THE GRADUATE INSTITUTE | GENEVA
INSTITUT DE HAUTES ETUDES
INTERNATIONALES ET DU DÉVELOPPEMENT
GRADUATE INSTITUTE OF INTERNATIONAL
AND DEVELOPMENT STUDIES

Graduate Institute of
International and Development Studies Working Paper No:
08/2013

Trade Effects of Export Taxes

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Abstract

Export taxes usage has recently risen. They are widely presumed to affect trade, but the lack of data has prevented a systematic evaluation of their trade effects. Based on a new dataset of tax rates at the product level, this paper estimates the distortionary trade effects of export taxes. The results, which are based on theory-consistent estimation of a structural gravity model, indicate that the elasticity of trade quantities to tax is -1.8 on average, rising to -5.5 for extractive sectors. The effects are driven by homogeneous goods. The results suggest that the burden of export taxes is shared by exporters and importers and that export taxes play a role in the rise of world prices.

TRADE EFFECTS OF EXPORT TAXES

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This draft: April 2013

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JEL codes: F13, F42, O24, Q37, H23

Keywords: Export taxes, export duties, export restrictions, export policy, trade policy, panel gravity models, GATT/WTO

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The underlying Panel Export Taxes (PET) Dataset is available at http://olga.solleder.org/export-taxes

I am grateful to Richard Baldwin, Tony Venables, Nicolas Berman and participants of the 2012 ETSG conference and 2013 Villars Research Workshop on International Trade for helpful comments and suggestions.

1. Introduction

1.1. Background

Export taxes, while part of trade policy scene for centuries[1], have recently come into the limelight at the policy level and in academic research, especially in relation to economic crises, strategic industrial policy for raw materials and volatility of food prices.

Policies affecting trade are subject to special scrutiny since 2008-2009 crises. In 2009 export taxes and restrictions emerged as ninth top category among state measures discriminating against foreign commercial interests (**Evenett 2009**). The trend continues upward[2] making export taxes and restriction the fifth top measure in 2012 after bail-outs, trade remedies, tariffs and non-tariff barriers (**Evenett 2012**).

The rise of export taxes relative to other measures may be explained by a lack of discipline on export taxes in the WTO law. Article XI of GATT stipulates, with some exceptions, that export should not be subject to quantitative restrictions, yet GATT does not specify any obligation on the maximum level of export taxes (**GATT 1947**). The notable exceptions are newly acceded members[3] that bound their export taxes in a manner similar to bindings on import tariffs (**WTO 2012**).

Subsequently, the United States, European Union and Mexico won a dispute concerning China's export restrictions on raw materials. The Panel emphasized that Chinese export taxes were inconsistent with China's accession commitments, namely the elimination of all export taxes except for a number of products listed in an Annex to its Protocol of Accession (**WTO Dispute Settlement 2012**). This case highlights the growing concerns of trading partners over the negative spillover effects of export taxes, especially where taxes are imposed by countries with market power able to exploit terms of trade.

China is far from being the only country employing beggar-thy-neighbour policies on raw materials. In 2010 export taxes were used by 19 producers (including top world exporters), according to the recent OECD inventory of the measures restricting export of raw materials (**Fliess and Mard 2012a**). The World Trade Report (**WTO 2010**) suggests that about one third of all export taxes are imposed on

[1] **Reid Smith (2009)** surveys the literature on the colonial use of export taxes and provided specific examples of export taxes from the colonial times to our days.

[2] The Global Trade Alert (GTA), a website monitoring policies affecting world trade, listed 128 export taxes and restrictions implemented by 68 jurisdictions and affecting 178 importing countries (accessed in November 2012). It also refers to 41 non-discriminatory measures. The statistics is not available separately for export taxes, as the smallest category includes both export taxes and restrictions.

[3] China, Mongolia, the Russian Federation, Saudi Arabia, Ukraine and Vietnam have bound their export taxes as part of their accession protocols.

natural resources. Given the distinct features of natural resources, including exhaustibility, price volatility, cartel behaviour, and the political economy of contracting with government, **Ruta and Venables (2012)** argue that current policies, including export taxes, are inefficient and suggests that mutual gains are possible upon coordinated policy reforms.

Another notable illustration of the importance of export taxes is the food crisis of 2007-2008. Export taxes, among other export restrictions, contributed to the increase in the level and volatility of food prices (**Anderson 2012**, **Bouet and Laborde 2010a**, and **FAO et al 2011**). **Giordani, Rocha, and Ruta (2012)** develop a model and provide evidence for the multiplier effect of export restrictions, whereby an increase in prices motivates governments to impose export restrictions leading to a decrease in the world supply and a further rise in prices, imploring further export restrictions. The multiplier effect is likely to hold for other types of commodities calling for an international debate on export restrictions, including export tax discipline.

The appropriate policy responses depend upon the magnitude of the trade effects which has not been firmly established. The analysis to date is limited to overviews and case studies, and research focusing on a specific product group or conducted at a very high level of aggregation, likely due to a lack of detailed and comprehensive data. In light of the raising importance of export taxes as a policy instrument and a lack of evidence in multi-country and multi-product settings, the primary objective of this paper is an empirical estimation of the trade effects of export taxes. Furthermore, the paper will evaluate the importance of export duties in terms of country and product coverage. The analysis was made possible by a new dataset on export taxes covering all products and multiple countries for two periods (Panel Export Taxes (PET) Dataset, **Solleder 2013**).

The rest of the paper is structured as follows: the remainder of **section 1** presents stylized facts on export taxes and summarizes relevant literature; **section 2** outlines the empirical approach and describes the data; **section 0** presents estimation results, while **section 4** tests the robustness of the results. Conclusions and suggestions for further research are presented in **section 5.**

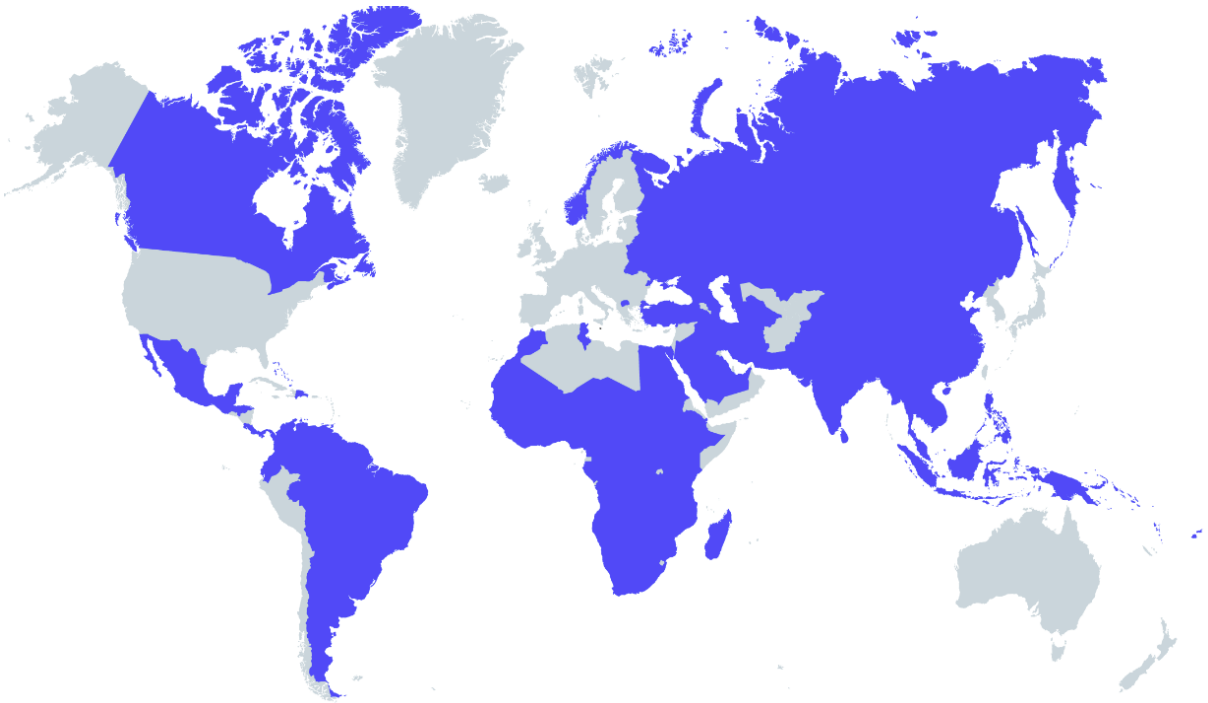
1.2. Stylized facts

This section presents *prima facie* evidence on export taxes, starting with the characteristics of the countries imposing export taxes and the trends in their application, followed by descriptive statistics for taxed products. Calculations are based on a new Panel Export Taxes (PET) Dataset (**Solleder 2013**) unless specified otherwise.

More than half of all countries and territories with independent trade policies apply export taxes (**Figure 1**). Most frequent use of export taxes is observed in Africa where 91% of surveyed countries

impose export taxes, followed by Asia (76%) and Americas (71%). The complete list of 111 tax imposing countries is provided in **Table 7** of the appendix alongside with the selected country characteristics. Key messages related to the WTO membership, regional trade agreements (RTAs) and developmental status are provided in below, juxtaposing the number of countries applying export taxes to the number of countries not employing this policy.

Figure 1 Tax imposing countries



Note: Dark blue shade indicates countries applying export taxes. Grey shade is used for countries that do not impose export taxes export taxes and for cases where information is not available.

The WTO membership is seemingly unrelated to the application of export taxes, which is not surprising given that export taxes are a WTO compliant instrument. Among WTO members, 93 countries apply export taxes and 62 countries do not (**Table 1**). This represents a significant increase from 2004 when 49 WTO members were reported to apply export taxes (**Piermartini 2004**). Furthermore, 11 observer countries, currently negotiating their WTO accession, impose export duties[4].

[4] Information on 15 other observer countries is not available. Data is contradictory for two WTO members, Australia and Tonga, and therefore was not included in the database. Low number of non-member countries in both groups is due to missing information for very small countries and countries not participating in international forums.

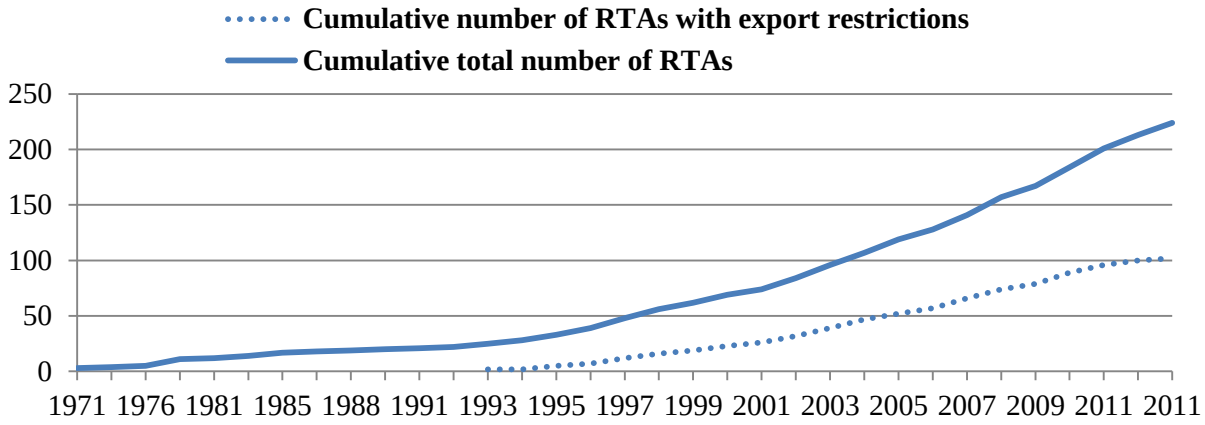
Table 1 Number of tax-imposing countries by the WTO membership and development level

	Number of countries/territories		
	imposing export taxes	not imposing export taxes	with information not available
WTO Membership			
- Member	93	62	2
- Observer	11	1	15
- Non-member	7	3	46
Development level			
- OECD	4	28	1
- Developing	67	28	3
- Least-developed	40	3	7

Note: Developing country group includes any country that is not a member of the OECD and does not have an LDC status.

Absent discipline on export taxes and loosely defined provisions on quantitative export restrictions in the WTO law coincided with the increasing number of provisions on export restrictions in the bilateral and regional trade agreements. Starting from early 90ies, almost every trade agreement contains provisions on export taxes and restrictions, cumulating in 102 agreements with such provisions in 2011 (out of total 224 agreements), as demonstrated in (**Figure 2**).

Figure 2 Number of trade agreements containing provisions on export restrictions



Source: Author's calculations based on the WTO's Regional Trade Agreements Information System.

A more fine-tuned analysis, separating taxes from other export restrictions is available in **Korinek and Bartos (2012)** who classified trade agreements into WTO-plus (forbidding export restrictions where the WTO allows them.), WTO-minus (allowing export restrictions where the WTO does not) and WTO-equal. Out of 92 surveyed RTAs, 64 agreements contain WTO-plus provisions on export taxes and 29 contain WTO-equal provisions. The paper concludes with a suggesting that good practise

and lessons learned while implementing export disciplines at regional level can benefit the multilateral trading system.

At the surface, the developmental status of the countries seems to be a good predictor whether a country imposes export duties. Richer countries (defined here on the basis of their OECD membership) are less frequent users of export duties, while practically every LDC (40 out of 43 countries surveyed) applies them (**Table 1**). The heterogeneity with regard to developmental status may in fact be driven by the differences in export baskets of LDCs and developed countries, and not by their income level. LDCs primary export natural resources and agricultural goods, two most taxed product groups. Among the OECD countries applying export taxes are Norway and Canada, both well-endowed with natural resources.

Export taxes are concentrated on a number of product groups, mostly metals and minerals, hides and skins, fishery and forestry products, as well as cereals, vegetable fats and oils and live animals. Extractive industries are taxed more frequently than agriculture or manufacturing (7.5% compare to 2.7% on average), while the tax rates are the highest for agricultural goods (24% compare to 17% on average, **Table 2**). Furthermore, tax frequency and rates are increasing with market share of products and decreasing with the degree of processing. So, goods with high market share and unprocessed goods are taxed more often and at higher rates.

Table 2 Number of taxed product lines and average tax rate, by level of processing

	(a) Products subject to export tax		(b) Average (unweighted) tax rate
	Number of products	Share in category	
Agriculture	3813	2.1%	24.0%
Manufacturing	8822	0.7%	17.9%
Extractive industries	9905	7.5%	13.6%
Total/Average	*22540*	*2.7%*	*17.0%*

Note: The table is based on the dataset including 20 tax imposing exporting countries, 169 partner countries 2 time periods and all traded goods subject to export tax.

The situation within each applying jurisdiction varies largely. Bangladesh taxed only 2 products in 2011 while China taxed 252 products in 2009, followed by Vietnam, taxing 159 products and Russia with 155 taxed goods (panel (b) of **Table 3**). As expected due to the ToT effect, countries tend to tax exports enjoying high market share. For example, in 2009, the average market share of non-taxed product exported by Russia is 9.6% against 29.2% for taxed commodities, 0.8% against 3.9% for

Nepal, and 1.4% against 1.8% for Sri Lanka[5]. The trend is reversed in China but this can be explained by a high diversity of successful industrial exports of China driving the statistics for non-taxed exports up.

Table 3 Frequency and coverage of export taxes over time

Country	Year 1	Year 2	(a) Share of trade subject to export taxes (HS6 level), %			(b) Number of HS6 lines subject to export taxes		
			Year 1	Year 2	Change	Year 1	Year 2	Change
Azerbaijan	2000	2001	n.a.	n.a.	n.a.	533	108	▼
Bangladesh	2010	2011	n.a.	n.a.	n.a.	0	2	▲
Belarus	2008	2010	33.7	0	▼	22	0	▼
Brazil	2005	2007	0.4	0.5	▲	13	12	▼
China	2007	2009	2.7	2.0	▼	132	252	▲
Côte D'Ivoire	2008	2009	29.6	38.6	▲	10	10	-
Egypt	2010	2011	0	0.4	▲	0	43	▲
Malawi	2010	2011	0	0.4	▲	0	14	▲
Malaysia	2007	2011	8.3	10.4	▲	81	75	▼
Mongolia	2010	2011	n.a.	n.a.	n.a.	0	2	▲
Nepal	2009	2010	18.8	13.3	▼	98	89	▼
Pakistan	2006	2007	0.1	0.4	▲	9	104	▲
Papua New Guinea	2007	2008	0	0.2	▲	22	42	▲
Russian Federation	2007	2009	9.3	5.5	▼	176	155	▼
South Africa	2007	2008	2.7	1.9	▼	5	5	-
Sri Lanka	2009	2010	0.5	12.9	▲	55	41	▼
Thailand	2007	2011	0.7	0.9	▲	69	63	▼
Ukraine	2007	2009	1.8	1.1	▼	53	52	▼
Vietnam	2008	2009	23.1	16.4	▼	197	159	▼
Zambia	2007	2011	0.05	0.4	▲	10	13	▲
Average			*7.8*	*6.2*	▼	*74.2*	*62.1*	▼

Note: The values of affected trade are calculated only for the countries for which direct trade statistics is available.

Even though the number of countries imposing export taxes is increasing, the trends in intensity of their application are ambiguous. In half of the surveyed countries the number of taxed commodities stayed the same or increased over time. Furthermore in 10 out of 17 countries the share of trade subject to taxes has increased (panel (a) of **Table 3**), either because of an increase in the number of taxed goods or a change in their export composition.

[5] Based on in-sample calculations at HS6 level, covering 20 exporting countries, without taking into account tax preferences.

To sum up, the export taxes are applied at product level, in some cases bilaterally. Product characteristics seem to be an important determinant of the coverage and the rate of export taxes. The number of applying countries has grown significantly, reaching 111 jurisdictions, but the tax frequency and coverage within countries does not show an upward trend.

1.3. Literature review

The main strands of literature on export taxes include overview reports, product and country-specific case studies and computable general equilibrium (CGE) models.

The overview reports are mostly prepared by international organisations most likely due to the effort required for collecting relevant data. A WTO report, based on the data from Trade Policy Reviews, weights costs and benefits of export taxes based on a simple theoretical model and a number of case studies. The paper argues that in normal situation an export tax is not a first-best policy, as it distorts price signals, encouraging inefficient resource allocations and dead-weight losses, and may have long-run consequences even if applied on a temporary basis (**Piermartini 2004**). These findings have been echoed in the World Trade Report (**WTO 2010**) analysing trade in natural resources.

The OECD made a major advancement in collecting and verifying information on measures restricting exports of raw materials. The corresponding inventory has been made available publically at the end of 2012 (**Fliess and Mard 2012b**). An earlier OECD report (**OECD 2010**) based on several contributions, concludes that export restrictions negatively affect the welfare of trading partners, increase uncertainty and discourage investments, can lead to policy escalation, and can improve terms of trade, but only temporarily. The report concludes that better policy alternatives are available, and calls for transparency and coordinated response.

An alternative dataset on export taxes have been produced by researchers in the International Food Policy Research Institute (IFPRI), who then simulated gains from the removal of export taxes based on MIRAGE global CGE model (**Bouët, Estrades, and Laborde 2011**). The simulations show that elimination of export taxes can increase global welfare, with gains accruing to importing countries and countries without market power, including some countries that currently impose export taxes. Other tax-imposing nations, e.g. Argentina can experience a loss of welfare, which can challenge potential export tax reforms. The overall results are driven by export taxes in the energy sector and taxes applied by CIS countries.

In an earlier paper **Bouët and Laborde (2010)** outlined theoretical expectations related to the impact of export taxes in partial and general equilibrium settings. The partial equilibrium effects of export taxes applied by a small and a large country are briefly summarized below.

When a small country applies an export tax, domestic producers prefer supplying local market than the world market as they are not taxed when selling domestically. The increased supply reduces the domestic price. When the domestic price reaches the level of world price net of tax, the producers are indifferent between exporting and serving the domestic market. Domestic consumers gain as they consume more at a lower price and the government gains due to increased revenues. Domestic producers lose as they sell less at lower price, and the overall loss is higher than the surplus of consumers and revenues (due to deadweight losses). The policy redistributes welfare from producers to the government and consumers (or downstream industries). The national welfare is unambiguously lower in the presence of export tax in a small country.

When a "large" country applies export tax it can influence the world price of the taxed good. A large country by definition is assumed to have a significant share of the world exports, so that the reduction in export of a taxed good leads to a sizable reduction of the total world exports of this product. Consumers gain and producers lose in the same way as described above, but the government revenues are augmented by the rise of the world price, or in other words by the improvements in the national terms of trade. If this increase in revenues exceeds the producer and deadweight losses, export taxes improve the national welfare of a large country.

Thus, a country with market power can find an optimal level of export taxes. **Kireyev (2010)** models export taxation under perfect completion and under oligopsony, using the cocoa exports from Côte d'Ivoire to calibrate the model, and finds that under both condition an export tax may be welfare-enhancing for a large tax imposing country. **Warr (2001)** applies general equilibrium model to identify optimal level of export tax on rice in Thailand and to estimate welfare effects. There are multiple studies of this type, but by definition they examine one sector in a specific country.

To the best of my knowledge, no paper has so far empirically evaluated trade effects of export taxes. This paper fills the gap in the empirical literature by estimating the elasticity of trade to export tax in the multi-country and multi-product settings and by exploring the heterogeneity of the effects by product characteristics.

2. Empirical approach

This section provides a very brief review of the gravity model literature, stating the selected model and juxtaposing various estimation approaches. It then lays down the empirical strategy and describes the underlying data.

2.1. Gravity model

Trade policies are mostly evaluated using computable general equilibrium models or gravity type estimations. A gravity model is the most suitable framework for this paper which aims at estimating trade effects of export taxes, without taking into account economic welfare or the general equilibrium feedback, such as reallocation of labour and capital across sectors.

For the ease of exposure, the burgeoning gravity literature can be roughly divided into three strands focusing respectively on the underlying theory, specification of gravity models and optimal estimation techniques. The gravity equation has been introduced by **Tinbergen (1962)**, with first microeconomic foundations due to **Anderson (1979)** and **Bergstrand (1985)**[6]. More recent theoretical development is an introduction of heterogeneity in gravity models, for example by **Helpman, Melitz, and Rubinstein (2008)** from a demand side, and by **Chaney (2008)** from a supply side.

Following **Baldwin and Taglioni (2006)**, this paper is based on the following structural gravity model:

$$V_{od} = {\tau_{od}}^{1-\sigma} \frac{Y_o E_d}{\Omega_o {P_d}^{1-\sigma}} \quad \Leftrightarrow$$

$$ln\, V_{od,t} = (1-\sigma)\, ln\, \tau_{od,t} + ln\ Y_{o,t} + ln\, E_{d,t} - ln\, \Omega_{o,t} - (1-\sigma)\, ln\, P_{d,t} \quad (1)$$

where subscript *o* denotes exporting country (or 'origin'), *d* is importing country ('destination'), *t* is time. V_{od} denotes total value of trade (per country or product), τ_{od} encompasses all trade costs, E_d is the destination nation's expenditure, Y_o is origin nation's output, σ is the elasticity of substitution among all varieties, and P_d is destination's CES price index capturing the degree of competition.

$$\Omega_{o,t} \equiv \sum_{i=1}^{R} ({\tau_{oi,t}}^{1-\sigma} \frac{E_{i,t}}{{P_{i,t}}^{1-\sigma}})$$

where Ω_o measures market potential, or the openness of origin nation's exports to world markets ('openness').

[6] Several extensive surveys of gravity literature are available, see for example **De Benedictis and Taglioni (2011)** or **Head and Mayer (2013)**.

In parallel to theoretical contributions, a large share of research is devoted to the choice of an appropriate empirical methodology for estimating gravity equations. One of the challenges of trade data is the presence of a large number of zeros, theoretically grounded by **Helpman, Melitz, and Rubinstein (2008)** and **Baldwin and Harrigan (2011)**. The former employs a two-step methodology for predicting positive trade flows, while **Silva and Tenreyro (2006, 2008** and **2010)** argue in favour of a Poisson Pseudo-Maximum Likelihood (PPML) estimator, in particular in cases where trade zeroes contribute to heteroscedasticity.

Most papers comparing estimation techniques utilise simulated data. The winners of these horse races of estimators depend on the data generating process and the assumptions on the form of heteroscedasticity. **Silva and Tenreyro (2006)** preferred PPML to NLS , GPML, OLS and ET-Tobit, **Martínez-Zarzoso (2007)** favoured FGLS to Gamma PML, PPML and Heckman selection; **Helpman, Melitz, and Rubinstein (2008)** advocated their two-step approach in comparison to NLS, semi-parametric and non-parametric estimation. **Martin and Pham (2008)** compared truncated OLS, ET-Tobit, PPML, Heckman selection, while **Siliverstovs and Schumacher 2009**) favoured PQML to OLS. **Burger, Van Oort, and Linders (2009)** suggested modified Poisson fixed-effects estimations (negative binomial, zero-inflated) as alternatives to log-normal and standard Poisson specification of the gravity model of trade. **Head and Mayer (2013)** convincingly advocated a toolkit approach whereby several estimators are used, which allows not only for robustness checks but also for a better understanding of the results and the characteristics of the underlying data.

2.2. Estimation strategy

The empirical strategy is based on the estimation of the gravity model in log-linearized form, specified in **Equation 1**. The rates of export taxes enter the equation explicitly. Their coefficient corresponds to the elasticity of trade to export taxes and is expected to have a negative sign.

The data has a panel structure with export taxes applied at bilateral level and varying by product[7] and over time. Theory consistent estimation of this dataset requires inclusion of product-specific time-variant price indexes and measures of market potential of exporting countries, which are not directly observable or measurable. Taking ratios can cancel out these variables, but the results are sensitive to a choice of reference data. Alternatively, these variables can be captured by combination of time-varying product- and exporter-specific dummy variables (origin-product-time), time-varying product- and importer-specific dummies (destination-product-time) and time-invariant bilateral product-specific

[7] Estimating a gravity model at industry or product level is widespread. **Anderson and Yotov (2010)** suggest that this approach permits to overcome aggregation bias.

dummies (origin-destination-product)[8]. An obvious disadvantage of the latter approach is its inability to identify the effects of the variables that are subsumed by the dummies.

This paper will be based on a dummy variable approach as it focuses on a product-level policy and does not aim at identifying any bilateral or country-level effects. One high dimensional set of dummies, namely destination-product-time will be introduced through fixed effects. The dimensionality of the data does not allow for explicit inclusion of the two remaining sets of dummy variables. The work-around strategy includes the application of an alternative iterative approach incorporating two-high dimensional fixed effects (referred to as '2WFE' hereafter) to the time-demeaned dataset[9]. The 2WFE approach, developed by (**Guimarães and Portugal 2009**), is based on the full Gauss-Seidel algorithm and allows for estimating linear regressions model with two high-dimensional fixed effects under minimal memory requirements.[10]

Head and Mayer (2013) generate data with different patterns and amount of missing trade flows and compare estimators using Monte Carlo simulations. They find 2WFE estimator provides identical estimates to the least squares with country dummies (as in **Harrigan (1996)** while not being subject to arbitrary limits. Furthermore they recommends 2WFE methods over double-demeaning, Bonus Vetus OLS (**Baier and Bergstrand 2009**) and tetrads (**Head, Mayer, and Ries 2010**).

2.3. Data

Trade statistics and export taxes will enter regressions explicitly, while all other standard gravity variables will be captured by dummies.

The setup of the paper requires using bilateral exports of tax-imposing nations because exports are generally recorded in free on board (f.o.b.) terms and do not include the value of export taxes (unlike imports that are reported in cost insurance and freight (c.i.f) terms that includes taxes). Trade statistics is sourced from ITC Trade Map and UNSD Comtrade. Ideally the trade data should be directly reported; however, in 4 cases I resorted to the use of mirror statistics due to a lack of direct data (for

[8] The dummy variable approach has been widely used since **Harrigan (1996)**, e.g. in **(Anderson and van Wincoop 2003**) and **Feenstra (2004)**. Furthermore, a number of papers underscores a need for theory-motivated selection of fixed effects and suggests fixed effects specification correctly measuring variables and controlling for unobservables (e.g. **Egger and Pfaffermayr 2003**, **Cheng and Wall 2004**, and **Baldwin and Taglioni 2006**).

[9] Time demeaning is an equivalent of inclusion of origin-destination-product dummies or fixed effects as long as the dataset is balanced and does not contain missing observations, which is the case.

[10] The alternative iterative approach is implemented in Stata by user-written reg2hdfe command. This estimator is only available for linear models, even though the approach can in be extended to non-linear settings. A review of Stata routines for fixed effects estimation is available in **McCaffrey et al. (2010)**.

details see **Table 10**). The mirror statistics is recorded in c.i.f., but the distortion will be corrected by including time-varying exporter dummies.

Export taxes belong to time-varying product-specific bilateral trade costs. The export tax data includes all export taxes (duties) and fiscal taxes on exports, whether temporary or permanent, applied to all products (for definitions refer to **Table 8**). The export tax data were obtained by the author from national sources (listed in **Table 9** for each country). Specific export taxes were converted to *ad valorem* equivalents based on **Solleder (2013)**.

To sum up, the paper is based on a product level (HS6) dataset covering 20 exporting countries and 169 importing partner countries representing 99% of world imports in 2010 (the tax rates are destination specific). The dataset includes two time periods for each country from 2000 to 2011 (see **Table 12** for summary statistics). Tax imposing countries are selected to the dataset if the rates of export taxes change over time, which is a necessary condition of applying panel techniques with fixed effects. Standard bilateral trade statistics in values and volumes is used as dependent variables. All independent variables, with exception of bilateral product-level trade costs, are captured by theory-motivated set of dummy variables.

3. Results

In this section, I present the results of the baseline regressions, discuss the approaches for incorporating zero trade flows and explore the heterogeneity in the impact of export taxes on trade by interacting export taxes with product characteristics.

3.1. Baseline results

The baseline results (a log-linearized model estimated by 2WFE on the time-demeaned dataset) are presented in column 1 of **Table 4**. The coefficient indicates negative, statistically significant impact of export taxes on trade of tax-imposing nations, with 1% increase in the rate of export taxes associated with 3.8% decrease in the exported quantity. The results for values are similar to the results for quantities, with the elasticity of trade values to tax equal to -2.8 (column 2 of **Table 4**). The direction and significance of the trade effects of export taxes correspond to the prior expectations. The high magnitude of the effect signifies high elasticity of trade to export taxes, and consequently suggests the economic importance of the policy for tax imposing nations and their trading partners.

Table 4 Trade effects of export taxes

	(1) 2WFE(ln) Export quantity	(2) 2WFE(ln) Export value	(3) 2WFE(ln+min_{dpt}) Export quantity	(4) 2WFE(ln+min_{dpt}) Export value
Tax rate	-3.775*** (1.260)	-2.840** (1.141)	-1.773** (0.778)	-1.180 (0.719)
Observations	1,244,776	1,244,776	1,378,618	1,378,618

*Note: Statistical significance: *** p<0.01, ** p<0.05, * p<0.1. Robust, clustered (by triplet origin-product-time) standard errors are reported in parentheses. Linear regressions models are estimated using an iterative approach with two high-dimensional fixed-effects (origin-product-time and destination-product-time) on the time-demeaned dataset (by origin-destination-product). All continuous variables are in logs. In regression (3) and (4) the data has been transformed before logarithmic transformation by adding the min trade value (by importer-product-year) to zero trade flows.*

By juxtaposing the results of the regressions in terms of quantities and in terms of values, I can identify who bears the tax burden and what happens with the prices of exported goods. When exporters are confronted with an export tax, they have two choices – either adjust the quantity exported or reduce the export price before tax (seller's price in f.o.b. terms). Depending on the price elasticity of demand and the price elasticity of supply the world price may increase with importers (buyers) absorbing part of the tax. Generally the tax incidence falls disproportionately on the group that responds the least to the price. The precise calculation of the pass-through fraction is out of scope of this paper, but the available estimation results suggest that trading partner of tax imposing nations

do bear tax burden. This point is worth discussing as it provides indications whether export tax is an innocuous domestic affair or a beggar-thy-neighbour policy.

As export value equals export quantity multiplied by price, the elasticity of export value to tax compounds a price effect (an increase in taxes leads to higher prices for exporters with market power) and a quantity effect (exporters reduce the exported quantity). In an extreme case with all exporters being able to impact the world price (pushing the tax burden on importers), the elasticity of quantity to tax would be zero, as export quantities would not change. In the other extreme case, with all exporters being prices takers, the elasticity of the value to tax would be zero, as the tax would be fully absorbed by exporters adjusting the quantity of exported goods, e.g. by selling more at the domestic market or reducing production. The significant negative coefficients for export taxes in regressions with quantities and regressions with values shows that both exporters and importers bear the tax burden as the adjustment happens for both quantity and value.

The baseline results can also indirectly indicate the impact of tax on prices. The elasticity of quantity to tax is smaller than the elasticity of value to tax, showing that export taxes increase world prices (compare column 1 and 2 of **Table 4**). Consider a tax increase of 1% leading to 3.8% decrease of exported quantity and 2.8% decrease of the total exported value. The difference must be driven by rising prices; otherwise export value would shrink to the same extent as quantity[11]. Another way to look at this is to take a ratio of the elasticity of quantity to tax and the elasticity of value to tax. The result is a ratio of the change in value to the change in quantity or, in other words, a change in 'unit value', a measure frequently used in empirical trade literature as a proxy for price.

To sum up, the higher is the difference between the elasticity of tax to quantities and the elasticity of tax to value, the higher the change of f.o.b. price and consequently the share of tax burden absorbed by importers (trading partners of tax imposing countries).

3.2. Zero trade flows

The results of the baseline estimations are likely to be biased because they are conditioned on positive trade flows (as log of zero is not defined, the linear iterative procedure does not take zero trade observations into account). Zeros are a frequent feature of trade data, increasing with the level of disaggregation. The stylized facts have prompted the development of a plethora of theories that can account for the features of trade data[12]. Furthermore, zeros can be merely reflect measurement errors

[11] This result is not driven by the fact that tax is part of the world price, because the dependent variable is export value in f.o.b. terms and f.o.b. price does not include export taxes.

[12] For example, **Haveman and Hummels (2004)** explained zeros by incomplete specialisation. **Helpman, Melitz, and Rubinstein (2008)** developed a model of self-selection of firms into export. **Baldwin and**

such as rounding and reporting thresholds. In case of this paper, zeros may also indicate trade flows that can be fully shut down by excessive exports taxes (and export taxes can be as high as 800%). Several mechanisms are more likely to be at play simultaneously and an appropriate estimation technique is paramount.

In this particular dataset 27% of all observations are zero[13]. To include these observations in the 2WFE estimation, I will adapt an approach developed by **Eaton and Kortum (2001)**[14]. I assume that there is a minimum level of trade *m*, such as when the gravity-predicted V_{odpt} falls below *m* the observed trade is zero. Although *m* is unknown, it can be approximated by the minimum observed trade flow.

The approach is intuitive as the minimum trade flow for a specific product and importer can reflect differences in market size, competition, trade barriers, as well as reporting and measurement issues. The approach is consistent with theory and does not require exclusion restrictions. Furthermore, unlike the practice of adding an arbitrary constant, or transforming the dependent variable using inverse hyperbolic sine[15], the approach with adding a minimum observed export value (referred to as '$\ln+\min_{dpt}$') is not scale dependent.

The results obtained by employing '$\ln+\min_{dpt}$' technique on the baseline specification are presented in column 3 and 4 of **Table 4** above). The results are similar to the results obtained by log-linearization, with elasticity of export quantity to tax equal to -1.8. The elasticity of export value to tax is -1.2, but it is only borderline significant (10.1%)[16]. The slightly lower magnitude of these coefficients in comparison to the baseline estimation is expected, as the regressions now incorporate zero export flows.

Harrigan (2011) suggested a variant of the Melitz model that can account for the observed trade patterns. **Eaton, Kortum and Sotelo (2012)** developed a heterogenous trade model with an integer number of firms providing explanations to both a small number of exporting firms and zero trade flows.

[13] In this dataset zeros account for only 27% of all observations, as time-invariant observations are controlled for by the panel fixed effects.

[14] **Eaton and Kortum (2001)** applied the technique to bilateral trade in capital goods. **Crozet, Head, and Mayer (2012)** argue that the approach is well suited for firm-level data. This paper will adapt it to product level dataset, by replacing zero trade flows with the minimum observed value for a given destination product and time period.

[15] The inverse hyperbolic sine transformation defined as $sinh^{-1}(x) = log(x + (x^2 + 1)^{1/2})$ is widely used in household literature following **Burbidge, Magee, and Robb (1988)**, and is finding its ways in the gravity literature, despite the fact that it has the same shortcomings as a more straightforward 'log+1' approach.

[16] The low level of statistical significance can be driven by a conservative approach to clustering standard errors. Other clustering approaches leave room to statistically significant results (see Table 5 of the robustness section).

Overall, my preferred approach is 2WFE estimation of time-demeaned dataset transformed using the minimum observed trade flows instead of zeros. The 2WFE estimations of log-linearized model that includes only positive trade flows are reported in all tables for comparison and denoted 'ln'.

3.3. Interactions

Stylized facts outlined in the introduction suggest that the impact of export taxes may be influenced by characteristics of the products. This subsection aims at identifying these characteristics by exploring the heterogeneity of the impact of export taxes on trade.

As a first step, I test the differences across agricultural, manufacturing and extractive sectors. Extractive sectors include minerals, fisheries and wood. This category of commodities is under special scrutiny following the WTO China-Raw Materials case (**WTO 2012**) and the OECD work in cataloguing and analysing export restrictions on raw materials (**Fliess and Mard 2012a**, and **OECD 2010**). To capture the differences in the impact of export taxes across sectors, I will employ interaction dummies (tax rate x sector) permitting different coefficients (elasticities) for each sector.

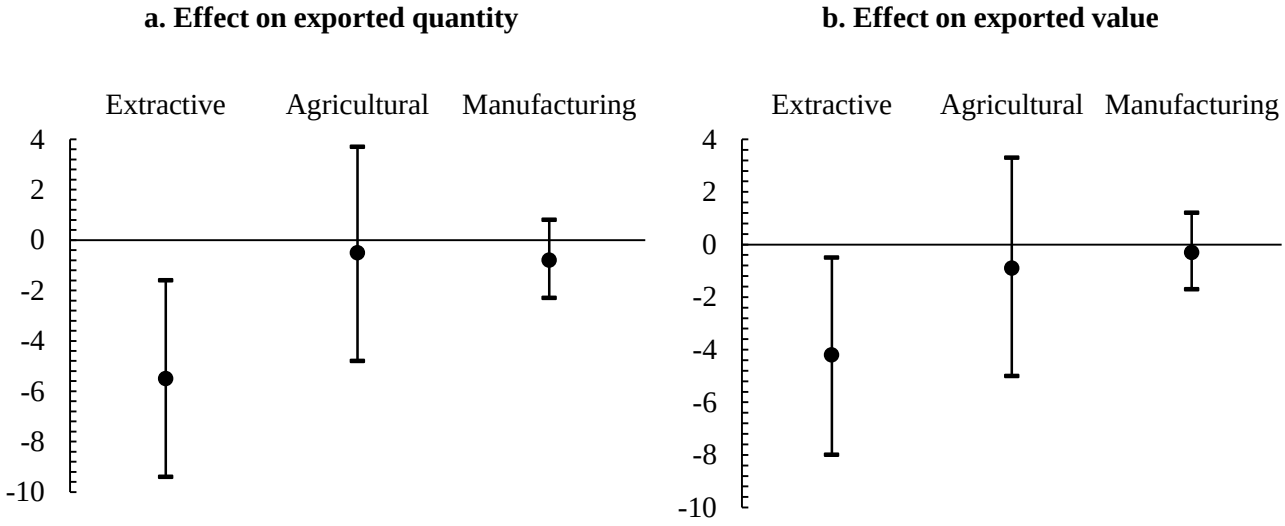
The results corroborate the anecdotal evidence, with the effect of export taxes on agricultural, manufacturing and extractive industries being statistically different from each other with the effects of export taxes on trade being driven by extractive industries (**Table 13**). The elasticity of export quantity to tax on extractive industries is estimated at -5.5 **(Figure 3)** or three times higher than the overall elasticity. The coefficient relating tax and export value is lower in absolute value (-4.2), suggesting that export taxes contribute to the rise of the world prices of the goods in the extractive sector, and that the burden of tax on extractive industries is borne by both exporters and importers.

In the case of extractive industries, the difference between the elasticity of exported quantity to the elasticity of exported value is larger than one, indicating over-shifting, that is the price of a taxed commodity is higher than the sum of the tax free price and the tax. This drawback requires further investigation. The most plausible explanations are measurement errors in trade data as well as the presence of mirror data in the sample (for countries where direct data is not available) which is based on c.i.f. values that include export taxes (driving the coefficient on taxes up in the regressions with values).

The results estimating the impact of export tax on trade in agricultural and manufacturing goods are not statistically significant **(Figure 3)**. In case of agricultural commodities, the most likely explanation is the use of export bans and quotas instead of export taxes, but the data for bans and quotas are not

readily available at product level[17]. The exclusion of bans and quotas biases the results upwards, as exports are reduced where there is seemingly no tax. Manufacturing goods may be shielded from the trade reducing effects of export taxes because these goods are more heterogeneous and therefore more difficult to replace than homogeneous products of the extractive industries.

Figure 3 Trade effects of export taxes by sector



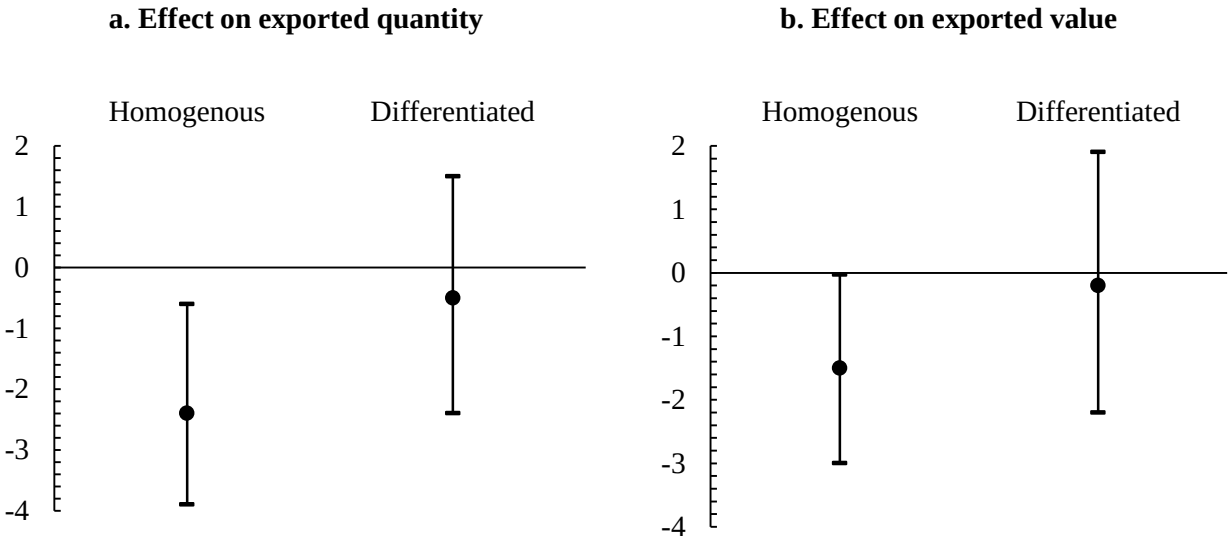
Note: Point estimates and 95% confidence intervals for the elasticity of trade to export taxes are plotted for each group based on the 2WFE ($ln+min_{dpt}$) estimation (see **Table 13** *for details).*

To test whether the degree of homogeneity is an important determinant of trade effects of export taxes, I interact tax rates with a dummy variable indicating whether the goods are homogeneous or differentiated. Following **Rauch (1999)**, homogeneous goods include commodities sold on organized exchanges and reference priced goods. Reference priced goods refer to products that can be quoted without mentioning the producers; they appear in trade publications (e.g. weekly Chemical Marketing Reporter based on the survey of suppliers). Export taxes applied to goods traded through organized exchanges are likely to lead to a decrease in trade quantity because buyers can easily switch to another supplier, since the commodities traded on organized exchanges are not differentiated by their country of origin or producer.

The results confirm prior expectations: the effect of export taxes on homogeneous goods is negative and statistically significant, while the data does not show any relations between export taxes on differentiated goods and their respective export values and quantities. The magnitude of the effects on homogeneous goods is very similar to the overall effect. The quantity elasticity is estimated at -2.4, while value elasticity is -1.5 (**Figure 4**).

[17] The OECD inventory of export restricting measures includes both prohibitions (bans) and quotas, but the dataset does not cover agricultural goods.

Figure 4 Trade effects of export taxes for homogeneous and differentiated goods



*Note: Point estimates and 95% confidence intervals for the elasticity of trade to export taxes are plotted for each group based on the 2WFE ($ln+min_{dpt}$) estimation (see **Table 14** for details).*

In conclusion of this sub-section, I address the endogeneity of export taxes and the identification of the impact. A correctly-specified theory-grounded gravity model is still subject to an econometric critique because trade policies are not exogenous variables; they depend on trade[18]. In the case of export taxes governments are more likely to tax traded goods and products with low elasticity of demand or substitution; and FTA members are more likely to be exempt from export taxes. In the estimated dataset, however, export taxes are not correlated with export quantities and values (**Table 11**), suggesting that endogeneity is not a big problem. A more thorough statistical testing for endogeneity requires identifying instrumental variables, an endeavour out of scope of this paper.

An identification problem can arise if several product-level policies are applied simultaneously by exporting countries. The impact of export taxes is captured by regressing changes in tax rates to changes in bilateral trade at HS6 level. As a result the coefficients may also reflect the effect of other exporter-specific time-varying bilateral product-level trade costs or policies, such as for example bans and quotas[19].

[18] **Baier and Bergstrand (2007)** studied the FTA variable's endogeneity, addressed the problem by using panel, instrumental-variable and control-function approaches and argued in favour of the panel technique.

[19] The most straightforward way to disentangle the effects of various trade costs is to include each of them explicitly in the regressions but data availability precludes this. More sophisticated econometric techniques, such as instrumental variable approaches and regression discontinuity design can be also potentially employed to ensure the internal validity of the results.

It's difficult to think of any other trade costs, except export-related measures, that would fall into this category. Conveniently, the OECD inventory contains all export-related measure (albeit only for raw materials) which allows establishing relations between export taxes and all other types of export restrictions. Products to which taxes are applied can be subject to other export restrictions, most often to a licensing requirement. However, if I consider only bilateral taxes and only those that changed over time, the number of cases where export taxes are applied concurrently with another restriction is limited to 5.5% of the taxed goods. Therefore, the potential confounding effect of other time-variant product-level bilateral policies by exporting country is likely to be limited[20].

The elasticity of export volumes to export taxes is -1.8 on average, -2.4 for homogenous goods and -5.5 for extractive sectors, and the elasticities of export values to export taxes are - 1.18, -1.5 and -4 respectively. These results cannot be compared to other gravity based numerical estimations as this empirical study of export taxes is the first in its class. Yet, the results can be compared to the findings of the studies that look at the coefficients on other trade costs, such as import tariffs or freight rates.

The coefficient on export taxes are in line with the coefficients of other gravity based estimations of trade costs. **Head and Mayer (2013)** provide a metadata analysis of 32 papers containing 744 elasticity coefficients. The median coefficient for structural gravity estimated with country fixed effects is -3.5 (based on 447 equations), and the median coefficient on tariffs (and / or freight rates) is -5.03 (435 equations).

The coefficients for extractive industries (-4.2 for values and -5.5 for volumes of export) seem to be quite high as setting up extractive industries requires significant investment, and the production of the mines are therefore expected to be quite price inelastic. Further work, which is out of scope of this paper, is required to firmly establish channels and mechanisms leading to such a significant elasticity of extractive sectors' export to export tax. Anecdotal evidence suggest that producers may find ways to switch product codes of exported commodities to avoid export taxes e.g. by adding a light processing stage (e.g. from copper to copper wire) or other alteration of the commodities. Furthermore, prohibitively high tariffs can lead to a complete shutdown of exports, driving the coefficients up. Given that export taxes get as high as 800% this is a plausible scenario. Finally, producers may try to bypass export taxes by channelling their exports through partner with established tax preferences. [21]

[20] From the side of the importing country, bilateral import tariffs can impact the results, but there have not been many changes in the past 5 years in the applied bilateral import tariffs.

[21] This paper takes into account destination-specific taxes; however, the estimation techniques do not allow differentiating coefficients on general export taxes and on preferential export taxes.

4. Robustness

In this section, the robustness of the results is tested by re-evaluating the baseline model using an alternative estimator. Then the sensitivity of the results to different levels of clustering of standard errors is discussed.

4.1. Poisson fixed effects

Poisson estimator is a good candidate for an alternative estimator as the dependent variables enter regressions in levels and therefore can include zeros. Furthermore, Poisson family estimators have other desirable properties, such as consistency in the presence of fixed effects[22] and robustness to arbitrary patterns of serial correlations. The coefficients are scale-invariant and can be interpreted the same way as linear estimation of the log-linearized gravity models. **Westerlund and Wilhelmsson (2006)** recommended Poisson fixed effects estimator to OLS on the basis of experiments with simulated and real data with a panel structure.

The disadvantage of Poisson estimator is a lack of approaches permitting to incorporate more than one set of high-dimensional fixed effects, leading to computational difficulties. I attempt to estimate the baseline specification containing three high-dimensional sets of dummy variables. The fixed effects absorb all time-invariant bilateral product-specific characteristics (origin-destination-product). Furthermore, product dummies were replaces by sector dummies (with the aim of reducing dimensionality) based on the assumption that products in the same sector have similar elasticity of substitution.

Most of the regressions based on Poisson fixed effects estimator with high-dimensional dummies did not converge. I have applied several work-around strategies suggested by **Silva and Tenreyro (2010)**. First, dependent variables have been rescaled as Poisson deals better with small values. Second, I tried different optimisation methods and convergence criteria. Finally, I identified and removed the regressors that may cause the nonexistence of the pseudo-maximum likelihood estimates using the algorithm from **Silva and Tenreyro (2011)**.

[22] In comparison to Logit and Probit fixed effects models which suffer from an incidental parameter problem leading to inconsistent estimation (**Wooldridge 2002**, p.483-84).

The Poisson specification that has converged includes bilateral product-specific fixed effects (origin-destination-product) and time-varying exporter dummies (origin-time). The coefficients are negative, -2 for regressions with quantities and -1.5 for regressions with value, and statistically significant (**Table 5**). The Poisson results are in line with the results obtained by applying the 2WFE on transformed data of the same specification (compare column 1-2 to column 3-4 of **Table 5**), and to the results of the baseline model that contains the full set of theory-consistent dummy variables (compare **Table 4** and **Table 5**). This suggests that the data is robust to different functional forms assumptions.

Table 5 Trade effects of export taxes (Poisson fixed effects estimator)

	(1) Poisson Export quantity	(2) Poisson Export value	(3) 2WFE(ln+min_{dpt}) Export quantity	(4) 2WFE(ln+min_{dpt}) Export value
Tax rate	-2.037*** (1.055)	-1.530*** (0.403)	-0.931*** (0.260)	-0.701*** (0.249)
Observations	1,569,000	1,569,000	1,378,618	1,378,618

*Note: Statistical significance: *** p<0.01, ** p<0.05, * p<0.1. Robust, clustered (by triplet origin-destination-product) standard errors are reported in parentheses. All regressions contain bilateral product-specific fixed effects (origin-destination-product) and time-varying exporter dummies (origin-time). The dependent variables are in natural logs for 2WFE estimators (ln+min_{dpt}) and in levels for Poisson. All continuous independent variables are in natural logs.*

4.2. Clustering

The estimated model based on **Equation 1** contains 3 high-dimensional fixed effects and clusters can be organized along one or several of these dimensions. This approach ensures that the intra-cluster correlation is taken into account and is not deflating standard errors.

I have clustered standard errors along time-varying exporter and product specific dimension (origin-product-time), as the decision for application of export taxes is taken by the governments of exporting countries (column 3 of **Table 6**). This approach is conservative as the standard errors are much higher than they would have been if the clustering had been done based on the triplet origin-destination-product (column 2) and just a bit lower than in case of clustering by destination-product time (column 4).

Table 6 Clustering standard errors at different levels

	Clusters			
	(1) No clustering	(2) Origin-destination-product	(3) Origin-product-time	(4) Destination-product-time
2WFE(ln+min_{dpt}) Export quantity	-1.773***	-1.773***	-1.773**	-1.773**
	(0.440)	(0.642)	(0.778)	(0.822)
2WFE(ln+min_{dpt}) Export value	-1.180***	-1.180**	-1.180	-1.180
	(0.411)	(0.563)	(0.719)	(0.723)

*Note: For each estimator the first row gives the coefficient on the tax rate, and the second row reports clustered standard errors. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1. All regressions contain bilateral product-specific fixed effects (origin-destination-product) and time-varying exporter dummies (origin-time). All continuous independent variables are in natural logs. The dependent variables are in natural logs of the transformed data (ln+min_{dpt}).*

To sum up, the results are robust to the model specification and estimation techniques. The identified negative statistically significant effect of export taxes on trade can be attributed to export taxes, as the data does not show signs of endogeneity, and the identification is done within a narrowly defined group (triplet exporter-importer-product) with all other variations controlled for by dummy variables.

5. Concluding remarks

This paper provides robust evidence of a strong link between export taxes and trade. Export taxes are associated with a sizable decrease of trade, especially when imposed on extractive sectors. The effects are driven by homogeneous goods. The results are somewhat expected but nonetheless important, especially in the context of food crisis and strategic industrial policies precluding partner countries' access to raw materials. The findings of the paper can be also useful in the context of regional trade negotiations and discussions on the role of the WTO in regulating export taxes.

The majority of export taxes are applied by developing countries which evoke environmental, developmental and fiscal goals as well as food security as reasons for imposing export duties[23]. Independently of the stated policy objectives, the upward trend in the application of export taxes is likely to continue. As noted by **Evenett and Jenny (2012)**, in a world of rising food prices and increasing demand for scarce natural resources, many governments may prefer welfare of consumers and processing industries to the interests of upstream producers (farming, mining), especially if emerging markets continue to grow generating global demand for both food and raw materials.

The welfare implications of export taxes directly depend on the market power of the countries and whether they are exporter or importer of the taxed commodity. The welfare impact on exporters without market power is ambiguous and depends on the elasticity of supply, demand and substitution. Furthermore, a reduction in exports of tax imposing nations may under certain conditions be welfare enhancing if the gains through achieving associated public policy objectives, e.g. domestic value addition, exceed losses associated with decreased exports. The calculation of the overall welfare effects of export taxes on tax imposing nations and their partners is one of the policy-relevant directions for future research.

Exporters with market power unambiguously gain as they can apply a welfare optimizing level of tax, push the burden of tax on importers and enjoy better terms of trade. Importers unambiguously lose. The world is however interdependent and beggar-thy-neighbour policies may have wider ramifications. If welfare of the world is concerned, then by **Lerner (1936)** symmetry all arguments for tariff liberalisation hold for export taxes.

Future research can focus on establishing the causal link between export taxes and trade, as well as on endogenizing government decisions with respect to export taxes. Establishing a causal link would

[23] Other policy objectives of export taxes include exploiting terms of trade; reducing inflationary pressure and stabilizing domestic prices; inducing export diversification, supporting infant industries and moving up the value chain; addressing local supply shortages; redistributing windfall profits and gains from currency devaluation; offsetting import tariff escalation; preventing smuggling, complementing diminishing import tariff revenues; as well as redistributing welfare among industries, consumers and producers.

require identification of strong and excludable instruments at product or sector level, which is a difficult task. Another avenue for future research is an identification of the true (as opposed to stated) policy objectives and the rationale for imposing export taxes, that is modelling government's decisions establishing the level of export taxes. Further research can also test for presence of a "domino effect" with importing countries trying to counteract export taxes (e.g. by reducing import tariffs) or a "juggernaut effect" with other exporting countries trying to mimic or coordinate their policies (e.g. by forming export tax cartels).

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Data sources

Definition of organized exchange, reference priced and differentiated commodities (Rauch 1999)
- http://econ.ucsd.edu/~jrauch/research_international_trade.html

FTA provisions
- WTO, Regional Trade Agreements Information System (RTA-IS), http://rtais.wto.org/

Export values and volumes
- International Trade Centre, Trade Map, www.intracen.org/marketanalysis.
- United Nations, UNSD Comtrade. http://comtrade.un.org

Export taxes
- Global Trade Alert (GTA). Policies that affect world trade http://www.globaltradealert.org
- OECD. Inventory of measures restricting exports of raw materials http://www.oecd.org/tad/non-tariffmeasures/
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Appendices

Table 7 Countries applying export taxes

Country or territory	WTO status	Country or territory	WTO status	Country or territory	WTO status
Africa		**Americas**		**Asia**	
Angola	Member	Antigua and Barbuda	Member	Bangladesh	Member
Benin	Member	Argentina	Member	Bhutan	Observer
Botswana	Member	Barbados	Member	Cambodia	Member
Burkina Faso	Member	Belize	Member	China	Member
Burundi	Member	Bermuda		East-Timor	
Cameroon	Member	Bolivia	Member	Hong Kong, China	Member
Central African Rep	Member	Brazil	Member	India	Member
Chad	Member	Canada	Member	Indonesia	Member
DRC (Kin)	Member	Colombia	Member	Lao	Observer
Congo (Bra)	Member	Costa Rica	Member	Malaysia	Member
Cote d'Ivoire	Member	Dominica	Member	Maldives	Member
Djibouti	Member	Dominican Republic	Member	Mongolia	Member
Egypt	Member	Ecuador	Member	Myanmar	Member
Ethiopia	Observer	Guatemala	Member	Nepal	Member
Gabon	Member	Guyana	Member	Pakistan	Member
Gambia	Member	Honduras	Member	Philippines	Member
Ghana	Member	Mexico	Member	Sri Lanka	Member
Guinea	Member	Panama	Member	Thailand	Member
Guinea-Bissau	Member	Paraguay	Member	Viet Nam	Member
Kenya	Member	St Kitts and Nevis	Member		
Lesotho	Member	Saint Lucia	Member	**Europe**	
Liberia	Observer	St Vincent and the Grenadines	Member	Macedonia	Member
Madagascar	Member	Sao Tome and Principe	Observer	Norway	Member
Malawi	Member	Suriname	Member	Turkey	Member
Mali	Member	Trinidad and Tobago	Member		
Mauritania	Member	Turks and Caicos		**Middle East**	
Morocco	Member	Uruguay	Member	Bahrain	Member
Mozambique	Member			Iraq	Observer
Namibia	Member	**CIS**		Iran	Observer
Niger	Member	Azerbaijan	Observer	Jordan	Member
Nigeria	Member	Belarus	Observer	Saudi Arabia	Member
Senegal	Member	Kazakhstan	Observer	UAE	Member
Sierra Leone	Member	Kyrgyzstan	Member		
South Africa	Member	Russia	Member	**Oceania**	
Sudan	Observer	Turkmenistan		Fiji	Member
Swaziland	Member	Ukraine	Member	French Polynesia	
Tanzania	Member			Kiribati	
Togo	Member			Papua New Guinea	Member
Tunisia	Member			Solomon Islands	Member
Uganda	Member			Tuvalu	
Zambia	Member			Vanuatu	Member
Zimbabwe	Member				

Note: Countries and territories included in the table applied export taxes for at least one product at least once in the period 2007-2012. If country is not listed in the table, it either does not impose export taxes or information for this country is not available.

Table 8 Export tax definitions

Type of tax	Definition
Export tax* (included in the database)	A tax collected on goods or commodities at the time they leave a customs territory. This tax can be set either on an *ad valorem* (value) basis, as a percentage paid on the value of exports (generally f.o.b. value) or in *non-ad valorem* forms, which include, inter alia, - specific taxes (on a per unit basis), - conditional taxes (maximum of two rates), - technical duties (rates calculated based on the product characteristics not captured by the product code), - variable taxes (*ad valorem* rates depend on the price of the good). Other terminology equivalent to export tax includes export tariff, export duty, export levy, export charge. In some countries the term "cess" is used. In French speaking countries, the term "exit tax" ("droit de sortie") is often used. Export tax is generally administered and collected by the Customs.
Fiscal tax on exports* (included in the database)	A tax not paid at the border, but which applies only or discriminates against goods or commodities intended for export. An example is when the sales tax which a government charges is higher for goods or commodities intended for export than when these goods or commodities are offered for sale in the domestic market. Other terminology equivalent to fiscal tax on exports is export royalty.
Export surtax*	A tax collected on goods or commodities at the time they leave a customs territory, and which is applied in addition to the normal export tax rate. They can be part of a progressive tax system or can be adapted to price trends and thus being of a temporary nature. Example: a USD 10 surcharge is applied on each tonne of a commodity exported when the world price of this commodity exceeds USD 1800 a tonne. Other terminology equivalent to export surtax is export surcharge.
Temporary export tax (included in the database)	Export tax applied on a temporary basis, generally for less than a year, with a defined end date. Depending on the jurisdiction, temporary export taxes can replace export taxes or be applied in addition to them. As export taxes, temporary export taxes can be expressed in *ad valorem* and *non-ad valorem* terms. A temporary export tax is generally collected by the Customs on goods or commodities at the time they leave a customs territory.
Para-fiscal contributions	Para-fiscal contributions are sector specific taxes collected to para-fiscal stabilization funds; export promotion and promotions funds or sectoral associations, e.g. National Coffee Growers' Federation. Para-fiscal contributions are indirectly returned to tax payers, by developing or promoting industry or improving the livelihood of the employees. They are generally collected by the fund or association benefiting from the tax revenues before the exported goods leave the production site. As export taxes, para-fiscal contributions can be expressed in *ad valorem* and *non-ad valorem* terms.
Bound rate of export tax	The maximum allowed or ceiling rate of export tax that binds government to keep the applied rates of export taxes below their bound rates. Applied export tax rate can be equal or lower than the bound rates. The bound rates can be negotiated in the

	WTO frameworks, as is the case for newly acceded members, or be specified in the national legislation. Sometimes the term "statutory" is used as an equivalent of "bound". The use of term statutory can be confusing, as in some countries it is also used to indicate para-fiscal contributions.

** Definitions are adopted from **(Fliess and Mard 2012a)***

Table 9 Coverage and data sources of the product-level dataset on export taxes

Country applying export taxes	Year 1	Year 2	Organization that provided data (data source)
Azerbaijan*	2000	2001	State Customs Committee (website)
Bangladesh	2010	2011	National Board of Revenue (website)
Belarus*	2008	2010	Governmental repository of legal texts under the Council of Ministers (website)
Brazil*	2005	2007	Chamber for Foreign Trade CAMEX -Câmara de Comércio Exterior (email)
China	2007	2009	General Administration of Customs (in Customs Tariff of Export of the People's Republic of China, the WTO library, paper-based)
Côte D'Ivoire	2008	2009	Kireyev 2010, and the WTO Secretariat TPR 2012 (documents online)
Egypt	2010	2011	Ministry of Finance (email)
Malawi	2010	2011	Ministry of Industry and Trade (email)
Malaysia*	2007	2011	Ministry of Trade and Industry (website)
Mongolia	2010	2011	Customs General Administration (website)
Nepal	2009	2010	Department of Customs and the Ministry of Finance (website and email)
Pakistan	2006	2007	Federal Board of Revenue (website)
Papua New Guinea	2007	2008	Department of Foreign Affairs and Trade (included in the tariff schedule submitted to ITC)
Russian Federation*	2007	2009	Legislation system "Garant" (website)
South Africa	2007	2008	South African Revenue Service (website) and Diamond and Precious Metal Regulator (email)
Sri Lanka	2009	2010	Customs Administration (website)
Thailand	2007	2011	Customs Department, Integrated Tariff Database (website)
Ukraine*	2007	2009	Legislations system "NAU" (website)
Vietnam	2008	2009	General Department of Customs (website)
Zambia	2007	2011	Revenue authority (included in the tariff schedule submitted to ITC)

Note: Countries marked with asterisk (*) apply preferential export taxes.

Table 10 Data sources for trade statistics

Country	Year 1	Year 2	Data source for trade statistics (specify if mirror statistics)
Azerbaijan	2000	2001	UN Comtrade (mirror)
Bangladesh	2010	2011	ITC Trade Map (mirror)
Belarus	2008	2010	ITC Trade Map
Brazil	2005	2007	UN Comtrade
China	2007	2009	ITC Trade Map
Cote D'Ivoire	2008	2009	ITC Trade Map
Egypt	2010	2011	ITC Trade Map
Malawi	2010	2011	UN Comtrade
Malaysia	2007	2011	ITC Trade Map
Mongolia	2010	2011	ITC Trade Map (mirror)
Nepal	2009	2010	ITC Trade Map
Pakistan	2006	2007	Comtrade
Papua New Guinea	2007	2008	Comtrade (mirror)
Russian Federation	2007	2009	ITC Trade Map
South Africa	2007	2008	ITC Trade Map
Sri Lanka	2009	2010	ITC Trade Map
Thailand	2007	2011	ITC Trade Map
Ukraine	2007	2009	ITC Trade Map
Vietnam	2008	2009	ITC Trade Map
Zambia	2007	2011	ITC Trade Map

Note: ITC Trade Map and UNSD Comtrade use methodologies which differ only with regard to the estimation of missing trade quantities. To avoid measurement errors the same dataset was used for each reporter.

Table 11 Correlation matrix

	quantity	value	taxave
quantity	1		
value	0.5075	1	
taxave	-0.0063	-0.0129	1

Note: The table is based on the dataset including 20 tax imposing exporting countries, 169 partner countries 2 time periods and all traded goods.

Table 12 Summary statistics for the panel dataset

Variable	Label	Obs	Mean	Std. Dev.	Min	Max
quantity	Export quantity, in metric ton	1,601,801	4,899	924,789	0	732,000,000
value	Export value, in 1000 USD	1,601,801	2,392	57,539	0	24,000,000
taxave	AVE equivalent of export tax, in %	1,601,600	0.2	4.1	0	811
For observations with positive tax						
quantity	Export quantity, in metric ton	22,540	18,098	312,841	0	20,500,000
value	Export value, in 1000 USD	22,540	7,373	80,125	0	4,061,647
taxave	AVE equivalent of export tax, in %	22,339	17	30	0	811

Note: The tables is based on the dataset including 20 tax imposing exporting countries, 169 partner countries 2 time periods and all traded goods.

Table 13 Trade effects of export taxes by sector

	(1) 2WFE(ln) Export quantity	(2) 2WFE(ln) Export value	(3) 2WFE(ln+min_{dpt}) Export quantity	(4) 2WFE(ln+min_{dpt}) Export value
Tax rate	-11.43***	-9.882***	-5.485***	-4.230**
(Reference group: extractive)	(2.615)	(2.522)	(1.980)	(1.888)
Agricultural x tax rate	9.917***	8.853***	4.936*	3.379
	(3.141)	(2.630)	(2.904)	(2.832)
Manufacturing x tax rate	9.909***	9.179***	4.719**	3.959*
	(3.008)	(2.895)	(2.124)	(2.021)
Observations	1,244,776	1,244,776	1,378,618	1,378,618

*Note: Statistical significance: *** p<0.01, ** p<0.05, * p<0.1. Robust, clustered (by triplet origin-product-time) standard errors are reported in parentheses. Linear regressions models are estimated using an iterative approach with two high-dimensional fixed-effects (origin-product-time and destination-product-time) on the time-demeaned dataset (by origin-destination-product). All continuous variables are in logs. In regression (3) and (4) the data has been transformed before logarithmic transformation by adding the min trade value (by importer-product-year) to zero trade flows.*

Table 14 Trade effects of export taxes on homogeneous and differentiated goods

	(1) 2WFE(ln) Export quantity	(2) 2WFE(ln) Export value	(3) 2WFE(ln+min_{dpt}) Export quantity	(4) 2WFE(ln+min_{dpt}) Export value
Tax rate	0.254	-0.218	-0.455	-0.169
(Reference group: differentiated goods)	(1.258)	(1.506)	(0.983)	(1.049)
Homogeneous goods x tax rate	-5.187***	-3.376*	-1.786	-1.370
	(1.850)	(1.972)	(1.305)	(1.300)
Observations	1,244,776	1,244,776	1,378,618	1,378,618

*Note: Statistical significance: *** p<0.01, ** p<0.05, * p<0.1. Robust, clustered (by triplet origin-product-time) standard errors are reported in parentheses. Linear regressions models are estimated using an iterative approach with two high-dimensional fixed-effects (origin-product-time and destination-product-time) on the time-demeaned dataset (by origin-destination-product). All continuous variables are in logs. In regression (3) and (4) the data has been transformed before logarithmic transformation by adding the min trade value (by importer-product-year) to zero trade flows. Homogeneous goods include goods sold on organized exchanges and reference priced goods following a liberal[24] classification as in **Rauch (1999)**.*

[24] Results remain largely unchanged when the conservative version of the classification is used.