	4.69	32
	Total (Average)	1886.19	64.55	(42)

(c) Top 10 developing country waste importers by aggregate volume from 1992 to 2011

Ranking	Country	Imports (million tonnes)	World share (%)	Average number of ENGOs
1	China	431.72	14.77	14
2	Turkey	208.66	7.14	12
3	India	83.60	2.86	20
4	Indonesia	49.68	1.70	12
5	Mexico	43.77	1.50	20
6	Malaysia	40.75	1.39	12
7	Thailand	33.54	1.15	15
8	United Arab Emirates	23.74	0.81	5
9	Egypt	20.65	0.71	13
10	Vietnam	18.76	0.64	5
	Total (Average)	954.87	32.68	(13)

Table 3: GDP, waste trade, and environmental NGOs by country status from 1992 to 2011

Country status	Share of world GDP(%)	Share of world waste exports(%)	Share of world waste imports(%)	Average number of ENGOs
Developed	75.28	81.39	61.32	1,165
Developing	24.72	18.61	38.68	741

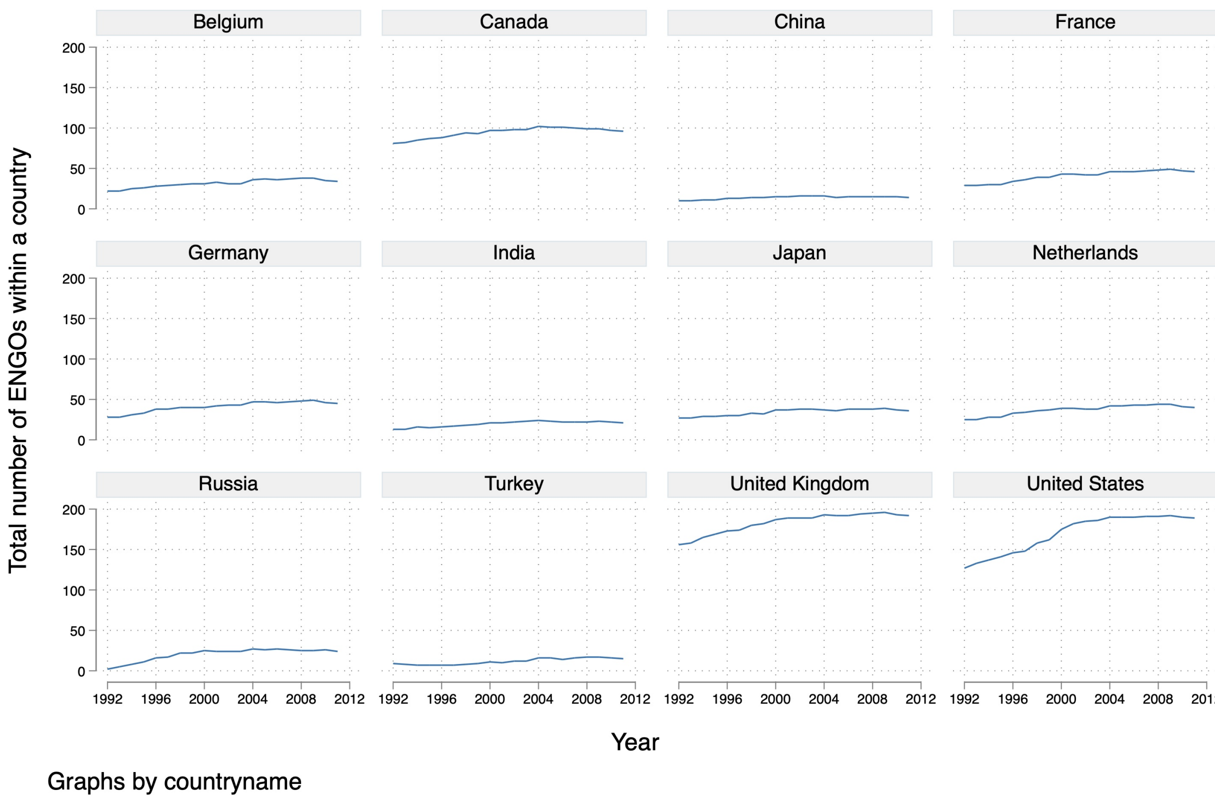

Figure 3: Number of environmental NGOs by country from 1992 to 2011

4 The empirical framework

Does strengthening environmental lobby groups lead less waste to be shipped from developed to developing countries? Our theoretical framework does not give an unambiguous answer. Depending on the waste-induced environmental damages and heterogeneity of group environmental preference, the effects of environmental lobbying on North-to-South waste trade can be either positive or negative. To provide some clarity on this question, we explore the novel dataset presented above and test the effects of environmental lobbying on waste trade in this section.

One immediate challenge in identifying the causal effects arises due to the potential for both omitted variable bias and reverse causality. Despite our endeavour to include as many as control variables, there may still exist some unobserved characteristics that might confound our results. For example, the time-varying country-specific multilateral resistance terms in Anderson and Van Wincoop (2003) and the firm-level heterogeneity in Helpman, Melitz and Rubinstein (2008) are found to be important factors in affecting trade flows and may also be correlated with the strength of environmental lobbying, but both are theoretical constructs that can not be directly observed by the researcher.[21] Also, as governments often alter trade policy in response to changes in environmental quality (Copeland, Shapiro and Taylor, 2021) and alter environmental policy in response to trade (Cherniwchan and Najjar, 2021), it's likely that increasing waste flows may incentivize governments to tighten policies and thereby reduce the need for environmental lobbies.

To address these empirical challenges, we employ two identification strategies. The first one is a gravity specification that explores within-country and cross-country variations and the second one uses a triple difference estimation strategy, which exploits the policy change brought by EU Waste Shipment Regulation (WSR). We discuss them with details in the following.

4.1 Gravity specification and descriptive results

In our first estimation, we implement the following gravity regression specifications:

$$\ln Y_{ijt} = \alpha + \beta_1 \ln \mathrm{ENGO}_{it} + \beta_2 \ln \mathrm{ENGO}_{jt} + \beta_3 \mathrm{X}_{ijt} + \beta_t + e_{ijt},$$

where $\ln Y_{ijt}$ is the natural log of aggregate waste exports in tonnes from a developed country i to a developing country j in year t, ENGO_{it} and ENGO_{jt} are the main variables of interest – the strength of environmental lobby groups at country i and country j respectively in year t, $\boldsymbol{X}_{ijt}$ is a vector of control variables as defined earlier, β_t are the year fixed effects to control for any global changes, and ε_{ijt} is the unobserved error term. Table 5 presents descriptive statistics for the right-hand-side variables in the gravity specification.

To identify the main coefficients of interest β_1 and β_2, we explore both cross-country and within-country variations in our sample and use ordinary least squares (OLS) with robust standard errors clustered by country pairs in our estimation. Table 6 reports the main estimation results; a more detailed description of the results is reported in Appendix D. While column 1, 4 and 7 present results for the baseline regressions with country-specific control variables, column 2, 5 and 8 include additional bilateral control variables, and column 3, 6 and 9 include additional country fixed effects to capture and net out

[21] One possible approach to address this endogeneity concern is to use country-year fixed effects as suggested by Baier and Bergstrand (2007) to control it. However, we would be unable to include the country-year fixed effects, since all the time-varying country-specific characteristics can be captured by these fixed effects, and as a result our main variables of interest would drop out because they are collinear with them.

Table 5: Descriptive statistics

	Obs.	Mean	S.D.	Min	Max
North-to-South waste exports (tonnes)	60,900	13,936.91	247,470.05	0.00	23,698,532.00
Total number of ENGOs exporter	60,900	33.30	40.23	0.00	196.00
Total number of ENGOs importer	60,900	8.52	6.29	0.00	29.00
Commercial energy use exporter (kg)	60,900	4,312.70	2,154.13	1,546.68	18,157.60
Commercial energy use importer (kg)	60,690	1,743.98	2,792.82	122.73	22,120.43
GDP exporter (billion dollars)	60,291	895.47	2,063.29	2.71	15,542.60
GDP importer (billion dollars)	60,410	118.09	381.53	0.65	7,551.50
Population exporter (million)	60,900	27.22	52.33	0.26	311.56
Population importer (million)	60,795	55.46	177.96	0.50	1,344.13
Capital/labour exporter (dollars)	60,900	162,176.66	68,496.50	25,831.81	408,884.69
Capital/labour importer (dollars)	60,795	51,887.45	66,395.61	0.00	647,583.31
Distance (km)	60,900	7,122.95	3,983.20	111.09	19,747.40
Common border dummy	60,900	0.01	0.09	0.00	1.00
Common language dummy	60,900	0.08	0.28	0.00	1.00
Colonial ties dummy	60,900	0.02	0.15	0.00	1.00
Both countries WTO members dummy	60,900	0.65	0.48	0.00	1.00
Regional trade agreements dummy	60,900	0.14	0.35	0.00	1.00
Both countries Basel ratification dummy	60,900	0.74	0.44	0.00	1.00

Table 6: North-to-South waste trade regression specifications

	Dependent variable: ln (North-to-South waste exports)								
	Exporter only			Importer only			Bilateral		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln (ENGO exporter)	-0.657***	-0.627***	0.149				-0.385**	-0.352***	0.151
	(0.179)	(0.168)	(0.253)				(0.155)	(0.133)	(0.239)
ln (ENGO importer)				-0.318**	-0.837***	0.063	-0.231*	-0.874***	-0.055
				(0.131)	(0.124)	(0.160)	(0.128)	(0.117)	(0.156)
Exporter-specific Controls	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Importer-specific Controls	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Bilateral Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Exporter FE	No	No	Yes	No	No	No	No	No	Yes
Importer FE	No	No	No	No	No	Yes	No	No	Yes
Observations	17512	17512	17512	17322	17322	17322	17309	17309	17309
R-squared	0.044	0.088	0.164	0.153	0.221	0.331	0.208	0.289	0.488

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors clustered at country-pairs are in parentheses. All regressions include a constant term and year fixed effects. Exporter and importer-specific controls include industry lobbying strength, population, GDP and capital-labour ratio. Bilateral controls include bilateral distance and dummy variables that indicating whether countries share a common border, common language, had colonial ties, are both members of WTO and Basel Convention, or in some regional trade agreements.

average differences across countries. The inclusion of country fixed effects in column 3, 6 and 9 seems to produce spurious results, as most of the estimated coefficients are either in unexpected signs or insignificant. One possible reason could be that including country fixed effects takes away much of the variation across countries – the main source of variation in our sample. The coefficients on our main variables of interest – environmental lobbying strength, proxyed by the number of ENGOs – are all negative and statistically significant at the 1% level for both exporter and importer in all the other specifications. This suggests that a strong environmental lobby group in either developed or developing country will result in less North-to-South waste exports. More specifically, a 10% increase in the number of ENGOs in the developed country will reduce waste exports by 3.52%, whereas a similar increase in the developing country will lower waste exports by 8.74%, according to our most preferred gravity specification – model 8.

The coefficient on industry lobbying strength of exporter is positive and statistically significant at the 1% level, implying that a strong industry lobby group in the developed country will result in more waste to be shipped abroad. This result is expected, since a powerful industry lobby group would typically lobby for a lower environmental standard and thus lead to more production, consequently resulting in more waste generation associated with more waste exports. However, the negative and statistically significant coefficient on the importer side of industry lobbying is surprising, as one would expect that more waste should be imported from developed countries if a strong industry lobby group exists in the developing country. While this result may seem counterintuitive, the main intuition behind it is that although capitalists often perceive lax regulations as more beneficial, they may diminish their lobbying efforts for a lower tariff rate when environmental damages play a pivotal role in their welfare calculation. Waste, as one of the dirtiest goods imaginable, poses several threats to the environment when not disposed of in sustainable ways, generating air and water pollution, contaminating soils, and exposing humans to pathogens and hazardous materials, etc. When damages caused by waste reach some threshold points where the losses may outweigh any gains from the profits due to a lower tariff, capitalists would find that a more stringent policy is actually more beneficial. This result provides an alternative explanation as to why many polluting firms may support more stringent environmental regulations as often observed in reality.[22] Whereas Grey (2018) demonstrates that the main reason behind corporate lobbying for environmental protection is that they can steal market share from their rivals, we argue that when environmental damages such as those caused by waste affect an individual's well-being more closely and directly and thereby play a role in the welfare calculation,

[22]For example, the US firm DuPont is believed to play a pivot role in the success of the Montreal Protocol aiming at a total phase out of CFCs for ozone protection (Barrett, 2003). During the 2015 Paris Agreement, many oil and gas producers have proposed the introduction of an ambitious global carbon price to reduce emissions (Grey, 2018).

more stringent regulations are likely to gain political support from firms.

The coefficients on other variables such as population, GDP, distance, common border, colonial ties and WTO are all statistically significant at either the 5% or 1% level. These results are quite consistent with the empirical trade literature, where more waste is traded among countries that have larger population, higher GDP, are closer together, share a common border or were once in a colonial relationship, and are members of the WTO. The negative (positive) and significant coefficients observed for the capital-labour ratio of the exporter (importer) are also consistent with Antweiler, Copeland and Taylor (2001) and Baggs (2009), confirming that more capital-intensive countries also tend to import more waste for disposal within their borders. The coefficient on Basel is negative and statistically significant in some specifications, which is expected as when both countries ratified the Basel Convention that aims to reduce toxic waste movements, countries are expected to trade less waste. The positive but insignificant coefficients on common language and RTA are a little surprising – as one would expect that countries that share the same language or both are in the same regional trade agreements should trade more.

4.2 Triple difference estimation

To provide further evidence of the effects of environmental lobbying on the North-to-South waste exports, we exploit an EU policy on waste shipments and use a triple difference estimation strategy. Increasing transboundary waste trade has called for an urgent need to regulate waste shipments and their inherent risks. In accordance with the Basel Convention and OECD decision on the control of hazardous waste, the European Union (EU) approved a main legislative act called Waste Shipment Regulation (WSR) in 2006 to regulate transboundary movements of waste. One of the main objectives of the regulation is to ensure that waste exported outside the EU does not create adverse effects on the environment or public health in the countries of destination, by prohibiting the export of hazardous waste to developing countries that are typically unable to manage the waste in an environmentally sound manner.[23]

Using this policy information, we explore the difference in terms of aggregate waste exports from EU developed countries (defined as a treatment group) relative to those in other non-EU developed countries (defined as a control group) to the developing world. The idea is that firms inside the EU market will be limited in their ability to ship their waste to developing countries due to the WSR regulation, while firms in other non-EU developed countries are less likely to be affected by this EU policy. This approach is a difference-in-difference framework, which highly relies on the common trend or parallel trend assumption. That is, after controlling for observable differences, treatment and

[23] See https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/662629/EPRS_BRI(2021)662629_EN.pdf.

control groups' aggregate waste exports to developing countries should be similar to each other and thus differences in the volume of trade post the policy between the two groups is purely due to the implementation of the EU-WSR. Therefore, in the absence of the regulation, waste exports in the treatment group would have followed the same trend as waste exports in the control group. Figure 4 illustrates the annual aggregate waste exports from EU developed and non-EU developed to the developing countries. Clearly, we can see that prior to year 2006, the waste exports trend is very similar between the two groups. However, there is a substantial increase in waste shipments from other non-EU developed countries after 2005, while the increasing trend for EU developed countries remains relatively steady.

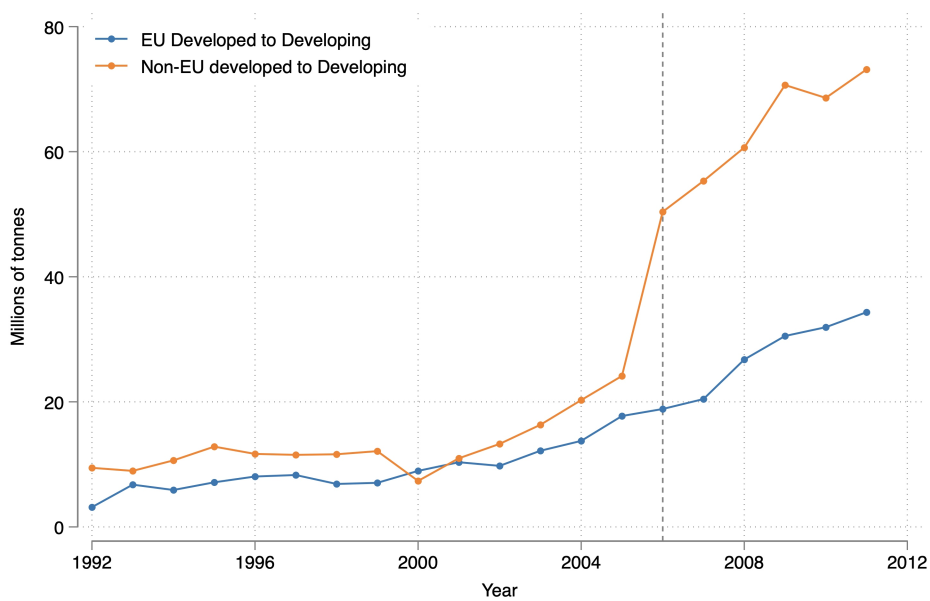

Figure 4: Total annual waste exports to developing countries

One possible explanation for this post-policy difference may be that the EU waste regulation effectively deters more domestic firms from shipping their waste to the developing world, as it would be considered as a violation of the law. But as Bernard (2015) has pointed out, firms can undertake both legal and illegal waste shipments that take different forms to bypass the regulation, including transporting waste on the black market, mixing different types of waste, declaring hazardous waste as non-hazardous, or classifying waste as second-hand goods. Nonetheless, waste exports from EU developed countries do not present the same substantial increase trend as those non-EU ones. One may wonder, without the regulation, would EU developed countries ship as much waste as the other non-EU developed countries? If so, where does their waste go?

The EU-WSR strictly bans the export of hazardous waste to developing countries, but it does allow trade between developed countries themselves. One explanation for the nonparallel waste increasing trend between EU and non-EU developed countries may be trade diversion. That is, EU developed countries may have shipped a large part of their waste to other non-EU developed countries, or simply there is more waste trade within the block. Figure 5 clarifies this question by plotting the total annual waste exports from EU developed countries to other non-EU developed countries and to themselves. Clearly, there is substantial within-EU waste trade post the implementation of EU-WSR while EU developed to non-EU developed waste trade remains relatively stable. This seems to further validate our parallel trend assumption.

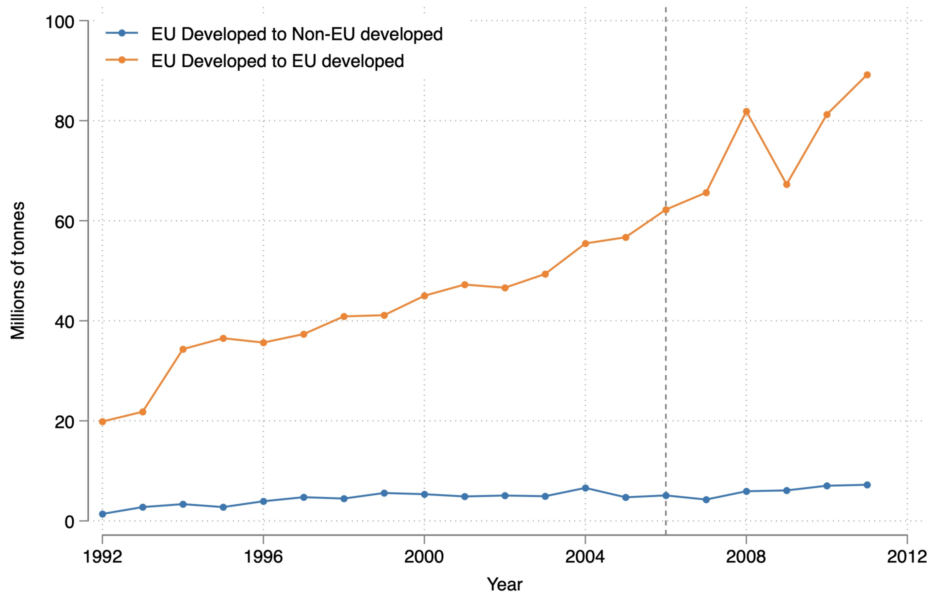

Figure 5: Total annual waste exports from EU developed countries

Exploring differences in waste exports between treatment and control groups, before and post the EU-WSR, and in environmental lobbying strength across countries, we thus implement the following specification for our triple-difference estimation:

$$
\begin{aligned}
\ln Y_{ijt} = {} & \alpha + \beta_1 * \text{Treatment}_i + \beta_2 * \text{Post}_t + \beta_3 \ln \text{ENGO}_{it} \\
& + \beta_4 * \text{Treatment}_i * \text{Post}_t + \beta_5 * \text{Treatment}_i * \ln \text{ENGO}_{it} + \beta_6 * \text{Post}_t * \ln \text{ENGO}_{it} \\
& + \beta_7 * \text{Treatment}_i * \text{Post}_t * \ln \text{ENGO}_{it} + \gamma X_{ijt} + \varepsilon_{ijt},
\end{aligned}
$$

where $\ln Y_{ijt}$ denotes the natural log of aggregate waste exports from a developed country i to a developing country j in year t. The dummy variable Treatment_i equals one if the country i belongs to an EU developed country, and equals zero otherwise. The dummy variable Post_t equals one if year t is equal to or greater than 2006, and equals zero otherwise. X_{ijt} is a vector of control variables defined as earlier, and ε_{ijt} is the unobserved error term. There is some concern that the number of environmental NGOs may be affected by the

EU policy. We thus use the number of environmental NGOs in 2005 as the baseline and replace the ones in other years with that in 2005.[24] $\beta_1, \beta_2, \beta_3$ are estimators for linear trends, $\beta_4, \beta_5, \beta_6$ are estimators for the double differences, and β_7 is the triple-difference estimator, our main coefficient of interest.

Table 7: Triple-difference exporter side regression specifications

	Dependent variable: ln (North-to-South waste exports)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treatment* Post* ln (ENGO exporter)	-0.811***	-0.874***	-0.916***	-0.883***	-0.889***	-0.778***	-0.839***	-0.773***	-0.670***
	(0.152)	(0.158)	(0.156)	(0.157)	(0.158)	(0.152)	(0.159)	(0.152)	(0.154)
Exporter-specific Controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bilateral Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	No	Yes	No	No	Yes	Yes	Yes
Exporter FE	No	No	No	No	Yes	No	Yes	No	Yes
Importer FE	No	No	No	No	No	Yes	No	Yes	Yes
Observations	17525	17512	17512	17512	17512	17512	17512	17512	17512
R-squared	0.015	0.046	0.083	0.093	0.158	0.413	0.167	0.415	0.483

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors clustered at country-pairs are in parentheses. Treatment equals one if the country belongs to an EU developed country. Post equals one if year is equal to or greater than 2006. ENGO uses the number of environmental NGOs in 2005 as the baseline. Exporter-specific controls include industry lobbying strength, population, GDP and capital-labour ratio. Bilateral controls include bilateral distance and dummy variables that indicating whether countries share a common border, common language, had colonial ties, are both members of WTO and Basel Convention, or in some regional trade agreements.

Table 7 reports the results of the triple-difference estimation on the exporter side, with a more detailed description in Appendix E.1. Column 1 describes the baseline result, column 2 include additional exporter-specific control variables, and column 3 add extra bilateral control variables. Additionally, column 4-9 include either year fixed effects, exporter fixed effects, importer fixed effects, combination of two or all three fixed effects, to capture and net out average differences across years, exporters and importers, respectively. Throughout all the specifications, the coefficient on the triple difference estimator does not change much – all negative and statistically significant at the 1% level. This means that the more environmental NGOs in 2005, the more pronounced is the decrease in waste exports triggered by the policy for the EU developed countries.

To further check whether this result holds, we implement the triple difference estimation using the gravity specification with main results reported in Table 8 and more details in Appendix E.2. The magnitude of the triple difference estimator only increases slightly, but are still negative and statistically significant at the 1% level. Therefore, we can conclude that a strengthening of environmental lobby groups does lead to a reduction in waste shipments from developed countries to developing countries.

[24] In fact, the results do not change much if we keep using the original number of ENGOs, as there is not much variation over time for ENGOs within countries and the log transformation makes the variation even smaller.

Table 8: Triple-difference gravity regression specifications

	Dependent variable: ln (North-to-South waste exports)					
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment* Post* ln (ENGO exporter)	-0.811***	-0.952***	-0.936***	-0.898***	-0.700***	-0.704***
	(0.152)	(0.159)	(0.157)	(0.157)	(0.153)	(0.154)
Exporter-specific Controls	No	Yes	Yes	Yes	Yes	Yes
Importer-specific Controls	No	Yes	Yes	Yes	Yes	Yes
Bilateral Controls	No	No	Yes	Yes	Yes	Yes
Year FE	No	No	No	Yes	No	Yes
Exporter FE	No	No	No	No	Yes	Yes
Importer FE	No	No	No	No	Yes	Yes
Observations	17525	17309	17309	17309	17309	17309
R-squared	0.015	0.213	0.290	0.296	0.489	0.490

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors clustered at country-pairs are in parentheses. Treatment equals one if the country belongs to an EU developed country. Post equals one if year is equal to or greater than 2006. ENGO uses the number of environmental NGOs in 2005 as the baseline. Exporter and importer-specific controls include industry lobbying strength, population, GDP and capital-labour ratio. Bilateral controls include bilateral distance and dummy variables that indicating whether countries share a common border, common language, had colonial ties, are both members of WTO and Basel Convention, or in some regional trade agreements.

5 Conclusion

In this paper, we develop a political economy model to investigate the role played by lobby groups on international trade in waste, an externality generated by production activities in a developed-country market that can be exported to a developing country for disposal but with a fee. The model assumes that groups have heterogeneous preferences for environmental quality and that the environmental and trade policy on the externality are endogenously determined by balancing the competing interests of an organized environmental and industry lobby group. We show that the politically chosen policy can be below, equal to or above the socially optimal level, depending on the heterogeneity of environmental attitudes and the degree of pollution damages from waste. Further, bringing theory to data to provide some empirical clarity on the effects of environmental lobbying, we find compelling evidence that environmental lobby groups exert a statistically significant impact on North-to-South waste exports reduction. Therefore, strengthening environmental NGOs can represent an important strategy in reducing international waste trade. Thus, it may be worthwhile for international donor organizations to provide support for the development of environmental NGOs all over the world (Binder and Neumayer, 2005; Fredriksson et al., 2005).

The paper has some limitations. First, we have modeled that environmental lobby groups only affect waste trade through the policy channel. But as demonstrated in Yu (2005), the amount of political contributions observed from environmental lobby groups is typically very small compared to industry ones, and thus the success of environmental lobbying is largely due to their greater effectiveness in pubic persuasion and the growing public environmental awareness. Also, as identified in Connelly et al. (2012), environmental NGOs can engage in various other activities to affect policymakers' perceived political support, such as producing scientific research and reports, organizing protests, staging public stunts, and so on. They can also use environmental litigation and courts to fill their goals (Bentata and Faure, 2015). Therefore, it would be interesting to extend our analysis to explore other possible mechanisms of environmental lobbying on waste trade.

Second, we do not seek to test the relationship between the strength of environmental lobby group and policy stringency, due to data availability and challenges. There is no explicit measurement of environmental tax on waste, and attempting to collect this information for a cross-country time-series study is prohibitively difficult. Though tariff data on waste is largely available,[25] it turns out to be very poor and information on many waste categories is missing. Also, as argued by Gawande and Krishna (2003), the trade barriers used in practice are a complicated combination of tariff and nontariff barriers, and trade protection has been heavily dominated in recent decades by the use of nontariff barriers. Given the particular nature of waste, it is not hard to imagine that most of the waste categories will be subject to nontariff barriers. Therefore, the use of available average or aggregate data to proxy for the country's overall ad valorem import tariff on waste will be unreliable.

Third, we have made the small open economy assumption and thus the price of waste is exogenous given. But as noted in the data, China has played a significant role in waste trade, and the Chinese waste ban in 2017 has undoubtedly affected the worldwide waste industry. It would be interesting to investigate how the results will change when the price of waste is endogenously determined. Finally, we have assumed that environmentalists are those not-in-back-yard ones that only care about domestic environmental protection. A natural extension will be modelling that they also care about other countries' environment. These are all relevant and promising extensions for future research.

[25]The tariff data on waste can be directly obtained from the WTO Tariff Download Facility, which contains comprehensive information on Most-Favoured-Nation (MFN) applied and bound tariffs at the standard codes of the Harmonized System (HS) for all WTO members. This information is sourced from submissions made to the WTO Integrated Data Base (IDB) for applied tariffs and imports and from the Consolidated Tariff Schedules (CTS) database for the bound duties of all WTO members. See more at https://www.wto.org/english/tratop_e/tariffs_e/tariff_data_e.htm.

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Appendices

A Examples

A.1 Examples for political equilibrium tax

Suppose the production function, utility function, cost function and damage function take the following forms respectively:

$$Y = F(K, L) = 2K^{\frac{1}{2}}L^{\frac{1}{2}}, \quad u(y) = Ay - \frac{1}{2}y^2, \quad \eta(Q) = \frac{1}{2}Q^2, \quad D(Z) = \frac{\gamma}{2}Z^2,$$

which will allow us to obtain an analytical solution. For simplicity, let $\bar{K} = 1$, then

$$Y = F(\bar{K}, L) = 2L^{\frac{1}{2}}, \quad F_L(\bar{K}, L) = L^{-\frac{1}{2}}, \quad F_{LL}(\bar{K}, L) = -\frac{1}{2}L^{-\frac{3}{2}}, \quad \frac{F_{LL}}{F_L^3} = -\frac{1}{2},$$

and we have

$$u'(y) = A - y, \quad \eta'(Q) = Q, \quad D'(Z) = \gamma Z.$$

From equation (8):

$$\left[u'\left(\frac{F(\bar{K}, \hat{L})}{n}\right) - t\right]F_L(\bar{K}, \hat{L}) - 1 = 0,$$

we can obtain the optimal labour and thereby output in the manufacturing sector as

$$\hat{L}(t) = \left(\frac{n(A-t)}{n+2}\right)^2, \quad \hat{Y}(t) = 2\hat{L}^{\frac{1}{2}} = \frac{2n(A-t)}{n+2}.$$

From equation (1), the optimal exported waste can be expressed as

$$\hat{Q}(t) = t - \mu.$$

Therefore, the optimal pollution is given by

$$\hat{Z}(t) = \hat{Y}(t) - \hat{Q}(t) = \frac{2n(A-t)}{n+2} - t + \mu.$$

To ensure $\hat{Y}, \hat{Q}, \hat{Z} > 0$, we would need

$$\mu < t < \frac{2nA + \mu(n+2)}{3n+2} < A.$$

Clearly,

$$\frac{d\hat{Y}(t)}{dt} = -\frac{2n}{n+2} < 0, \quad \frac{d\hat{Q}(t)}{dt} = 1 > 0, \quad \frac{d\hat{Z}(t)}{dt} = -\frac{2n}{n+2} - 1 < 0,$$

Then, we have

$$\frac{d\hat{\Pi}}{dt} = \hat{Q} - \hat{Y}\frac{F_{LL}}{F_L^3}\frac{d\hat{Y}}{dt} = t - \mu - \frac{2n(A-t)}{n+2}(-\frac{1}{2})(-\frac{2n}{n+2}) = t - \mu - \frac{2n^2(A-t)}{(n+2)^2},$$

and

$$\frac{d\hat{\Pi}}{d\hat{Z}} = \frac{\frac{d\hat{\Pi}}{dt}}{\frac{d\hat{Z}}{dt}} = \frac{t-\mu-\frac{2n^2(A-t)}{(n+2)^2}}{-\frac{2n}{n+2}-1} = \frac{2n^2(A-t)-(t-\mu)(n+2)^2}{(3n+2)(n+2)}$$

To ensure $\frac{d\hat{\Pi}}{dt} < 0$ or $\frac{d\hat{\Pi}}{d\hat{Z}} > 0$, we need

$$t < \frac{2n^2A + \mu(n+2)^2}{3n^2+4n+4}.$$

It can be easily verified that

$$\frac{2n^2A + \mu(n+2)^2}{3n^2+4n+4} < \frac{2nA + \mu(n+2)}{3n+2}.$$

Therefore, the resulting political equilibrium tax must satisfy the condition:

$$\mu < t < \frac{2n^2A + \mu(n+2)^2}{3n^2+4n+4}.$$

Finally, from equation (10), we have

$$t - n\bar{\beta}\gamma\hat{Z} + \frac{1-\lambda_0}{\delta+\lambda_0}\left[(n\beta_W - n\bar{\beta})\gamma\hat{Z} + \frac{d\hat{\Pi}}{d\hat{Z}}\right] = 0.$$

That is,

$$t + \gamma\frac{m_3\bar{\beta}_M - (\delta+1)n\bar{\beta}}{\delta + \frac{m_1+m_2}{n}}\left[\frac{2n(A-t)}{n+2} - t + \mu\right] + \frac{\frac{m_3}{n}}{\delta + \frac{m_1+m_2}{n}}\left[\frac{2n^2(A-t)-(t-\mu)(n+2)^2}{(3n+2)(n+2)}\right] = 0$$

For numerical illustrations, we use the following parameter values:

$$n = 10, \quad \mu = 2.5, \quad A = 5, \quad \bar{L} = 10, \quad m_1 = 3, \quad m_2 = 2, \quad m_3 = 5, \quad \delta = 0.5.$$

Thus,

$$\lambda_0 = \frac{m_1+m_2}{n} = 0.5, \quad \frac{1-\lambda_0}{\delta+\lambda_0} = \frac{0.5}{0.5+0.5} = 0.5$$

Example 1. Suppose the average environmental preference for each group is such that

$$\beta_C = 0.01 < \bar{\beta} = 0.2 < \beta_W = 0.25 < \beta_E = 0.36,$$

with

$$m_1\beta_C + m_2\beta_E + m_3\beta_W = 3 \times 0.01 + 2 \times 0.36 + 5 \times 0.25 = 2 = 10 \times 0.2 = n\bar{\beta}$$

and $\gamma = 3$, then the political economy equilibrium tax can be solved as

$$t^{**} = 3.7867 \in \left(\mu = 2.5, \frac{2n^2A + \mu(n+2)^2}{3n^2 + 4n + 4} = 3.9535\right).$$

Thus, we have

$$\hat{L}(t^{**}) = 1.0223, \quad \hat{Y}(t^{**}) = 2.0222, \quad \hat{Q}(t^{**}) = 1.2867, \quad \hat{Z}(t^{**}) = 0.7355,$$

and the Pigovian tax is

$$t^* = n\bar{\beta}\gamma\hat{Z} = 4.4130 > t^{**} = 3.7867.$$

Example 1 shows that when $\beta_W \geq \beta$, the political economy equilibrium tax on the externality is below the Pigovian level.

Example 2. Suppose the average environmental preference for each group is such that

$$\beta_C = 0.02 < \beta_W = 0.18 < \bar{\beta} = 0.2 < \beta_E = 0.52,$$

with

$$m_1\beta_C + m_2\beta_E + m_3\beta_W = 3 \times 0.02 + 2 \times 0.52 + 5 \times 0.18 = 2 = 10 \times 0.2 = n\bar{\beta}$$

and $\gamma = 1$, then the political economy equilibrium tax can be solved as

$$t^{**} = 3.4101 \in \left(\mu = 2.5, \frac{2n^2A + \mu(n+2)^2}{3n^2 + 4n + 4} = 3.9535\right).$$

Thus, we have

$$\hat{L}(t^{**}) = 1.7554, \quad \hat{Y}(t^{**}) = 2.6498, \quad \hat{Q}(t^{**}) = 0.9101, \quad \hat{Z}(t^{**}) = 1.7398,$$

and the Pigovian tax is

$$t^* = n\bar{\beta}\gamma\hat{Z} = 3.4795 > t^{**} = 3.4101.$$

Example 2 shows that when $\beta_W < \bar{\beta}$ but $D'(\hat{Z})$ is small enough (i.e., $\gamma = 1$), the political economy equilibrium tax on the externality is below the Pigovian level.

Example 3. We retain the same average environmental preference for each group as in Example 2:

$$\beta_C = 0.02 < \beta_W = 0.18 < \bar{\beta} = 0.2 < \beta_E = 0.52,$$

but now $\gamma = 5$, then the political economy equilibrium tax is

$$t^{**} = 3.9219 \in \left(\mu = 2.5, \frac{2n^2 A + \mu(n+2)^2}{3n^2 + 4n + 4} = 3.9535\right).$$

Thus, we have

$$\hat{L}(t^{**}) = 0.8071, \quad \hat{Y}(t^{**}) = 1.7968, \quad \hat{Q}(t^{**}) = 1.4219, \quad \hat{Z}(t^{**}) = 0.3749,$$

and the Pigovian tax is

$$t^* = n\bar{\beta}\gamma\hat{Z} = 3.7486 < t^{**} = 3.9219.$$

Example 3 shows that when $\beta_W < \bar{\beta}$ and $D'(\hat{Z})$ is large enough (i.e., $\gamma = 5$), the political economy equilibrium tax on the externality is above Pigovian level.

A.2 Examples for political economy tariff rate

Suppose the cost function and damage function both take the quadratic forms:

$$C(I) = \frac{1}{2}I^2, \quad D(I) = \frac{\alpha}{2}I^2,$$

which will allow us to obtain an analytical solution. Then, we have

$$C'(I) = I, \quad D'(I) = \alpha I.$$

From equation (12), we can obtain the optimal imported waste as

$$\hat{I}(\tau) = (1-\tau)\mu,$$

and thus

$$\frac{d\hat{I}}{d\tau} = -\mu, \quad \frac{d\hat{\Pi}}{d\tau} = -\mu\hat{I}, \quad \frac{d\hat{\Pi}}{d\hat{I}} = \frac{\frac{d\hat{\Pi}(\tau)}{d\tau}}{\frac{d\hat{I}(\tau)}{d\tau}} = \hat{I}.$$

Therefore, equation (13) becomes

$$\left[\mu\tau - n\bar{\beta}\alpha\hat{I}\right] + \frac{1-\lambda_0}{\delta+\lambda_0}\left[(n\beta_W - n\bar{\beta})\alpha\hat{I} + \hat{I}\right] = 0.$$

For numerical illustrations, we retain some of the same parameter values used in the North:

$$n = 10, \quad \mu = 2.5, \quad m_1 = 3, \quad m_2 = 2, \quad m_3 = 5, \quad \delta = 0.5.$$

Thus,

$$\lambda_0 = \frac{m_1 + m_2}{n} = 0.5, \quad \frac{1-\lambda_0}{\delta+\lambda_0} = \frac{0.5}{0.5+0.5} = 0.5$$

Example 4. Suppose the average environmental preference for each group is such that

$$\beta_C = 0.01 < \bar{\beta} = 0.2 < \beta_W = 0.25 < \beta_E = 0.36,$$

and $\alpha = 3$, then the political economy equilibrium tariff rate can be solved as

$$\tau^{**} = 0.8261 \in [0,1].$$

Thus, the optimal imported waste is

$$\hat{I} = 0.4348,$$

and the social optimal tariff rate is

$$\tau^* = \frac{n\bar{\beta}\alpha\hat{I}}{\mu} = 1.0435 > \tau^{**} = 0.8261.$$

Example 4 shows that when $\beta_W \geq \bar{\beta}$, the political economy equilibrium tariff rate on the imported externality is below the social optimal one.

Example 5. Suppose the average environmental preference for each group is such that

$$\beta_C = 0.02 < \beta_W = 0.18 < \bar{\beta} = 0.2 < \beta_E = 0.52,$$

and $\alpha = 1$, then the political economy equilibrium tariff rate can be solved as

$$\tau^{**} = 0.6154 \in [0,1].$$

Thus, the optimal imported waste is

$$\hat{I} = 0.9615,$$

and the social optimal tariff rate is

$$\tau^* = \frac{n\bar{\beta}\alpha\hat{I}}{\mu} = 0.7692 > \tau^{**} = 0.6154.$$

Example 5 shows that when $\beta_W < \bar{\beta}$ but $D'(\hat{I})$ is small enough (i.e., $\alpha = 1$), the political economy equilibrium tariff rate on the imported externality is below the social optimal one.

Example 6. We retain the same average environmental preference for each group as in Example 5:

$$\beta_C = 0.02 < \beta_W = 0.18 < \bar{\beta} = 0.2 < \beta_E = 0.52,$$

but now $\alpha = 5$, then the political economy equilibrium tariff rate is

$$\tau^{**} = 0.9091 \in [0, 1].$$

Thus, the optimal imported waste is

$$\hat{I} = 0.2273,$$

and the social optimal tariff rate is

$$\tau^* = \frac{n\bar{\beta}\alpha\hat{I}}{\mu} = 0.9091 = \tau^{**}.$$

Example 6 shows that when $\beta_W < \bar{\beta}$ and $D'(\hat{I})$ is large enough (i.e., $\alpha = 5$), the political economy equilibrium tariff rate on the imported externality is identical to the social optimal one.

B Effects of environmental movement

Proof. Rewrite equation (10) as

$$t = n\bar{\beta}D'(\hat{Z}(t)) - \frac{1-\lambda_0}{\delta+\lambda_0}\left[(n\beta_W - n\bar{\beta})D'(\hat{Z}(t)) + \frac{d\hat{\Gamma}/dt}{d\hat{Z}/dt}\right],$$

then

$$\frac{dt}{dm_2} = (\beta_E - \beta_W)D'(\hat{Z}(t)) + n\bar{\beta}D''(\hat{Z}(t))\frac{d\hat{Z}}{dt}\frac{dt}{dm_2} + \frac{\frac{1}{n}(\delta+1)}{(\delta+\lambda_0)^2}\left[(n\beta_W - n\bar{\beta})D'(\hat{Z}(t)) + \frac{d\hat{\Pi}/dt}{d\hat{Z}/dt}\right]$$

$$-\frac{1-\lambda_0}{\delta+\lambda_0}\left[-(\beta_E - \beta_W)D'(\hat{Z}(t)) + (n\beta_W - n\bar{\beta})D''(\hat{Z}(t))\frac{d\hat{Z}}{dt}\frac{dt}{dm_2} + \frac{\frac{d^2\hat{\Pi}}{dt}\frac{dt}{dm_2}\frac{d\hat{Z}}{dt} - \frac{d\hat{\Pi}}{dt}\frac{dt}{dm_2}\frac{d^2\hat{Z}}{dt^2}}{(\frac{d\hat{Z}}{dt})^2}\right].$$

Combine terms on the right hand, we have

$$\frac{dt}{dm_2} = \frac{1+\delta}{\delta+\lambda_0}(\beta_E - \beta_W)D'(\hat{Z}(t)) + \frac{(1+\delta)n\bar{\beta} - (1-\lambda_0)n\beta_W}{\delta+\lambda_0}D''(\hat{Z}(t))\frac{d\hat{Z}}{dt}\frac{dt}{dm_2}$$

$$+\frac{\frac{1}{n}(\delta+1)}{(\delta+\lambda_0)^2}\left[(n\beta_W - n\bar{\beta})D'(\hat{Z}(t)) + \frac{d\hat{\Pi}/dt}{d\hat{Z}/dt}\right] - \frac{1-\lambda_0}{\delta+\lambda_0}\frac{\frac{d^2\hat{\Pi}}{dt}\frac{d\hat{Z}}{dt} - \frac{d\hat{\Pi}}{dt}\frac{d^2\hat{Z}}{dt^2}}{(\frac{d\hat{Z}}{dt})^2}\frac{dt}{dm_2}.$$

Now, combine the term dt/dm_2, then

$$\left[1 - \frac{(1+\delta)n\bar{\beta} - (1-\lambda_0)n\beta_W}{\delta+\lambda_0}D''(\hat{Z}(t))\frac{d\hat{Z}}{dt} + \frac{1-\lambda_0}{\delta+\lambda_0}\frac{\frac{d^2\hat{\Pi}}{dt}\frac{d\hat{Z}}{dt} - \frac{d\hat{\Pi}}{dt}\frac{d^2\hat{Z}}{dt^2}}{(\frac{d\hat{Z}}{dt})^2}\right]\frac{dt}{dm_2}$$

$$= \frac{1+\delta}{\delta+\lambda_0}(\beta_E - \beta_W)D'(\hat{Z}(t)) + \frac{\frac{1}{n}(\delta+1)}{(\delta+\lambda_0)^2}\left[(n\beta_W - n\bar{\beta})D'(\hat{Z}(t)) + \frac{d\hat{\Pi}/dt}{d\hat{Z}/dt}\right].$$

That is,

$$\frac{dt}{dm_2} = \frac{\frac{1+\delta}{\delta+\lambda_0}(\beta_E - \beta_W)D'(\hat{Z}(t)) + \frac{\frac{1}{n}(\delta+1)}{(\delta+\lambda_0)^2}\left[(n\beta_W - n\bar{\beta})D'(\hat{Z}(t)) + \frac{d\hat{\Pi}/dt}{d\hat{Z}/dt}\right]}{1 - \frac{(1+\delta)n\bar{\beta} - (1-\lambda_0)n\beta_W}{\delta+\lambda_0}D''(\hat{Z}(t))\frac{d\hat{Z}}{dt} + \frac{1-\lambda_0}{\delta+\lambda_0}\frac{\frac{d^2\hat{\Pi}}{dt}\frac{d\hat{Z}}{dt} - \frac{d\hat{\Pi}}{dt}\frac{d^2\hat{Z}}{dt^2}}{(\frac{d\hat{Z}}{dt})^2}}.$$

Note that the denominator is exactly $\frac{d\Omega}{dt}$ as we derived earlier:

$$\frac{d\Omega}{dt} \equiv 1 - n\bar{\beta}D''(\hat{Z})\frac{d\hat{Z}}{dt} + \frac{1-\lambda_0}{\delta+\lambda_0}\left((n\beta_W - n\bar{\beta})D''(\hat{Z})\frac{d\hat{Z}}{dt} + \frac{\frac{d^2\hat{\Pi}}{dt}\frac{d\hat{Z}}{dt} - \frac{d\hat{\Pi}}{dt}\frac{d^2\hat{Z}}{dt^2}}{(\frac{d\hat{Z}}{dt})^2}\right) > 0,$$

and the second term in the numerator can be rewritten from equation (10) as

$$\left[(n\beta_W - n\bar{\beta})D'(\hat{Z}) + \frac{d\hat{\Pi}}{d\hat{Z}}\right] = -\frac{\delta+\lambda_0}{1-\lambda_0}\left[t - n\bar{\beta}D'(\hat{Z})\right] = -\frac{n}{m_3}(\delta+\lambda_0)\left[t - n\bar{\beta}D'(\hat{Z})\right].$$

Therefore,

$$\frac{dt}{dm_2} = \frac{\frac{1+\delta}{\delta+\lambda_0}(\beta_E - \beta_W)D'(\hat{Z}) - \frac{1+\delta}{(\delta+\lambda_0)}\frac{1}{m_3}\left[t - n\bar{\beta}D'(\hat{Z})\right]}{\frac{d\Omega}{dt}},$$

or

$$\frac{dt}{dm_2} = \frac{\frac{1+\delta}{\delta+\lambda_0}\frac{1}{m_3}\left[m_3(\beta_E - \beta_W)D'(\hat{Z}) - \left(t - n\bar{\beta}D'(\hat{Z})\right)\right]}{\frac{d\Omega}{dt}}.$$

□

C Waste categories and country list

Table C1: 87 Categories of Internationally Traded Waste by HS code

HS Code	Commodity Description
180200	Cocoa; shells, husks, skins and other cocoa waste
230320	Beet-pulp, bagasse and other waste of sugar manufacture; whether or not in the form of pellets
230330	Brewing or distilling dregs and waste; whether or not in the form of pellets
230800	Vegetable materials and vegetable waste, vegetable residues and by-products; whether or not in the form of pellets, of a kind used in animal feeding, not elsewhere specified or included
251720	Macadam of slag, dross or similar industrial waste; whether or not incorporating the materials in item no. 2517.10
252530	Mica; waste
261800	Slag, granulated (slag sand); from the manufacture or iron or steel
261900	Slag, dross; (other than granulated slag), scalings and other waste from the manufacture of iron or steel
262011	Slag, ash and residues; (not from the manufacture of iron or steel), containing mainly zinc, hard zinc spelter
262019	Slag, ash and residues; (not from the manufacture of iron or steel), containing mainly zinc, other than hard zinc spelter
262021	Slag, ash and residues; (not from the manufacture of iron or steel), containing mainly lead; leaded gasoline sludges and leaded anti-knock compound sludges
262029	Slag, ash and residues; (not from the manufacture of iron or steel), containing mainly lead; excluding leaded gasoline sludges and leaded anti-knock compound sludges
262020	Ash and residues; (not from the manufacture of iron or steel), containing mainly lead
262030	Slag, ash and residues; (not from the manufacture of iron or steel), containing mainly copper

(To be continued)

HS Code	Commodity Description
262040	Slag, ash and residues; (not from the manufacture of iron or steel), containing mainly aluminium
262050	Ash and residues; (not from the manufacture of iron or steel), containing mainly vanadium
262060	Slag, ash and residues; (not from the manufacture of iron or steel), containing arsenic, mercury, thallium or their mixtures, of a kind used for the extraction of arsenic or those metals or for the manufacture of their chemical compounds
262091	Slag, ash and residues; (not from the manufacture of iron or steel), containing antimony, beryllium, cadmium, chromium or their mixtures
262099	Slag, ash and residues; (not from the manufacture of iron or steel), containing mainly metals or their compounds, n.e.c. in heading no. 2620
262100	Slag and ash nes, including seaweed ash (kelp)
262110	Slag and ash; ash and residues from the incineration of municipal waste
262190	Slag and ash n.e.c. in chapter 26; including seaweed ash (kelp) but excluding ash and residues from the incineration of municipal waste
300680	Pharmaceutical goods; waste pharmaceuticals
300692	Pharmaceutical goods; waste pharmaceuticals
382510	Residual products of the chemical or allied industries, not elsewhere specified or included; municipal waste
382520	Residual products of the chemical or allied industries, not elsewhere specified or included; sewage sludge
382530	Residual products of the chemical or allied industries, not elsewhere specified or included; clinical waste
382541	Residual products of the chemical or allied industries, not elsewhere specified or included; halogenated waste organic solvents
382549	Residual products of the chemical or allied industries, not elsewhere specified or included; waste organic solvents, other than halogenated
382550	Residual products of chemical or allied industries, not elsewhere specified or included; wastes of metal pickling liquors, hydraulic fluids, brake fluids and anti-freeze fluids
382561	Residual products of the chemical or allied industries, not elsewhere specified or included; (other than sewage sludge, municipal waste or waste covered in 27.10); other wastes n.e.c. in 3825; those mainly containing organic constituents
382569	Residual products of the chemical or allied industries, not elsewhere specified or included; (other than sewage sludge, municipal waste or waste covered by 27.10); other wastes n.e.c. in 3825; except those mainly containing organic constituents
391510	Ethylene polymers; waste, parings and scrap
391520	Styrene polymers; waste, parings and scrap
391530	Vinyl chloride polymers; waste, parings and scrap
391590	Plastics n.e.c. in heading no. 3915; waste, parings and scrap
400400	Rubber; waste, parings and scrap of rubber (other than hard rubber) and powders and granules obtained therefrom

(To be continued)

HS Code	Commodity Description
411520	Leather; parings and other waste, of leather or composition leather; not suitable for the manufacture of leather articles; leather dust, powder and flour
450190	Cork; waste cork, crushed, granulated or ground cork
470710	Paper or paperboard; waste and scrap, of unbleached kraft paper or paperboard or corrugated paper or paperboard
470720	Paper or paperboard; waste and scrap, paper or paperboard made mainly of bleached chemical pulp, not coloured in the mass
470730	Paper or paperboard; waste and scrap, paper or paperboard made mainly of mechanical pulp (e.g. newspapers, journals and similar printed matter)
470790	Paper or paperboard; waste and scrap, of paper or paperboard n.e.c. in heading no. 4707 and of unsorted waste and scrap
500300	Silk waste (including cocoons unsuitable for reeling, yarn waste and garnetted stock)
510320	Wool and hair; waste of wool or of fine animal hair, including yarn waste, but excluding garnetted stock and noils of wool or of fine animal hair
520210	Cotton; yarn waste (including thread waste)
520291	Cotton; garnetted stock waste
520299	Cotton; waste other than garnetted stock and yarn (including thread) waste
530130	Flax; tow and waste, including yarn waste and garnetted stock
550510	Fibres; waste (including noils, yarn waste and garnetted stock), of synthetic fibres
550520	Fibres; waste (including noils, yarn waste and garnetted stock), of artificial fibres
700100	Glass; cullet and other waste and scrap of glass, glass in the mass
711230	Waste and scrap of precious metal or of metal clad with precious metal; ash containing precious metal or precious metal compounds
711291	Waste and scrap of precious metals; of gold, including metal clad with gold but excluding sweepings containing other precious metals
711292	Waste and scrap of precious metals; of platinum, including metal clad with platinum but excluding sweepings containing other precious metals
711299	Waste and scrap of precious metals; waste and scrap of precious metals including metal clad with precious metals, other than that of gold and platinum and excluding ash which contains precious metal or precious metal compounds
720410	Ferrous waste and scrap; of cast iron
720421	Ferrous waste and scrap; of stainless steel
720429	Ferrous waste and scrap; of alloy steel (excluding stainless)
720430	Ferrous waste and scrap; of tinned iron or steel
720441	Ferrous waste and scrap; turnings, shavings, chips, milling waste, sawdust, fillings, trimmings and stampings, whether or not in bundles
720449	Ferrous waste and scrap; n.e.c. in heading no. 7204
740400	Copper; waste and scrap
750300	Nickel; waste and scrap
760200	Aluminium; waste and scrap
780200	Lead; waste and scrap
790200	Zinc; waste and scrap

(To be continued)

HS Code	Commodity Description
800200	Tin; waste and scrap
810197	Tungsten (wolfram); waste and scrap
810297	Molybdenum; waste and scrap
810330	Tantalum; waste and scrap
810420	Magnesium; waste and scrap
810530	Cobalt; waste and scrap
810730	Cadmium; waste and scrap
810830	Titanium; waste and scrap
810930	Zirconium; waste and scrap
811020	Antimony; waste and scrap
811213	Beryllium; waste and scrap
811222	Chromium; waste and scrap
811252	Thallium; waste and scrap
854810	Waste and scrap of primary cells, primary batteries and electric accumulators; spent primary cells, spent primary batteries and spent electric accumulators

Table C2: Country list

35 developed countries				
Australia	Austria	Belgium	Canada	Cyprus
Czechia	Denmark	Estonia	Finland	France
Hong Kong SAR, China	Germany	Greece	Iceland	Ireland
Israel	Italy	Japan	Latvia	Lithuania
Luxembourg	Malta	Netherlands	New Zealand	Norway
Portugal	Singapore	Slovakia	Slovenia	South Korea
Spain	Sweden	Switzerland	United Kingdom	United States
87 developing countries				
Albania	Algeria	Argentina	Armenia	Azerbaijan
Bahrain	Bangladesh	Belarus	Benin	Bolivia
Bosnia and Herzegovina	Botswana	Brazil	Bulgaria	Cambodia
Cameroon	Chile	China	Colombia	Congo
Costa Rica	Croatia	Côte d'Ivoire	Dominican Republic	Ecuador
Egypt	El Salvador	Ethiopia	Gabon	Georgia
Ghana	Guatemala	Haiti	Honduras	Hungary
India	Indonesia	Iran	Jamaica	Jordan
Kazakhstan	Kenya	Kuwait	Kyrgyzstan	Lebanon
Malaysia	Mauritius	Mexico	Moldova	Mongolia
Morocco	Mozambique	Namibia	Nepal	Nicaragua
Nigeria	North Macedonia	Oman	Pakistan	Panama
Paraguay	Peru	Philippines	Poland	Qatar
Romania	Russia	Saudi Arabia	Senegal	South Africa
Sri Lanka	Sudan	Syria	Tanzania	Thailand
Togo	Trinidad and Tobago	Tunisia	Turkey	Ukraine
United Arab Emirates	Uruguay	Venezuela	Vietnam	Yemen
Zambia	Zimbabwe			

D Additional OLS estimation results

Table D1: OLS Exporter side waste regression specifications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln (ENGO exporter)	0.240**	0.002	-0.453***	-0.328*	-0.657***	-0.660***	-0.627***
	(0.109)	(0.124)	(0.158)	(0.172)	(0.179)	(0.168)	(0.168)
ln (Industry exporter)		1.198***	1.211***	1.470***	1.433***	1.546***	1.688***
		(0.266)	(0.265)	(0.284)	(0.282)	(0.275)	(0.272)
ln (Population exporter)			0.430***	1.042***	-0.516	-0.745**	-0.642*
			(0.086)	(0.212)	(0.342)	(0.334)	(0.330)
ln (GDP exporter)				-0.627***	1.026***	1.303***	1.228***
				(0.210)	(0.359)	(0.348)	(0.346)
ln (Capital/labour exporter)					-2.347***	-2.319***	-2.372***
					(0.429)	(0.431)	(0.428)
ln (Distance)						-0.329***	-0.389***
						(0.106)	(0.120)
Common border						3.194***	3.194***
						(0.679)	(0.657)
Common language						0.114	0.051
						(0.313)	(0.309)
Colonial ties						0.336	0.313
						(0.447)	(0.432)
WTO							1.146***
							(0.153)
RTA							0.236
							(0.194)
Basel							0.472**
							(0.214)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17525	17525	17525	17512	17512	17512	17512
R^2	0.007	0.017	0.030	0.033	0.044	0.073	0.088

Robust standard errors in parentheses, clustered at country-pairs

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table D2: OLS Importer side waste regression specifications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln (ENGO importer)	1.215***	1.200***	-0.068	-0.320**	-0.318**	-0.608***	-0.837***
	(0.102)	(0.102)	(0.125)	(0.130)	(0.131)	(0.123)	(0.124)
ln (Industry importer)		-0.139*	0.331***	-0.256*	-0.312**	-0.577***	-0.312**
		(0.079)	(0.082)	(0.139)	(0.143)	(0.141)	(0.136)
ln (Population importer)			0.910***	0.369***	0.531***	0.456***	0.748***
			(0.063)	(0.119)	(0.148)	(0.143)	(0.133)
ln (GDP importer)				0.689***	0.519***	0.730***	0.571***
				(0.130)	(0.157)	(0.153)	(0.144)
ln (Capital/labour importer)					0.252*	0.278**	0.320***
					(0.135)	(0.127)	(0.114)
ln (Distance)						-0.528***	-0.668***
						(0.102)	(0.109)
Common border						2.542***	2.307***
						(0.611)	(0.546)
Common language						0.422*	0.187
						(0.249)	(0.234)
Colonial ties						0.531	0.751**
						(0.378)	(0.356)
WTO							1.457***
							(0.163)
RTA							0.303*
							(0.181)
Basel							-1.617***
							(0.201)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17437	17417	17417	17332	17322	17322	17322
R^2	0.051	0.052	0.142	0.151	0.153	0.188	0.221

Robust standard errors in parentheses, clustered at country-pairs

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table D3: OLS Gravity waste regression specifications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln (ENGO exporter)	0.365***	0.112	-0.270**	-0.150	-0.385**	-0.373***	-0.352***
	(0.106)	(0.120)	(0.136)	(0.146)	(0.155)	(0.137)	(0.133)
ln (ENGO importer)	1.272***	1.273***	0.001	-0.257**	-0.231*	-0.631***	-0.874***
	(0.105)	(0.103)	(0.122)	(0.127)	(0.128)	(0.114)	(0.117)
ln (Industry exporter)		1.248***	1.134***	1.385***	1.375***	1.709***	1.723***
		(0.257)	(0.231)	(0.247)	(0.246)	(0.228)	(0.221)
ln (Industry importer)		-0.117	0.434***	-0.161	-0.231*	-0.589***	-0.297**
		(0.077)	(0.079)	(0.136)	(0.138)	(0.132)	(0.129)
ln (Population exporter)			0.574***	1.163***	0.083	-0.282	-0.211
			(0.075)	(0.198)	(0.306)	(0.289)	(0.283)
ln (Population importer)			0.984***	0.447***	0.634***	0.548***	0.849***
			(0.060)	(0.115)	(0.137)	(0.125)	(0.124)
ln (GDP exporter)				-0.608***	0.538*	1.006***	0.922***
				(0.197)	(0.319)	(0.297)	(0.292)
ln (GDP importer)				0.681***	0.465***	0.795***	0.566***
				(0.127)	(0.146)	(0.135)	(0.132)
ln (Capital/labour exporter)					-1.648***	-1.895***	-1.857***
					(0.381)	(0.370)	(0.365)
ln (Capital/labour importer)					0.313***	0.323***	0.338***
					(0.120)	(0.104)	(0.101)
ln (Distance)						-0.995***	-1.144***
						(0.099)	(0.111)
Common border						2.156***	2.055***
						(0.594)	(0.559)
Common language						0.404*	0.265
						(0.227)	(0.221)
Colonial ties						0.611*	0.685**
						(0.358)	(0.339)
WTO							1.577***
							(0.161)
RTA							0.027
							(0.179)
Basel							-0.234
							(0.166)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17437	17417	17417	17319	17309	17309	17309
R^2	0.058	0.070	0.189	0.202	0.208	0.271	0.289

Robust standard errors in parentheses, clustered at country-pairs
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table D4: OLS full estimation results with all control variables and fixed effects included

	Dependent variable: ln (North-to-South waste exports)								
	Exporter only			Importer only			Bilateral		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln (ENGO exporter)	-0.620***	-0.627***	0.149				-0.294**	-0.352***	0.151
	(0.161)	(0.168)	(0.253)				(0.129)	(0.133)	(0.239)
ln (ENGO importer)				-0.818***	-0.837***	0.063	-0.872***	-0.874***	-0.055
				(0.121)	(0.124)	(0.160)	(0.117)	(0.117)	(0.156)
ln (Industry exporter)	1.633***	1.688***	1.024**				1.747***	1.723***	1.763***
	(0.264)	(0.272)	(0.512)				(0.218)	(0.221)	(0.480)
ln (Industry importer)				-0.290**	-0.312**	0.773***	-0.307**	-0.297**	0.912***
				(0.128)	(0.136)	(0.289)	(0.125)	(0.129)	(0.289)
ln (Population exporter)	-0.277	-0.642*	-1.004				0.382*	-0.211	-0.423
	(0.190)	(0.330)	(1.107)				(0.201)	(0.283)	(1.086)
ln (Population importer)				0.858***	0.748***	0.168	0.984***	0.849***	0.607
				(0.108)	(0.133)	(0.429)	(0.113)	(0.124)	(0.422)
ln (GDP exporter)	0.848***	1.228***	-0.164				0.305	0.922***	-0.398
	(0.199)	(0.346)	(0.285)				(0.204)	(0.292)	(0.262)
ln (GDP importer)				0.444***	0.571***	0.187	0.416***	0.566***	0.033
				(0.107)	(0.144)	(0.159)	(0.117)	(0.132)	(0.151)
ln (Capital/labour exporter)	-1.989***	-2.372***	0.564				-1.266***	-1.857***	0.994**
	(0.328)	(0.428)	(0.518)				(0.304)	(0.365)	(0.467)
ln (Capital/labour importer)				0.407***	0.320***	0.900***	0.476***	0.338***	1.090***
				(0.109)	(0.114)	(0.216)	(0.102)	(0.101)	(0.214)
ln (Distance)	-0.310***	-0.389***	-0.483***	-0.643***	-0.668***	-1.028***	-1.058***	-1.144***	-1.966***
	(0.118)	(0.120)	(0.120)	(0.108)	(0.109)	(0.123)	(0.110)	(0.111)	(0.125)
Common border	3.185***	3.194***	2.781***	2.340***	2.307***	2.124***	2.095***	2.055***	1.516***
	(0.659)	(0.657)	(0.655)	(0.554)	(0.546)	(0.492)	(0.570)	(0.559)	(0.534)
Common language	0.056	0.051	-0.089	0.163	0.187	0.185	0.250	0.265	0.167
	(0.314)	(0.309)	(0.293)	(0.236)	(0.234)	(0.211)	(0.225)	(0.221)	(0.193)
Colonial ties	0.324	0.313	0.640	0.778**	0.751**	1.026***	0.697**	0.685**	0.982***
	(0.443)	(0.432)	(0.439)	(0.359)	(0.356)	(0.297)	(0.351)	(0.339)	(0.284)
WTO	0.746***	1.146***	1.132***	1.285***	1.457***	-0.018	1.227***	1.577***	0.106
	(0.127)	(0.153)	(0.144)	(0.133)	(0.163)	(0.140)	(0.132)	(0.161)	(0.136)
RTA	0.295	0.236	0.362**	0.324*	0.303*	0.403**	0.086	0.027	0.129
	(0.195)	(0.194)	(0.178)	(0.181)	(0.181)	(0.170)	(0.179)	(0.179)	(0.164)
Basel	0.010	0.472**	1.121***	-1.749***	-1.617***	-2.331***	-0.598***	-0.234	-0.560***
	(0.184)	(0.214)	(0.144)	(0.185)	(0.201)	(0.179)	(0.149)	(0.166)	(0.118)
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Exporter FE	No	No	Yes	No	No	No	No	No	Yes
Importer FE	No	No	No	No	No	Yes	No	No	Yes
Observations	17512	17512	17512	17322	17322	17322	17309	17309	17309
R^2	0.078	0.088	0.164	0.218	0.221	0.331	0.281	0.289	0.488

Robust standard errors in parentheses, clustered at country-pairs
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

E Triple-difference estimation results

E.1 Exporter side specification

Table E1: Triple-difference exporter side regression specifications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treatment	-2.356***	-2.431***	-1.788**	-2.832***	-2.149**	-2.586***	-2.817***
	(0.805)	(0.799)	(0.827)	(0.866)	(0.868)	(0.835)	(0.833)
Post	-1.379***	-1.461***	-1.586***	-1.241***	-1.793***	-1.825***	-1.888***
	(0.364)	(0.359)	(0.363)	(0.374)	(0.391)	(0.383)	(0.377)
ln (ENGO exporter)	-0.013	-0.233	-0.639***	-0.611***	-0.931***	-0.895***	-0.841***
	(0.142)	(0.155)	(0.175)	(0.174)	(0.176)	(0.164)	(0.163)
Treatment* Post	2.802***	2.805***	3.161***	3.395***	3.076***	3.284***	3.280***
	(0.575)	(0.573)	(0.583)	(0.586)	(0.597)	(0.595)	(0.591)
Treatment* ln (ENGO exporter)	0.443**	0.539**	0.420*	0.689***	0.620***	0.698***	0.744***
	(0.215)	(0.213)	(0.219)	(0.229)	(0.230)	(0.224)	(0.223)
Post* ln (ENGO exporter)	0.468***	0.487***	0.515***	0.513***	0.542***	0.540***	0.535***
	(0.090)	(0.090)	(0.090)	(0.091)	(0.094)	(0.093)	(0.091)
Treatment* Post* ln (ENGO exporter)	-0.811***	-0.799***	-0.885***	-0.928***	-0.874***	-0.927***	-0.916***
	(0.152)	(0.153)	(0.155)	(0.155)	(0.158)	(0.158)	(0.156)
ln (Industry exporter)		0.948***	1.053***	1.447***	1.671***	1.715***	1.718***
		(0.285)	(0.285)	(0.303)	(0.299)	(0.289)	(0.284)
ln (Population exporter)			0.413***	1.143***	-0.090	-0.152	0.052
			(0.088)	(0.191)	(0.241)	(0.234)	(0.239)
ln (GDP exporter)				-0.754***	0.598**	0.691***	0.462*
				(0.185)	(0.245)	(0.236)	(0.242)
ln (Capital/labour exporter)					-2.156***	-1.925***	-1.771***
					(0.349)	(0.352)	(0.350)
ln (Distance)						-0.331***	-0.346***
						(0.108)	(0.121)
Common border						3.263***	3.237***
						(0.671)	(0.652)
Common language						0.053	-0.036
						(0.311)	(0.310)
Colonial ties						0.216	0.229
						(0.453)	(0.445)
WTO							0.762***
							(0.129)
RTA							0.219
							(0.192)
Basel							-0.098
							(0.183)
Observations	17525	17525	17525	17512	17512	17512	17512
R^2	0.015	0.020	0.031	0.037	0.046	0.075	0.083

Robust standard errors in parentheses, clustered at country-pairs
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E2: Triple-difference exporter side regression specifications with year FE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treatment	-2.310***	-2.376***	-1.742**	-2.980***	-1.785*	-2.159**	-1.999**
	(0.804)	(0.798)	(0.826)	(0.890)	(0.918)	(0.886)	(0.879)
Post	0.000	0.000	0.000	-1.591***	-2.524***	-2.662***	-4.122***
	(.)	(.)	(.)	(0.427)	(0.479)	(0.468)	(0.531)
ln (ENGO exporter)	-0.016	-0.248	-0.650***	-0.610***	-1.000***	-0.974***	-0.931***
	(0.141)	(0.154)	(0.174)	(0.175)	(0.182)	(0.170)	(0.168)
Treatment* Post	2.745***	2.735***	3.092***	3.414***	2.880***	3.065***	3.067***
	(0.572)	(0.571)	(0.580)	(0.586)	(0.601)	(0.598)	(0.593)
Treatment* ln (ENGO exporter)	0.434**	0.532**	0.415*	0.731***	0.549**	0.615***	0.557**
	(0.214)	(0.213)	(0.219)	(0.235)	(0.239)	(0.232)	(0.231)
Post* ln (ENGO exporter)	0.470***	0.491***	0.519***	0.513***	0.552***	0.551***	0.585***
	(0.090)	(0.090)	(0.090)	(0.091)	(0.096)	(0.094)	(0.093)
Treatment* Post* ln (ENGO exporter)	-0.800***	-0.784***	-0.870***	-0.934***	-0.833***	-0.882***	-0.883***
	(0.152)	(0.152)	(0.154)	(0.155)	(0.158)	(0.158)	(0.157)
ln (Industry exporter)		0.994***	1.096***	1.514***	1.699***	1.748***	1.841***
		(0.289)	(0.288)	(0.306)	(0.300)	(0.289)	(0.286)
ln (Population exporter)			0.410***	1.250***	-0.419	-0.534	-0.442
			(0.088)	(0.219)	(0.356)	(0.346)	(0.339)
ln (GDP exporter)				-0.865***	0.945**	1.094***	1.028***
				(0.218)	(0.375)	(0.363)	(0.358)
ln (Capital/labour exporter)					-2.484***	-2.307***	-2.328***
					(0.442)	(0.443)	(0.437)
ln (Distance)						-0.336***	-0.423***
						(0.108)	(0.122)
Common border						3.256***	3.210***
						(0.668)	(0.649)
Common language						0.066	-0.018
						(0.309)	(0.306)
Colonial ties						0.250	0.270
						(0.451)	(0.437)
WTO							1.178***
							(0.153)
RTA							0.151
							(0.192)
Basel							0.425**
							(0.210)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17525	17525	17525	17512	17512	17512	17512
R^2	0.017	0.023	0.034	0.040	0.050	0.079	0.093

Robust standard errors in parentheses, clustered at country-pairs

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E3: Triple-difference exporter side regression specifications with exporter FE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treatment	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)
Post	-1.538***	-1.587***	-1.320***	-1.316***	-1.315***	-1.219***	-0.973***
	(0.361)	(0.363)	(0.364)	(0.364)	(0.363)	(0.356)	(0.353)
ln (ENGO exporter)	0.516	-0.303	0.432	3.935**	3.927**	5.678***	5.687***
	(0.325)	(0.415)	(0.518)	(1.718)	(1.727)	(1.695)	(1.054)
Treatment* Post	2.701***	2.623***	2.336***	2.323***	2.332***	2.437***	2.834***
	(0.576)	(0.575)	(0.571)	(0.584)	(0.596)	(0.588)	(0.591)
Treatment* ln (ENGO exporter)	-0.220	-0.034	0.245	-0.357*	-0.352	-0.604***	-1.975***
	(0.174)	(0.203)	(0.240)	(0.210)	(0.215)	(0.214)	(0.319)
Post* ln (ENGO exporter)	0.516***	0.529***	0.505***	0.504***	0.504***	0.475***	0.457***
	(0.091)	(0.091)	(0.090)	(0.091)	(0.091)	(0.089)	(0.088)
Treatment* Post* ln (ENGO exporter)	-0.785***	-0.759***	-0.709***	-0.707***	-0.710***	-0.744***	-0.889***
	(0.154)	(0.154)	(0.152)	(0.155)	(0.159)	(0.157)	(0.158)
ln (Industry exporter)		0.506	0.609	0.595	0.613	0.409	-0.399
		(0.434)	(0.437)	(0.457)	(0.463)	(0.459)	(0.480)
ln (Population exporter)			-1.905**	-2.052**	-2.058**	-3.121***	-4.705***
			(0.849)	(1.028)	(1.022)	(1.004)	(1.037)
ln (GDP exporter)				0.028	0.036	0.192	-0.239
				(0.169)	(0.176)	(0.173)	(0.178)
ln (Capital/labour exporter)					-0.058	0.350	-0.258
					(0.488)	(0.479)	(0.495)
ln (Distance)						-0.460***	-0.435***
						(0.109)	(0.119)
Common border						2.846***	2.831***
						(0.697)	(0.657)
Common language						-0.048	-0.088
						(0.300)	(0.296)
Colonial ties						0.597	0.634
						(0.460)	(0.444)
WTO							0.807***
							(0.123)
RTA							0.413**
							(0.178)
Basel							0.659***
							(0.131)
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17525	17525	17525	17512	17512	17512	17512
R^2	0.115	0.115	0.116	0.116	0.116	0.145	0.158

Robust standard errors in parentheses, clustered at country-pairs

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E4: Triple-difference exporter side regression specifications with importer FE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treatment	-2.659***	-2.791***	-1.732***	-2.539***	-2.029***	-1.833***	-2.147***
	(0.648)	(0.626)	(0.631)	(0.642)	(0.653)	(0.566)	(0.562)
Post	-1.169***	-1.276***	-1.479***	-1.213***	-1.629***	-1.449***	-1.318***
	(0.374)	(0.368)	(0.369)	(0.372)	(0.386)	(0.391)	(0.383)
ln (ENGO exporter)	0.368***	0.093	-0.586***	-0.565***	-0.808***	-0.532***	-0.635***
	(0.116)	(0.125)	(0.135)	(0.134)	(0.140)	(0.124)	(0.122)
Treatment* Post	2.252***	2.263***	2.872***	3.071***	2.839***	2.774***	2.504***
	(0.578)	(0.576)	(0.583)	(0.582)	(0.593)	(0.597)	(0.584)
Treatment* ln (ENGO exporter)	0.627***	0.755***	0.567***	0.775***	0.723***	0.626***	0.751***
	(0.169)	(0.167)	(0.167)	(0.170)	(0.173)	(0.147)	(0.148)
Post* ln (ENGO exporter)	0.466***	0.492***	0.541***	0.539***	0.562***	0.536***	0.507***
	(0.091)	(0.090)	(0.090)	(0.089)	(0.093)	(0.094)	(0.092)
Treatment* Post* ln (ENGO exporter)	-0.702***	-0.689***	-0.838***	-0.876***	-0.837***	-0.852***	-0.778***
	(0.151)	(0.151)	(0.152)	(0.152)	(0.154)	(0.155)	(0.152)
ln (Industry exporter)		1.170***	1.362***	1.675***	1.848***	2.176***	2.141***
		(0.236)	(0.224)	(0.238)	(0.240)	(0.214)	(0.212)
ln (Population exporter)			0.717***	1.283***	0.353*	0.239	0.084
			(0.065)	(0.164)	(0.199)	(0.184)	(0.189)
ln (GDP exporter)				-0.587***	0.432**	0.620***	0.724***
				(0.158)	(0.198)	(0.181)	(0.187)
ln (Capital/labour exporter)					-1.636***	-1.611***	-1.698***
					(0.289)	(0.274)	(0.276)
ln (Distance)						-1.804***	-1.803***
						(0.132)	(0.134)
Common border						2.030***	1.970***
						(0.497)	(0.491)
Common language						0.370*	0.353*
						(0.200)	(0.198)
Colonial ties						0.444	0.480*
						(0.283)	(0.281)
WTO							0.300***
							(0.103)
RTA							-0.065
							(0.182)
Basel							-0.859***
							(0.121)
Importer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17525	17525	17525	17512	17512	17512	17512
R^2	0.281	0.289	0.321	0.325	0.331	0.409	0.413

Robust standard errors in parentheses, clustered at country-pairs

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E5: Triple-difference exporter side regression specifications with year and exporter FE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treatment	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)
Post	0.000	0.000	0.000	-1.770***	-1.777***	-1.676***	-4.069***
	(.)	(.)	(.)	(0.508)	(0.507)	(0.499)	(0.539)
ln (ENGO exporter)	0.498	-0.693	0.276	1.900	1.864	3.710*	1.108
	(0.324)	(0.432)	(0.713)	(2.096)	(2.095)	(2.061)	(1.287)
Treatment* Post	2.649***	2.399***	2.261***	2.348***	2.332***	2.417***	2.852***
	(0.574)	(0.568)	(0.573)	(0.589)	(0.598)	(0.591)	(0.594)
Treatment* ln (ENGO exporter)	-0.218	0.110	0.176	0.294	0.289	0.067	-0.752***
	(0.173)	(0.208)	(0.223)	(0.188)	(0.189)	(0.190)	(0.174)
Post* ln (ENGO exporter)	0.517***	0.556***	0.537***	0.535***	0.534***	0.502***	0.614***
	(0.091)	(0.092)	(0.093)	(0.093)	(0.093)	(0.091)	(0.089)
Treatment* Post* ln (ENGO exporter)	-0.774***	-0.694***	-0.674***	-0.696***	-0.690***	-0.722***	-0.839***
	(0.153)	(0.152)	(0.152)	(0.156)	(0.160)	(0.159)	(0.159)
ln (Industry exporter)		1.490***	1.383***	1.457***	1.423***	1.165**	1.367***
		(0.506)	(0.512)	(0.519)	(0.523)	(0.516)	(0.521)
ln (Population exporter)			-1.168	-1.153	-1.114	-2.298**	-0.752
			(1.126)	(1.156)	(1.155)	(1.134)	(1.154)
ln (GDP exporter)				-0.141	-0.160	0.044	-0.117
				(0.283)	(0.288)	(0.284)	(0.289)
ln (Capital/labour exporter)					0.120	0.481	0.190
					(0.518)	(0.510)	(0.528)
ln (Distance)						-0.457***	-0.488***
						(0.109)	(0.120)
Common border						2.840***	2.771***
						(0.698)	(0.654)
Common language						-0.048	-0.094
						(0.300)	(0.293)
Colonial ties						0.598	0.644
						(0.460)	(0.438)
WTO							1.138***
							(0.143)
RTA							0.343*
							(0.178)
Basel							1.217***
							(0.143)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17525	17525	17525	17512	17512	17512	17512
R^2	0.117	0.118	0.118	0.118	0.118	0.146	0.167

Robust standard errors in parentheses, clustered at country-pairs
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E6: Triple-difference exporter side regression specifications with year and importer FE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treatment	-2.638***	-2.760***	-1.711***	-2.764***	-1.981***	-1.731***	-2.185***
	(0.648)	(0.625)	(0.631)	(0.658)	(0.682)	(0.592)	(0.593)
Post	0.000	0.000	0.000	-1.371***	-1.995***	-1.907***	-1.300***
	(.)	(.)	(.)	(0.419)	(0.451)	(0.450)	(0.472)
ln (ENGO exporter)	0.368***	0.084	-0.591***	-0.557***	-0.820***	-0.553***	-0.636***
	(0.116)	(0.125)	(0.135)	(0.135)	(0.144)	(0.129)	(0.126)
Treatment* Post	2.225***	2.220***	2.837***	3.129***	2.785***	2.698***	2.489***
	(0.576)	(0.574)	(0.581)	(0.582)	(0.592)	(0.596)	(0.584)
Treatment* ln (ENGO exporter)	0.623***	0.752***	0.565***	0.835***	0.715***	0.608***	0.761***
	(0.169)	(0.167)	(0.167)	(0.174)	(0.178)	(0.151)	(0.154)
Post* ln (ENGO exporter)	0.467***	0.494***	0.542***	0.537***	0.564***	0.539***	0.505***
	(0.091)	(0.089)	(0.089)	(0.089)	(0.093)	(0.094)	(0.093)
Treatment* Post* ln (ENGO exporter)	-0.697***	-0.679***	-0.830***	-0.889***	-0.825***	-0.836***	-0.773***
	(0.151)	(0.150)	(0.152)	(0.152)	(0.154)	(0.155)	(0.152)
ln (Industry exporter)		1.200***	1.386***	1.751***	1.878***	2.208***	2.168***
		(0.239)	(0.227)	(0.241)	(0.241)	(0.215)	(0.213)
ln (Population exporter)			0.715***	1.439***	0.326	0.161	0.112
			(0.065)	(0.186)	(0.286)	(0.262)	(0.261)
ln (GDP exporter)				-0.746***	0.459	0.701***	0.692***
				(0.183)	(0.294)	(0.268)	(0.267)
ln (Capital/labour exporter)					-1.662***	-1.689***	-1.677***
					(0.357)	(0.340)	(0.338)
ln (Distance)						-1.806***	-1.805***
						(0.132)	(0.134)
Common border						2.027***	1.964***
						(0.497)	(0.491)
Common language						0.375*	0.352*
						(0.200)	(0.198)
Colonial ties						0.456	0.481*
						(0.283)	(0.282)
WTO							0.250*
							(0.140)
RTA							-0.073
							(0.183)
Basel							-0.874***
							(0.135)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17525	17525	17525	17512	17512	17512	17512
R^2	0.283	0.291	0.323	0.328	0.332	0.411	0.415

Robust standard errors in parentheses, clustered at country-pairs

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E7: Triple-difference exporter side regression specifications with all FE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treatment	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)
Post	0.000	0.000	0.000	-1.446***	-1.456***	-0.986**	-0.827
	(.)	(.)	(.)	(0.484)	(0.484)	(0.476)	(0.510)
ln (ENGO exporter)	1.449***	-0.599*	-0.756	0.194	0.138	2.034	1.254
	(0.203)	(0.308)	(0.660)	(2.142)	(2.135)	(2.100)	(1.261)
Treatment* Post	2.356***	2.033***	2.081***	2.302***	2.275***	2.246***	2.097***
	(0.565)	(0.556)	(0.560)	(0.572)	(0.582)	(0.579)	(0.575)
Treatment* ln (ENGO exporter)	-0.126	0.389***	0.333*	0.573***	0.565***	0.241	-0.554***
	(0.098)	(0.132)	(0.171)	(0.171)	(0.172)	(0.167)	(0.149)
Post* ln (ENGO exporter)	0.519***	0.570***	0.577***	0.571***	0.570***	0.500***	0.469***
	(0.085)	(0.086)	(0.086)	(0.086)	(0.086)	(0.086)	(0.086)
Treatment* Post* ln (ENGO exporter)	-0.743***	-0.640***	-0.647***	-0.702***	-0.692***	-0.719***	-0.670***
	(0.150)	(0.148)	(0.148)	(0.151)	(0.155)	(0.155)	(0.154)
ln (Industry exporter)		1.933***	1.971***	2.157***	2.101***	1.960***	1.983***
		(0.497)	(0.504)	(0.514)	(0.515)	(0.510)	(0.508)
ln (Population exporter)			0.412	0.485	0.548	-0.425	-0.424
			(1.165)	(1.199)	(1.189)	(1.169)	(1.163)
ln (GDP exporter)				-0.366	-0.397	-0.285	-0.328
				(0.280)	(0.282)	(0.276)	(0.273)
ln (Capital/labour exporter)					0.198	0.650	0.672
					(0.519)	(0.511)	(0.508)
ln (Distance)						-1.953***	-1.933***
						(0.117)	(0.124)
Common border						1.533***	1.530***
						(0.534)	(0.532)
Common language						0.156	0.158
						(0.195)	(0.194)
Colonial ties						0.956***	0.959***
						(0.286)	(0.287)
WTO							0.340**
							(0.141)
RTA							0.124
							(0.162)
Basel							-0.444***
							(0.115)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17525	17525	17525	17512	17512	17512	17512
R^2	0.403	0.404	0.404	0.405	0.405	0.482	0.483

Robust standard errors in parentheses, clustered at country-pairs
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

E.2 Gravity specification

Table E8: Triple-difference gravity regression specifications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	-2.356***	-2.867***	-2.869***	-1.659**	-2.900***	-2.324***	-2.822***	-3.341***
	(0.805)	(0.786)	(0.774)	(0.733)	(0.747)	(0.760)	(0.687)	(0.669)
Post	-1.379***	-1.450***	-1.517***	-1.799***	-1.915***	-2.198***	-2.333***	-2.280***
	(0.364)	(0.374)	(0.368)	(0.375)	(0.392)	(0.400)	(0.395)	(0.383)
ln (ENGO exporter)	-0.013	0.079	-0.146	-0.528***	-0.517***	-0.775***	-0.676***	-0.739***
	(0.142)	(0.139)	(0.151)	(0.158)	(0.157)	(0.161)	(0.138)	(0.132)
Treatment* Post	2.802***	2.988***	2.973***	3.349***	3.654***	3.389***	3.553***	3.323***
	(0.575)	(0.586)	(0.584)	(0.591)	(0.598)	(0.608)	(0.615)	(0.598)
Treatment* ln (ENGO exporter)	0.443**	0.573***	0.655***	0.476**	0.807***	0.741***	0.816***	0.978***
	(0.215)	(0.207)	(0.205)	(0.193)	(0.196)	(0.199)	(0.182)	(0.179)
Post* ln (ENGO exporter)	0.468***	0.433***	0.453***	0.532***	0.543***	0.575***	0.570***	0.558***
	(0.090)	(0.092)	(0.091)	(0.091)	(0.092)	(0.094)	(0.094)	(0.091)
Treatment* Post* ln (ENGO exporter)	-0.811***	-0.859***	-0.842***	-0.927***	-0.997***	-0.952***	-1.009***	-0.936***
	(0.152)	(0.155)	(0.155)	(0.155)	(0.157)	(0.159)	(0.162)	(0.157)
ln (ENGO importer)		1.189***	1.183***	-0.065	-0.297**	-0.293**	-0.676***	-0.866***
		(0.100)	(0.099)	(0.113)	(0.120)	(0.120)	(0.108)	(0.114)
ln (Industry exporter)			0.972***	1.194***	1.650***	1.823***	2.024***	2.032***
			(0.280)	(0.253)	(0.275)	(0.274)	(0.249)	(0.241)
ln (Industry importer)			-0.119	0.442***	-0.178	-0.243*	-0.589***	-0.402***
			(0.076)	(0.079)	(0.133)	(0.137)	(0.131)	(0.128)
ln (Population exporter)				0.585***	1.394***	0.406*	0.324	0.383*
				(0.077)	(0.185)	(0.236)	(0.219)	(0.218)
ln (Population importer)				1.003***	0.433***	0.690***	0.622***	0.846***
				(0.059)	(0.111)	(0.131)	(0.121)	(0.119)
ln (GDP exporter)					-0.840***	0.243	0.393*	0.282
					(0.178)	(0.237)	(0.219)	(0.216)
ln (GDP importer)					0.710***	0.429***	0.728***	0.583***
					(0.121)	(0.139)	(0.129)	(0.126)
ln (Capital/labour exporter)						-1.672***	-1.548***	-1.502***
						(0.331)	(0.313)	(0.308)
ln (Capital/labour importer)						0.370***	0.393***	0.439***
						(0.121)	(0.105)	(0.102)
ln (Distance)							-0.981***	-1.119***
							(0.101)	(0.112)
Common border							2.295***	2.153***
							(0.590)	(0.561)
Common language							0.396*	0.247
							(0.229)	(0.221)
Colonial ties							0.408	0.466
							(0.363)	(0.346)
WTO								1.255***
								(0.133)
RTA								-0.072
								(0.175)
Basel								-0.813***
								(0.154)
Observations	17525	17437	17417	17417	17319	17309	17309	17309
R^2	0.015	0.062	0.068	0.190	0.206	0.213	0.274	0.290

Robust standard errors in parentheses, clustered at country-pairs
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E9: Triple-difference gravity regression specifications with year FE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	-2.310***	-2.789***	-2.811***	-1.635**	-2.857***	-1.907**	-2.278***	-2.576***
	(0.804)	(0.779)	(0.767)	(0.730)	(0.759)	(0.794)	(0.720)	(0.705)
Post	0.000	0.000	-2.750***	-2.346***	0.000	-2.894***	-3.255***	-4.046***
	(.)	(.)	(0.411)	(0.422)	(.)	(0.512)	(0.499)	(0.534)
ln (ENGO exporter)	-0.016	0.074	-0.179	-0.545***	-0.527***	-0.859***	-0.782***	-0.829***
	(0.141)	(0.137)	(0.148)	(0.157)	(0.157)	(0.165)	(0.144)	(0.137)
Treatment* Post	2.745***	2.871***	2.850***	3.282***	3.608***	3.181***	3.305***	3.104***
	(0.572)	(0.582)	(0.580)	(0.588)	(0.595)	(0.609)	(0.618)	(0.602)
Treatment* ln (ENGO exporter)	0.434**	0.559***	0.655***	0.475**	0.800***	0.660***	0.708***	0.804***
	(0.214)	(0.205)	(0.203)	(0.192)	(0.199)	(0.205)	(0.187)	(0.185)
Post* ln (ENGO exporter)	0.470***	0.443***	0.466***	0.537***	0.547***	0.585***	0.582***	0.594***
	(0.090)	(0.092)	(0.091)	(0.091)	(0.092)	(0.096)	(0.096)	(0.093)
Treatment* Post* ln (ENGO exporter)	-0.800***	-0.836***	-0.816***	-0.912***	-0.988***	-0.909***	-0.958***	-0.898***
	(0.152)	(0.154)	(0.154)	(0.154)	(0.156)	(0.159)	(0.162)	(0.157)
ln (ENGO importer)		1.284***	1.288***	0.009	-0.246*	-0.233*	-0.628***	-0.849***
		(0.104)	(0.104)	(0.121)	(0.126)	(0.126)	(0.112)	(0.115)
ln (Industry exporter)			1.085***	1.247***	1.668***	1.838***	2.038***	2.103***
			(0.283)	(0.256)	(0.277)	(0.275)	(0.250)	(0.242)
ln (Industry importer)			-0.095	0.443***	-0.166	-0.244*	-0.601***	-0.336***
			(0.076)	(0.079)	(0.136)	(0.137)	(0.131)	(0.129)
ln (Population exporter)				0.582***	1.373***	-0.000	-0.204	-0.136
				(0.077)	(0.208)	(0.324)	(0.302)	(0.295)
ln (Population importer)				0.985***	0.431***	0.627***	0.537***	0.816***
				(0.060)	(0.115)	(0.139)	(0.126)	(0.124)
ln (GDP exporter)					-0.819***	0.672**	0.954***	0.864***
					(0.205)	(0.337)	(0.313)	(0.307)
ln (GDP importer)					0.697***	0.481***	0.809***	0.607***
					(0.127)	(0.147)	(0.135)	(0.132)
ln (Capital/labour exporter)						-2.072***	-2.084***	-2.067***
						(0.403)	(0.384)	(0.377)
ln (Capital/labour importer)						0.322***	0.332***	0.357***
						(0.123)	(0.106)	(0.102)
ln (Distance)							-0.989***	-1.176***
							(0.100)	(0.113)
Common border							2.252***	2.110***
							(0.586)	(0.554)
Common language							0.422*	0.272
							(0.228)	(0.220)
Colonial ties							0.441	0.497
							(0.361)	(0.340)
WTO								1.599***
								(0.161)
RTA								-0.116
								(0.176)
Basel								-0.429**
								(0.173)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17525	17437	17417	17417	17319	17309	17309	17309
R^2	0.017	0.070	0.077	0.193	0.208	0.216	0.277	0.296

Robust standard errors in parentheses, clustered at country-pairs
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E10: Triple-difference gravity regression specifications with country FE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
Post	-1.277***	-1.188***	-1.547***	-1.561***	-1.597***	-1.645***	-1.321***	-1.271***
	(0.344)	(0.347)	(0.339)	(0.344)	(0.347)	(0.345)	(0.341)	(0.340)
ln (ENGO exporter)	1.442***	1.455***	-0.399	-0.505	3.046	2.251	4.066**	1.859*
	(0.202)	(0.203)	(0.289)	(0.523)	(2.487)	(1.932)	(1.878)	(1.101)
Treatment* Post	2.358***	2.339***	2.167***	2.181***	2.299***	2.333***	2.319***	2.156***
	(0.566)	(0.570)	(0.553)	(0.553)	(0.567)	(0.579)	(0.577)	(0.573)
Treatment* ln (ENGO exporter)	-0.124	-0.119	0.321**	0.293	0.189	0.011	-0.381**	-0.512
	(0.098)	(0.098)	(0.127)	(0.191)	(0.209)	(0.173)	(0.154)	(0.321)
Post* ln (ENGO exporter)	0.521***	0.500***	0.551***	0.554***	0.547***	0.560***	0.493***	0.465***
	(0.085)	(0.086)	(0.084)	(0.084)	(0.084)	(0.084)	(0.084)	(0.084)
Treatment* Post* ln (ENGO exporter)	-0.744***	-0.741***	-0.677***	-0.678***	-0.712***	-0.726***	-0.755***	-0.700***
	(0.150)	(0.151)	(0.147)	(0.146)	(0.149)	(0.154)	(0.153)	(0.153)
ln (ENGO importer)		-0.030	-0.288***	-0.291**	-0.264**	-0.250**	-0.260**	-0.148
		(0.106)	(0.111)	(0.119)	(0.124)	(0.125)	(0.127)	(0.134)
ln (Industry exporter)			1.427***	1.455***	1.602***	1.520***	1.452***	1.596***
			(0.431)	(0.436)	(0.446)	(0.445)	(0.439)	(0.446)
ln (Industry importer)			1.431***	1.410***	1.255***	0.827***	0.941***	0.920***
			(0.251)	(0.257)	(0.282)	(0.291)	(0.290)	(0.287)
ln (Population exporter)				0.232	0.077	-0.469	-1.371	-1.191
				(1.040)	(1.138)	(1.104)	(1.076)	(1.068)
ln (Population importer)				-0.099	-0.320	0.367	0.466	0.511
				(0.337)	(0.367)	(0.386)	(0.384)	(0.387)
ln (GDP exporter)					-0.264	-0.203	-0.082	-0.103
					(0.197)	(0.195)	(0.191)	(0.192)
ln (GDP importer)					0.283**	0.115	0.110	0.146
					(0.129)	(0.130)	(0.130)	(0.130)
ln (Capital/labour exporter)						-0.133	0.312	0.407
						(0.481)	(0.470)	(0.465)
ln (Capital/labour importer)						0.919***	1.073***	1.070***
						(0.206)	(0.207)	(0.208)
ln (Distance)							-1.989***	-1.974***
							(0.118)	(0.125)
Common border							1.519***	1.516***
							(0.537)	(0.535)
Common language							0.154	0.155
							(0.194)	(0.193)
Colonial ties							0.987***	0.988***
							(0.284)	(0.284)
WTO								0.104
								(0.103)
RTA								0.090
								(0.164)
Basel								-0.478***
								(0.108)
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17525	17437	17417	17417	17319	17309	17309	17309
R^2	0.402	0.402	0.406	0.406	0.407	0.409	0.488	0.489

Robust standard errors in parentheses, clustered at country-pairs

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E11: Triple-difference gravity regression specifications with all FE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
Post	0.000	0.000	-1.810***	-1.874***	0.000	-1.774***	-1.376**	-1.029*
	(.)	(.)	(0.411)	(0.473)	(.)	(0.607)	(0.593)	(0.625)
ln (ENGO exporter)	1.449***	1.464***	-0.574*	-0.734	0.319	0.779	2.686	1.679
	(0.203)	(0.204)	(0.307)	(0.660)	(2.164)	(2.101)	(2.060)	(1.240)
Treatment* Post	2.356***	2.347***	2.057***	2.100***	2.321***	2.370***	2.373***	2.214***
	(0.565)	(0.568)	(0.550)	(0.555)	(0.571)	(0.580)	(0.579)	(0.576)
Treatment* ln (ENGO exporter)	-0.126	-0.121	0.385***	0.325*	0.568***	0.524***	0.194	-0.425
	(0.098)	(0.098)	(0.132)	(0.172)	(0.170)	(0.168)	(0.163)	(0.351)
Post* ln (ENGO exporter)	0.519***	0.501***	0.561***	0.567***	0.559***	0.577***	0.506***	0.472***
	(0.085)	(0.086)	(0.085)	(0.085)	(0.085)	(0.085)	(0.085)	(0.085)
Treatment* Post* ln (ENGO exporter)	-0.743***	-0.742***	-0.645***	-0.651***	-0.708***	-0.719***	-0.754***	-0.704***
	(0.150)	(0.151)	(0.146)	(0.146)	(0.150)	(0.154)	(0.154)	(0.154)
ln (ENGO importer)		-0.194	-0.182	-0.187	-0.146	-0.077	-0.117	-0.075
		(0.145)	(0.146)	(0.150)	(0.151)	(0.152)	(0.154)	(0.154)
ln (Industry exporter)			1.877***	1.914***	2.119***	2.022***	1.875***	1.894***
			(0.488)	(0.495)	(0.506)	(0.502)	(0.493)	(0.493)
ln (Industry importer)			1.396***	1.378***	1.279***	0.849***	0.950***	0.909***
			(0.269)	(0.282)	(0.289)	(0.293)	(0.291)	(0.289)
ln (Population exporter)				0.433	0.479	0.240	-0.723	-0.809
				(1.167)	(1.215)	(1.171)	(1.149)	(1.143)
ln (Population importer)				-0.067	-0.219	0.610	0.683	0.634
				(0.387)	(0.395)	(0.423)	(0.422)	(0.421)
ln (GDP exporter)					-0.400	-0.398	-0.291	-0.314
					(0.279)	(0.277)	(0.270)	(0.268)
ln (GDP importer)					0.193	0.027	0.012	0.036
					(0.155)	(0.152)	(0.152)	(0.151)
ln (Capital/labour exporter)						0.088	0.529	0.578
						(0.499)	(0.488)	(0.484)
ln (Capital/labour importer)						0.997***	1.151***	1.124***
						(0.211)	(0.212)	(0.212)
ln (Distance)							-1.989***	-1.972***
							(0.118)	(0.125)
Common border							1.511***	1.510***
							(0.537)	(0.535)
Common language							0.153	0.155
							(0.194)	(0.193)
Colonial ties							0.987***	0.988***
							(0.284)	(0.284)
WTO								0.111
								(0.135)
RTA								0.096
								(0.164)
Basel								-0.455***
								(0.118)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17525	17437	17417	17417	17319	17309	17309	17309
R^2	0.403	0.404	0.407	0.407	0.409	0.410	0.489	0.490

Robust standard errors in parentheses, clustered at country-pairs
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$