Enhancing Knowledge for Renewed Policies against Poverty

Working Paper n°12

Trade Performance of Free Trade Zones

Jean-Marc Siroën, Ayçil Yücer
Dauphine

This project is funded by the European Union under the 7th Research Framework Programme (theme SSH) Grant agreement nr 290752. The views expressed in this press release do not necessarily reflect the views of the European Commission.

DOCUMENT DE TRAVAIL DT/2014-09

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Jean-Marc SIROËN
Ayçil YÜCER

UMR DIAL 225
Place du Maréchal de Lattre de Tassigny 75775 • Paris Cedex 16 •Tél. (33) 01 44 05 45 42 • Fax (33) 01 44 05 45 45
• 4, rue d'Enghien • 75010 Paris • Tél. (33) 01 53 24 14 50 • Fax (33) 01 53 24 14 51
E-mail : dial@dial.prd.fr • Site : www.dial.prd.fr

TRADE PERFORMANCE OF FREE TRADE ZONES

Jean-Marc Siroën
PSL, Université Paris-Dauphine,
LEDa, IRD UMR DIAL, 75016 Paris, France
jean-marc.siroen@dauphine.fr

Ayçil Yücer
University of Dokuz Eylül,
Department of Economics, Izmir 35160 Turkey
PSL, Université Paris-Dauphine,
LEDa, IRD UMR DIAL, 75016 Paris, France
ayicily@gmail.com

Document de travail UMR DIAL

Septembre 2014

Abstract:

Free trade zones (FTZ) have become widespread with the liberalisation of international trade and investment. They are a key player in the deepening of the global value chain (GVC). However, little is known about their contribution to world trade due to a lack of information on their location and status. This paper sets out to improve knowledge in this area by analysing the trade performance of FTZ countries at macro-level with a focus on FTZ externalities and distortive costs. We have built an original database of FTZs where we define them as processing zones benefiting from import tariff incentives. We show that FTZs raise trade only by easing the negative impact of protection. As importers of components and raw materials, they raise the rest of the world's exports. This confirms the contribution of FTZs to the GVC. This result is robust to a change in the model specification, errors and bias due to data collection issues and sample composition.

Key words: Free Trade Zones, Export Processing Zones, Trade Policy, Gravity Models.

Résumé

Les zones de libre-échange (ZFE) ont proliféré avec la libéralisation du commerce et de l'investissement. Elles jouent un rôle clé dans l'approfondissement de la chaîne mondiale de valeur. Toutefois, leur contribution au commerce international est peu connue, du fait du manque d'informations sur leur localisation et leur statut. Cet article tente d'améliorer leur connaissance en analysant les performances commerciales des pays abritant des ZFE avec un focus sur les externalités et les coûts dus aux distorsions. Nous avons ainsi construit une base de données originale sur les ZFE définies comme des zones de transformation industrielle bénéficiant d'incitations sur les droits de douane. Nous montrons que les ZFE ne contribuent à augmenter le commerce du pays qu'en réduisant l'impact négatif du protectionnisme. En tant qu'importateurs de composants et de matières premières, elles augmentent les exportations des autres pays, ce qui confirme la contribution des ZFE à la chaîne globale de valeur. Ce résultat est robuste avec d'autres spécifications du modèle, les erreurs et les biais dus aux problèmes de collecte des données et de composition de l'échantillon.

Mots Clés : Zones franches commerciales, Zones franches de transformation pour l'exportation, Politique commerciale, Modèle de gravité.

JEL Code: F13, F14, F23, F43, F63

I. Introduction

UNCTAD statistics report that the flow of foreign direct investment into developing countries and transition economies rose from 31% for the 1990-1994 period to 50% for the 2008-2012 period. The share of China in world trade grew from 5.9% to 11.4% from 1993 and 2012.[1] These spectacular growth patterns are often said to be due to the pro-trade policies conducted by developing and emerging countries over these periods. With trade openness, these countries were able to make the most of their comparative advantage in low labour costs. The development of a global value chain (GVC) then drove forward the integration of developing and emerging countries into trade globalisation based on their specialisation in unskilled labour intensive tasks such as in the apparel and electronic assembly sectors (Cattaneo *et al.*, 2010).

At the same time, the number and size of free trade zones (FTZs) or export processing zones (EPZs), seen as a specific kind of free trade zone (FTZ) for processing imported inputs, exploded during the period (Singa Boyenge, 2007). As Aggarwal (2005, p. 4) puts it, "The adoption of export-led growth strategies by developing countries has led to a considerable increase in the number of EPZs across the world." In the countries concerned, specific and offshore legislation benefits firms that import raw materials and components for processing before exporting them to the world market. Beneficiary firms are frequently located in an autonomous enclave (e.g. the Chinese "special zones"), but can also be spread around the country (e.g. the Mexican maquiladoras). The advantages that EPZ firms enjoy are exceptions to national regulations and usually exemption from tariffs on imported inputs and tax breaks.[2] These privileges are generally limited to re-exported goods with restrictions on domestic market sales. FTZs make an otherwise unappealing national location attractive. Yet the WTO considers these exemptions to be subsidies.[3,4]

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[1] WTO statistics.

[2] Milberg & Amengual (2008) consider the following typical incentives: (a) exemption from some or all export taxes; (b) exemption from some or all duties on imports of raw materials and intermediate goods; (c) exemption from direct taxes such as profits taxes, municipal and property taxes; (d) exemption from indirect taxes such as VAT on domestic purchases; (e) exemption from national foreign exchange controls; (f) free profit repatriation for foreign companies; (g) provision of streamlined administrative services especially to facilitate import and export; (h) free provision of enhanced physical infrastructure for production, transport and logistics.

[3] Creskoff and Walkenhorst (2009) consider that, "Incentives related to special economic zones can be broadly grouped into three categories: (i) measures that are consistent with the World Trade Organization, notably exemptions from duties and taxes on goods exported from special economic zones; (ii) measures that are prohibited or subject to challenge under World Trade Organization law, notably export subsidies and import substitution or domestic content subsidies; and (iii) measures where World Trade Organization consistency depends on the facts of the particular case."

[4] On 19th December 2013, the European Union requested consultations with Brazil with respect to certain measures concerning taxation and charges in some goods produced in Free Trade Zones, and tax advantages for exporters.

FTZs have been studied from different angles. The largest body of literature is based on case studies, which analyse the nature and performance of zones. One of the main issues addressed is the contribution of FTZs to economic development. Some authors speak of a "catalytic" effect, which depends on the linkages between EPZs and the rest of the domestic economy and is triggered by a learning effect that improves the ability of local firms to export and upgrade their technology (Johansson & Nilsson, 1997; Wei, 1998; Din, 1994). A more recent body of literature contends that specialisation in the GVC gives FTZs the opportunity to promote more sustainable development, giving them the possibility to exploit their comparative advantages in tasks intensive in low-skilled labour (UNCTAD, 2013). Wu (2009) believes that, "The combination of labour and capital in EPZs provides a chance for developing countries to absorb foreign direct investment (FDI) and be linked to the global economy with minimum impact on the domestic economy, as the goods produced in EPZs are exported." FIAS (2008) reports that zones have been effective, albeit unevenly, in addressing economic growth objectives (see also Engman *et al.*, 2007).

This optimistic point of view, even mitigated, is balanced by another large body of literature taking in memoranda, reports and working papers from international organisations, international trade unions and civil society, which addresses the repercussions of exemptions from national regulations. FTZ have frequently been perceived as lawless areas where sweatshops can burgeon freely. The economic, social and environmental impacts of FTZs are controversial (Milberg & Amengual, 2008), as is the contribution of certain zones to illegal trade and money laundering (ICC, 2013).

In addition, the special regimes applied in FTZs have, as potential sources of distortions, to be offset by the expected effects of their externalities for the country due the combination of manufactured activities and the spread of new methods and technology by multinational firms.

Paradoxically, there have been no assessments made of the success of what constitutes the mainspring of FTZs/EPZs – the promotion of trade. Whereas case studies can identify success and failure stories, we know nothing about the contribution of FTZs to world trade. In some countries (China, Mexico, Sri Lanka, etc., see Milberg & Amengual, 2008), the largest share of exports comes from FTZs, which underpins the intuition of a positive effect. However, we also have to consider adverse effects. For example, some exporting firms may well desert their initial area of establishment to relocate to an FTZ. So although the FTZ is a success, the location of exports has merely been displaced within the country. In terms of the GVC, high import tariffs raise the cost of imported inputs and affect the competitiveness of firms. FTZs can eliminate this counter-productive effect of high tariffs on imported inputs. FTZs then sustain questionable protectionist final product policy without harming the competitiveness of the export processing industries. So there is no certainty that protectionist countries with FTZs export more than less protectionist countries without FTZs.

One reason why there are no cross-cutting studies is the lack of databases on the subject due to problems with all the different definitions of FTZs, regime opacity (frequently non-compliant with WTO rules), and the significant number of inoperative FTZs. The only

available database was last updated for ILO in 2007 (Singa Boyenge, 2007) with a debatable definition of FTZs.[5]

The purpose of this paper is to test the link between the contributions of FTZs to exports and the host country's trade protection policy. We use a traditional gravity model based on an original database of FTZs.

We find that an exporting country's exports are frequently driven up by its own FTZs, but also by FTZs in importing partner countries. Yet this result is not robust. When we consider an interaction variable between the presence of EPZs and tariff level, FTZ countries export significantly less compared with non-FTZ countries. However, this is more or less offset by the interaction variable's positive coefficient. The suggestion is that the effect of FTZs on exports might be positive only due to higher tariffs on regular imports. In actual fact, FTZs offset the effects of high tariffs on trade. These results are robust to different specifications.

In the second section, we present our definitions of FTZs and EPZs, which differ from other definitions given by the literature, and we present the expected effects of FTZs on trade. The third section presents the model and the results of a gravity estimation with variables for country characteristics and remoteness indices to control for "multilateral resistance". The fourth section presents the robustness tests. We propose a "two-step" strategy including country fixed effects to reduce the risk of bias due to omitted variables. We also test the results on different samples constructed using a restrictive and then broad definition of FTZs. Lastly, we address the specific cases of the USA and China. We conclude in the fifth section.

II. Definitions

The definition of free trade zones (FTZ) is extensively discussed in the literature, which gives them a whole host of names, e.g. special economic zones (SEZ), free economic zones (FEZ), export processing zones (EPZ), technological free zones (TFZ), free ports (FP), industrial free zones (IFZ), enterprise zones, specialised zones, logistic zones, Maquiladoras, etc. These names refer to differences in their characteristics such as geographic form (concentrated or widespread), type of business (transit, processing, commercial, etc.) and industrial specialisation (service, technology, logistics, etc.). In their broadest definition, FTZs are deemed exceptions to national tariff and/or fiscal policy. Export processing zones (EPZs) imply a transformation of imported inputs before exporting a processed good. Better production conditions, laxer legal provisions and trade facilities may come with these fiscal and tariff policy incentives.

Contrary to popular belief, tariff advantages for investors might or might not be conditional on a minimum export share of total production, e.g. 100% means no access to the country's

[5] See also the list of EPZs put together by the World Economic Processing Zones Association (http://www.wepza.org/)

domestic market. Often, as in Bangladesh, FTZ[6] sales are allowed up to 20% on the domestic market. In some countries such as Uruguay[7] and Thailand[8], there is no limit. In these cases, sales on the domestic market are allowed only once import duties have been paid on entry to the country's domestic market. Hence EPZ firms do not benefit from preferential access to the domestic market (e.g. Bangladesh).[9] However, some countries use duty-free domestic access as a further incentive to attract investment into the FTZ. For example, in Mauritius,[10] EPZ businesses are allowed to sell up to 20% of their production duty free on the domestic market under the export enterprise scheme.[11] Another extreme case is the Free Trade Zone of Manaus (FTZM) in Brazil, which has been created under Free Trade Zone legislation "to promote the development and regional integration of border areas in the northern region, for which they are granted fiscal incentives."[12] Indeed, FTZM enterprises benefit from advantageous tariff regulations conditional on the local value-added (Basic Productive Process (PPB) criteria) created in the total production process rather than a restriction on export share.

A zone that imports and processes also to meet domestic market demand should display a different export-import structure. So we will call these entities Export-Import Processing Zones (EMPZ).[13] Briefly, this paper uses the following definitions: FTZs are defined as zones in which goods are processed, mainly or partly from imported inputs, and where import and/or export tariff advantages are granted investors conditionally or not on their exports. In our study, we consider that an FTZ is either an EPZ (Export Processing Zone) or an EMPZ (Export-Import Processing Zone):

- EPZs form one sub-category of FTZs in which investors benefit from tariff advantages conditionally on their exports. They can "export" their production to the domestic market, partly or without restriction, but must pay tariffs on imported inputs processed for those goods delivered within the country.
- EMPZs represent the other sub-category of FTZs. In these zones, a limited or complete share of production or turnover can be "exported" to the domestic market without paying tariffs. This could also be seen as an indirect incentive to raise performance and exports in a "heterogeneous firm" process (Melitz, 2003), by means of both incentives and economies of scale, spillovers and so on.

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[6] WTO Trade Policy Review Bangladesh (2012), WT/TPR/S/270.

[7] WTO Trade Policy Review Uruguay (2012), WT/TPR/S/263.

[8] WTO Trade Policy Review Thailand (2012), TPR/S/255/Rev.1.

[9] In some countries, EPZs are not part of the national customs territory (e.g. Turkey).

[10] The Mauritius Free Port Board of Investment (2006). http://www.efreeport.com/default.aspx?Guid=4e9a9004-43af-473f-b16d-74b9deab3107&nm=OPP

[11] WTO Trade Policy Review Mauritius (2008), WT/TPR/S/198/Rev.1.

[12] WTO Trade Policy Review Brazil (2009), TPR/S/212/Rev.1.

[13] These definitions do not differentiate between two kinds of FTZ: the "cluster" type where incentives are dictated strictly by geographical criteria and frequently administrated by an autonomous authority; and the "maquiladora" type where beneficiary firms may be spread throughout a region or country.

The growth in FTZs, as defined above, has come in tandem with a redistribution of the different stages of the production process in the GVC. EPZs frequently specialise in the assembly of imported inputs, just before re-exporting and selling the final product. EMPZs, on the other hand, frequently tie in with the regional development policy of the host country as it gives unbounded access to the target region, the domestic market and, potentially, to neighbouring and world markets by means of tariff cuts and/or tax breaks.

By definition, an EPZ should increase the exports of the EPZ firm by imposing export targets, but also by creating new trade opportunities for new and existing investors by means of lower transaction trade costs (tariff policy) and/or adapted infrastructure, tax breaks, transport facilities etc. Investors in EMPZs, however, are faced with a trade-off between sales to the domestic market and to international markets. The choice will depend on the firm's competitiveness, which will increase with lower input and production costs under EMPZ regulation, and on the level of protection on the domestic market, which will give EMPZ firms a competitive advantage on the domestic market. The competitiveness gain may not be enough to compete internationally. In this case, compared with EPZs, EMPZs can be expected to export less for higher imports into the zone. However, if the stated aim of FTZs is to raise exports, then their success is to be evaluated in terms of their contribution to raising the country exports.

A country with FTZs would be expected to export (final goods) and import (inputs) more than countries without these incentives. Conversely, a country without FTZs would be expected to export (intermediate goods) and to import (final goods) relatively more to and from countries with FTZs. For example, Denmark, which has no FTZs, would be expected to export more intermediate goods to China and import more final products from China.

However, tariff, tax and regulatory incentives for exporting beneficiary companies generate distortions in the national economy and on global markets. These distortions create ambiguities about the net effects of FTZs on well-being and growth as well as on exports and the trade balance.

Firstly, EPZs may be unable to attract foreign investment: unsuitable incentives, poor infrastructure, poor governance, etc. The EPZs would then be inactive even though the country's legislation encouraged their creation.

Secondly, industrial plants may be relocated to the FTZ to gain a "windfall effect". The EPZ's exports would then merely replace exports from other parts of the country.

Thirdly, foreign importers may prefer to import more from an EPZ with advantageous tariff rates and produce at a lower cost. Their imports would then be at the expense of the rest of the country. ("trade diversion" effect).

Lastly, domestic firms providing intermediate goods to domestic export firms may suffer from a "preference erosion" effect. Before free trade zones were created, domestic suppliers

(including subsidiaries of foreign firms) were protected by high tariffs.[14] Tariff exemptions for exporting beneficiary companies remove this protection at the expense of existing domestic suppliers and, more broadly, prevent domestic firms from entering the industry when incentives are specifically targeted at foreign investment. This "preference erosion" effect may offset the "trade creation" gain due to the substitution of imported inputs to a less competitive domestic supply. Higher imports of inputs also reduce the value-added content of exports and thereby the contribution of exports to growth and employment.

In the next section, we estimate an augmented gravity model in order to estimate the impact of FTZs, EPZs and EMPZs on a country's trade. To this end, we construct a worldwide FTZ database. We also briefly present the sources used for this database and how we differentiate EMPZs from EPZs.

III. The gravity model: specification and results

As mentioned above, the impact of FTZs at country level is not easy to predict due to potential differences between EPZs and EMPZs. In all cases, exemption from tariffs and better trade and infrastructure facilities would have a trade creation impact for the zone, but this impact may be offset at national level by the relocation of domestic enterprises to the zone, by the trade diversion impact and/or by the preference erosion affecting exporting firms' domestic suppliers and reducing their gain from economies of scale and hence their exports. In the case of EMPZ, we can also expect to find "preference erosion" affecting domestic demand since domestic firms lose their preferential access to the domestic market.

The gravity model of trade is used in the literature to estimate the national trade structure. It can also be augmented to evaluate the impact of different trade policy variables e.g. regional trade agreements. In this paper, we estimate a gravity model of trade in cross-section to evaluate the FTZ impact, using bilateral export values across 122 countries (see Appendix 1) in 2008. All the countries were WTO members in 2008. This choice was made based on access to verifiable information on RTAs, tariffs and trade policy and also to compare countries sharing common rules.

In line with the recent literature, we estimate the models using a pseudo Poisson maximum likelihood (PPML) estimator. Work by Santos Silva and Tenreyro (2006) has driven a consensus that the PPML estimator is a strong tool for dealing with the "zero trade" values that are otherwise dropped when the model is linearised. PPML even works with numerous zeroes, as is the case with the gravity models (Santos Silva & Tenreyro, 2011). On the other hand, the PPML estimator corrects the estimation bias due to the heteroskedasticity of the trade data.

[14] Domestic suppliers to EPZ firms generally benefit from a drawback scheme that entitles them to tax and tariff breaks as if they were also "exporters". However, this does not guarantee that they will maintain their market share since, without trade barriers, they may fail to compete with international firms on the domestic market.

In the first model, we use an augmented gravity structure to control for the countries' unilateral and bilateral (dyadic) characteristics:

$$X_{ij} = \exp[\alpha_0 + \alpha_1 \ln(Y_i) + \alpha_2 \ln(Y_j) + \alpha_3 \ln(YperCap_i) + \alpha_4 \ln(YperCap_j) + \alpha_5 \ln(D_{ij}) + \alpha_6 \ln(R_{ij}) + \alpha_7 \ln(R_{ji}) + \alpha_8 LL_i + \alpha_9 LL_j + \alpha_{10} RTA_{ij} + \alpha_{11} EC27_{ij} + \alpha_{12} CONT_{ij} + \alpha_{13} LANG_{ij} + \alpha_{14} COL_{ij}]\eta_{ij} \quad (1)$$

The *control variables* are as follows:

X_{ij} is the value of exports from country *i* to country *j* in current US$,
Y_i, Y_j are the nominal GDP of country *i, j* in current US$,
$YperCap_i$, $YperCap_j$is the nominal per capita GDP of country *i, j* in current US$,
D_{ij} is the geodesic distance between *i* and *j*.
R_{ij}, $R_{ji}$is the remoteness index of country *i* with respect to its partners other than *j*, and vice versa
LL_i, $LL_j$is a binary variable for whether country *i, j* are landlocked
RTA_{ij} is a binary variable for a regional trade agreement between *i* and *j* other than the EU,
$EC27_{ij}$ is a binary variable for European Union (27) countries *i* and *j,*
$CONT_{ij}$ is a binary variable for the contiguity of *i* and *j,*
$LANG_{ij}$ is a binary variable for a common language between *i* and *j,*
COL_{ij} is a binary variable for a colonial linkage between *i* and *j.*

GDPs and per capita GDPs are taken from the WDI database. We use the CEPII dist-cepii.xls database for the variables of distance, landlocked, contiguity (common border variable), language (*CEPII*'s common language variable, which is 1 when the same language "is spoken by at least 9% of the population in both countries") and colony (if "two countries have ever had a colonial link"). The RTA and EU27 variables are constructed by the WTO RTA database authors. RTAs are exceptions to the WTO MFN clause. They can create a bias in the tariff impact estimation if they are not controlled for. Remoteness indices are calculated in keeping with Helliwell (1998):

$$R_{ij} = 1/\sum_{m \neq j}[D_{im}/GDP_m]$$

The higher R_{ij}, the farther away country *i* is from countries *m* other than its partner *j* ($m \neq j$) and/or the closer it is to countries *m* with relatively low GDPs. The more remote the country, the higher trade can be expected to be between *i* and its partner *j*.

In the second model, we introduce our FTZ dummy variable separately for exporter country *i* and importer country *j*. In other words, FTZ_i measures the impact of the FTZ programme in country *i* on the exports of country *i* to a given importer *j*. Likewise, FTZ_j measures the impact of an FTZ in country *j* on its imports from a given exporter *i*. When both countries -

exporter i and importer j - have an FTZ programme, then the total impact will be the sum of their separate impacts.[15]

We know from Anderson and van Wincoop (2003) that gravity models need to introduce a "multilateral resistance (MR)" term, which considers partners' accessibility to other markets. Models usually introduce country fixed effects to control for MR. However, in cross-section, our variables of interest – FTZ_i and FTZ_j – would be perfectly collinear with the country fixed effects. Our introduction of country specific variables and a remoteness index is a reasonable way of dealing with multilateral resistance. However, we also test an alternative method in the following section.

A country's choice of FTZ policy depends on the national tariff policy. Countries with high tariff rates may use FTZ programmes more frequently (see Appendix 2) in order to offset the counterproductive impacts of protection on the cost of imported inputs. If tariff rates are not controlled for, FTZ countries will appear to import less on average due to their high national tariff rates and the FTZ impact will be downward biased. Therefore, we introduce exporter and importer average MFN applied tariff rates ($\ln MFN_i$ and $\ln MFN_j$)[16] for non-agricultural industries taken from the WTO tariff database for 2008 (or 2007 if not available).

$$X_{ij} = \exp\left[\alpha_0 + \beta_1 \ln MFN_i + \beta_2 \ln MFN_j + \beta_3 FTZ_i + \beta_4 FTZ_j + \sum_{t=1} \alpha_t Control\ Variables_t\right]\eta_{ij} \quad (2)$$

Our definition of FTZ is quite restrictive even though we have included the "maquiladora" type of FTZ. We cover only those FTZs with a processing activity that benefit from tariff exemptions under specific conditions that differentiate beneficiary firms from non-beneficiary firms. For example, we exclude free ports, transit zones, "duty free" zones and zones eligible for other incentives excluding tariff exemptions.

The FTZ database was constructed firstly by consulting the WTO *Trade Policy Reviews*, written independently by the WTO Secretariat, and the *Investment Climate Statements* published by the US Department of State. These two resources systematically provide information on national FTZ policy and activity. However, we also drew on academic resources, published papers and books and reports by international organisations such as the UN, the WB, etc.[17] Our restrictive criteria mean that the number of countries with FTZs is somewhat smaller than the number found in the literature. We found for our sample of 122

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[15] The total trade impact of the FTZ programme in exporter i and importer j will be, $\Delta X_{ij} = exp\left(\beta_3 FTZ_i + \beta_4 FTZ_j\right)$

[16] The exact form of the tariff variable in the model is $\ln(avrMFN_i + 1)$. "Zero" MFN tariff rates become undefined under the natural logarithm. Hence, we add "1" to each of the MFN tariff rates.

[17] For example, we took Singa Boyenge (2007), FIAS (2008), Tiefenbrun (2012), Farole & Akinci, ed. (2011), Bost, ed. (2010) and hundreds of documents on specific regions, countries and zones. All sources will soon be available online at *ftz.dauphine.fr*.

countries that 62 countries have an active FTZ programme, while an FTZ programme exists in nine other countries, but is not active (see Appendix 1). Our "activity" criterion is defined as having at least one firm on the FTZ programme. We consider that if tax advantages are possible in specific EU countries, then tariff exemptions would be non-compliant with the EU Treaty. We therefore consider that there are no FTZs in the EU.[18]

The expected trade impact of an FTZ will change with the country's tariff rates. In other words, the FTZ impact offsets the negative impact of tariffs on trade (exports and imports) and the higher the national tariff rates, the higher the FTZ impact on trade. An FTZ programme in a country with high tariff rates will boost trade (exports and imports) and attract more investment to the zone than in a country with low tariff rates. Taking this to the extreme, if a country's tariff rates are equal to zero, then it makes no sense to cut the tariff rates for FTZ firms. Hence in the third model, the FTZ impact is estimated in interaction with MFN tariff rates.

$$X_{ij} = \exp\left[\alpha_0 + \sum_{t=1} \alpha_t Control\ Variables_t + \beta_1 \ln\ MFN_i + \beta_2 \ln MFN_j + \beta_3 FTZ_i + \beta_4 FTZ_j + \beta_5 FTZ_i * \ln MFN_i + \beta_6 FTZ_j * \ln MFN_j\right]\eta_{ij} \quad (3)$$

In our last two models, we differentiate the trade impact of EPZs from EMPZs (see Appendix 1). In line with the structure of Model 2, we introduce EPZ and EMPZ dummies separately for exporter *i* and importer *j*.

$$X_{ij} = \exp\left[\alpha_0 + \beta_1 \ln\ MFN_i + \beta_2 \ln MFN_j + \gamma_1 EPZ_i + \gamma_2 EPZ_j + \gamma_3 EMPZ_i + \gamma_4 EMPZ_j + \sum_{t=1} \alpha_t Control\ Variables_t\right]\eta_{ij} \quad (4)$$

The interaction model takes the following form when the FTZ variable is decomposed into EPZ and EMPZ:

$$X_{ij} = \exp\left[\alpha_0 + \beta_1 \ln\ MFN_i + \beta_2 \ln MFN_j + \gamma_1 EPZ_i + \gamma_2 EPZ_j + \gamma_3 EMPZ_i + \gamma_4 EMPZ_j + \gamma_5 EPZ_i * \ln MFN_i + \gamma_6 EPZ_j * \ln MFN_j + \gamma_7 EMPZ_i * \ln MFN_i + \gamma_8 EMPZ_j * \ln MFN_j + \sum_{t=1} \alpha_t Control\ Variables_t\right]\eta_{ij} \quad (5)$$

Table 1 shows the estimation results. The first column shows the results for the basic gravity model augmented with traditional control variables. The estimated impacts of the traditional variables are as expected and significant. The impact of distance is negative and around -0.68. The impact of exporter and importer GDP is positive. And exports from country *i* to partner *j* increase with increasing remoteness from the rest of the world and vice versa. $YperCap_i$ and $YperCap_j$ are introduced into the model to control for the sample countries' level of development. However, their impacts are approximately zero and not significant. We control separately for the impact of the European Union, which has a clear "deep integration"

[18] To be more precise, although EU regulations allow for a specific inward processing system, it is not restricted to specific zones. Inward processing is excluded from free zones with a dispensation for the old free port of Hamburg, the Canary Islands, Azores, Madeira and overseas departments (Council Regulation (EEC) No. 2913/92 of 12 October 1992, Art. 173)

commitment among its members comparatively to other more or less operational RTAs. Our results show a positive significant impact for the 27 members in 2008. The average trade impact of other RTAs notified to WTO is found to be slightly positive, but not significant. Contiguity, common language and common colonial history between *i* and *j* increase trade. Landlocked countries, however, export significantly less and import less, but this impact is not significant.

Model 2, presented in the second column of Table 1, estimates the impact of FTZs and MFN tariff rates. Exporting country exports decrease significantly not only with the importer's tariff, but also with its own tariff. In fact, high import tariff rates are indicative of a trade policy that affects both imports and exports (retaliation by partners, higher imported input costs for tradable goods, etc.).

The trade impact of FTZs in the exporting and importing countries is positive. Nevertheless, it is only significant at 10% for the exporting countries. A country with an FTZ programme imports 1.7 ($e^{0.527}$) times more than a country without an FTZ programme, other things being equal. Nevertheless, its impact on exports is found to be moderate (around 1.2 times) and is only significant at 10%. The impact of the control variables does not change to any considerable extent, except in the case of the remoteness coefficients, which are now smaller, especially for the importer. Lower tariff rates across the more isolated countries might be captured by the remoteness index.

The third column presents the results for Model 3 in which we assume that the FTZ impact interacts with the country's national tariff policy, the first depending on the second. All the variables of interest are significant: tariff rates, FTZ and interactive terms. The estimated coefficient of FTZ_j is significant at 10%. When interactive variables are used, the impact of the variables cannot be interpreted separately. In fact, Model 3 assumes that the impact of tariffs will be different between countries with and without FTZs. Likewise, the FTZ impact is assumed to vary with the tariffs.

When exporter *i* has an FTZ programme, the impact of its import tariffs on exports is the sum of the coefficient (-0.898) of the tariff rate variable (*LnMFNi)*) and the coefficient (0.977) of the interactive variable (FTZ_i*$LnMFN_i$). In this case, the total impact is positive and around 0.079 (0.977-0.898). The tariff impact on the exports of countries without an FTZ programme is equal to the coefficient of the tariff rate variable, hence -0.898. In other words, a 1% increase in MFN tariff rates raises the exports of exporter country *i* by 0.079% provided it has an FTZ programme, while it reduces the exports of countries without an FTZ programme by 0.90%. Hence, as shown by the results of Model 3, FTZs offset and slightly override the negative impact of tariff rates on exports.

Table 1: PPML Estimates of FTZ (EPZ-EMPZ) impact

VARIABLES	(1) Basic	(2) FTZ	(3) FTZ interaction	(4) EPZ-EMPZ	(5) EPZ-EMPZ interaction
Ln(Dij)	-0.685***	-0.667***	-0.680***	-0.664***	-0.671***
	(0.042)	(0.039)	(0.035)	(0.039)	(0.035)
Ln(Yi)	0.733***	0.757***	0.782***	0.761***	0.797***
	(0.031)	(0.025)	(0.024)	(0.024)	(0.024)
Ln(Yj)	0.743***	0.740***	0.754***	0.740***	0.760***
	(0.030)	(0.020)	(0.018)	(0.020)	(0.018)
Ln(YperCapi)	-0.005	-0.124**	-0.018	-0.083	0.003
	(0.046)	(0.050)	(0.046)	(0.052)	(0.050)
Ln(YperCapj)	0.017	-0.097**	-0.025	-0.097***	-0.037
	(0.038)	(0.040)	(0.032)	(0.038)	(0.034)
Ln(Rij)	1.384***	1.130***	0.902***	1.110***	0.892***
	(0.145)	(0.128)	(0.125)	(0.125)	(0.125)
Ln(Rji)	1.137***	0.700***	0.549***	0.710***	0.558***
	(0.136)	(0.123)	(0.123)	(0.120)	(0.121)
RTAij	0.040	0.092	0.046	0.095	0.058
	(0.088)	(0.091)	(0.078)	(0.089)	(0.078)
EC27ij	0.516***	0.685***	0.732***	0.681***	0.735***
	(0.140)	(0.160)	(0.133)	(0.155)	(0.131)
CONTij	0.580***	0.636***	0.610***	0.628***	0.609***
	(0.108)	(0.099)	(0.091)	(0.098)	(0.091)
LANGij	0.365***	0.207***	0.206***	0.213***	0.244***
	(0.069)	(0.070)	(0.067)	(0.069)	(0.069)
COLij	-0.208**	-0.165**	-0.120	-0.154**	-0.120
	(0.088)	(0.078)	(0.076)	(0.076)	(0.074)
LLi	-0.148*	-0.132	-0.109	-0.118	-0.084
	(0.086)	(0.082)	(0.082)	(0.082)	(0.083)
LLj	-0.135	-0.155*	-0.148	-0.154	-0.140
	(0.099)	(0.094)	(0.091)	(0.094)	(0.090)
LnMFNi		-0.556***	-0.898***	-0.573***	-0.902***
		(0.125)	(0.116)	(0.123)	(0.116)
LnMFNj		-0.794***	-1.000***	-0.783***	-0.985***
		(0.099)	(0.094)	(0.095)	(0.088)
FTZi		0.193*	-1.391***		
		(0.101)	(0.233)		
FTZj		0.527***	-0.461*		
		(0.113)	(0.251)		
*FTZi*LnMFNi*			0.977***		
			(0.148)		
*FTZj*LnMFNj*			0.620***		
			(0.125)		
EPZi				0.347**	-0.610
				(0.144)	(0.379)
EMPZi				0.140	-1.731***
				(0.099)	(0.286)
EPZj				0.518***	-0.259
				(0.109)	(0.270)
EMPZj				0.513***	-0.611*
				(0.120)	(0.327)
*EPZi*LnMFNi*					0.667***
					(0.183)
*EMPZi*LnMFNi*					1.140***
					(0.174)
*EPZj*LnMFNj*					0.507***
					(0.137)
*EMPZj*LnMFNj*					0.696***
					(0.154)
Constant	10.406***	7.552***	1.933	6.910***	1.185
	(2.379)	(1.722)	(1.662)	(1.681)	(1.714)
Observations	14,116	14,116	14,116	14,116	14,116
R-squared (Pseudo)	0.753	0.795	0.837	0.802	0.838

*Robust standard errors are in parentheses. All inferences are based on the Huber-White Sandwich estimate of variance. *** p<0.01, ** p<0.05, * p<0.1*

However, the impact of the importer's tariff on the exports of *i* to *j* presents a different structure. The overall impact of tariffs is negative and a 1% increase in tariff rates reduces the imports of countries with an FTZ by 0.38% (-1.00+0.62) or, in other words, the exports of countries to a given partner country *j* with an FTZ.[19] This time, FTZs only partially offset the tariff impact.

However, it is not easy to measure the specific impact of an FTZ in terms of elasticity, as is done above for the tariff impact. The problem is that the FTZ impact will be different for each tariff level since the impact also depends on the interactive term used with the tariff rates. For example, our results find that the positive impact of an FTZ grows with increasing tariff rates, but that an FTZ country *i* exports one-quarter ($e^{-1.391}$=1/4) of the exports of a non-FTZ country when tariff rates are "0". Meanwhile, we can use predictive margins to find the FTZ impact for different levels of tariff rates and see whether FTZ countries can export (import) more than non-FTZ countries. Tracking the marginal effect of an FTZ on the predicted $\hat{X}_{ij}$[20].A "0" tariff rate is not realistic for an FTZ country.[21]

To this end, we use the average marginal effects (AME) method, which calculates the average estimated bilateral exports from country *i* to country *j* assuming first that no exporter country *i* has an FTZ programme (FTZ_i=0) and then assuming that all countries have an FTZ programme (FTZ_i=1). It is also computed for seven different of tariff rate scales ($\ln MFN_i$, from 0.5 to 3.5, with a 0.5 interval). Average MFN tariff rates in the sample are a maximum of 28.8% (ln(28.8+1)=3.39). Then for each country pair *ij,* we estimate X_{ij} for FTZ_i=1 (although country *i* does not actually have an FTZ programme in reality). Then we take the average of all predicted X_{ij} at each tariff level. We do the same thing for FTZ_i=0. Hence we observe separately the impact of MFN tariff rates for the two groups of countries (FTZ and No FTZ). Graph 1 traces the values for the predicted $\hat{X}_{ij}$ and the difference between the ftzi=0 and ftzi=1 curves gives the value of the predictive margins for the FTZi impact at each tariff level.

Countries with an FTZ export more above a certain tariff rate threshold (MFN>3.48).[22] When tariff rates are low, however,[23] FTZ programmes appear to be inefficient at increasing exports. The graph also shows that FTZs are a "second best" solution compared to low tariff rates

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[19] We assume that the exports of *i* to *j* mirror the imports of *j* from *i*. $\sum_i X_{ij} = \sum_j M_{ji}$

[20] Note that the impact of an FTZ on the predicted $\hat{X}_{ij}$ is itself a function of $\hat{X}_{ij}$:

$$d\hat{X}_{ij}/dFTZ_i = \hat{X}_{ij}(-1.391 + 0.977 ln MFN_i).$$

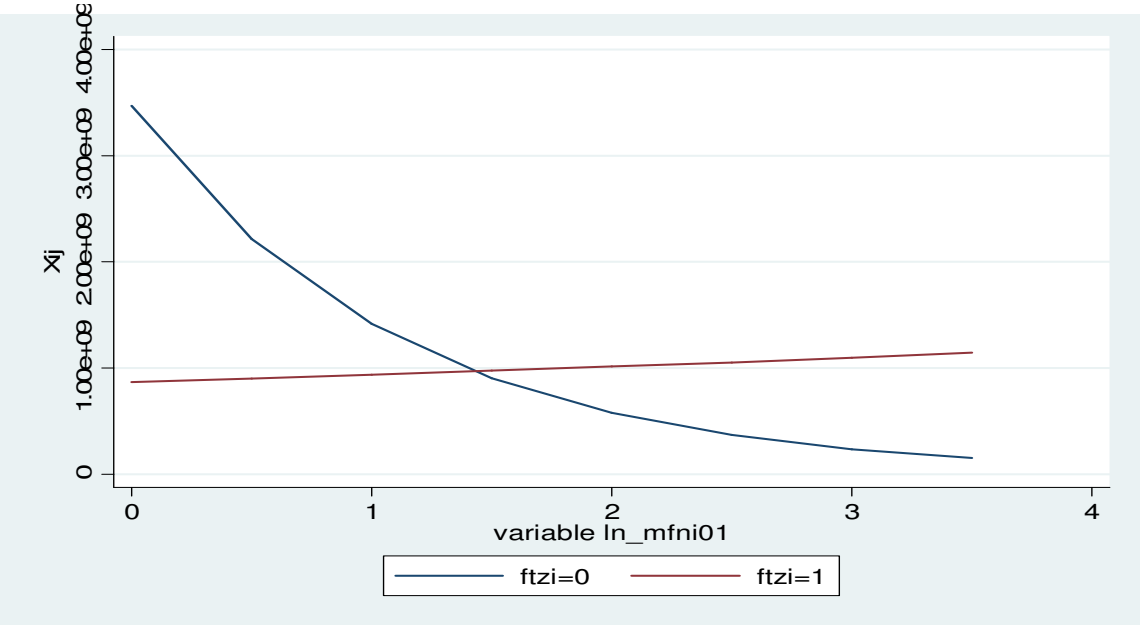
[21] As mentioned in Cameron & Trivadi (2009), "An ME (marginal effect), or partial effect, most often measures the effect on the conditional mean of y of a change in one of the regressors, say X_k. In the linear regression model, the ME equals the relevant slope coefficient, greatly simplifying analysis. For nonlinear models, this is no longer the case, leading to remarkably many different methods for calculating MEs."

[22] The intersection point in Graph 1 is around 1.5. We can then calculate the MFN level as ($e^{1.5}$-1) = 3.48.

[23] Note that the lowest MFN tariff rate for the FTZ countries in the sample is 2.4, which is $ln(MFN_i+1)=ln(2.4+1)=1.23$. For MFN rates below 1.23, Graph 1 and Graph 2 are not realistic.

since, even at very high tariff rates, FTZ country exports are lower than among the lower tariff countries.

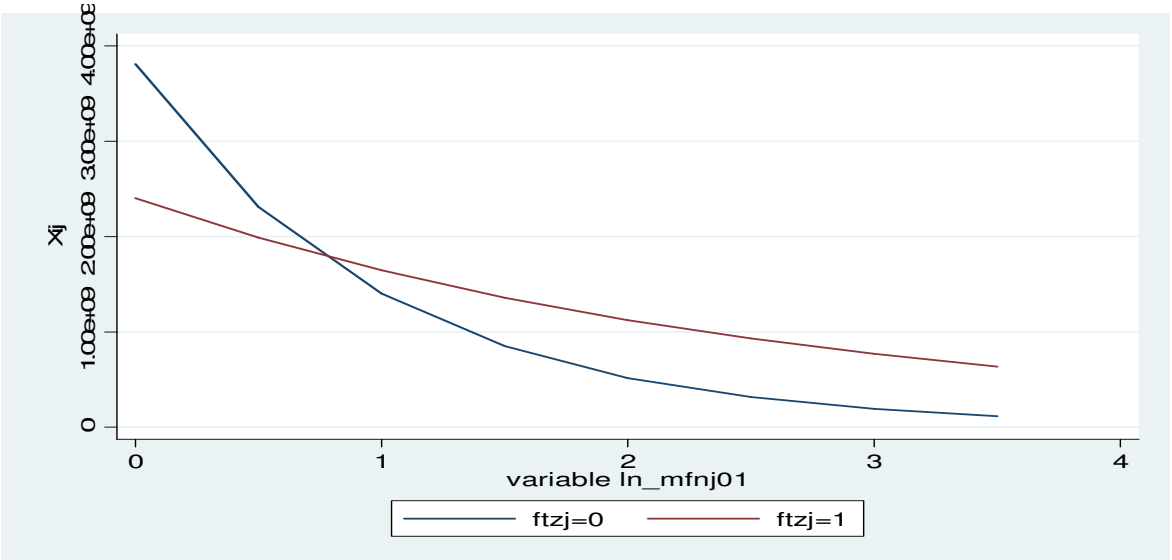
Graph 1: Predictive margins and MFN tariff rates (for exporters with and without an FTZ programme)



Note: variable ln_mfni01 in the graph represents $lnMFN_i$.

Graph 2 presents the Graph 1 calculations for importing countries and shows the average predicted $\hat{X}_{ij}$ when none of the importer countries is assumed to have an FTZ programme (FTZ_j=0) and when all importer countries are assumed to have an FTZ programme (FTZ_j=1). In this case, the higher tariff rates reduce estimated average exports between i and j. However, the slope is steeper for countries without an FTZ.

Graph 2: Predictive margins and MFN tariff rates (for importers with and without an FTZ programme)



Note: variable ln_mfnj01 in the graph represents $lnMFN_j$.

Lastly, Table 1, Column 4 shows the results separately for EPZs and EMPZs. The tariff rate impact is similar to that found with Model 2. Other control variables are also consistent with the previous estimations. Having an EPZ in exporter country *i* has a positive, significant (at 5%) impact on exports, while the impact of having an EMPZ is smaller and not significant. On the importer side, the impact of having an EPZ or EMPZ is similar and significant; both raise imports to importer *j* from its partner *i*. In the last column, we again estimate an interactive model to identify the separate trade structures for EPZ and EMPZ countries. The EMPZ dummy is significantly negative and different to the coefficient for the EPZ dummy (-1.731<-0.610). However, EMPZ country exports rise with the higher tariff rates (-0.902+1.140=0.238).[24] The higher tariff rates may motivate firms to set up in the EMPZ, since they have privileged (free of import tariffs) access to the domestic market. These higher tariff rates on the domestic market may attract greater investment and raise the exports of the country to the rest of the world. On the other hand, the impact (0.677) of an EPZ programme offsets the negative impact of tariff rates (-0.902) on the exports of *i*. Controlling for EMPZ countries, we observe that the overall tariff impact (-0.902+0.677=-- 0.225) on the exports of EPZ country *i* is negative. However, the number of EMPZ countries is unfortunately very small and the analysis is highly dependent on their performances. Namely, eleven countries are concerned: Argentina, Bahrain, Brazil, Jordan, Korea, Kuwait, Morocco, Mauritius, Thailand, USA and Zimbabwe. The trade structure of the USA might explain this result, which we will discuss further in the robustness analysis.

IV. Robustness analysis

The literature points out that trade between two countries also depends on their ability to trade with all countries. The higher the cost of access to the world markets, the more the country will trade with countries where access is relatively easier. For example, the negative effect of bilateral distance has to be put into perspective from the point of view of the average distance of a country from the rest of the world. Barriers would affect an isolated country differently to a country close to the world markets. Anderson and van Wincoop (2003) show that the usual remoteness index, as used previously, does not solve the problem properly. A country's trade structure depends on its own market price and its partners' market prices, which reflects "Multilateral Resistance (MR)". The usual way for the model to control for MR is to introduce country fixed effects, which capture all exporter and importer country observable and unobservable characteristics.

However, as discussed above, an important limitation when introducing fixed effects into a cross-section analysis is the collinearity of the fixed effects with our variables of interest: MFN tariff rates and FTZ dummy.

[24] Given that the max MFN tariff rate is 3.4 in our database, the positive impact of tariff rates on the exports of EMPZ countries is at max 0.238*3.4=0.8092. This impact is lower than -1.731. Hence, even at max tariff rates, EMPZ countries export less than EPZ countries.

A two-stage estimation process can overcome this problem (e.g. Eaton and Kortum (2002), Martinez-Zarsoso and Nowak-Lehmann (2003), Duc *et al.* (2008)). This method estimates a first-stage regression with exporter/importer fixed effects and the basic model's other bilateral variables such as distance, contiguity, colonial ties, etc. "Multilateral resistance" and omitted variables are then controlled for by country fixed effects. In a second stage, we regress the estimated fixed effects on the unilateral variables. In this manner, we are able to estimate the impact of FTZ while correcting for any bias due to omitted variables. We estimate this model again using the PPML estimator.

Our first-stage model is then as follows,

$$X_{ij} = \exp[\alpha_i + \alpha_j + \alpha_1 RTA_{ij} + \alpha_2 EC27_{ij} + \alpha_3 CONT_{ij} + \alpha_4 LANG_{ij} + \alpha_5 COL_{ij}]\eta_{ij}$$

The results are shown in Table 2.

Table 2: PPML estimates for the first-stage fixed effect model

VARIABLES	(1)
Dependent Variable	X_{ij}
Ln(Dij)	-0.658***
	(0.033)
RTAij	0.139*
	(0.076)
EUij	0.750***
	(0.106)
CONij	0.534***
	(0.071)
LANGij	0.267***
	(0.061)
COLij	0.104
	(0.087)
Constant	No constant
Observations	14,116

*Robust standard errors are in parentheses. All inferences are based on the Huber-White Sandwich estimate of variance. *** p<0.01, ** p<0.05, * p<0.1*

Our first-stage regression results compared with the bilateral variable estimates in Model 1 and Model 2 in the previous section reveal a significant (10%), positive RTA impact. Yet colonial history is not significant, as it is not incidentally significant either in Model 3 and Model 5 with interaction variables. We observe only a slight change in distance impact.

In the second stage, we use the estimated values of the fixed effects and regress separately for exporter and importer on the unilateral variables. This model contains 122 observations. Our variables of interest are then exporter *i* (importer *j*) MFN applied tariff rates and the FTZ dummy for *i (j)*. The remoteness variable (R_i *and* R_j) is calculated unilaterally in keeping with earlier work by Helliwell (1997).

$$\alpha_i = \exp[\alpha_0 + \alpha_1 \ln(Y_i) + \alpha_2 \ln(YperCap_i) + \alpha_3 \ln(R_i) + \alpha_4 LL_i + \beta_1 \ln MFN_i + \beta_2 FTZ_i]\eta_{ij} \quad (2a')$$

$$\alpha_j = \exp[\alpha_0 + \alpha_1 \ln(Y_j) + \alpha_2 \ln(YperCap_j) + \alpha_3 \ln(R_j) + \alpha_4 LL_j \alpha_0 + \beta_1 \ln MFN_j + \beta_2 FTZ_j]\eta_{ij} \quad (2b')$$

Table 3a and Table 3b show the results of the second-stage regression for exporter fixed effects (α_i) and importer fixed effects (α_j). Model 2a' and 2b' control for the same variables as Model 2 in the previous section, Model 3a' and 3b' are in line with Model 3, and so on.

Table 3a: PPML estimates for exporter fixed effects (second-stage regression)

VARIABLES	(1a') Basic	(2a') FTZ	(3a') FTZ interaction	(4a') EPZ-EMPZ	(5a') EPZ-EMPZ interaction
Dependent Variable	α_i	α_i	α_i	α_i	α_i
Ln(Yi)	0.766***	0.769***	0.795***	0.771***	0.809***
	(0.060)	(0.059)	(0.056)	(0.057)	(0.056)
Ln(YperCapi)	-0.029	-0.151	-0.064	-0.114	-0.037
	(0.090)	(0.111)	(0.106)	(0.103)	(0.108)
Ln(Ri)	1.248***	1.019***	0.812***	1.005***	0.794***
	(0.279)	(0.229)	(0.211)	(0.227)	(0.216)
LLi	-0.153	-0.193	-0.142	-0.176	-0.111
	(0.203)	(0.185)	(0.164)	(0.186)	(0.170)
LnMFNi		-0.522**	-0.865***	-0.531**	-0.881***
		(0.207)	(0.143)	(0.210)	(0.154)
FTZi		0.170	-1.216***		
		(0.182)	(0.412)		
*FTZi*LnMFNi*			0.859***		
			(0.252)		
EPZi				0.298	-0.479
				(0.262)	(0.699)
EMPZi				0.135	-1.505***
				(0.189)	(0.511)
*EPZi*LnMFNi*					0.582*
					(0.334)
*EMPZi*LnMFNi*					1.003***
					(0.306)
Constant	16.397***	16.231***	13.141***	15.652***	12.320***
	(3.049)	(2.360)	(1.972)	(2.505)	(2.412)
Observations	122	122	122	122	122
R-squared (Pseudo)	0.905	0.898	0.919	0.906	0.927

*Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1*

The impact of an FTZ in *i* is not significant. In Model 2 of Table 1, this result is calculated as 0.193 and significant at 10%, which is slightly lower than in Table 1. However, the negative tariff rate impact is lower in 2a' and less significant than in Table 1. In Model 3a' including interaction variables, the total impact (-0.865+0.859= -0.006) of an increase in tariff rates in FTZ countries appears to slightly reduce national exports, but the difference is not significant. Model 3 of Table 1 turns up a slight positive impact (0.079). FTZs appear to totally offset the negative impact of tariffs on the country's exports without any further positive effect. Hence FTZ countries consistently export less (-1.261) compared with non-FTZ countries at each tariff rate.

Model 4b' in Table 3a' shows the results for the impact of EPZs and EMPZs on the exports of country *i*. The EMPZ coefficient is in line with the results in Table 1, but is not significant. Model 5b' is in line with the previous results. The total impact of tariffs is negative for EPZ countries (-0.881+0.582=-0.299) and positive for EMPZ countries (-0.881+1.003=0.122). However, the coefficient of the interactive term for the EPZ countries (EPZ_i*$LnMFN_i$) is now less significant.

Table 3b: PPML estimates for importer fixed effects (second-stage regression)

	(1b')	(2b')	(3b')	(4b')	(5b')
VARIABLES	Basic	FTZ	FTZ interaction	EPZ-EMPZ	EPZ-EMPZ interaction
Dependent Variable	α_j	α_j	α_j	α_j	α_j
Ln(Yj)	0.797***	0.756***	0.772***	0.755***	0.771***
	(0.056)	(0.024)	(0.024)	(0.025)	(0.024)
Ln(YperCapj)	0.003	-0.074*	-0.023	-0.082	-0.035
	(0.045)	(0.045)	(0.040)	(0.056)	(0.053)
Ln(Rj)	0.994***	0.629***	0.500***	0.632***	0.502***
	(0.251)	(0.129)	(0.152)	(0.129)	(0.152)
LLj	-0.084	-0.105	-0.084	-0.108	-0.088
	(0.171)	(0.108)	(0.088)	(0.110)	(0.088)
LnMFNj		-0.712***	-0.908***	-0.711***	-0.907***
		(0.111)	(0.086)	(0.110)	(0.086)
FTZj		0.569***	-0.197		
		(0.080)	(0.191)		
*FTZj*LnMFNj*			0.485***		
			(0.115)		
EPZj				0.540***	-0.238
				(0.148)	(0.462)
EMPZj				0.576***	-0.190
				(0.080)	(0.209)
*EPZj*LnMFNj*					0.484**
					(0.195)
*EMPZj*LnMFNj*					0.487***
					(0.125)
Constant	14.011***	13.467***	11.568***	13.596***	11.752***
	(3.045)	(1.332)	(1.500)	(1.441)	(1.631)
Observations	122	122	122	122	122
R-squared (Pseudo)	0.932	0.988	0.991	0.988	0.991

*Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1*

The results in Table 3b need to be compared again with the results in Table 1 to identify the importer characteristics. In Model 1b', the remoteness variable for importer *j* is lower, but significant at 1% and positive as expected. The result in Model 2b' is closer to Table 1. An FTZ programme in country *j* significantly raises its imports (0.569), in keeping with the previous estimates. In Model 3b', the total tariff impact is calculated as -0.423 (-0.908+0.485). This is in line with the Model 3 result of 0.38. FTZs raise imports, which partially offset the negative impact of tariffs.

The impact of EPZs and EMPZs on imports is positive and significant, as estimated before. In the last model, Model 5b', the total impact of tariff rates is negative, but lower in EPZ and EMPZ countries with their positive offsetting impact on imports (0.484 for EPZs and 0. 487 for EMPZs).

This paper uses an original database drawing on abundant documentation. However, most of the time, FTZs are not transparent. Information is either not available or unreliable. Therefore, in this section, we check the robustness of our results as against plausible errors in the database. For this, we use Model 2 and its interactive version and Model 3, which we believe best reflect the relationship between tariff rates and FTZs and their impact on trade. Table 4 presents the results.

The first column shows the results taking a "broad" definition of FTZ programmes. Hitherto, we have taken the criterion of minimum activity in the FTZ to construct our FTZ dummy.

However, this could be seen as a selection bias since countries where FTZs are active can be considered already "successful". In fact, some countries with FTZs never manage to attract investment. The FTZ dummy now takes the value "1" whether or not the FTZ programme is active. The non-FTZ countries are then those that do not have an FTZ programme at all.

The first column (Table 4) shows that the results for the control variables and the tariff rates do not change. An FTZ in importer *j* has a positive impact to a similar extent as in Model 2 in Table 1. FTZ impacts on the exports of exporter *i* are again positive and significant, albeit slightly higher. In the interactive model (Column 2), the results are again similar to the previous models: tariffs have a negative impact offset by the positive impact of the FTZ interaction variable.

In Column 3, we show the results for "a restricted" definition of the FTZ database. This time, we retain only the countries with "very active" FTZ programmes. We again find similar results: FTZs in exporter *i* have no significant impact on exports (previously significant at 10%), while their impact indexed by the import country is positive and again significant. In Column 4, we again find that FTZs have a non-significant or negative impact, with a significantly positive interaction variable.

We also change the status of the USA from an FTZ country to a non-FTZ country. FTZ importers within the USA are exempt from paying duty on merchandise that is re-exported. In addition, the "tariff rate rationalisation" principle eliminates the "inverted tariff" effect found when the duty rate for an imported component or raw material is higher than that which would apply to an import of the final product into which the component or raw material had been incorporated (Tiefenbrun ed., 2012, p.8)[25]. However, even with 260 FTZs in operation, total zone-related manufacturing activity comes to around US$400 million a year (Tiefenbrun ed., 2012), which is negligible compared with the value of US exports (Vicens Feliberty, 2013). The risk is then that the USA unduly influences the results.

In the sixth and seventh columns, we again observe a higher negative impact of tariff rates when the USA is considered not to have an FTZ programme. We also observe a positive, highly significant impact of an FTZ on the exports of country *i* (Table 4, Column 5). The interaction variable (Table 4, Column 6) is still significant and positive, with its coefficient quite close to the previous estimates. The introduction of interaction variables inverses the signs for the coefficients of FTZ_i and FTZ_j . However compared with the reference model (Table 1, Column 3), their impact is smaller and non-significant. Changing the USA's status weakens the negative impact of FTZs on trade.

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[25] The FTZ procedure in USA is quite complex. FTZs are outside of the customs territory (CBP) and, as with most other FTZs, products may enter the domestic market only after paying the relevant duty. However, as explained by US Customs and Border Protection, "*The rate of the duty and tax on the merchandise admitted to a zone may change as a result of operations conducted within the zone. Therefore, the zone user who plans to enter the merchandise for consumption to CBP territory may normally elect to pay either the duty rate applicable on the foreign material placed in the zone or the duty rate applicable on the final article transferred from the zone whichever is to his advantage*."

Table 4: FTZ Database Robustness

VARIABLES	(1) FTZ (broad)	(2) FTZ (broad)	(3) FTZ (restricted)	(4) FTZ (restricted)	(5) FTZ (USA=0)	(6) FTZ (USA=0)
Dependent Variable	X_{ij}	X_{ij}	X_{ij}	X_{ij}	X_{ij}	X_{ij}
Ln(Dij)	-0.668***	-0.685***	-0.663***	-0.671***	-0.622***	-0.644***
	(0.039)	(0.035)	(0.040)	(0.036)	(0.037)	(0.037)
Ln(Yi)	0.756***	0.785***	0.762***	0.779***	0.791***	0.789***
	(0.025)	(0.024)	(0.025)	(0.024)	(0.025)	(0.024)
Ln(Yj)	0.742***	0.758***	0.732***	0.739***	0.810***	0.808***
	(0.020)	(0.018)	(0.021)	(0.019)	(0.023)	(0.022)
Ln(YperCapi)	-0.118**	0.004	-0.140***	-0.046	-0.012	0.026
	(0.051)	(0.045)	(0.051)	(0.045)	(0.045)	(0.046)
Ln(YperCapj)	-0.095**	-0.014	-0.093**	-0.032	-0.060*	-0.030
	(0.040)	(0.032)	(0.044)	(0.035)	(0.032)	(0.031)
Ln(Rij)	1.130***	0.886***	1.148***	0.966***	0.897***	0.822***
	(0.128)	(0.127)	(0.127)	(0.125)	(0.129)	(0.129)
Ln(Rji)	0.716***	0.558***	0.702***	0.599***	0.584***	0.526***
	(0.122)	(0.122)	(0.123)	(0.118)	(0.118)	(0.122)
RTAij	0.090	0.040	0.102	0.059	0.131*	0.093
	(0.090)	(0.077)	(0.093)	(0.084)	(0.076)	(0.073)
EUij	0.708***	0.774***	0.581***	0.590***	0.664***	0.676***
	(0.161)	(0.132)	(0.159)	(0.135)	(0.125)	(0.117)
Contiguityij	0.635***	0.605***	0.629***	0.603***	0.647***	0.623***
	(0.099)	(0.091)	(0.101)	(0.094)	(0.094)	(0.092)
Comlangij	0.203***	0.197***	0.244***	0.270***	0.319***	0.293***
	(0.070)	(0.066)	(0.070)	(0.069)	(0.061)	(0.059)
Colonyij	-0.165**	-0.113	-0.181**	-0.155**	-0.156*	-0.133
	(0.079)	(0.077)	(0.077)	(0.075)	(0.085)	(0.085)
LLi	-0.132	-0.107	-0.145*	-0.135	-0.073	-0.095
	(0.082)	(0.082)	(0.082)	(0.083)	(0.082)	(0.083)
LLj	-0.154	-0.144	-0.189**	-0.194**	-0.069	-0.088
	(0.095)	(0.091)	(0.094)	(0.091)	(0.091)	(0.091)
LnMFNi	-0.567***	-0.951***	-0.498***	-0.748***	-0.750***	-0.891***
	(0.125)	(0.112)	(0.128)	(0.125)	(0.109)	(0.108)
LnMFNj	-0.797***	-1.025***	-0.729***	-0.855***	-0.882***	-0.983***
	(0.100)	(0.094)	(0.098)	(0.093)	(0.088)	(0.090)
FTZi	0.228**	-1.505***	0.053	-1.390***	0.762***	-0.370
	(0.102)	(0.226)	(0.096)	(0.246)	(0.130)	(0.299)
FTZj	0.535***	-0.522**	0.434***	-0.387	0.698***	-0.176
	(0.114)	(0.244)	(0.121)	(0.289)	(0.100)	(0.240)
*FTZi*LnMFNi*		1.081***		0.857***		0.601***
		(0.144)		(0.152)		(0.152)
*FTZj*LnMFNj*		0.671***		0.493***		0.463***
		(0.124)		(0.134)		(0.122)
Constant	7.612***	1.458	7.827***	3.518**	-0.120	-1.432
	(1.729)	(1.696)	(1.714)	(1.599)	(1.840)	(1.877)
Observations	14,116	14,116	14,116	14,116	14,116	14,116
R-squared	0.795	0.840	0.788	0.823	0.819	0.829

*Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1*

Lastly, we change our sample of 122 countries by dropping China. The high performance of Chinese SEZs, EPZs and other similar zones and their large share in China's exports are largely discussed in the literature. China's recent high performance in world trade is almost completely driven by its Special Economic Zones. Therefore, it is important to check whether China's good performance is not over-represented in our estimations. Table 5 presents the results again for Model 2 and 3 of Table 1. The results are very similar to the previous ones.

The FTZ impact on countries' exports is positive, but not very high ($e^{0.229}$=1.25 times larger) and FTZ countries import significantly more from their partners. The interactive model shows a slightly positive overall impact (-0.797+0.846=0.049) of tariffs in FTZ countries.

Table 5: Robustness for China's FTZ impact (PPML)

	(1)	(2)
VARIABLES	FTZ	FTZ interaction
Dependent Variable:	X_{ij}	X_{ij}
LnMFNi	-0.483***	-0.797***
	(0.093)	(0.092)
LnMFNj	-0.711***	-0.926***
	(0.073)	(0.070)
FTZi	0.229**	-1.150***
	(0.099)	(0.230)
FTZj	0.487***	-0.445**
	(0.094)	(0.208)
*FTZi*LnMFNi*		0.846***
		(0.145)
*FTZj*LnMFNj*		0.579***
		(0.109)
Constant	6.659***	1.929
	(1.768)	(1.806)
Observations	13,874	13,874
R-squared (Pseudo)	0.832	0.859

*Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1*

V. Conclusion

FTZs raise trade only by easing the negative impact of protection. FTZ impacts on imports are higher and more robust than their impact on exports.

FTZs in exporting countries raise trade by offsetting the negative impact of protection on imported inputs. At the same time, they raise the rest of the world's exports. This result is robust to a change in the way of handling "multilateral resistance", omitted variables and errors or bias due to the data and sample. The double-edged effect – imports and exports – confirms the contribution of FTZs to the GVC. The offsetting effect is greater for EMPZs than for EPZs.

The question often asked about FTZs and the balance between distortion effects and "stimulating" effects is irrelevant here. The right question is: do the trade creation effects of FTZs offset the negative effects of protection in the country? This paper can give no hard-and-fast answer because the net trade gains and losses are too tight to come to a clear-cut conclusion.

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Appendix 1: Country List and Zone Status

ISO Code	IMF Code	Country Name	FTZ Status
AGO	614	Angola	No active FTZ programme
ALB	914	Albania	No active FTZ programme
ARE	466	United Arab Emirates	Active EPZ
ARG	213	Argentina	Active EMPZ
ARM	911	Armenia	No FTZ programme
AUS	193	Australia	No FTZ programme
AUT	122	Austria	No FTZ programme
BDI	618	Burundi	Active EPZ
BEL	124	Belgium	No FTZ programme
BEN	638	Benin	Active EPZ
BFA	748	Burkina Faso	No active FTZ programme
BGD	513	Bangladesh	Active EPZ
BGR	918	Bulgaria	No FTZ programme
BHR	419	Bahrain	Active EMPZ
BLZ	339	Belize	Active EPZ
BOL	218	Bolivia	Active EPZ
BRA	223	Brazil	Active EMPZ
BRN	516	Brunei	No FTZ programme
CAN	156	Canada	No FTZ programme
CHE	146	Switzerland	No FTZ programme
CHL	228	Chile	Active EPZ
CHN	924	China	Active EPZ
CIV	662	Côte d'Ivoire	No active FTZ programme
CMR	622	Cameroon	Active EPZ
COD	636	Democratic Republic of the Congo	No FTZ programme
COL	233	Colombia	Active EPZ
CPV	624	Cape Verde	No active FTZ programme
CRI	238	Costa Rica	Active EPZ
CYP	423	Cyprus	No FTZ programme
CZE	935	Czech Republic	No FTZ programme
DEU	134	Germany	no FTZ programme
DJI	611	Djibouti	No FTZ programme
DNK	128	Denmark	No FTZ programme
DOM	243	Dominican Republic	Active EPZ
ECU	248	Ecuador	Active EPZ
EGY	469	Egypt	Active EPZ
ESP	184	Spain	No FTZ programme
EST	939	Estonia	No FTZ programme
FIN	172	Finland	No FTZ programme
FJI	819	Fiji	No FTZ programme
FRA	132	France	No FTZ programme
GAB	646	Gabon	No FTZ programme

GBR	112	United Kingdom	No FTZ programme
GHA	652	Ghana	Active EPZ
GIN	656	Guinea	No FTZ programme
GMB	648	Gambia	Active EPZ
GNB	654	Guinea Bissau	No FTZ programme
GRC	174	Greece	No FTZ programme
GTM	258	Guatemala	Active EPZ
HKG	532	Hong Kong	No FTZ programme
HND	268	Honduras	Active EPZ
HRV	960	Croatia	Active EPZ
HTI	263	Haiti	Active EPZ
HUN	944	Hungary	No FTZ programme
IDN	536	Indonesia	Active EPZ
IND	534	India	Active EPZ
IRL	178	Ireland	No FTZ programme
ISR	436	Israel	No FTZ programme
ITA	136	Italy	No FTZ programme
JAM	343	Jamaica	Active EPZ
JOR	439	Jordan	Active EMPZ
JPN	158	Japan	No FTZ programme
KEN	664	Kenya	Active EPZ
KGZ	917	Kyrgyzstan	Active EPZ
KHM	522	Cambodia	Active EPZ
KOR	542	Korea	Active EMPZ
KWT	443	Kuwait	Active EMPZ
LKA	524	Sri Lanka	Active EPZ
LTU	946	Lithuania	No FTZ programme
LUX	137	Luxembourg	No FTZ programme
LVA	941	Latvia	No FTZ programme
MAR	686	Morocco	Active EMPZ
MDA	921	Moldova	Active EPZ
MDG	674	Madagascar	Active EPZ
MDV	556	Maldives	No FTZ programme
MEX	273	Mexico	Active EPZ
MLI	678	Mali	No active FTZ programme
MLT	181	Malta	No FTZ programme
MNG	948	Mongolia	No active FTZ programme
MOZ	688	Mozambique	Active EPZ
MRT	682	Mauritania	No active FTZ programme
MUS	684	Mauritius	Active EMPZ
MWI	676	Malawi	Active EPZ
MYS	548	Malaysia	Active EPZ
NER	692	Niger	No FTZ programme
NGA	694	Nigeria	Active EPZ
NIC	278	Nicaragua	Active EPZ

NLD	138	Netherlands	No FTZ programme
NPL	558	Nepal	No FTZ programme
NZL	196	New Zealand	No FTZ programme
OMN	449	Oman	Active EPZ
PAK	564	Pakistan	Active EPZ
PAN	283	Panama	Active EPZ
PER	293	Peru	Active EPZ
PHL	566	Philippines	Active EPZ
PNG	853	Papua New Guinea	No FTZ programme
POL	964	Poland	No FTZ programme
PRT	182	Portugal	No FTZ programme
PRY	288	Paraguay	Active EPZ
QAT	453	Qatar	No FTZ programme
ROM	968	Romania	No FTZ programme
RWA	714	Rwanda	No active FTZ programme
SAU	456	Saudi Arabia	No FTZ programme
SEN	722	Senegal	Active EPZ
SGP	576	Singapore	No FTZ programme
SUR	366	Surinam	No FTZ programme
SVK	936	Slovak Republic	No FTZ programme
SVN	961	Slovenia	No FTZ programme
SWE	144	Sweden	No FTZ programme
TGO	742	Togo	Active EPZ
THA	578	Thailand	Active EMPZ
TUN	744	Tunisia	Active EPZ
TUR	186	Turkey	Active EPZ
TZA	738	Tanzania	Active EPZ
UGA	746	Uganda	No FTZ programme
URY	298	Uruguay	Active EPZ
USA	111	United States	Active EMPZ
VEN	299	Venezuela	Active EPZ
VNM	582	Vietnam	Active EPZ
ZAF	199	South Africa	Active EPZ
ZMB	754	Zambia	Active EPZ
ZWE	698	Zimbabwe	Active EMPZ

Appendix 2: Tariff Rates of Countries with or without FTZs

	Average MFN Applied (Non-Agriculture) Tariff Rates			
	Min	Max	Mean	Std. Dev.
No FTZ	0	28.8	6.58	5.24
FTZ	2.4	25.5	9.46	4.53
EPZ	2.4	25.5	9.40	4.54
EMPZ	2.7	18.3	8.84	4.80

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