From micro to macro: Demand and supply-side determinants of the trade elasticity

Maria Bas[y] Thierry Mayer[z] Mathias Thoenig [x]

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Abstract

This paper combines two rm-level customs datasets for French and Chinese exporters to

1 Introduction

The response of trade flows to a change in trade costs, summarized as the aggregate trade elasticity, is a central element in any evaluation of the welfare impacts of trade liberalization. Arkolakis et al. (2012) recently showed that it is actually one of the (only) two sufficient statistics needed to calculate Gains From Trade (GFT), under a surprisingly large set of alternative modeling assumptions — the ones most commonly used by recent research in the field. Measuring those elasticities has therefore been the topic of a long-standing literature, with recent debates about the appropriate source of identification (exchange rate versus tariff changes in particular), aggregation issues (Imbs and Mejean (2014), Ossa (2012) for instance), and how those elasticities might vary according to the theoretical model at hand (Simonovska and Waugh (2012)). The most common usage is to estimate this elasticity in a *macro-level* bilateral trade equation that Head and Mayer (2014) label structural gravity, its specification being fully consistent with many different structural models of trade. While the estimation method is independent of the model, the interpretation of this elasticity is not. With a homogeneous firms model of the Krugman (1980) type in mind, the estimated elasticity turns out to reveal a demand-side parameter only. When instead considering heterogeneous firms a la Melitz (2003), the literature has proposed that the macro-level trade elasticity is driven solely by a supply-side parameter describing the dispersion of the underlying heterogeneity distribution of firms. This result has been shown with several demand systems (CES by Chaney (2008), linear by Melitz and Ottaviano (2008), translog by Arkolakis et al. (2010) for instance), but relies critically on the assumption of a Pareto distribution. The trade elasticity then provides an estimate of the dispersion parameter of the Pareto.[1]

Our paper shows that both existing interpretations of the estimated elasticities are too extreme: When the Pareto assumption is relaxed, the aggregate trade elasticity is a mix of demand and supply parameters. A second important consequence of abandoning Pareto is that the trade elasticity is no longer constant across country pairs. Estimating the aggregate trade elasticity with gravity hence becomes problematic because structural gravity does not apply anymore. We argue in this paper that quantifying trade elasticities at the aggregate level makes it necessary to use micro-level information when moving away from the Pareto assumption. We provide a method using firm-level export values for estimating all the components of the aggregate trade elasticity: i) the CES parameter that governs the intensive margin and ii) the supply side parameters that drive the extensive margin.

Our approach features several steps. The first one isolates the demand side parameter using firm-level exports by French and Chinese firms to destinations that confront those firms with different levels of tariffs. We maintain the traditional CES demand system combined with monopolistic competition, which yields a *firm-level* gravity equation specified as a ratio-type estimation so as to eliminate unobserved characteristics of both the exporting firm and the importer country. This method is called tetrads by Head et al. (2010) since it combines a set of four trade flows into an ratio of ratios called an export tetrad and regresses it on a corresponding tariff tetrad for the same product-country combinations.[2]

[1] In the ricardian Eaton and Kortum (2002) setup, the trade elasticity is also a supply side parameter reflecting heterogeneity, but this heterogeneity takes place at the national level, and reflects the scope for comparative advantage.

[2] Other work in the literature also relies on the ratio of ratios estimation. Romalis (2007) uses a similar method to estimate the effect of tariffs on trade flows at the product-country level. He estimates the effects of applied tariff changes within NAFTA countries (Canada and Mexico) on US imports at the product level. Hallak (2006) estimates a fixed effects gravity model and then uses a ratio of ratios method in a quantification exercise. Caliendo and Parro (2014) also use ratios of ratios and rely on asymmetries in tariffs to identify industry-level elasticities.

Our identi cation strategy relies on there being enough variation in tari s applied by di erent

Our paper also contributes to the literature studying the importance of the distribution assumption of heterogeneity for trade patterns, trade elasticities and welfare. Head et al. (2014), Yang (2014), Melitz and Redding (2013) and Feenstra (2013) have recently argued that the simple gains from trade formula proposed by Arkolakis et al. (2012) relies crucially on the Pareto assumption, which kills important channels of gains in the heterogenous rms case. The alternatives to Pareto considered to date in welfare gains quanti cation exercises are i) the truncated Pareto by Helpman et al. (2008), Melitz and Redding (2013) and Feenstra (2013), and ii) the Lognormal by Head et al. (2014) and Yang (2014). A key simplifying feature of Pareto is to yield a constant trade elasticity, which is not the case for alternative distributions. Helpman et al. (2008) and Novy (2013) have produced gravity-based evidence showing substantial variation in the trade cost elasticity across country pairs. Our contribution to that literature is to use the estimated demand and supply-side parameters to construct predicted bilateral elasticities for aggregate ows under the Lognormal assumption, and compare theirion,est-88wftre gra728(vit)27(y-based)-328(estimairsr)]T -17 tradeeaibiutesd

Our objective is to estimate the trade elasticity, 1 identified on cross-country differences in applied tariffs (that are part of $_n$). This involves controlling for a number of other determinants (\nuisance" terms) in equation (2). First, it is problematic to proxy for A_n, since it includes the ideal CES price index P_n, which is a complex non-linear construction that itself requires knowledge of . A well-known solution used in the gravity literature is to capture (A_n) with destination country fixed effects (which also solves any issue arising from omitted unobservable n-specific determinants). This is however not applicable here since A_n and $_n$ vary across the same dimension. To separate those two determinants, we use a second set of exporters, based in a country that faces different levels of applied tariffs, such that we recover a bilateral dimension on .

A second issue is that we need to control for firm-level marginal costs (w). Again measures of firm-level productivity and wages are hard to obtain for two different source countries on an exhaustive basis. In addition, there might be a myriad of other firm-level determinants of export performance, such as quality of products exported, managerial capabilities... which will remain unobservable. We use a ratio-type estimation, inspired by Hallak (2006), Romalis (2007) and Head et al. (2010), that removes observable and unobservable determinants for both firm-level and destination factors. This method uses four individual export flows to calculate ratios of ratios: an approach referred to as *tetrads* from now on. We now turn to a presentation of this method.

2.2 Microfoundations of a ratio-type estimation

To implement tetrads at the micro level, we need firm-level datasets for two origin countries reporting exports by firm-product and destination country. Second, we also require information on bilateral trade costs faced by firms when selling their products abroad that differ across exequation (2):

$$\frac{x_n(\ _{j;\mathrm{FR}})}{x_k(\ _{j;\mathrm{FR}})} = \frac{_{n\mathrm{FR}}}{_{k\mathrm{FR}}}^{1} \quad \frac{A_n}{A_k} \quad \frac{_n(\ _{j;\mathrm{FR}})}{_k(\ _{j;\mathrm{FR}})} \tag{3}$$

To eliminate the aggregate attributes of importing countries n and k, we require two sources of rm-level data to have information on export sales by destination country of rms located in at least two di erent exporting countries. This allows to take the ratio of equation (3) over the same ratio for a rm with rank j located in China:

$$\frac{x_n(\ _{j;\mathrm{FR}})=x_k(\ _{j;\mathrm{FR}})}{x_n(\ _{j;\mathrm{CN}})=x_k(\ _{j;\mathrm{CN}})} = \frac{_{n\mathrm{FR}}=\ _{k\mathrm{FR}}}{_{n\mathrm{CN}}=\ _{k\mathrm{CN}}}^{1} \quad \frac{_n(\ _{j;\mathrm{FR}})=\ _k(\ _{j;\mathrm{FR}})}{_n(\ _{j;\mathrm{CN}})=\ _k(\ _{j;\mathrm{CN}})}: \tag{4}$$

Denoting tetradic terms with a e symbol, one can re-write equation (4) as

$$\tilde{x}_{fj;n;kg} = \tilde{e}^{1}_{fn;kg} \quad \tilde{e}_{fj;n;kg}; \tag{5}$$

which will be our main foundation for estimation.

2.3 Estimating equation

With equation (5), we can use tari s to identify the rm-level trade elasticity, 1 . Restoring the product subscript (p), and using i = FR or CN as the origin country index, we specify bilateral trade costs as a function of applied tari s, with ad valorem rate t^p_{ni} and of a collection of other barriers, denoted with D_{ni}. Those include the classical gravity covariates such as distance, common language, colonial link and common border. Taking the example of a continuous variable such as distance for D_{ni}:

$$^{p}_{ni} = (1 + t^p_{ni})D_{ni}; \tag{6}$$

which, once introduced in the logged version of (5) leads to our estimable equation

$$\ln \tilde{x}^p_{fj;n;kg} = (1 \quad)\ln \quad 1 + \hat{t}^p_{fn;kg} \quad + (1 \quad) \quad \ln \hat{D}_{fn;kg} + \ln \tilde{e}^p_{fj;n;kg} \tag{7}$$

The dependent variable is constructed by the ratio of ratios of exports for j = 1 to 25, that is rms ranking from the top to the 25th exporter for a given product. Our procedure is the following: Firms are ranked according to their export value for each product and reference importer country k. We then take the tetrad of exports of the top French rm over the top Chinese rm exporting the same product to the same destination. The set of destinations for each product is therefore limited to the countries where both the top French and Chinese rm export that product. In order to have enough variation in the dependent variable, we complete the missing export values of each product-destination combination with the export tetrads of the top 2 to the top 25 rms.

It is apparent in equation (7) that the identi cation of the e ect of tari s is possible over several dimensions: essentially across i) destination countries and ii) products, both interacted with variance across reference countries. In our estimations, we investigate the various dimensions, by sequentially including product-reference or destination reference xed e ects to the baseline speci cation.

There might be unobservable destination country characteristics, such as political factors or uncertainty on trading conditions, that can generate a correlated error-term structure, potentially biasing downwards the standard error of our variable of interest. Hence, standard errors are clustered at the destination level in the baseline speci cations.[7]

Finally, one might be worried by the presence of unobserved bilateral trade costs that might be correlated with our measure of applied tari s. Even though it is not clear that the correlation with those omitted trade costs should be systematically positive, we use, as a robustness check, an a more inclusive measure of applied trade costs, the Ad Valorem Equivalent (AVE) tari s from WITS and MAcMAp databases, described in the next section.

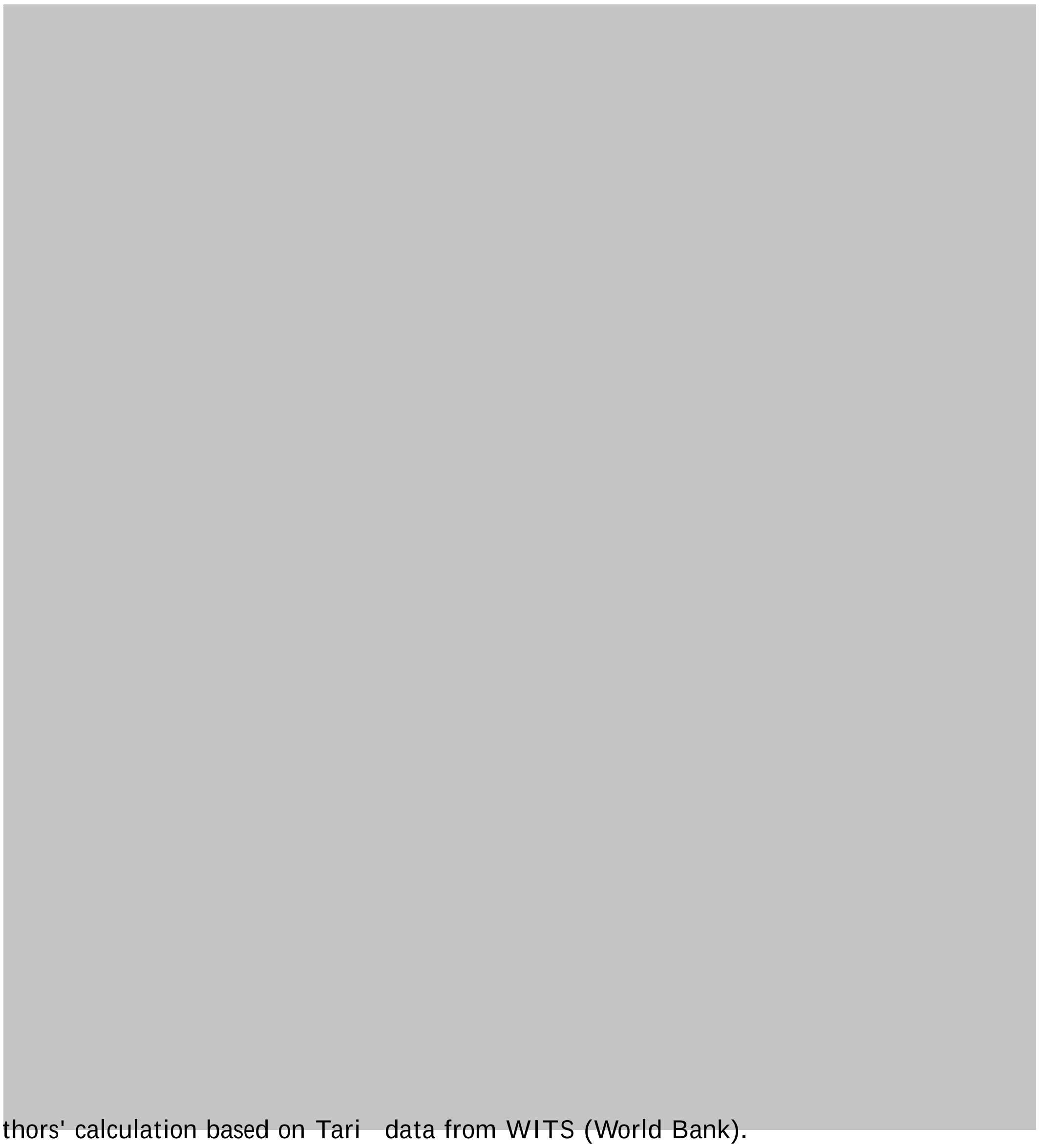
3 Data

Trade: Our dataset is a panel of Chinese and French exporting rms in the year 2000. The

Table 1: Average percentage point di erence between the applied tari to France and China by reference importer country and industry (2000)

Reference importer:	Germany		Japan	
	Full sample	Tetrad regression sample	Full sample	Tetrad regression sample
Agriculture	-3.07	-5.64	.43	.76
Food	-7.89	-10.09	2.27	.76
Textile	-7.17	-7.18	5.24	4.6
Wearing apparel	-9.34	-7.41	6.21	6.57
Leather	-1.5	-.98	8.14	4.64
Wood	-1.39	-2.08	2.53	3.98
Paper	0	0	1.41	1.61
Edition	-.79	0	.26	.85
Coke prod	0	0	.93	1.73
Chemical	-1.28	-.28	2.51	2.32
Rubber & Plastic	-1.27	-.71	2.54	2.81
Non Metallic	-1.47	-3.46	1.17	1.22
Basic metal products	-1.89	-.84	1.86	1.47
Metal products	-.68	-1.06	1.41	2.06
Machinery	-.25	-.22	.18	0
O ce	-.16	0	0	0
Electrical Prod	-.38	-.82	.38	.39
Equip. Radio, TV	-1.73	-1	0	0
Medical instruments	-.58	-.67	.15	.36
Vehicles	-2.22	-.87	0	0
Transport	-1.27	-1.43	0	0
Furniture	-.52	-.77	1.92	1.98

Figure 1: Average percentage point difference between the applied tariff to France and China by reference importer country and industry (2000)



Source: Authors' calculation based on Tariff data from WITS (World Bank).

3.2 Estimating sample

As explained in the previous section, we estimate the elasticity of exports with respect to tariffs at the firm-level relying on a ratio-type estimation. The dependent variable is the log of a double ratio of ratios of firm-level exports of firms with rank j of product p to destination n. The two ratios use the French/Chinese origin of the firm, and the reference country dimensions.

Firms are ranked according to their export value for each hs6 line and reference importer country. We first take the ratio of ratios of exports of the top 1 French and Chinese firms and then we complete the missing export values for hs6 product-destination pairs with the ratio of ratios of exports of the top 2 to the top 25 firms. The final estimating sample is composed of 61,310 (26,547 for the top 1 exporting firm) hs6-product, destination and reference importer country pairs observations in the year 2000.

The number of hs6 products and destination countries used in the estimations is lower than the ones available in the original French and Chinese customs datasets since to construct the ratio of ratios of exports we need that the top 1 (to top 25) French exporting firm exports the same hs6 product that the top 1 (to top 25) Chinese exporting firm to at least the reference country as well as the destination country. The total number of hs6 products in the estimating sample corresponds to 2439. The same restriction applies to destination countries. The number of destination countries is 68.

Table 2 present descriptive statistics on the main variables at the destination country level for the 68 countries present in the estimating sample. Columns (1) and (2) of Table 2 reports population and GDP for each destination country in 2000. Columns (3) to (5) display, for each destination country the ratio of total exports, average exports and total number of exporting firms between France and China to each market in 2000. The final column displays the ratio of distances separating our two exporters from each of the importing economies, and is used as the ranking variable. Only 12 countries in our estimating sample are closer to China than to France. In all of those, the number of Chinese exporters is larger than the number of French exporters, and the total value of Chinese exports largely exceeds the French one. On the other end of the spectrum, countries like Belgium and Switzerland witness much larger counts of exporters and total flows from France than from China.

4 Results

4.1 Graphical illustration

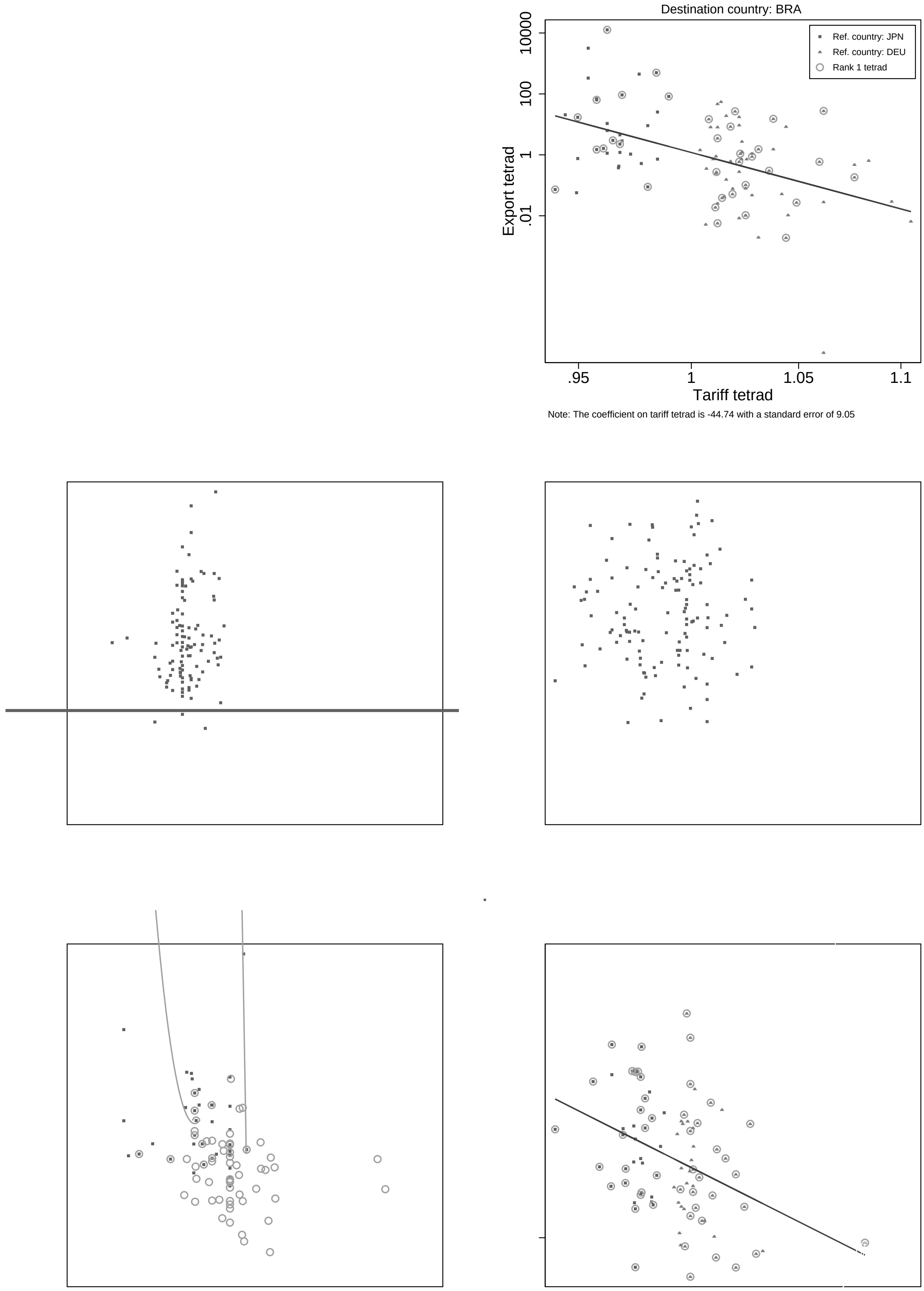
Before estimating the firm-level trade elasticity using the ratio type estimation, we turn to describing graphically the relationship between export flows and applied tariffs tetrads for different destination countries across products.

Using again the two main reference importer countries (k is Germany or Japan), we calculate for each hs6 product p the tetradic terms for exports of French and Chinese firms ranked $j = 1$ to 25th as $\ln \tilde{x}^p_{\{j;n;k\}} = \ln x^p_n(\phi_{j;\mathrm{FR}}) - \ln x^p_k(\phi_{j;\mathrm{FR}}) - \ln x^p_n(\phi_{j;\mathrm{CN}}) + \ln x^p_k(\phi_{j;\mathrm{CN}})$ and the tetradic term for applied tariffs at the same level as $\ln (1 + \hat{t}3$

Table 2: Destination countries characteristics in 2000

	Population	GDP	Ratio France / China: Total exports	Average exports	Number exporters	Distance
CHE	7	246	29.24	1.68	17.42	.06
BEL	10	232	9.64	1.21	7.95	.06
NLD	16	387	2.04	1.01	2.02	.08
GBR	60	1443	4.89	2.37	2.06	.09
ESP	40	581	14.38	3.82	3.76	.1
DEU	82	1900	5.04	2.13	2.37	.1
ITA	57	1097	7.33	2.7	2.71	.11
AUT	8	194	10.73	1.84	5.84	.12
IRL	4	96	8.52	1.37	6.2	.12
PRT	10	113	18.05	1.99	9.09	.13
CZE	10	57	5.47	2.46	2.22	.13
MAR	28	33	11.34	1.54	7.35	.16
DNK	5	160	3.15	1.07	2.94	.16
MLT	0	4	17.03	9.17	1.86	.18
POL	38	171	4.04	1.51	2.67	.18
NOR	4	167	3.19	2.15	1.49	.22
SWE	9	242	5.91	2.66	2.22	.22
BGR	8	13	5.13	2.21	2.32	.24
GRC	11	115	4.42	1.75	2.52	.24
MDA	4	1	169.62	6.08	27.89	.28
BLR	10	13	1.23	.16	7.49	.28
EST	1	6	1.33	.43	3.13	.3
FIN	5	121	1.9	.86	2.2	.32
GHA	20	5	1.23	1.79	.69	.38
NGA	125	46	1.39	2.4	.58	.38
CYP	1	9	2.73	2.33	1.17	.39
LBN	4	17	3.3	2	1.65	.43
JOR	5	8	1.15	2.37	.49	.45
GAB	1	5	117.02	2	58.6	.46
BRB	0	3	2.38	1.95	1.22	.47
BRA	174	644	1.83	1.86	.99	.5
DOM	9	20	2.8	2.44	1.15	.52
VEN	24	117	1.4	2.58	.54	.52
PRY	5	14.44d11c851(.52)]9(01737)-3219(.49)-3506(.24)]TJ 0 -14.446 Bd [(P468-3352(5)-3934(8)-336065.13)-2544(9.17				

Figure 2: Unconditional tetrad evidence: by importer



individual HS6 products, which are the ones for which we maximize the number of observations in the dataset. Again (apart from the tools sector, where the relationship is not significant), all those sectors exhibit strong reaction to tariff differences across importing countries. A synthesis of this evidence for individual sectors can be found by averaging tetrads over a larger set of products. We do that in Figure 4.1 for the 96 products that have at least 30 destinations in common in our sample for French and Chinese exporters. The coefficient is again very large in absolute value and highly significant. The next section presents regression results with the full sample, both dimensions of identification, and the appropriate set of gravity control variables which will confirm this descriptive evidence and, as expected reduce the steepness of the estimated response.

4.2 Baseline results

This section presents the estimates of the trade elasticity with respect to applied tariffs from equation (7) for all reference importer countries (Australia, Canada, Germany, Italy, Japan, New Zealand, Poland and the UK) pooled in the same specification. Standard errors are clustered by destination-reference importing country. Columns (1) to (3) of Table 3 show the results using as dependent variable the ratio of the top 1 exporting French and Chinese firm. Columns (2) presents estimations on the sample of positive tetraded tariffs and column (3) controls for the tetradic terms of Regional Trade Agreements (RTA). Columns (4) to (6) of Table 3 present the estimations using as dependent variable the ratio of firm-level exports of the top 1 to the top 25 French and Chinese firm at the hs6 product level. These estimations yield coefficients for the applied tariffs (1) that range between -4.8 and -1.74. Note that In both cases, the coefficients on applied tariffs are reduced when including the RTA, but that the tariff variable retains statistical significance, showing that the effect of tariffs is not restricted to the binary impact of going from positive to zero tariffs.

Estimations in Table 3 exploit the variation in tariffs applied to France and China across both products and destination countries. We now focus on the variation of tariffs within hs6-products across destination countries. To that effect, Table 4 includes hs6 product - reference importer country fixed effects and standard errors are clustered by destination-reference country pair. The coefficients for the applied tariffs (1) range from -4.8 to -1.7 for the pair of the top 1 exporting French and Chinese firms (columns (1) to (3)). Columns (4) to (6) present the results using as dependent variable the pair of the top 1 to the top 25 firms. In this case, the applied tariffs vary from -3.8 to -2.3. While RTA has a positive and significant effect, it again does not capture the whole effect of tariff variations across destination countries on export flows. Note also that distance and contiguity have the usual and expected signs and very high significance, while the presence of a colonial link and of a common language has a much more volatile influence.

Figure 3: Unconditional tetrad evidence: by product

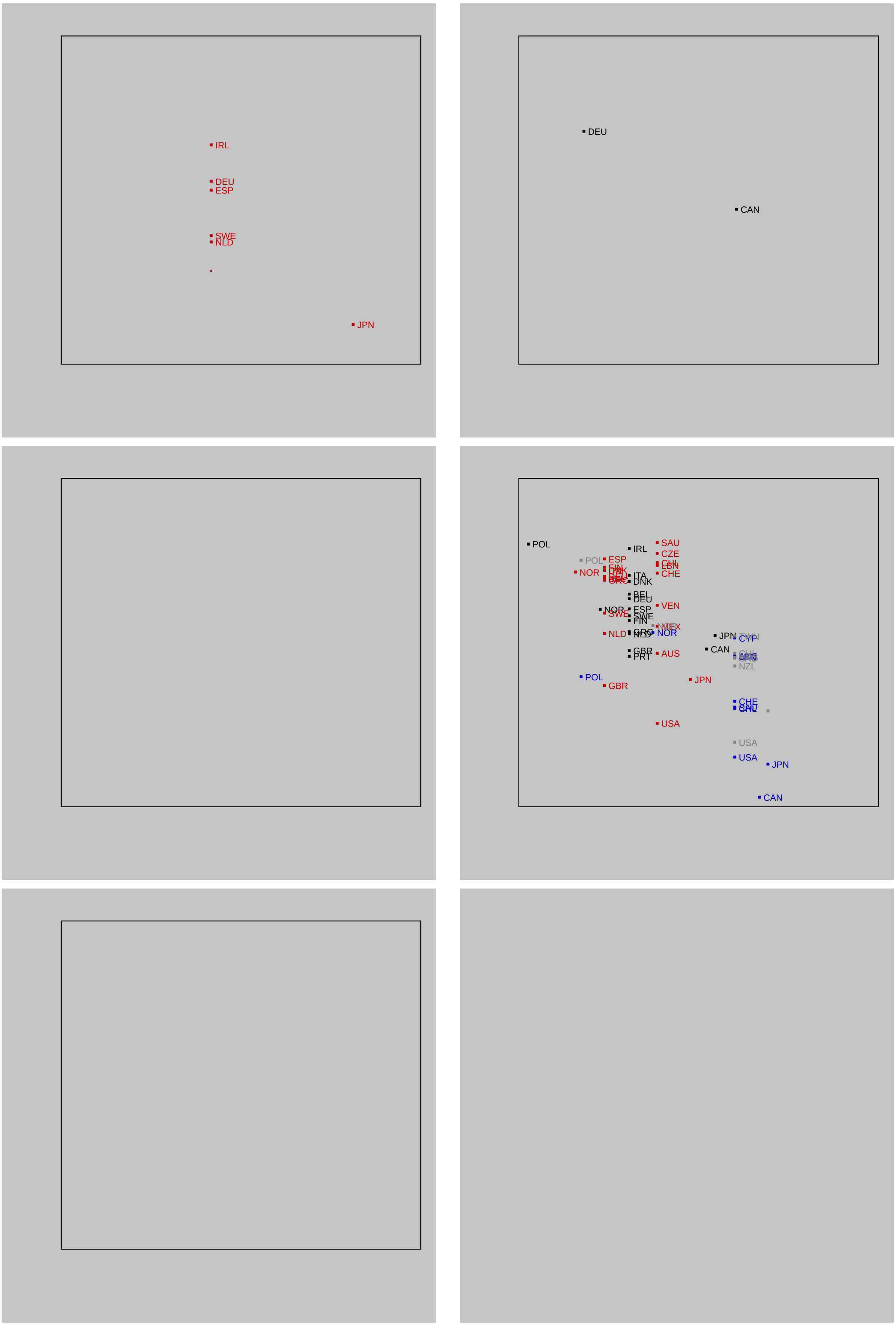


Table 3: Intensive margin elasticities.

Dependent variable:	Top 1 rm-level exports			Top 1 to 25 rm-level exports		
	(1)	(2)	(3)	(4)	(5)	(6)

Figure 4: Unconditional tetrad evidence: averaged over top products

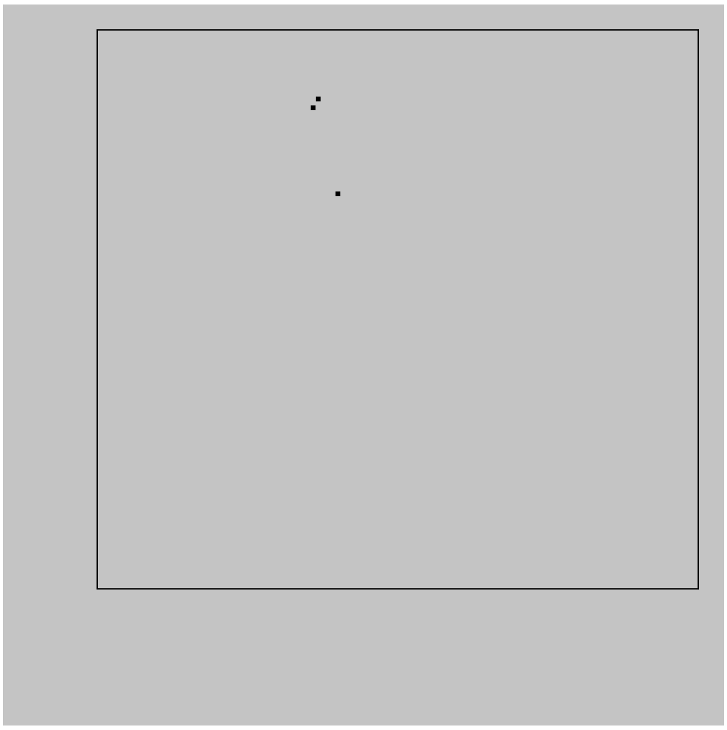


Table 4: Intensive margin elasticities. Within-product estimations.

Dependent variable:	Top 1 rm-level exports			Top 1 to 25 rm-level exports		
	(1)	(2)	(3)	(4)	(5)	(6)
Applied Tari	-4.20[a]	-4.76[a]	-1.70	-3.76[a]	-3.75[a]	-2.34[a]
	(1.06)	(1.54)	(1.08)	(0.71)	(0.93)	(0.64)
Distance	-0.48[a]	-0.44[a]	-0.16[a]	-0.45[a]	-0.45[a]	-0.24[a]
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)
Contiguity	0.78[a]	0.80[a]	0.70[a]			

As a more demanding specification, still identifying trade elasticity across destinations, we now restrict the sample to countries applying non-MFN tariffs to France and China. The sample of these xed e ects implies that the source of identi cation comes from variations within destination countries across hs6-products in applied tari s to both origin countries, France and China, by the reference importer countries. Columns (1) and (3) present estimations on the full sample, while columns (2) and (4) report estimations on the sample of positive tetraded tari s. The trade elasticity ranges from -2.81 to -5.28 with an average value around -3.8. Estimations in columns (5) and (6) restrict the destination countries to be the ones applying non-MFN duties. The sample size drops radically, with the trade elasticities remaining of the expected sign and order of magnitude, but losing in statistical signi cance.

Table 6: Intensive margin elasticities. Within-country estimations.

	Top 1		Top 1 to 25			
Dependent variable:	rm-level exports		rm-level exports			
Sample:	Full		Full		non-MFN	
	(1)	(2)	(3)	(4)	(5)	(6)
Applied Tari	-2.81[a]	-4.23[a]	-2.97[a]	-5.28[a]	-1.33	-4.33[a]

$_{ni}(\;)$, thus biasing downwards our estimate of the trade elasticity. Our approach of tetrads that focuses on highly ranked exporters for each hs6-market combination should however not be too sensitive to that issue, since those are rms that presumably have such a large productivity that their idiosyncratic destination shock is of second order. In order to verify that intuition, we

Table 7: Correcting for the selection bias.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ref. country:	Australia		Brazil		Canada		Germany		UK	
	OLS	EK Tobit	OLS	EK Tobit	OLS	EK Tobit	OLS	EK Tobit	OLS	EK Tobit
Applied Tari	1.35[a]	-6.19[a]	1.13[a]	-5.80[a]	2.67[a]	-4.51[a]	2.87[a]	-2.42[a]	2.44[a]	-4.11[a]
	(0.25)	(1.33)	(0.27)	(1.40)	(0.24)	(1.34)	(0.21)	(0.88)	(0.22)	(1.09)
RTA	-0.55[a]	1.86[a]	-0.56[a]	2.95[a]	-0.56[a]	2.57[a]	-0.82[a]	2.48[a]	-0.81[a]	2.97[a]
	(0.07)	(0.46)	(0.09)	(0.46)	(0.08)	(0.40)	(0.07)	(0.34)	(0.06)	(0.36)
Distance	0.01	-0.16	0.06[c]	0.16	0.01	0.25	-0.03	-0.14	-0.00	0.02
	(0.02)	(0.17)	(0.03)	(0.17)	(0.03)	(0.15)	(0.03)	(0.13)	(0.02)	(0.14)
Common language	0.15[a]	3.98[a]	0.20[a]	4.42[a]	0.30[a]	5.45[a]	0.08[b]	4.42[a]	0.18[a]	5.07[a]
	(0.05)	(0.27)	(0.08)	(0.35)	(0.05)	(0.26)	(0.04)	(0.18)	(0.03)	(0.18)
Contiguity	0.07[b]	1.52[a]	0.10[b]	1.33[a]	0.08[b]	0.89[a]	0.19[a]	1.62[a]	0.21[a]	0.92[a]
	(0.03)	(0.15)	(0.04)	(0.20)	(0.03)	(0.15)	(0.03)	(0.10)	(0.03)	(0.12)
Colony	0.39[b]	3.22[a]	0.79[a]	1.87[a]	0.35[a]	1.58[b]	0.63[a]	2.24[a]	0.84[a]	2.86[a]
	(0.17)	(0.67)	(0.14)	(0.72)	(0.12)	(0.63)	(0.11)	(0.55)	(0.12)	(0.59)
GDP_n	0.14[a]	1.63[a]	0.15[a]	1.44[a]	0.19[a]	1.76[a]	0.19[a]	1.60[a]	0.18[a]	1.63[a]
	(0.02)	(0.08)	(0.02)	(0.08)	(0.02)	(0.08)	(0.02)	(0.07)	(0.01)	(0.06)
$Population_n$	0.05[b]	0.84[a]	0.06[a]	0.99[a]	0.01	0.73[a]	-0.01	0.83[a]	-0.00	0.85[a]
	(0.02)	(0.09)	(0.02)	(0.11)	(0.02)	(0.10)	(0.02)	(0.07)	(0.02)	(0.07)
Chinese exporter dummy	0.40[a]	1.14[a]	0.19[a]	1.04[a]	0.47[a]	0.76[a]	0.46[a]	1.45[a]	0.51[a]	1.49[a]
	(0.04)	(0.21)	(0.05)	(0.24)	(0.04)	(0.20)	(0.03)	(0.15)	(0.04)	(0.17)
# of dest. by rm	0.20[a]	2.17[a]	0.23[a]	2.24[a]	0.17[a]	2.06[a]	0.15[a]	2.14[a]	0.16[a]	2.14[a]
	(0.01)	(0.05)	(0.01)	(0.05)	(0.01)	(0.04)	(0.01)	(0.03)	(0.01)	(0.03)
Observations	445979	3066253	256043	1672328	460467	2822200	731259	5045119	686051	4672816
R^2	0.045		0.046		0.053		0.078		0.064	
Pseudo R^2		0.081		0.089		0.085		0.074		0.074

Notes: All estimations include xed e ects for each hs6 product level. Standard errors are clustered at the hs6-destination-origin country level. All estimations include a constant that is not reported. Applied tari is the logarithm of applied tari plus one at the hs6 product level and destination country. a, b and c denote statistical signi cance levels of one, ve and ten percent respectively.

Table 8: Correcting for the selection bias.(cont.)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ref. country:	Italy		Japan		Mexico		Poland		Thailand	
	OLS	EK Tobit	OLS	EK Tobit	OLS	EK Tobit	OLS	EK Tobit	OLS	EK Tobit
Applied Tari	2.59[a]	-3.29[a]	0.83[a]	-3.16[b]	0.60[b]	-4.78[a]	1.65[a]	-2.46[b]	1.05[a]	-3.40[b]
	(0.21)	(0.87)	(0.28)	(1.59)	(0.29)	(1.67)	(0.28)	(1.19)	(0.31)	(1.61)
RTA	-0.94[a]	2.01[a]	-0.17[c]	3.54[a]	-0.46[a]	2.02[a]	-0.39[a]	2.38[a]	-0.55[a]	2.38[a]
	(0.07)	(0.37)	(0.10)	(0.53)	(0.10)	(0.49)	(0.11)	(0.47)	(0.11)	(0.59)
Distance	-0.07[b]	-0.20	0.18[a]	0.58[a]	0.08[b]	-0.06	0.07	-0.06	0.00	0.01
	(0.03)	(0.15)	(0.04)	(0.19)	(0.03)	(0.18)	(0.04)	(0.16)	(0.04)	(0.19)
Common language	0.05	4.36[a]	0.36[a]	4.18[a]	0.21[a]	4.11[a]	0.16[b]	4.32[a]	0.24[a]	4.23[a]
	(0.04)	(0.18)	(0.06)	(0.31)	(0.07)	(0.33)	(0.06)	(0.30)	(0.08)	(0.41)
Contiguity	0.14[a]	1.64[a]	0.02	1.32[a]	0.07	1.42[a]	0.05	1.59[a]	-0.01	1.51[a]
	(0.03)	(0.10)	(0.05)	(0.17)	(0.05)	(0.20)	(0.04)	(0.16)	(0.05)	(0.25)
Colony	0.73[a]	2.79[a]	0.57[a]	3.46[a]	0.71[a]	2.91[a]	0.67[a]	2.42[a]	0.54[a]	3.89[a]
	(0.13)	(0.53)	(0.14)	(0.97)	(0.14)	(0.66)	(0.15)	(0.69)	(0.15)	(0.89)
GDP_n	0.19[a]	1.55[a]	0.14[a]	2.02[a]	0.13[a]	1.85[a]	0.18[a]	1.49[a]	0.16[a]	1.73[a]
	(0.01)	(0.06)	(0.02)	(0.11)	(0.02)	(0.09)	(0.02)	(0.09)	(0.02)	(0.11)
$Population_n$	-0.02	0.82[a]	0.07[a]	0.48[a]	0.07[a]	0.47[a]	0.02	0.77[a]	0.06[b]	0.64[a]
	(0.02)	(0.07)	(0.02)	(0.12)	(0.03)	(0.12)	(0.02)	(0.10)	(0.03)	(0.11)
Chinese exporter dummy	0.44[a]	1.25[a]	0.39[a]	0.98[a]	0.32[a]	0.80[a]	0.53[a]	1.83[a]	0.31[a]	1.34[a]
	(0.04)	(0.16)	(0.04)	(0.29)	(0.05)	(0.23)	(0.06)	(0.26)	(0.05)	(0.26)
# of dest. by rm	0.17[a]	2.15[a]	0.21[a]	2.06[a]	0.23[a]	2.31[a]	0.23[a]	2.23[a]	0.28[a]	2.26[a]
	(0.01)	(0.03)	(0.01)	(0.05)	(0.01)	(0.06)	(0.01)	(0.05)	(0.01)	(0.06)
Observations	719485	4839867	320329	1742412	280489	1922465	270022	1699798	186694	1224907
R^2	0.076		0.043		0.049		0.055		0.045	
Pseudo R^2		0.073		0.090		0.091		0.081		0.089

Notes: All estimations include xed e ects for each hs6 product level. Standard errors are clustered at the hs6-destination-origin country level. All estimations include a constant that is not reported. Applied tari is the logarithm of applied tari plus one at the hs6 product level and destination country. a, b and c denote statistical signi cance levels of one, ve and ten percent respectively.

performance of entrants in this market following a change in our variable of interest: variable trade costs.

Under Pareto, the mean-to-min ratio, for a given origin, should be constant and independent of the size of the destination market. This pattern of scale-invariance is not observed in the data where we see that mean-to-min ratios increase massively in big markets | a feature consistent with a log-normal distribution of rm-level productivity. In the last step of the section we compare

Equation (12) means that the aggregate trade elasticity may not be constant across country pairs because of the $_{ni}$ term. In order to evaluate those bilateral trade elasticities, combining (13) with (10) reveals that we need to know the value of bilateral cuto s a . In order to obtain those, we de ne the following function

$$H(a\ )\quad \frac{1}{a^{\ 1}}\int_0^{a} a^{1}\quad \frac{g(a)}{G(a\ )}da; \tag{14}$$

a monotonic, invertible function which has a straightforward economic interpretation in this model. It is the ratio of average over minimum performance (measured as $a^{\ 1}$) of rms located in i and exporting to n. Using equations (1) and (9), this ratio also corresponds to the observed mean-to-min ratio of sales:

$$\frac{x_{ni}}{x_{ni}(a_{ni})} = H(a_{ni}): \tag{15}$$

For our two origin countries (France and China), we observe the ratio of average to minimum trade ows for each destination country n. Using equation (15), one can calibrate $\hat{a}_{n;\mathrm{FRA}}$ and $\hat{a}_{n;\mathrm{CHN}}$ the estimated value of the export cuto for French and Chinese rms exporting to n as a function of the mean-to-min ratio of French and Chinese sales on each destination market n

$$\hat{a}_{n;\mathrm{FRA}} = H^{\ 1}\ \frac{x_{n;\mathrm{FRA}}}{x^{\mathrm{MIN}}_{n;\mathrm{FRA}}}\ ; \qquad \text{and} \qquad \hat{a}_{n;\mathrm{CHN}} = H^{\ 1}\ \frac{x_{n;\mathrm{CHN}}}{x^{\mathrm{MIN}}_{n;\mathrm{CHN}}}\ : \tag{16}$$

Equipped with the dyadic cuto s we combine (12), (13) and (10) to obtain the aggregate trade elasticities

$$\frac{d\ln X_{n\mathrm{FRA}}}{d\ln\ _{n\mathrm{FRA}}} = 1\quad \hat{}\quad \frac{x^{\mathrm{MIN}}_{n;\mathrm{FRA}}}{x_{n;\mathrm{FRA}}}\quad \frac{\hat{a}_{n;\mathrm{FRA}}g(\hat{a}_{n;\mathrm{FRA}})}{G(\hat{a}_{n;\mathrm{FRA}})}; \tag{17}$$

$$\frac{d\ln X_{n\mathrm{CHN}}}{d\ln\ _{n\mathrm{CHN}}} = 1\quad \hat{}\quad \frac{x^{\mathrm{MIN}}_{n;\mathrm{CHN}}}{x_{n;\mathrm{CHN}}}\quad \frac{\hat{a}_{n;\mathrm{CHN}}g(\hat{a}_{n;\mathrm{CHN}})}{G(\hat{a}_{n;\mathrm{CHN}})}; \tag{18}$$

where ^ is our estimate of the intensive margin (the demand-side parameter) from previous sections. Our inference procedure is characterized by equations (16), (17) and (18). We can also calculate two other trade margins: the elasticity of : 6.145 4.11TJ/F17 11.fr45 4.937 Td [()]Tf 7.491 0 Td mean-to-min ratio

$$\frac{d\ln X_{n\mathrm{FRA}}}{d\ln\ _{n\mathrm{FRA}}} = \underbrace{1-}_{\text{intensive margin}} + \underbrace{\frac{1}{x_{n;\mathrm{FRA}}/x^{\mathrm{MIN}}_{n;\mathrm{FRA}}}}_{\text{min-to-mean}} \underbrace{\frac{d\ln N_{n\mathrm{FRA}}}{d\ln\ _{n\mathrm{FRA}}}}_{\text{extensive margin}}; \qquad (21)$$

This decomposition shows that the aggregate trade elasticity is the sum of the intensive margin and the (weighted) extensive margin. The weight on the extensive margin depends only on the mean-to-min ratio, our observable measuring the dispersion of relative rm performance. Intuitively, the weight of the extensive margin should be decreasing when the market gets easier. Indeed easy markets have larger rates of entry, $G(a\ )$, and therefore increasing presence of weaker rms which augments dispersion measured as $H(a$

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Figure 5: Theoretical and Empirical Mean-to-Min ratios

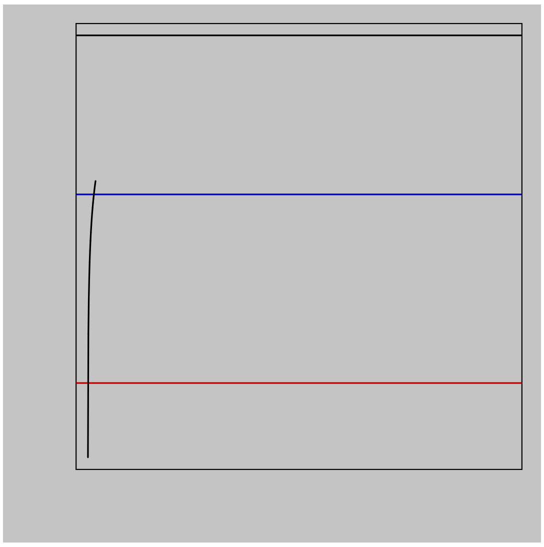
(a) theory

(b) data

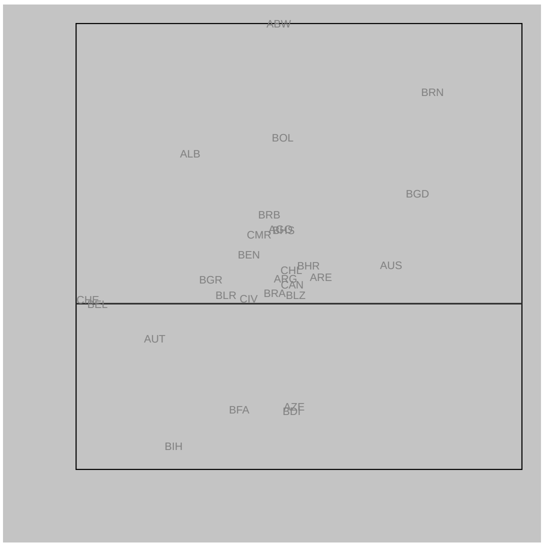
Panel (b) of figure 5 depicts the empirical application of the H value for French and Chinese exporters in 2000 for all countries in the world. On the x-axis is the share of exporters serving each of those markets. Immediately apparent is the non-constant nature of the mean-to-min ratio in the data, contradicting the Pareto prediction. This finding is very robust when considering alternatives to the minimum sales (which might be noisy if only because of statistical threshold effects) for the denominator of H, that is different quantiles of the export distribution.

Figure 6 turns to the predicted trade elasticities in its panel (a). Those are calculated for each destination country for both Chinese and French exporters using the cutoff equations revealed from empirical values of H and using equation (16). Again, the Pareto case has a constant prediction

Figure 6: Predicted trade elasticities: $''_{n\mathrm{FRA}}=''_{n\mathrm{CHN}}$

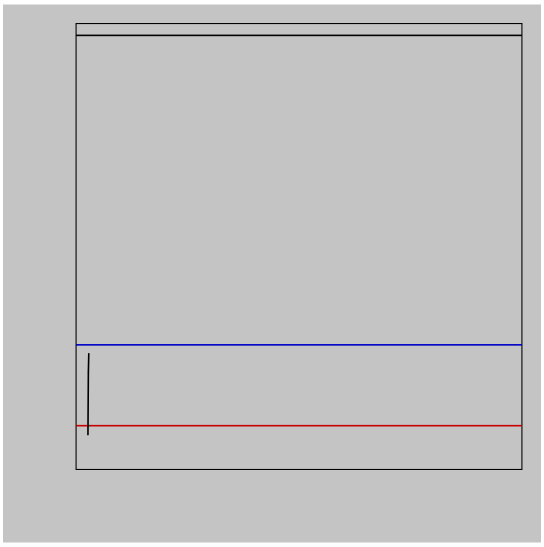


(a) theory



(b) predicted elas. vs distance

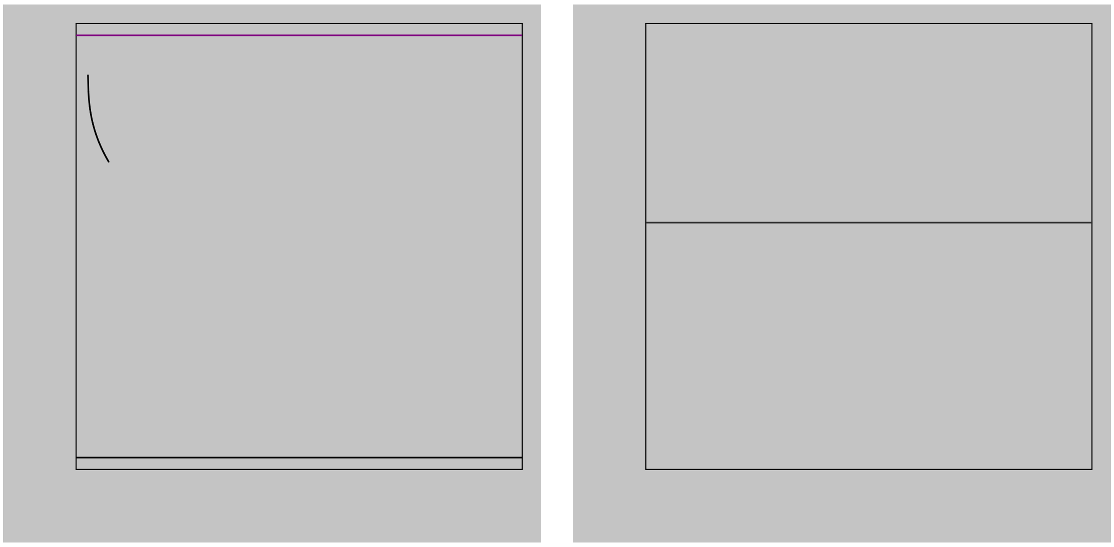
Figure 7: Predicted elasticities: extensive margin



(a) theory

(b) predicted elas. vs distance

Figure 8: Predicted elasticities: average exports



(a) theory (b) predicted elas. vs distance

5.3 Comparison with macro-based estimates of trade elasticities

We now can turn to empirical estimates of aggregate elasticities to be compared with our predictions. Those are obtained using aggregate versions of our estimating tetrad equations presented above, which is very comparable to the traditional method used: a gravity equation with country xed e ects and a set of bilateral trade costs covariates, on which a constant trade elasticity is assumed. Column (1) of Table 9 uses the same sample of product-markets as in our benchmark rm-level estimations and runs the regression on the tetrad of aggregate rather than individual exports. Column (2) uses the same covariates but on the count of exporters, and column (3) com-

Table 9: Elasticites of total ows, count of exporters and average trade ows.

	Tot. (1)	# exp. (2)	Avg. (3)	Tot. (4)	# exp. (5)	Avg. (6)	Tot. (7)	# exp. (8)	Avg. (9)
Applied Tari	-7.11^a	-5.44^a	-1.67^b	-4.27^a	-2.98^a	-1.28^b	-5.63^a	-2.85^a	-2.79^a
	(0.83)	(0.71)	(0.65)	(0.69)	(0.71)	(0.59)	(0.91)	(0.50)	(0.66)
Distance	-0.83^a	-0.57^a	-0.26^a	-0.40^a	-0.20^a	-0.20^a	-0.80^a	-0.55^a	-0.25^a
	(0.04)	(0.03)	(0.02)	(0.06)	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)
Contiguity	0.61^a	0.28^a	0.33^a	0.53^a	0.21^a	0.32^a	0.69^a	0.38^a	0.31^a
	(0.13)	(0.09)	(0.06)	(0.12)	(0.08)	(0.06)	(0.13)	(0.09)	(0.06)
Colony	0.86^a	0.62^a	0.24^a	0.21	0.06	0.15	1.03^a	0.83^a	0.19^c
	(0.13)	(0.11)	(0.08)	(0.14)	(0.10)	(0.10)	(0.19)	(0.13)	(0.10)
Common language	0.17^c	0.28^a	-0.11^c	0.52^a	0.58^a	-0.06	0.11	0.15^c	-0.04
	(0.09)	(0.09)	(0.06)	(0.09)	(0.08)	(0.07)	(0.09)	(0.09)	(0.06)
RTA				1.36^a	1.18^a	0.18^b			
				(0.12)	(0.06)	(0.08)			
Observations	61310	61310	61310	61310	61310	61310	23015	23015	23015
R^2	0.347	0.552	0.076	0.365	0.598	0.076	0.351	0.534	0.084
rmse	1.60	0.72	1.31	1.58	0.68	1.31	1.46	0.67	1.19

Notes: All estimations include xed e ects for each product-reference importer country combination. Standard errors are clustered at the destination-reference importer level. All estimations include a constant that is not reported. The dependent variable is the tetradic term of the logarithm of total exports at the hs6-destination-origin country level in columns (1), (4) and (7); of the number of exporting rms by hs6-destination and origin country in columns (2), (5) and (8) and of the average exports at the hs6-destination-origin country level in columns (3), (6) and (9). Applied tari is the tetradic term of the logarithm of applied tari plus one. Columns (7) to (9) present the estimations on the sample of positive tetraded tari s and non-MFN tari s. ^{a}, ^{b} and ^{c} denote statistical signi cance levels of one, ve and ten percent respectively.

Wooldridge, J. W. (2006). Cluster sample methods in applied econometrics: An extended analysis. Working paper, Michig0[eg0Ugehig0[eUnivlysis.-ang27(45,)-.--26542. `2006‹2(Firm6542.)he(Clogeneit)pap

A Empirical Appendix

Table 11: Average di erence between applied tari s to France and China by destination country. Full sample

	France < China		France = China		France > China	
	Tari	# HS6	Tari	# HS6	Tari	# HS6
ARG	.	0	0	5113	.	0
AUS	.	0	0	4188	1.91	905
AUT	-5.71	2134	0	2799	.	0
BEL	-5.71	2134	0	2799	.	0
BGD	.	0	0	5106	.	0
BGR	.	0	0	5059	.	0
BLR	.	0	0	4559	.	0
BOL	.	0	0	5113	.	0
BRA	.	0	0	5113	.	0
BRB	.	0	0	2020	.	0
BRN	.	0	0	5079	.	0
CAN	-3.87	15	0	2877	3.07	2178
CHE	.	0	0	3938	.	0
CHL	.	0	0	5113	.	0
COL	.	0	0	5113	.	0
CRI	.	0	0	5113	.	0
CUB	.	0	0	5112	.	0
CYP	.	0	0	4929	.	0
CZE	.	0	0	5113	.	0
DEU	-5.71	2134	0	2799	.	0
DNK	-5.71	2134	0	2799	.	0
DOM	.	0	0	5008	.	0
ESP	-5.71	2134	0	2799	.	0
EST	.	0	0	5113	.	0
FIN	-5.71	2134	0	2799	.	0
GAB	.	0	0	5108	.	0
GBR	-5.71	2134	0	2799	.	0
GHA	.	0	0	5019	.	0
GRC	-5.71	2134	0	2799	.	0
GTM	.	0	0	5113	.	0
HND	.	0	0	5113	.	0
IDN	.	0	0	5110	.	0
IRL	-5.71	2134	0	2799	.	0
IRN	.	0	0	5113	.	0
ITA	-5.71	2134	0	2799	.	0
JAM	.	0	0	5113	.	0
JOR	.	0	0	5085	.	0
JPN	-.18	3	0	2771	4.06	2256
KEN	.	0	0	4554	.	0
LAO	.	0	0	4977	.	0
LBN	.	0	0	5067	.	0
LKA	.	0	0	5090	.	0
MAR	.	0	0	5113	.	0
MDA	.	0	0	5068	.	0
MEX	.	0	0	5084	.	0
MLT	.	0	0	5109	.	0
NGA	.	0	0	5113	.	0
NLD	-5.71	2134	0	2799	.	0
NOR	.	0	0	4770	.	0
NPL	.	0	0	5096	.	0
NZL	.	0	0	3220	1.15	1876
PAN	.	0	0	5110	.	0
PER	.	0	0	5113	.	0
PHL	.	0	0	5112	.	0
POL	-9.51	4234	0	485	7.14	388
PRT	-5.71	2134	0	2799	.	0
PRY	.	0	0	5113	.	0
SAU	.	0	0	4799	.	0
SLV	.	0	0	5113	.	0
SWE	-5.7	2136	0	2800	.	0
THA	.	0	0	5056	.	0
TWN	.	0	0	5113	.	0
TZA	.	0	0	5113	.	0
UGA	.	0	0	5110	.	0
URY	.	0	0	4829	.	0
USA	.	0	0	4768	.	0
VEN	.	0	0	5109	.	0
YEM	.	0	0	5111	.	0

Notes: The table reports the average di erence across hs6 products of applied tari s by destination country n to France and China and the corresponding number of hs6 products when the tari applied to France is lower than to China (columns (1) and (2)), when the applied tari to both origin countries is the equal (columns (3) and (4)) and when the tari applied to France is higher than to China (columns (5) and (6)).

B Theoretical Mean-to-Min ratios under Pareto and Log-

With a lognormal productivity, equation (27) leads to

$$H^{\mathrm{LN}}(a_{ni}) = \frac{h[(\ln a_{ni} + \quad)= \quad]}{h[(\ln a_{ni} + \quad)= \quad + (\qquad 1) \quad]}; \tag{30}$$

An attractive feature of our quantification procedure relates to the small number of relevant parameters to be calibrated. Under Pareto, equations (25) and (29) show that only the shape parameter   matters. Similarly, under a Lognormal, only the calibration of the second-moment of the distribution, , is necessary for inverting the H function to reveal the cutoff and for quantifying the aggregate elasticity: This last point stems from the fact that shifting the first moment, , affects (27) and (30) in an identical way and so has no impact on the quantification.